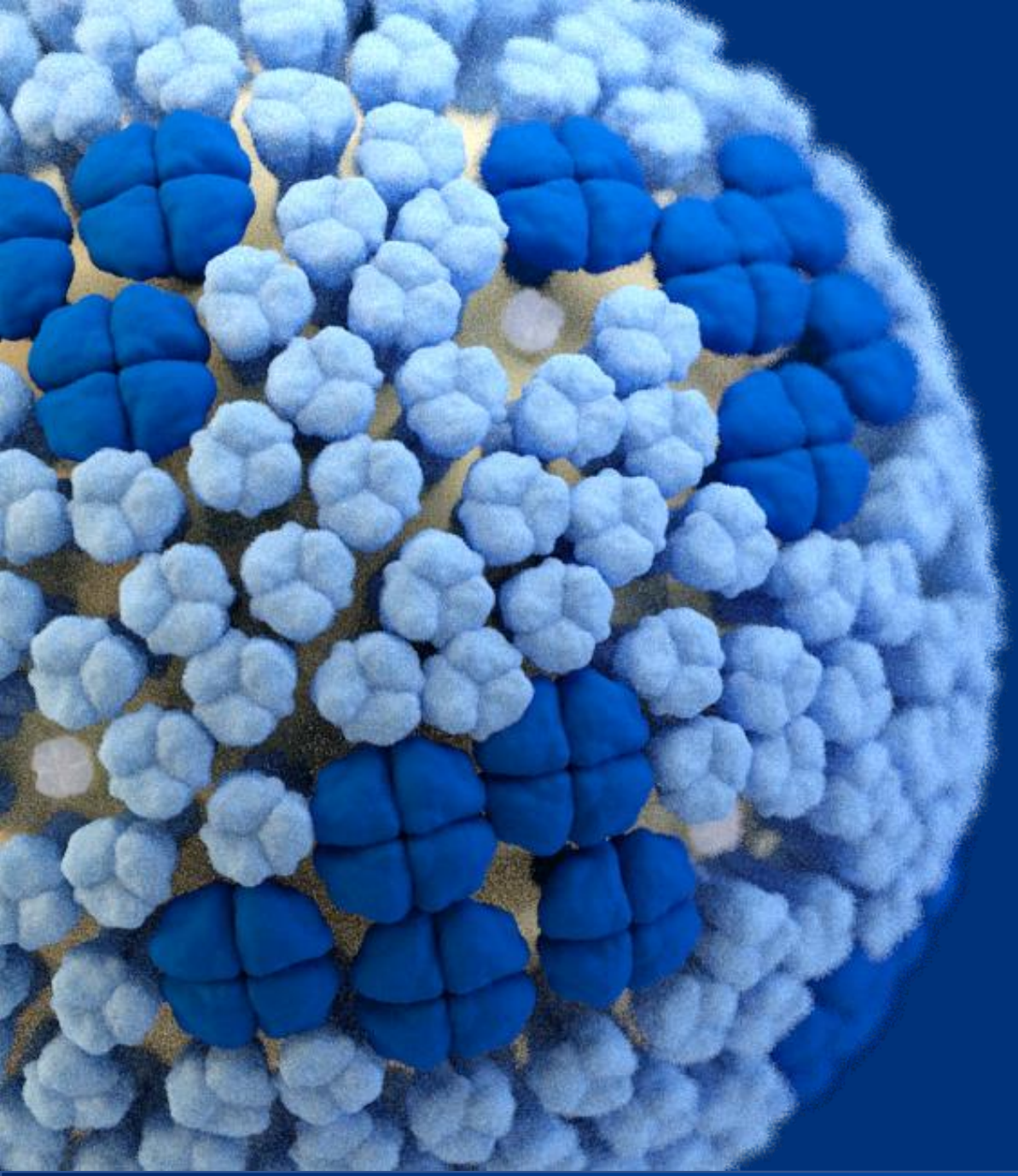
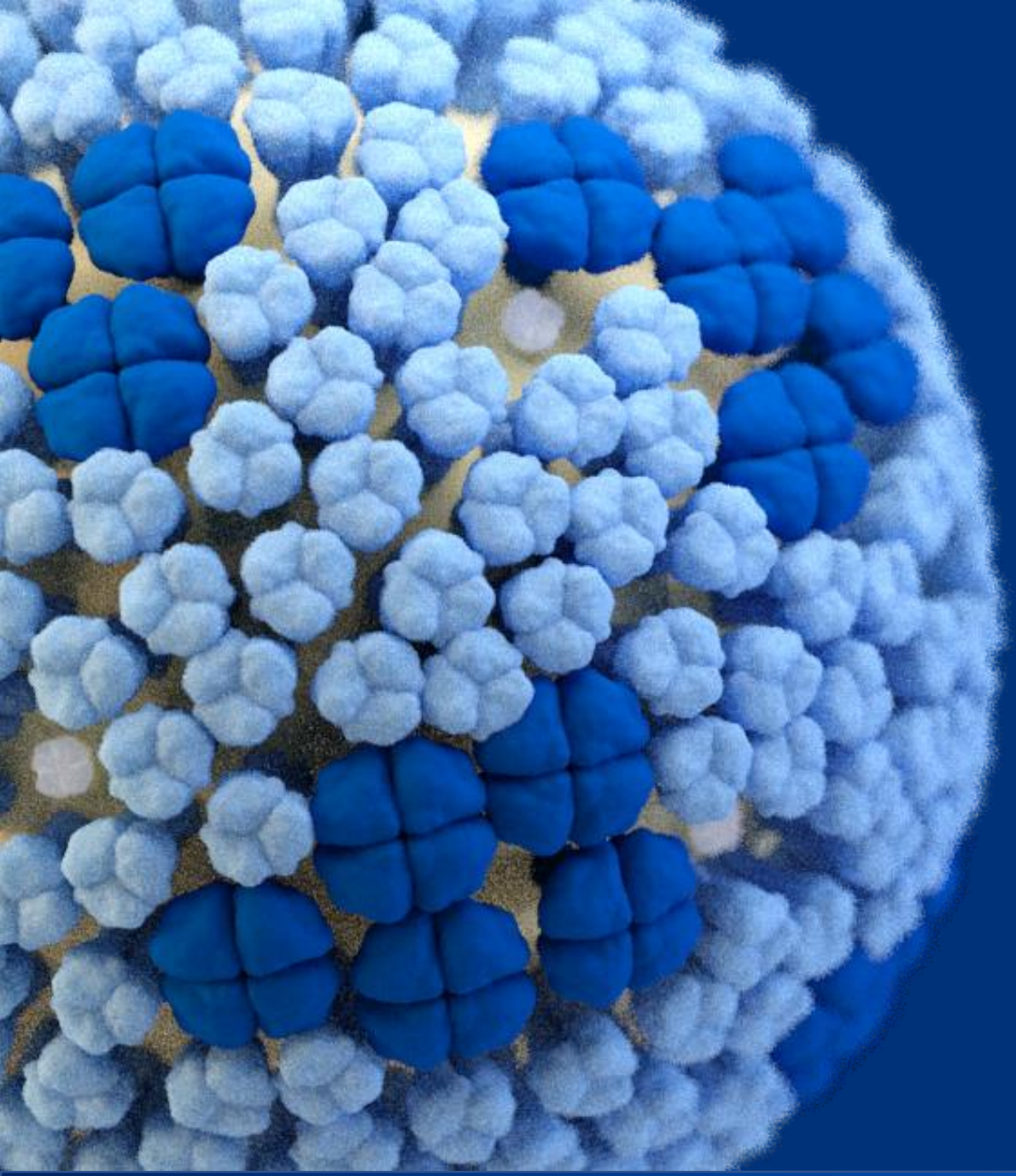


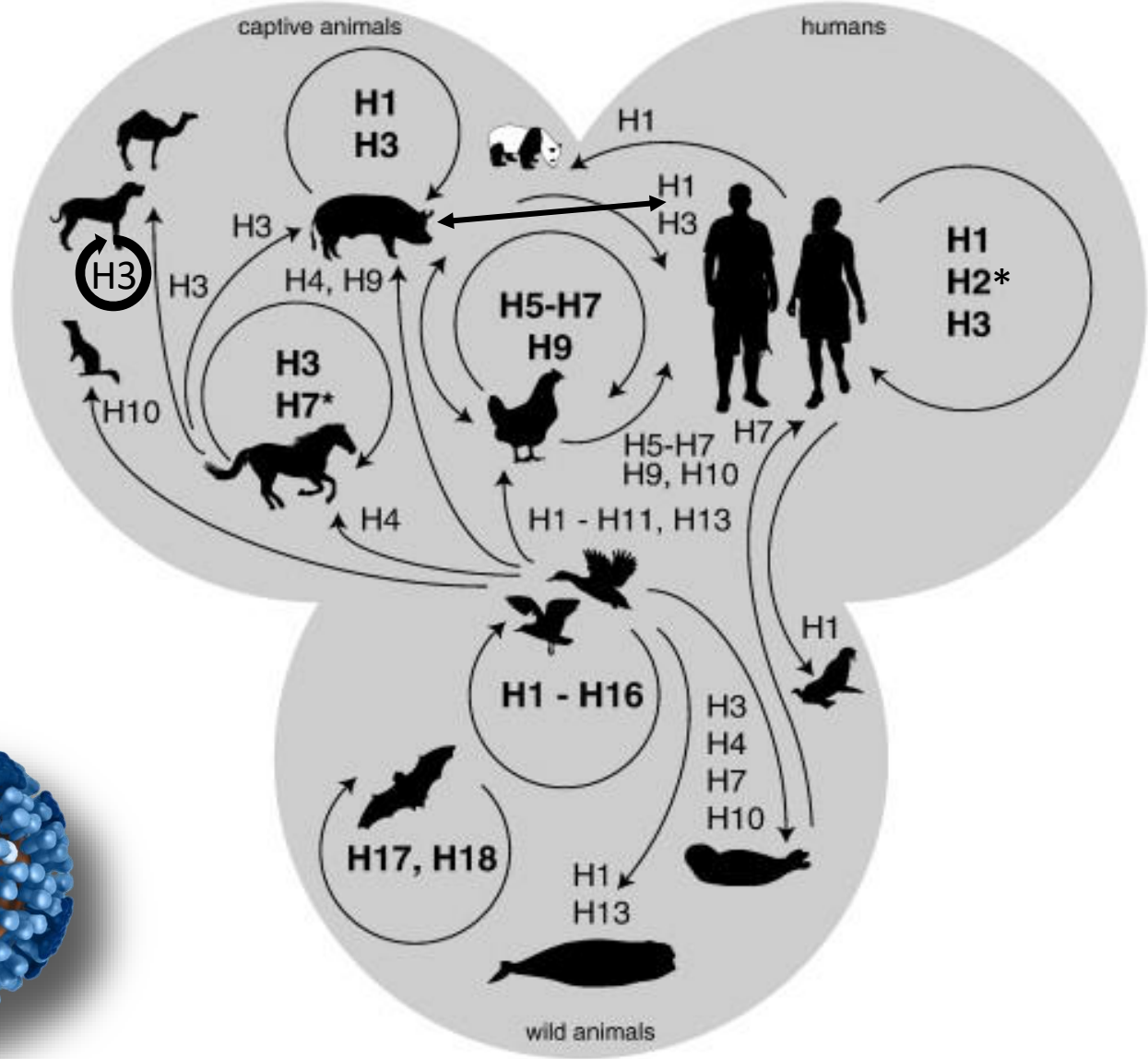
Zoonotic Influenza Epidemiologic and Laboratory Considerations

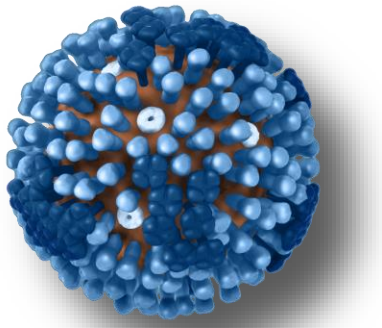
Christine M. Szablewski, DVM, MPH
Global Influenza Branch
Influenza Division
US Centers for Disease Control and Prevention



Animal Influenza Viruses

Influenza A Virus Reservoirs and Inter-species (Zoonotic) Transmission





Source (modified): https://www.sciencedirect.com/science/article/pii/S2352771415000026?via%3Dihub

Emerging Animal, Zoonotic, Novel, and Pandemic Influenza A Viruses

H9N2 *1998-2025*

2003-2019
H7N7

2009-2025 (2012)
H1N1(v)
H1N2(v)
H3N2(v)

2004-2010
H10N7

2004-2020
H7N3

1997-2025
H5N1
H5Nx

2013-2019
H7N9

2009
H1N1
Pandemic

2016
H7N2

2018
H7N4

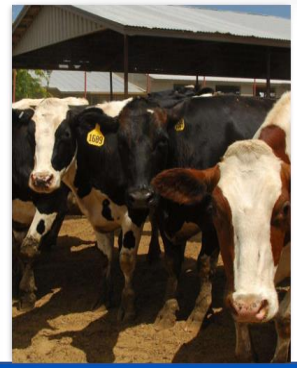
2022-2023
H3N8

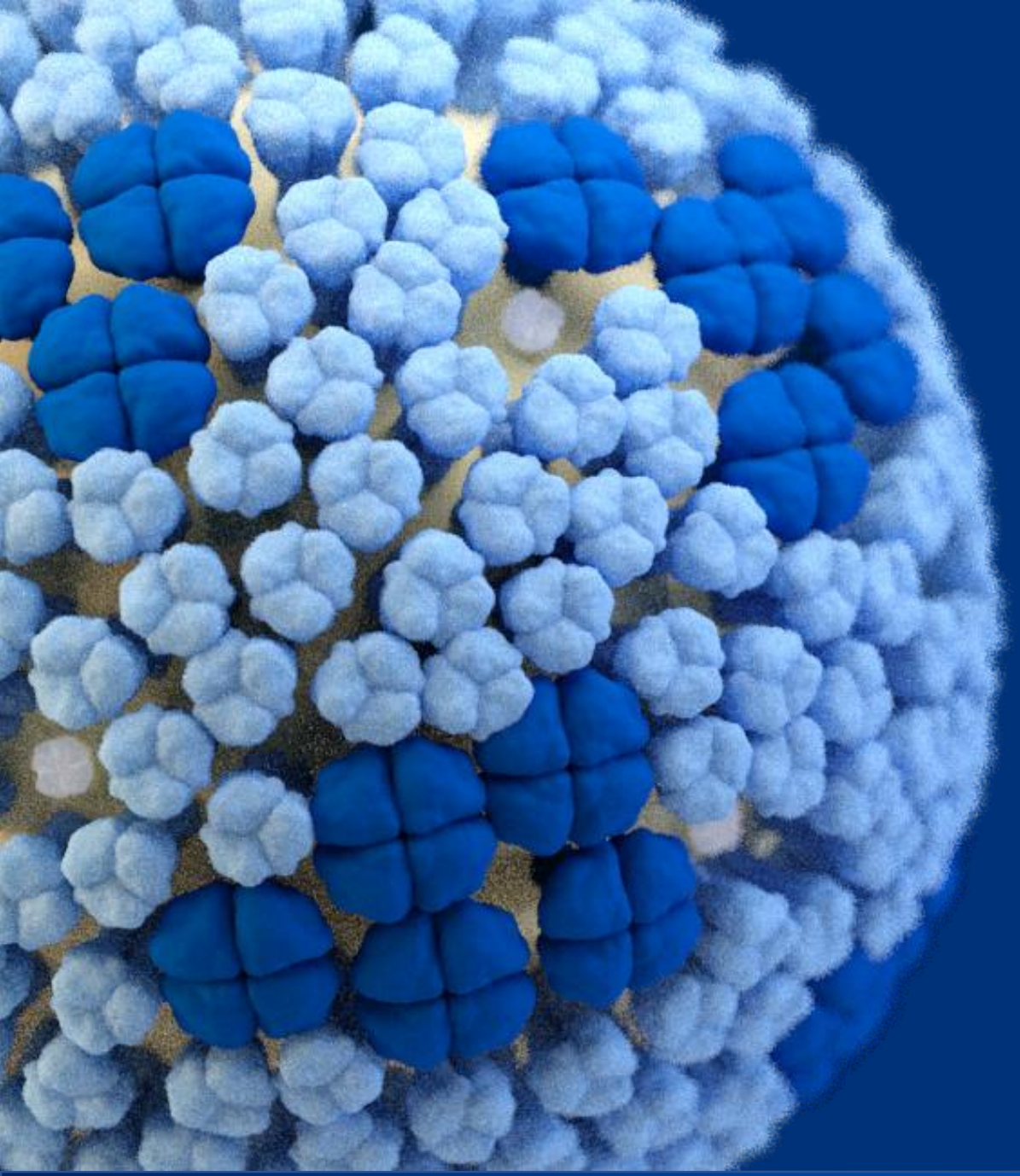
2024
H10N5

2021-2024
H10N3

2014-2024
H5N6
H5N8

2013
H6N1
H10N8





Swine Influenza A Virus

Swine Influenza Viruses (SIV)

- Swine influenza virus (SIV or IAV-S)
  - Clinically causes mild respiratory illness in swine with high morbidity but low mortality
    - Coughing (barking)
    - Sneezing
    - High Fever
    - Difficulty breathing
    - Runny nose
    - Not Eating
    - Lethargy
    - Conjunctivitis
  - SIV is widespread in North and South America, Asia, and Europe
    - It is not reportable to the World Organization for Animal Health
    - Commercial and autogenous influenza vaccines are available for pigs
  - Common swine subtypes: A(H1N1), A(H1N2), A(H3N2)

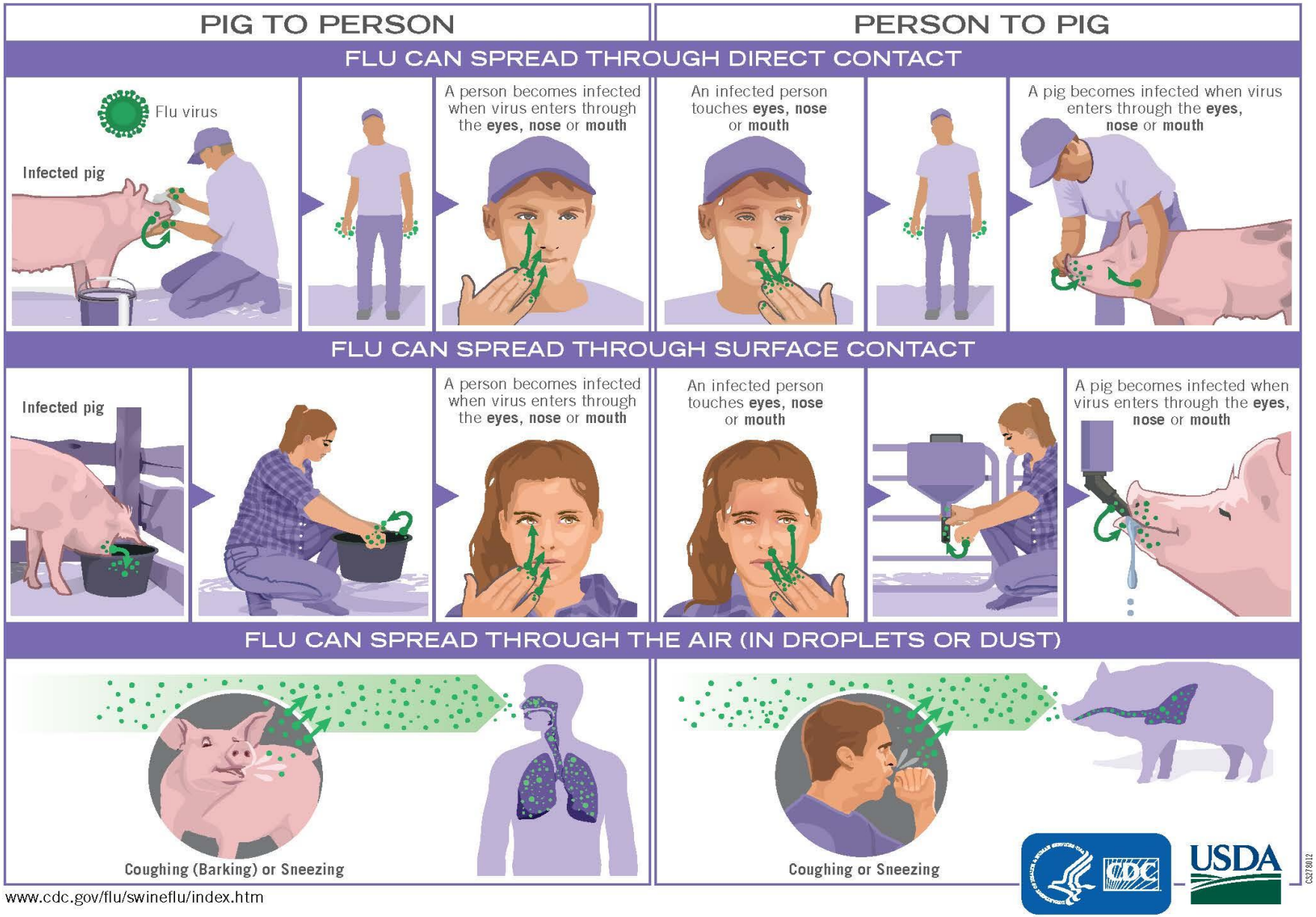
https://www.woah.org/en/disease/swine-influenza/

Variant Swine Influenza Viruses (SIV)

- Swine influenza viruses do not normally infect humans
  - Clinical characteristics consistent with seasonal influenza
  - When a person is infected with an SIV it is called a “variant virus”; a “v” is added to the end of the virus subtype
    - Example: A(H3N2)v

FLU CAN SPREAD BETWEEN PIGS AND PEOPLE

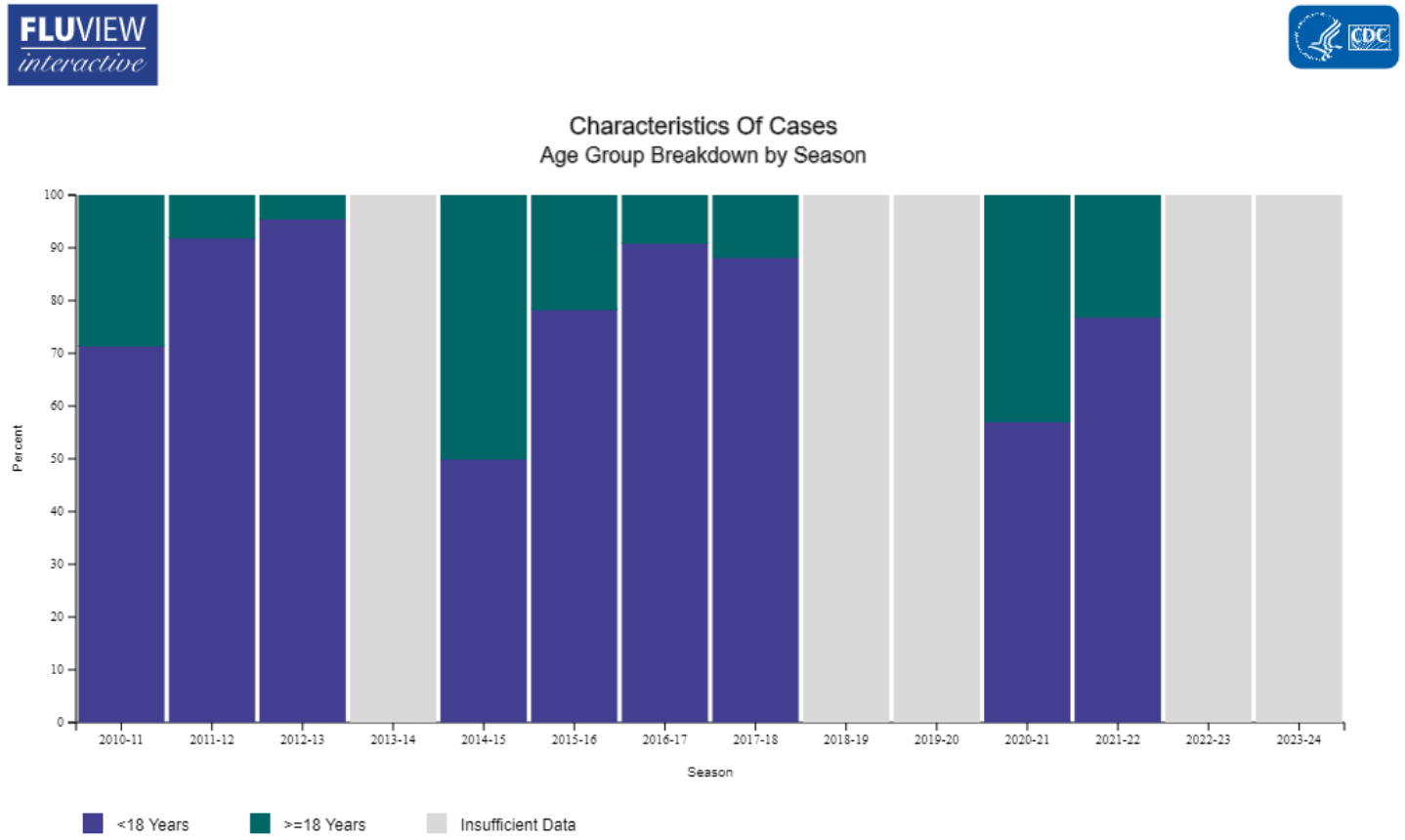
Information for people exposed to pigs, including people who enter the swine barns at agricultural fairs or people who raise pigs for show or farming



www.cdc.gov/flu/swineflu/index.htm

US Variant Swine Influenza Viruses (SIV)

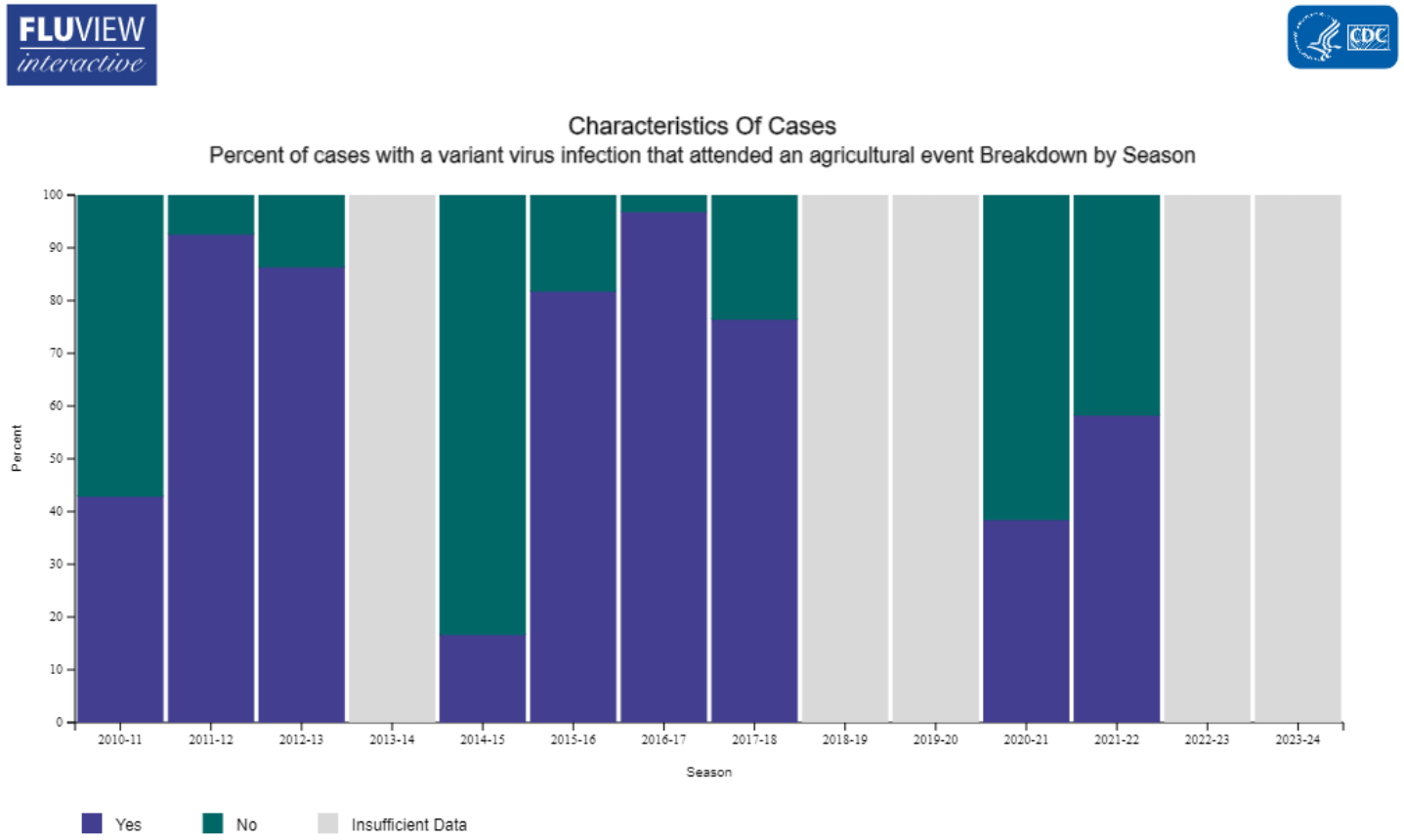
- Most infections have occurred in children



https://www.cdc.gov/fluview/index.html

US Variant Swine Influenza Viruses (SIV)

- Most report direct or indirect exposure to swine
  - Agricultural exhibition
  - Farm exposure
- Limited transmission from close contact with an infected person has been observed

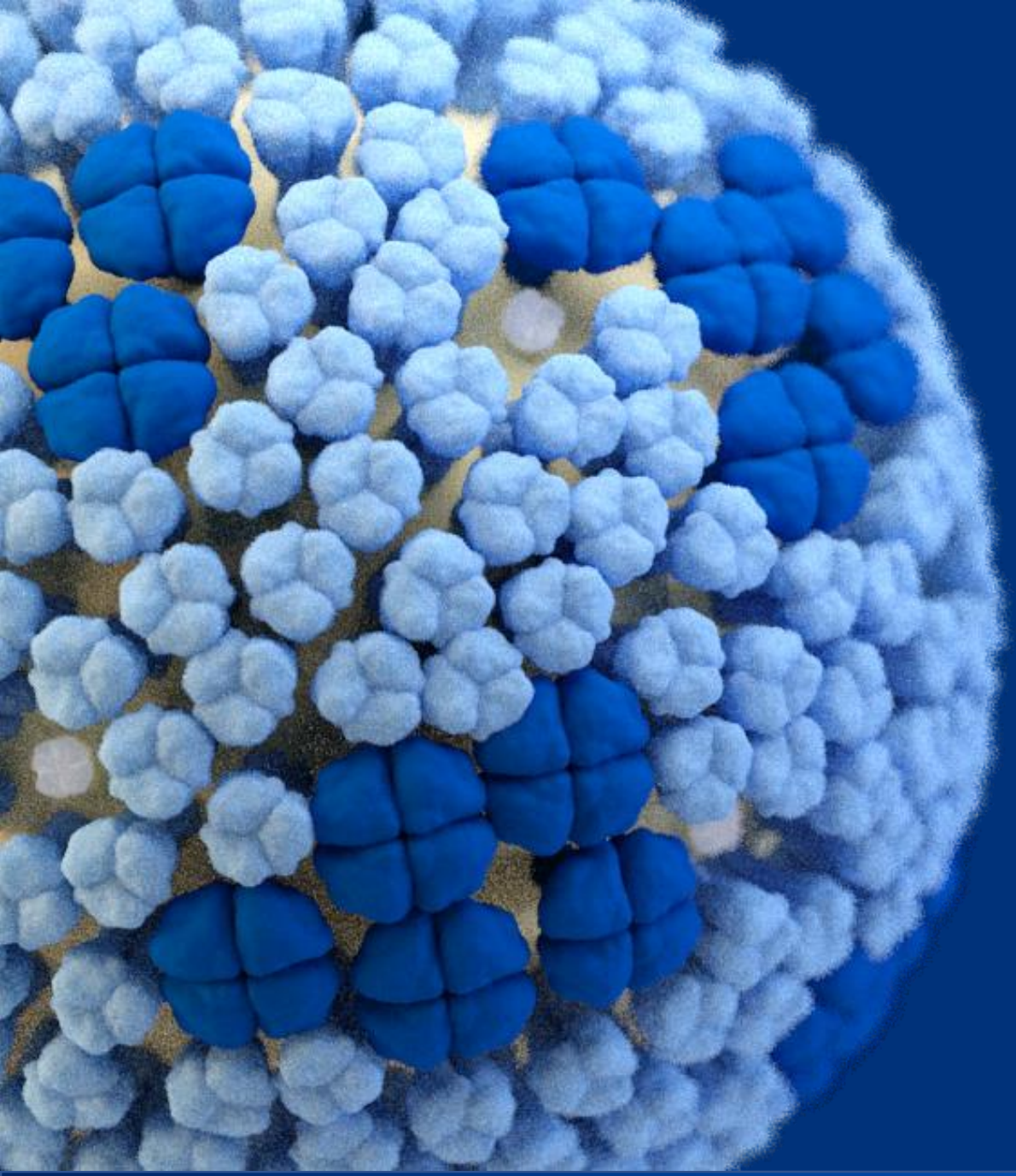


Prevention of Variant Influenza

- For those at high risk of developing severe disease
  - Avoid pigs and swine barns
  - If persons at higher risk of serious flu complications cannot avoid exposure to pigs, they should wear a well-fitting mask that covers the nose and mouth to reduce the risk of exposure to flu viruses from pigs.
  - They should also wash their hands with soap and running water before and after exposure to pigs or a swine barn. If soap and water are not available, use an alcohol-based hand rub.

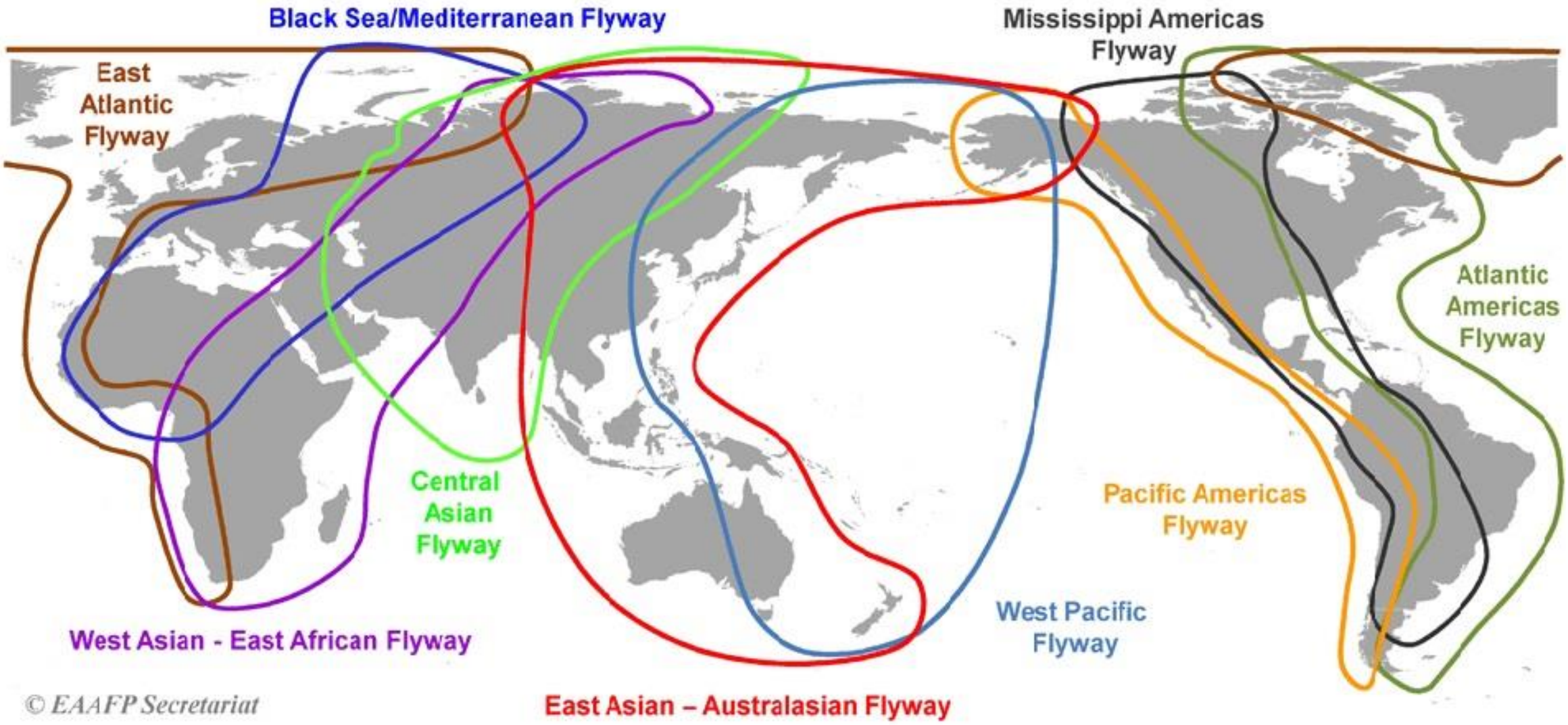
Prevention of Variant Influenza

- Don’t eat, drink or put anything in your mouth in pig areas
- Wash your hands often with soap and running water before and after exposure to pigs. If soap and water are not available, use an alcohol-based hand rub.
- Avoid close contact with pigs that look or act ill
- Take protective measures if you must come in contact with sick pigs
- Avoid contact with pigs if you have flu symptoms



Avian Influenza A Virus

Avian Influenza A Viruses and Migratory Aquatic Bird Flyways



https://eaaflyway.net/the-flyway/

Low Path versus High Path in Poultry

- Low Pathogenicity Avian Influenza (LPAI)
  - Poultry are generally asymptomatic
- Highly Pathogenic Avian Influenza (HPAI)
  - High fatality cause of rapid flock die-off
- Only H5 and H7 subtypes can be HPAI, and H5/H7 LPAI can spontaneously become HPAI
- Reservoir species (waterfowl) may appear asymptomatic

Minnesota turkey farm H5N1 die-off, via Indiana State Board of Animal Health

Avian Influenza Viruses (AIV) in Poultry

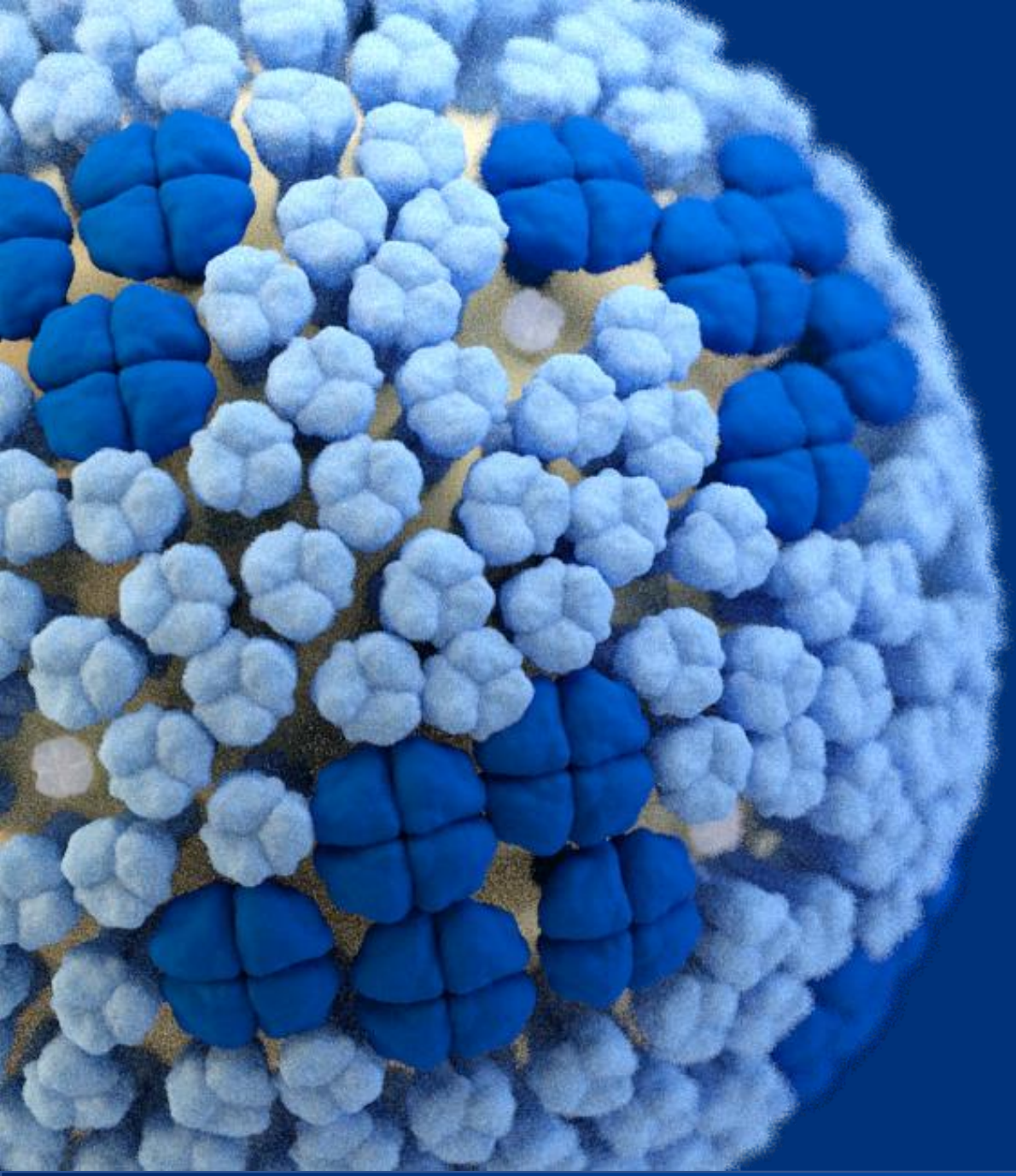
- HPAI
  - Sudden death without any prior signs of illness
  - Lack of energy and appetite
  - A drop in egg production or soft-shelled, misshapen eggs
  - Swelling of the eyelids, comb, wattles, and shanks
  - Purple discoloration of the wattles, comb, and legs
  - Gasping for air (difficulty breathing)
  - Nasal discharge, coughing, sneezing
  - Twisting of the head and neck (torticollis)
  - Stumbling or falling down
  - Diarrhea
- LPAI
  - No signs of illness
  - Mild to severe respiratory distress
  - Lack of Energy and appetite
  - Decreased egg production
  - Diarrhea
- HPAI is reportable to the World Organization for Animal Health
- Biosecurity is key to protecting flocks

https://www.woah.org/en/disease/avian-influenza/

Avian Influenza Viruses (AIV) in Mammals

- Cattle
  - Reduced milk production
  - Abnormal milk appearance (thickened and discolored)
  - Decreased appetite/ruminations
  - Fever
  - Respiratory signs
  - No signs of illness
- Cats
  - Found dead
  - Neurologic signs
- HPAI has been detected in multiple other mammal species:
  - Bears
  - Big cats
  - Seal
  - Mink
  - Sea lions
  - Red foxes
  - Goats
  - Alpacas

https://www.aphis.usda.gov/h5n1-hpai



Influenza A Surveillance in Animal Populations

Global Impact of Avian Influenza

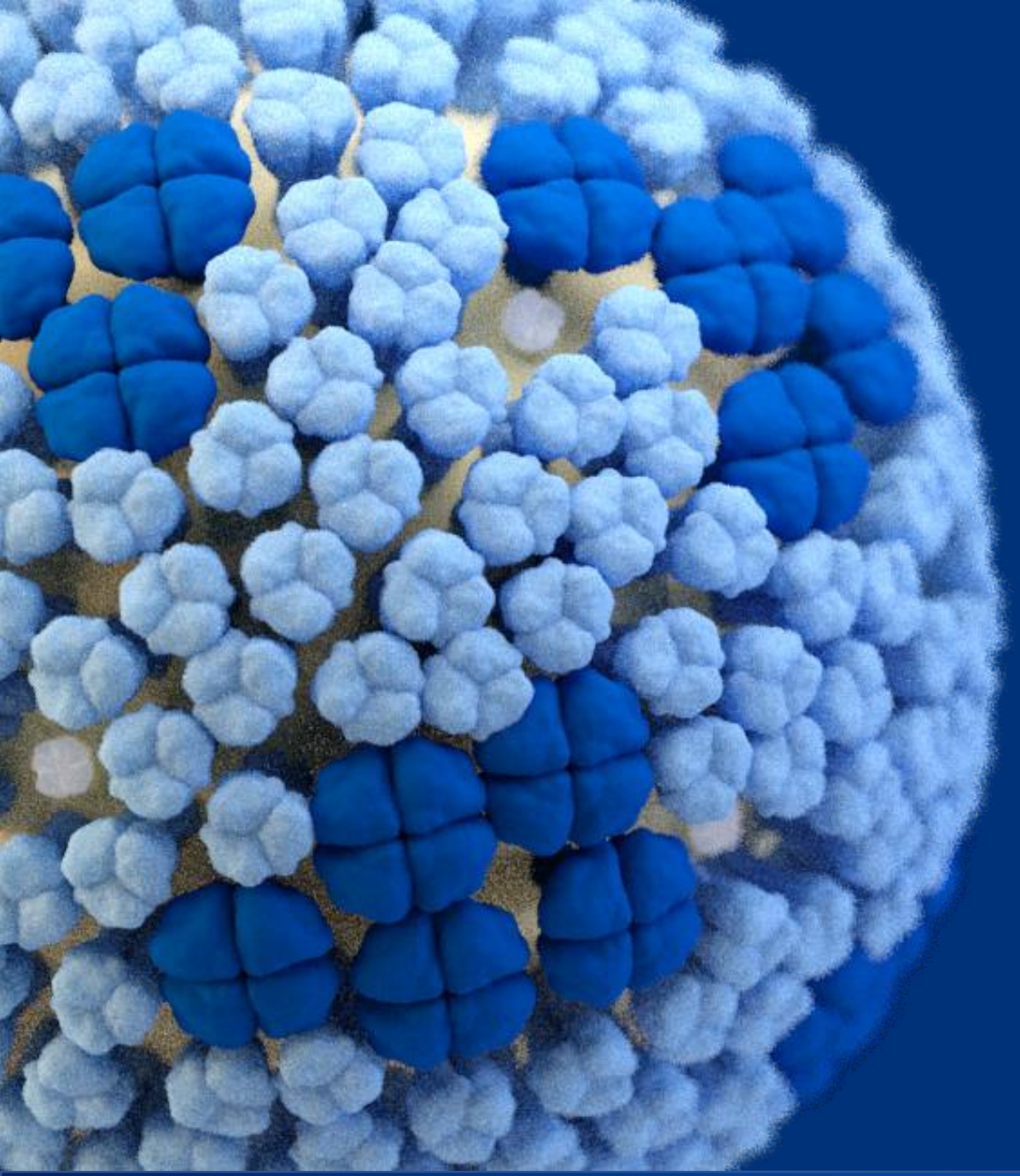
1. Economic Consequences
   - Farmer investment, bird, and job losses
   - Trade restrictions
2. Consequences for wildlife and biodiversity including cross over into other species
3. Sporadic spill over into humans sometimes with high case fatality ratios

Objectives for Influenza A Virus Surveillance in Animals

1. Monitor genetic evolution of animal influenza to better understand endemic and emerging influenza virus ecology
2. Make influenza virus isolates available for research and add to the databases for genetic analysis of isolates and related information
3. Selecting proper isolates for the development of diagnostic reagents, updating diagnostic assays, and vaccine recommendations

Considerations for Animal Surveillance

- Collect samples in regions representing various geographic locations and flyways.
- Collect samples in locations representing animal-human interface such as live bird market, agriculture fair etc.
- Collect samples from various animal species: poultry, wild bird, swine, etc.
- Samples collected from animals usually yield better sequence results than environmental samples
- Do not put multiple swabs in the same collection tube as mixed samples are very difficult to sequence
- Maintain cold chain transportation, keep samples frozen and minimize freeze/thaw cycles.
- Select samples that are positive for influenza A with a Ct value <=32 from a real-time RT-PCR assay (targeting the matrix gene) to send to CDC
- If able to generate sequences on site, please submit sequences to public database such as GISAID and GenBank.

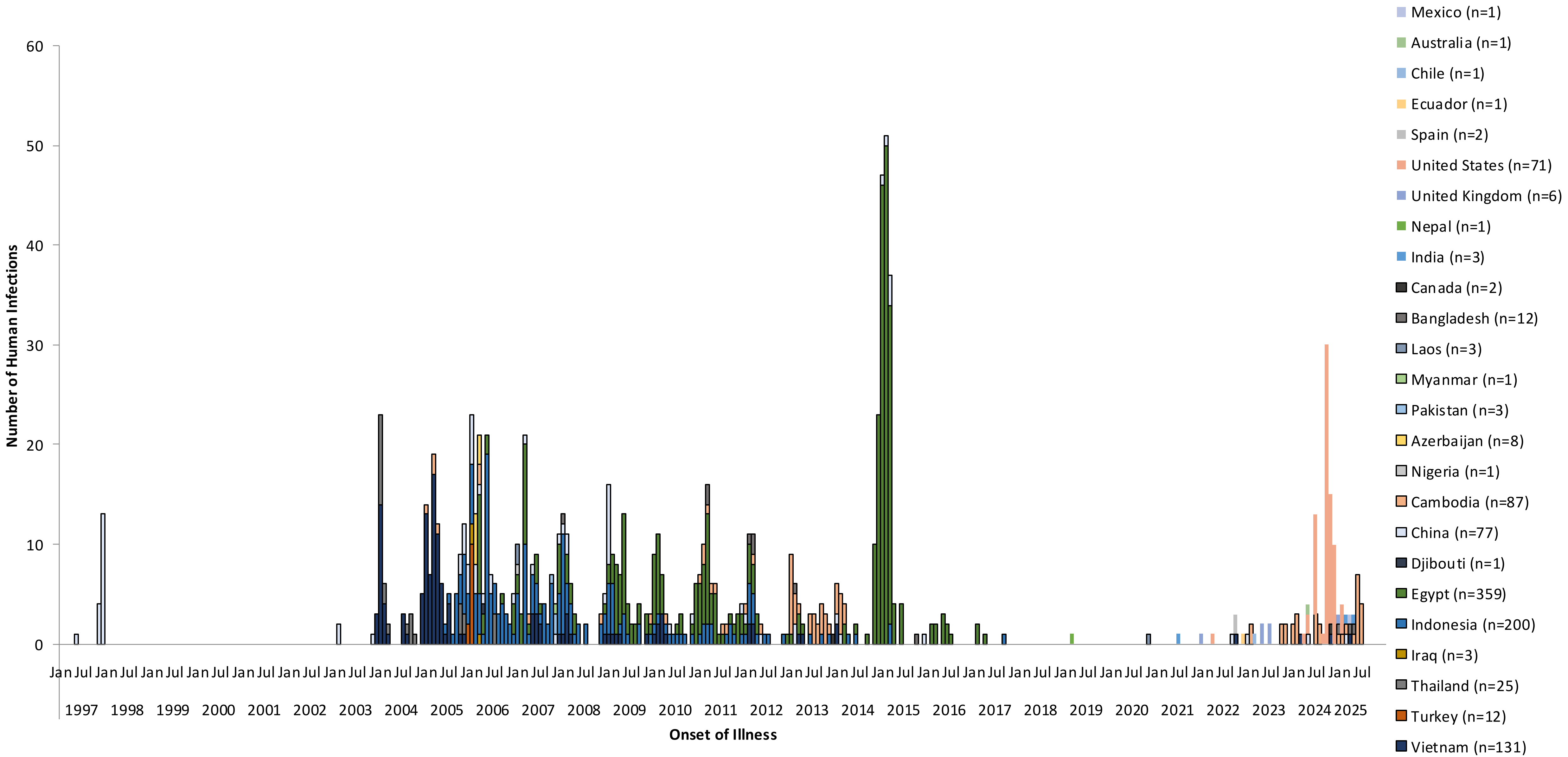


Human Infections with Avian Influenza A Viruses

Bird Flu Virus Infections in Humans

- Illness in humans from bird flu virus infections have ranged in severity from no symptoms or mild illness to severe disease that resulted in death
- The spread of bird flu viruses from one infected person to a close contact is very rare, and when it has happened, it has only spread to a few people.
    - However, because of the possibility that bird flu viruses could change and gain the ability to spread easily between people, monitoring for human infection and person-to-person spread is important for public health
- However, other subtypes of avian influenza have caused infections in humans including A(H3N8, H5N2, H5N6, H5N8, H7N2, H7N3, H7N4, H9N2, H10N3, H10N5, and H10N8)
- A(H7N9) and A(H5N1) viruses have been responsible for most human illness from bird flu viruses worldwide to date

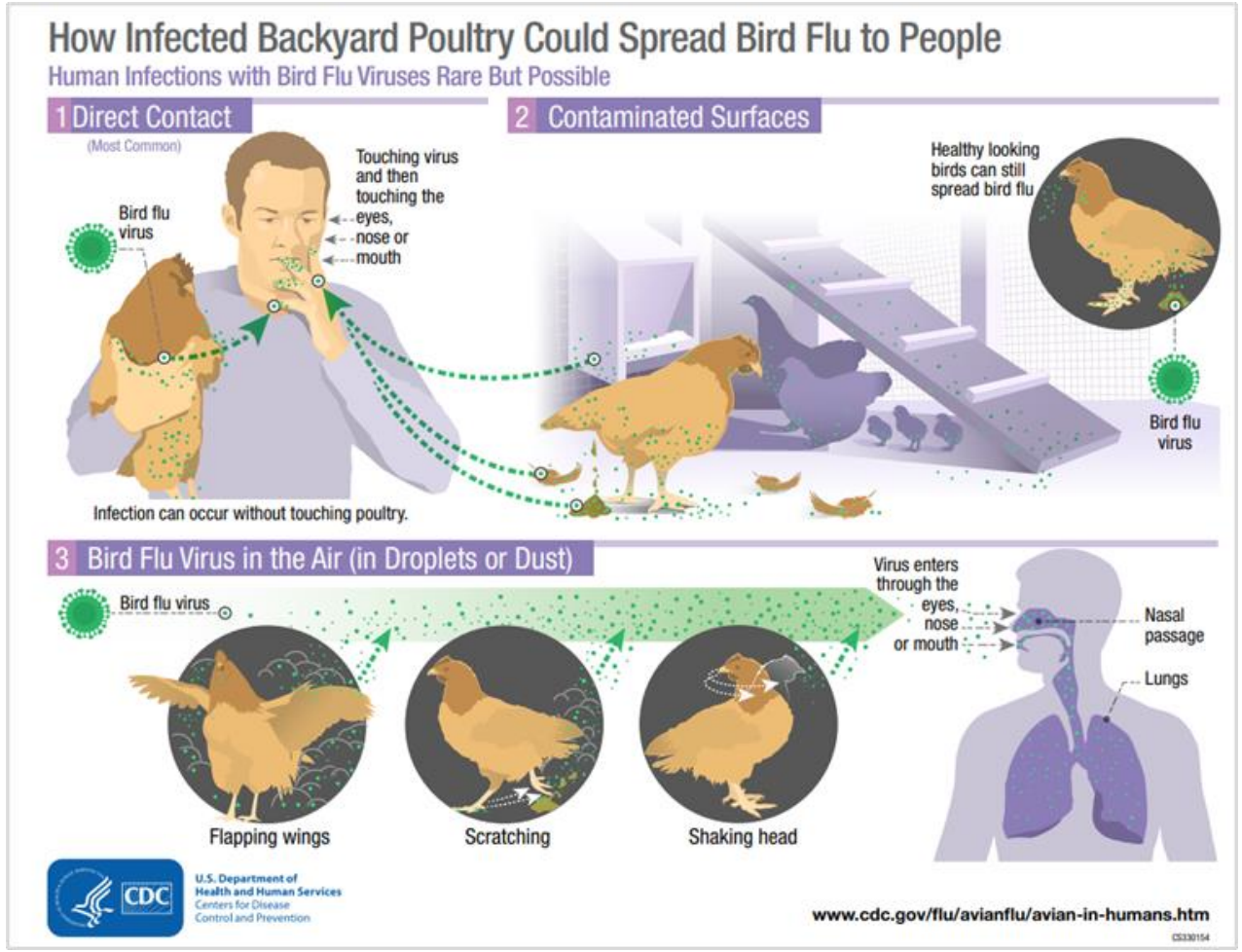
Epidemic Curve of Human Cases of A(H5N1) by Illness Onset or Report Date, 1997-2025 by Country (N=1012)



*Recent US cases of H5 also included

Human Exposures to HPAI A(H5N1) Viruses

- Historically, human infections have been the result of:
  - **Poultry exposures**
    - **Direct/close contact with sick/dead poultry**
    - Visiting a live poultry market
  - **Exposure to other infected animals**
    - **Direct contact or close exposure (swans, dairy cows)**
  - Limited, non-sustained human-to-human transmission has occurred globally in the past



Clinical Findings in A(H5N1) Cases (Worldwide)

Clinical findings in mild illness (incubation period: mean 3 days (2-7 days)

- Fever or feverishness, nonproductive cough, muscle aches, malaise, headache, sore throat, myalgia
  - Abdominal pain; vomiting and diarrhea can occur
  - Eye discomfort/redness/eye discharge (conjunctivitis) can occur 1-2 days after exposure

Progression to lower respiratory tract disease (5-7 days after symptom onset): difficulty breathing, shortness of breath, chest pain, tachypnea

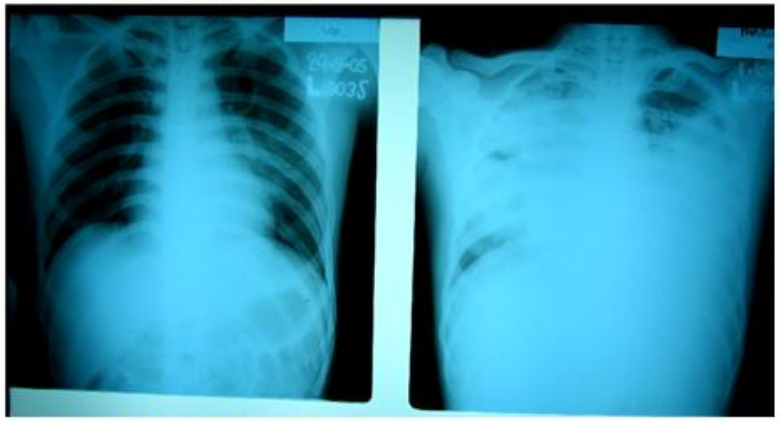
- Hospital admission findings:
  - Clinical: hypoxia, signs of pneumonia
  - Laboratory: leukopenia, lymphopenia, mild-to-moderate thrombocytopenia
  - Radiographic findings: Bilateral pneumonia: patchy, interstitial, lobar, diffuse infiltrates, opacities, consolidation

Figure 1. Conjunctivitis with Subconjunctival Hemorrhage in Both Eyes.

Uyeki NEJM 2024

37-yo woman, illness day #7
Admission CXR

Illness day #10; died day #11



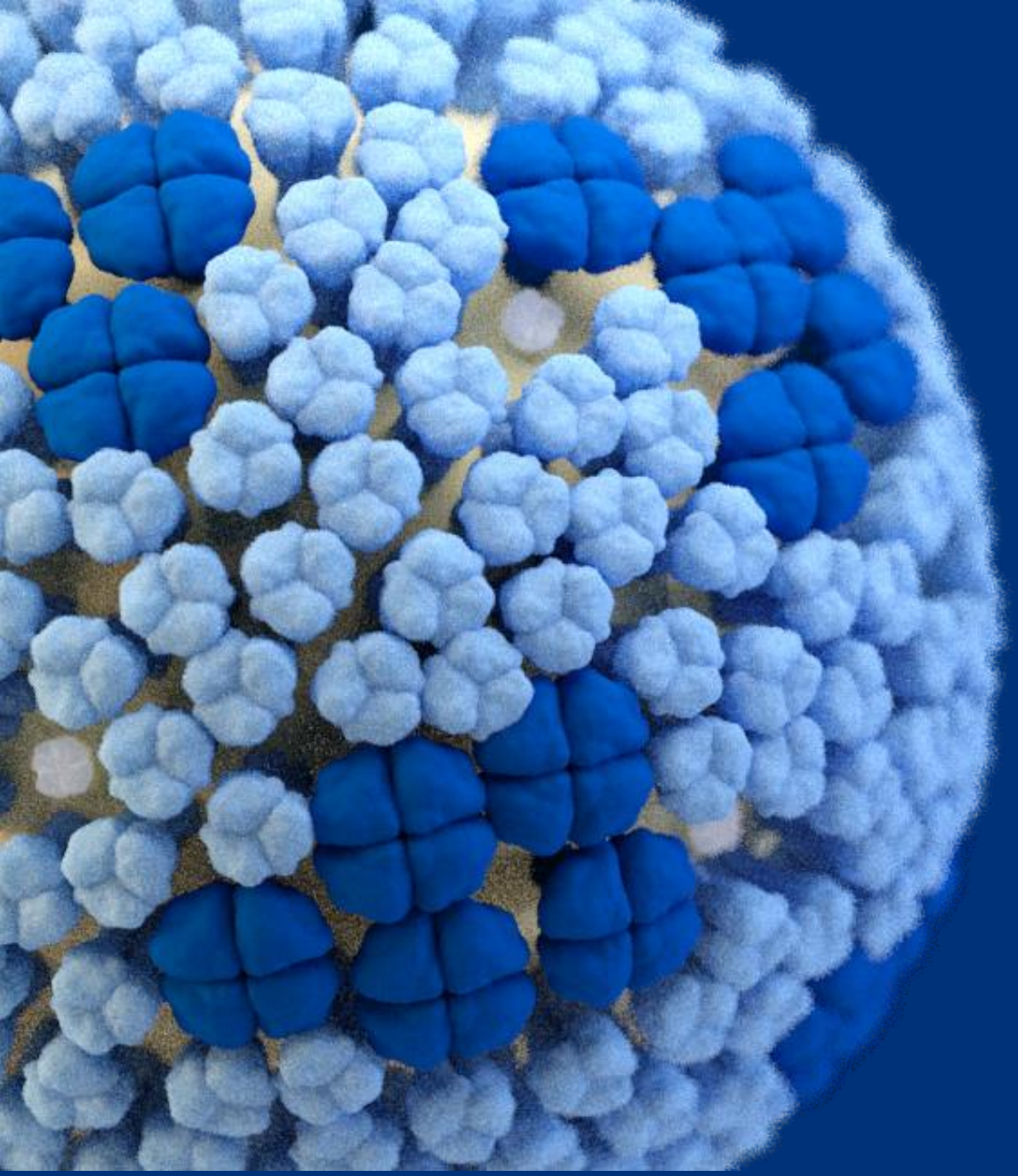
21-yo male, illness day #5
Admission CXR

Illness day #12; survived
(not ventilated)

T Uyeki, CDC September 2005

Clinical Complications of HPAI A(H5N1) Virus Infection

- **Pneumonia is the most common complication**
  - Progression to respiratory failure, and acute respiratory distress syndrome
  - Community-acquired bacterial co-infection is rare; ventilator associated pneumonia in intubated patients
- **Other complications**
  - Acute kidney injury
  - Sepsis, shock, disseminated intravascular coagulation, multi-organ failure (respiratory & renal failure)
  - Cardiac failure
  - Atypical complications
    - Encephalitis, meningoencephalitis
    - Reye syndrome with salicylate exposure
    - Spontaneous abortion



Human Surveillance, Testing, and Investigation

Protect Yourself From H5N1 When Working With Farm Animals

H5N1 is a bird flu virus that could make you sick. Wear recommended personal protective equipment (PPE) when working directly or closely with sick or dead animals, animal feces, litter, raw milk, and other materials that might have the virus.

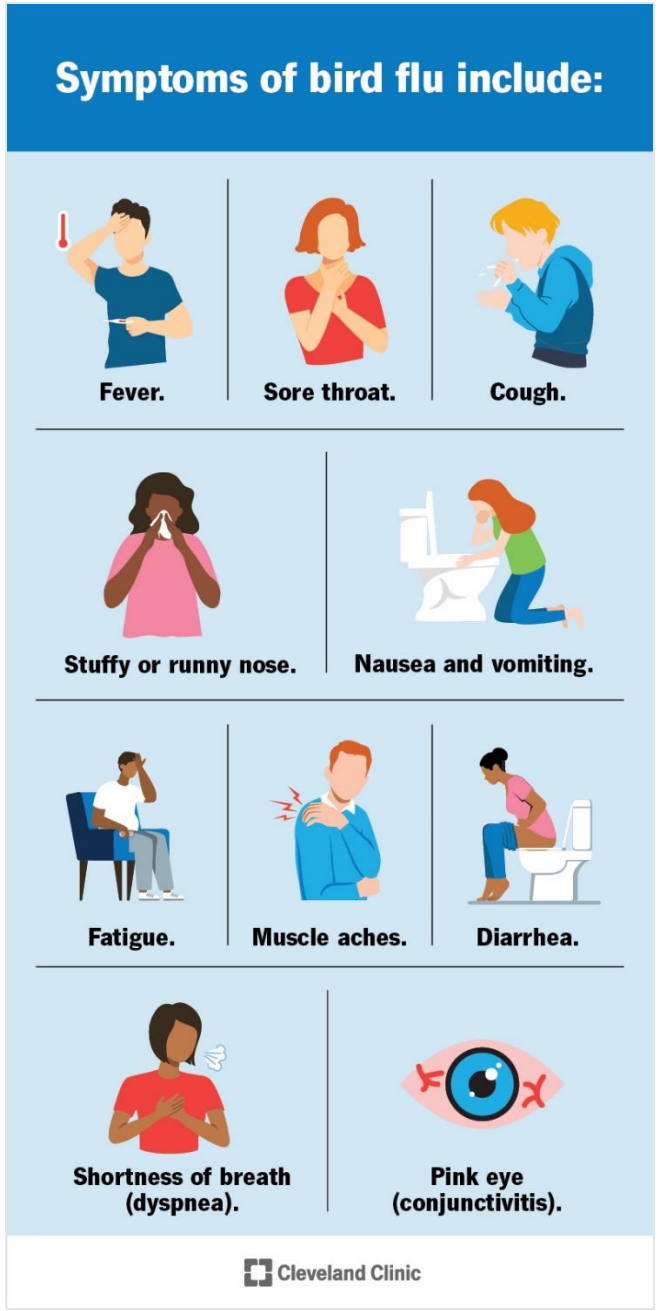
Wash hands with soap and water, then put on PPE in this order:

1. Fluid-resistant coveralls
2. Waterproof apron, if needed for job task
3. NIOSH Approved® Respirator (e.g., N95® filtering facepiece respirator or elastomeric half mask respirator)
4. Properly-fitted unvented ***or*** indirectly vented safety goggles or face shield
5. Head cover or hair cover
6. Gloves
7. Boots

Scan to learn how to put on and take off a respirator

Symptom Monitoring

- All people with direct or close exposure to infected animals **should be monitored for illness during exposure and for 10 days after their last exposure.**
- Signs/symptoms may include:
  - feeling feverish, cough, sore throat, runny or stuffy nose, muscle or body aches, headaches, fatigue, **eye redness (or conjunctivitis)**, shortness of breath or difficulty breathing
  - less commonly, diarrhea, nausea, vomiting, or seizures
- If signs/symptoms develop in person with relevant exposure, recommend they seek medical care and testing and isolate

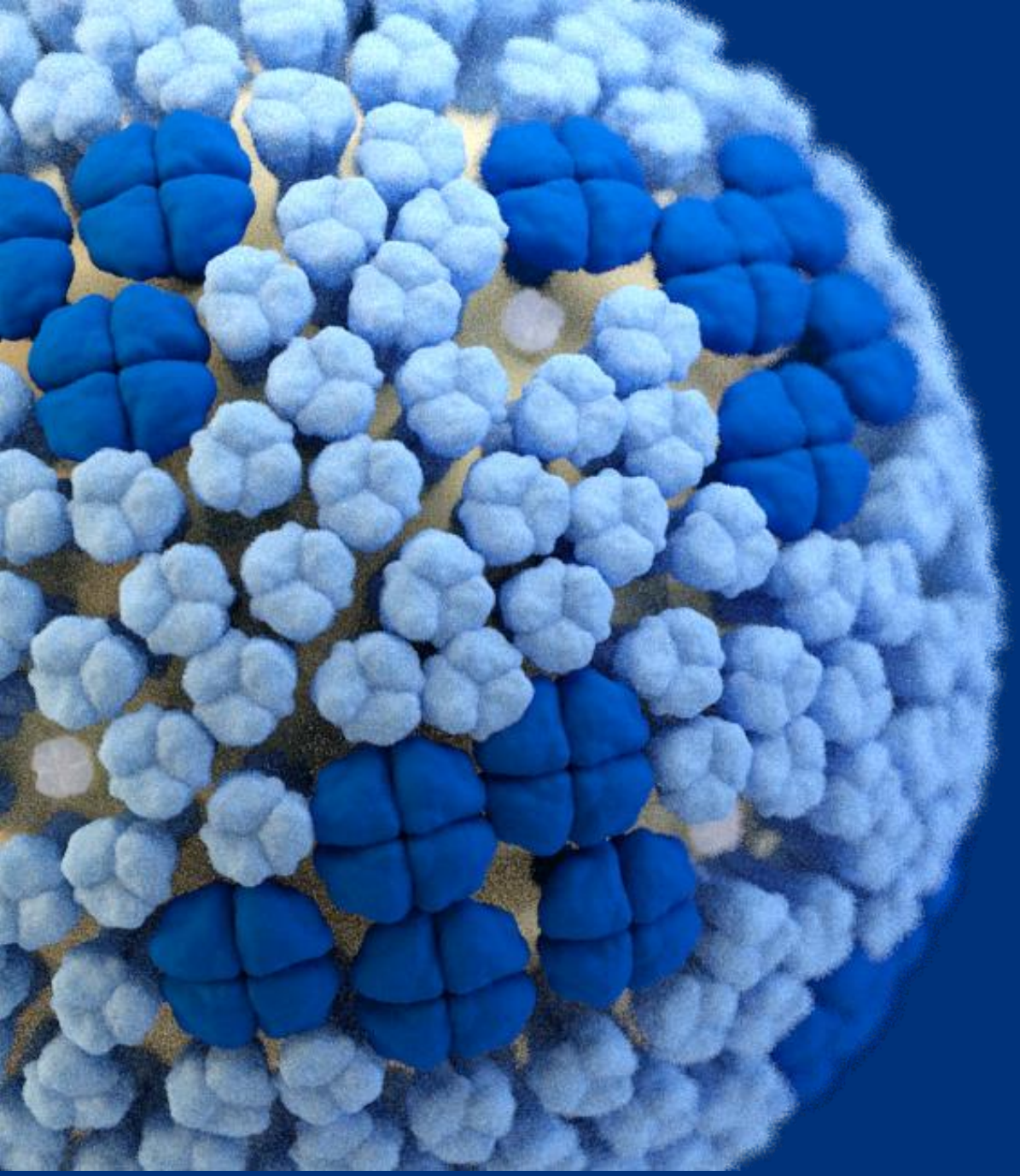


https://www.who.int/publications/i/item/B09337

Criteria for Avian Influenza A Virus Testing

- Testing should be performed on persons who meet Epidemiologic **AND** Clinical criteria or Public health response criteria
  - Epidemiologic Criteria
    - Close contact with a person who is a suspected or confirmed AIV case
    - Exposure in areas where animals or humans have been with suspected or confirmed AIV
    - Visiting, working, or living in setting with infected animal
    - Handling AIV samples in a lab setting
  - Clinical Criteria
    - Persons with signs and symptoms consistent with acute or lower respiratory tract infection or conjunctivitis, or complications of acute respiratory illness without an identified cause
  - Public Health Response
    - Asymptomatic persons whom public health authorities determine that testing is necessary.
    - Asymptomatic persons who meet another locally adapted case definition

https://www.who.int/publications/i/item/B09337



Specimen Collection & Storage

Influenza Testing (Outpatients)

- **If AIV infection is suspected (use recommended PPE*):**
  - **<u>Patients with acute respiratory symptoms</u>:**
    - **Collect (1) a nasopharyngeal swab, and (2) combined nasal and throat swab specimens**
      - **Place each specimen into separate tubes of viral transport media**
  - **<u>Patients with conjunctivitis</u>:**
    - **Collect (1) a conjunctival swab, and (2) a nasopharyngeal swab**
      - » **Place each specimen into separate tubes of viral transport media**

➢ **Influenza A virus subtyping and A(H5) virus testing at a public health laboratory**

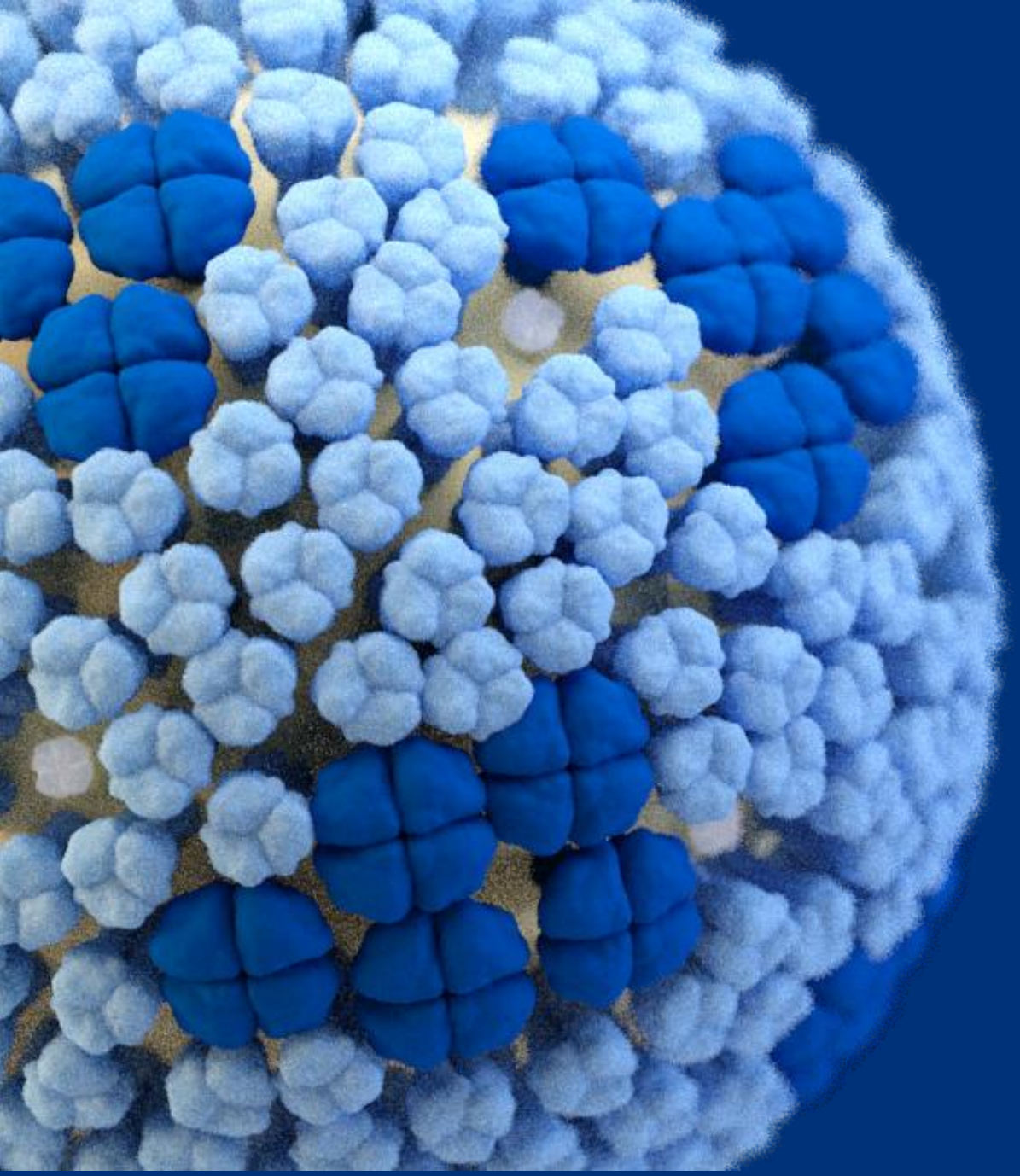
- ***Clinical tests may not be able to differentiate A(H5N1) virus from seasonal influenza A(H3N2) and A(H1N1)pdm09 viruses***
  - ***Need to perform subtyping of influenza A viruses (H1, H3), and A(H5) assays (possibly A(H7) and A(H9))***

*PPE: gown, gloves, NIOSH approved N95 filtering facepiece respirator, eye protection

Influenza Testing (Hospitalized Patients)

- **Infection Prevention and Control Measures**
  - Place patient in an **airborne infection isolation room with negative pressure**
  - Recommended PPE: **gown, gloves, NIOSH approved N95 filtering facepiece respirator, eye protection**

- **Patients with lower respiratory tract disease**
  - ***Collect multiple respiratory specimens from different sites on multiple days for patients with suspected HPAI A(H5N1) virus infection to maximize potential for diagnosis***
  - Collect **upper respiratory specimens** (NP swab, combined nasal & throat swabs), and **sputum** for influenza A and A(H5) virus testing at public health laboratories
  - Intubated patients: Also collect **endotracheal aspirate specimens (or BAL fluid)**



Laboratory and Epidemiology Coordination and Collaboration within Novel Influenza Virus Responses

Importance of Epidemiology–Laboratory Collaboration in H5N1 Investigations

- Rapid case confirmation
- Accurate case definitions & surveillance
- Targeted testing & resource use
- Faster outbreak detection & control
- Stronger data quality & linkage
- Informed public health guidance
- Improved preparedness for future threats

Monitoring of Exposed Persons in the United States

Targeted H5 surveillance (since March 24, 2024)

Note: Targeted H5 surveillance data will be updated on the first Friday of every month.

Total people monitored	Total people tested	Human cases
18,600+ after exposure to infected animals	**880+** after exposure to infected animals	**64** cases detected through targeted H5 surveillance

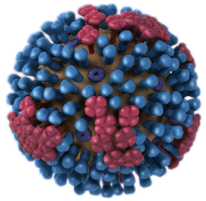
National flu surveillance (since February 25, 2024)

Note: National flu surveillance data will be updated on the first Friday of every month.

Specimens tested	Human cases
204,843+ specimens tested that would have detected influenza A(H5) or other novel influenza viruses	**6** case detected through national flu surveillance

CDC Influenza Risk Assessment Tool (IRAT)

- **Evaluative tool for prioritizing resources for pandemic preparedness**
- **Emergence** is the risk of a novel influenza virus acquiring the ability to spread easily and efficiently in people
- **Public health impact** is the potential severity of human disease caused by the virus, the burden on society if a novel influenza virus were to begin spreading efficiently and sustainably among people
- Viruses scored using 10 risk elements by USG SMEs for emergence and public health impact



Virus

1. **Genomic variation**
2. **Receptor binding**
3. **Transmission in Laboratory animals**
4. **Antivirals and Treatment Options**

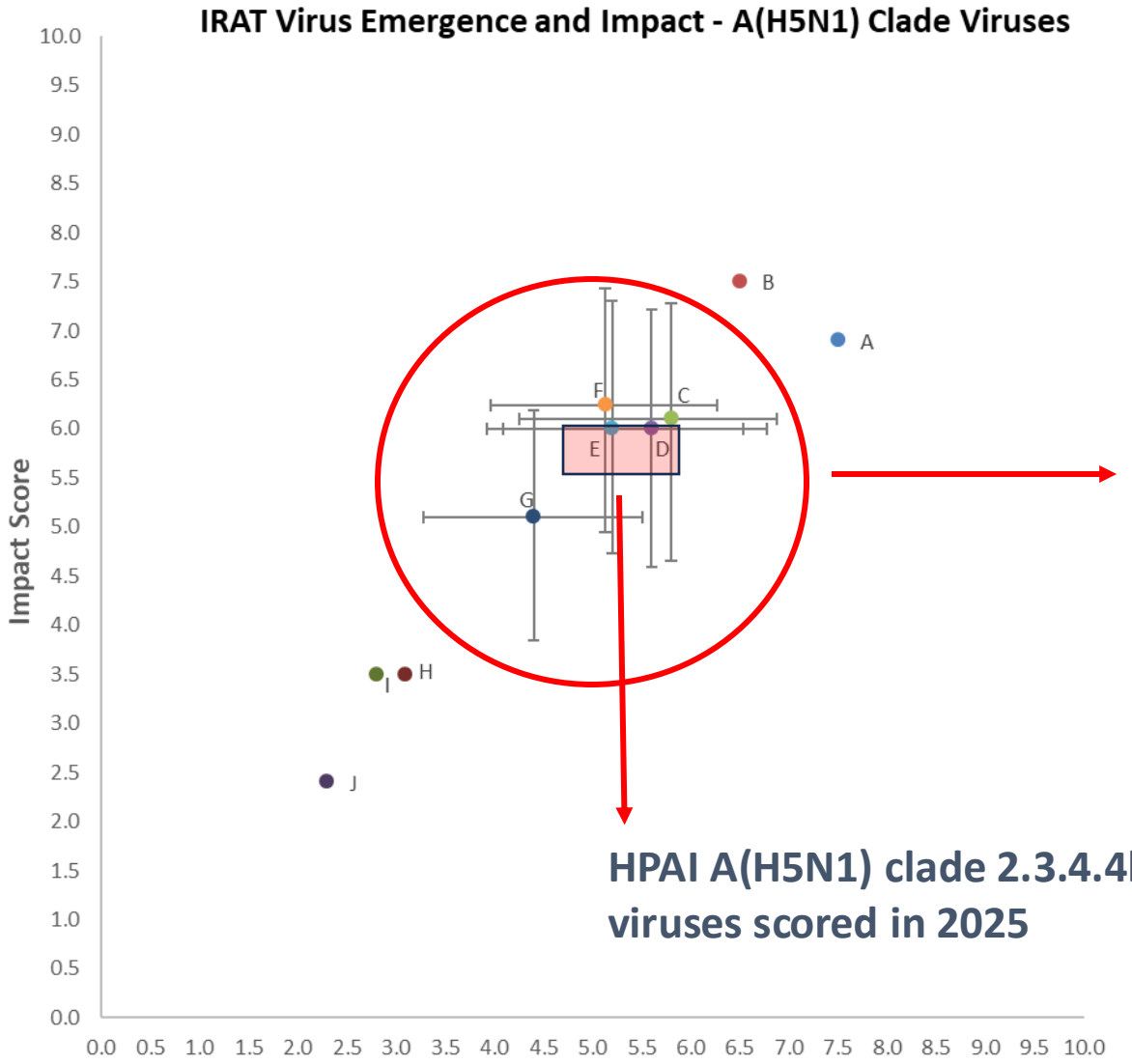
Population

5. **Existing Population Immunity**
6. **Disease Severity and Pathogenesis**
7. **Antigenic Relationship to Vaccine Candidates**

Ecology

8. **Global Geographic Distribution**
9. **Infection in Animals, Human Risk of Infection**
10. **Human Infections and Transmission**

Influenza Risk Assessment Tool (IRAT) for Potential Pandemic Risk



HPAI A(H5N1) clade 2.3.4.4b viruses

HPAI A(H5N1) clade 2.3.4.4b viruses scored in 2025

[Influenza Risk Assessment Tool (IRAT) | Pandemic Influenza (Flu) | CDC]

Importance of Genetic Characterization in Avian Influenza Investigations

- Traces viral origin & evolution
- Detects mutations affecting spread
- Guides antivirals & vaccine development/recommendations
- Differentiates strains for outbreak monitoring
- Strengthens global surveillance
- Informs public health risk assessment

H5 Human Cases – Virus Characterization to Date

Overall findings: Viruses maintain primarily avian genetic characteristics; lack changes that would make the virus better adapted to infect or spread among humans

- **Diagnostics**: No impact to current CDC influenza diagnostic assay's ability to detect A(H5N1) viruses
- **Anti-viral Susceptibility**:
  - 3 WA cases: reduced susceptibility to oseltamivir, no expected impact on effectiveness of oseltamivir
  - 1 CA case: reduced susceptibility to baloxavir, which is currently not a recommended antiviral treatment
- **Candidate Vaccine Viruses** (CVVs)
  - HA of human influenza virus very closely related to **available CVVs**
  - Vaccines made with CVVs would be expected to provide protection against this virus
  - The U.S. Government is developing vaccines against avian influenza A(H5N1) viruses in case they are needed

How CDC is monitoring influenza data among people to better understand the current avian influenza A (H5N1) situation | BirdFlu | CDC

Benefits of Epi–Lab Coordination in Seroprevalence Studies

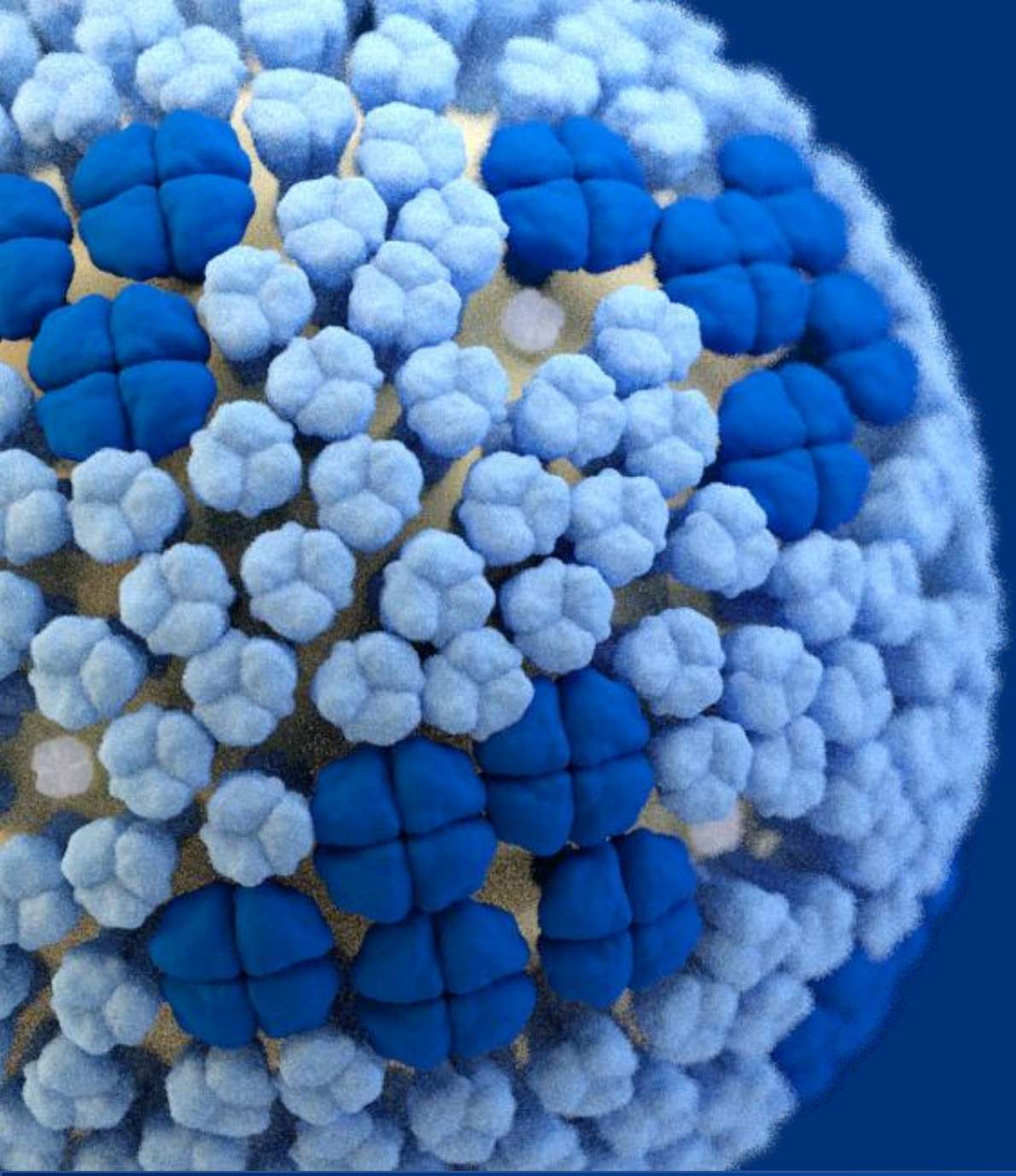
- Stronger study design & assay selection
- Accurate assessment of past infections
- Higher data quality & reliability
- Integrated interpretation of results
- Guides prevention & policy decisions
- Contributes to global understanding

Seroprevalence Studies

- **Serostudies with Michigan and Colorado**
  - Findings published in **MMWR**
  - Provided better understanding of farmworker exposure and risk, including asymptomatic infection
  - Resulted in CDC updating guidance to strengthen prevention activities

- **Serosurvey with Ohio Department of Health and American Association of Bovine Practitioners**
  - *Notes from the Field* published in MMWR
  - Identified recent infection in people who did not recall symptoms and in individual who worked in a state without known animal detection
  - Elevates need for faster, systematic detection of positive herds

https://www.cdc.gov/mmwr/volumes/73/wr/mm7344a2.htm?s_cid=mm7344a2_w
https://www.cdc.gov/mmwr/volumes/74/wr/mm7404a2.htm?s_cid=mm7404a2_w



Influenza A(H5N1)
Case Investigation
Sithor Kandal District
Prey Veng Province

March 2, 2023

Background

- Cambodia's first H5N1 case was reported in 2005; between 2005 and 2014 Cambodia reported 56 H5N1 cases, of which 66% were fatal
  - Certain types of H5N1 are endemic in poultry in Cambodia, and historically sporadic infections in humans in Cambodia have occurred and are expected
- CDC has supported influenza surveillance and investigations in Cambodia including:
  - Supporting severe acute respiratory infection surveillance and diagnostics since 2006
  - Training Cambodia government staff in both the health and animal sector on multidisciplinary rapid response for novel influenza investigations
  - Having an influenza subject matter expert on the ground to support capacity building and investigations

Overview

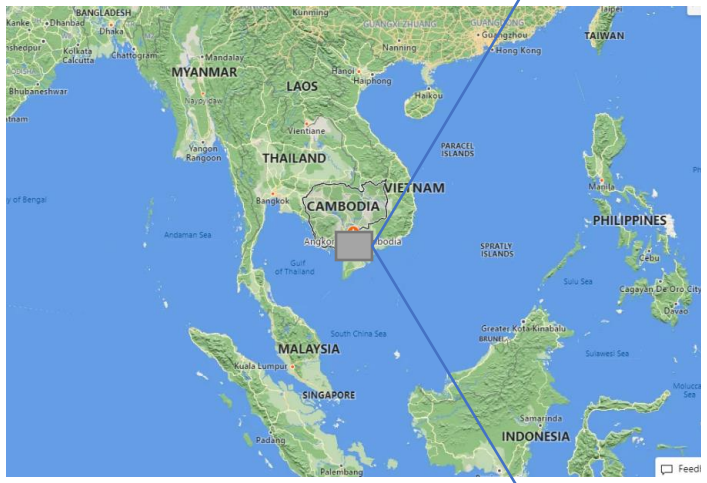
- On February 23, 2023, Cambodia's National Influenza Surveillance System reported a human case of influenza A(H5N1) at the National Pediatric Hospital in Phnom Penh
- The case was an 11-year old girl from in Prey Veng Province
- Ministries of Health, Agriculture, and Environment immediately initiated investigation and response activities

Field Investigation: H5N1 Case Village setting

- Village Population: 1952
  - Number of Families: 375
- Predominant economy/occupation of village inhabitants: agriculture/famers
- There are family fed backyard poultry (Dec 2022 information)
  - Chicken: 7563 head
  - Duck: 1500 head
- Since early Feb there have been reports of ill poultry:
  - Chicken deaths: 22
  - Duck deaths: 3

Objectives of the Investigation

- To identify the mode of transmission
- To actively find additional cases
- To see if there is human to human transmission
- To implement control measure including case management



Prey Veng province also borders Vietnam

Residence of H5N1 case In Prey Veng Province

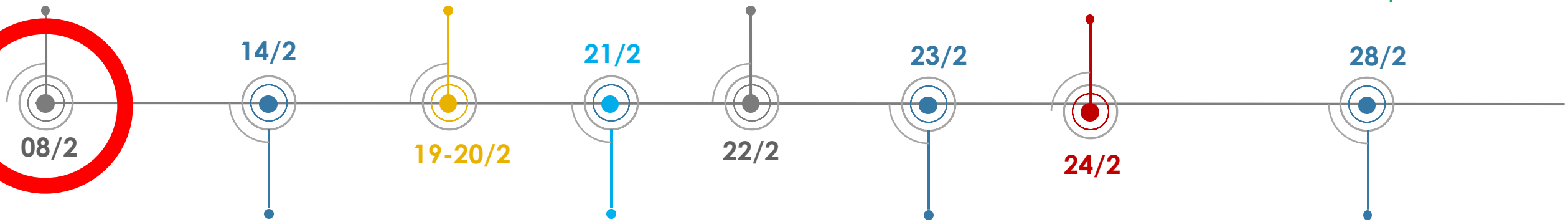
Prey Veng Province also reported wild bird deaths in early Feb 2023

Objective 1: To identify the mode of transmission

- Chicken coop at the house where the girl lived
  - Chicken climb up the ladder
  - Roost in the nest
- 2 chickens died 8 Feb at the house, 6 days before onset of illness (Feb 14)
- Father was called to get poultry
  - He butchered and cooked it at his house (high-risk behavior)
  - He and his son ate the poultry, son not ill/neg (no risk for eating cooked chicken)
- Assumption: chicken were positive for H5N1 (no test results yet)

H5N1 Case and Exposure timeline 2023

Note all dates are DD/M format



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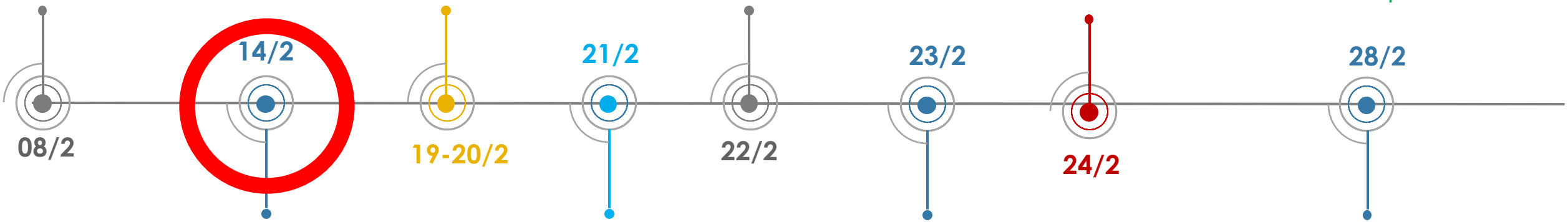

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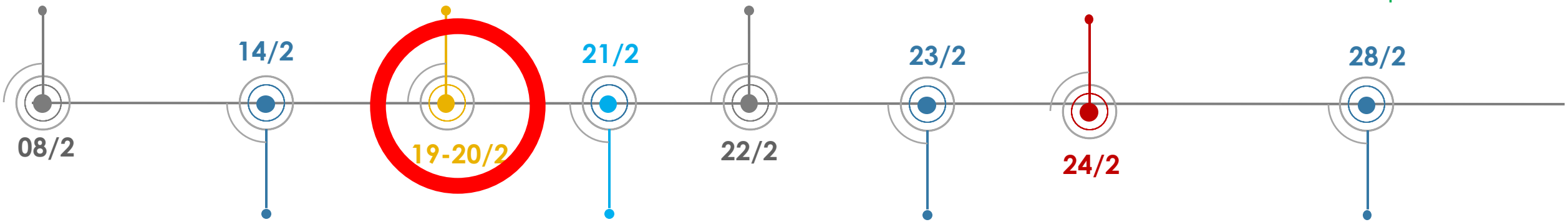

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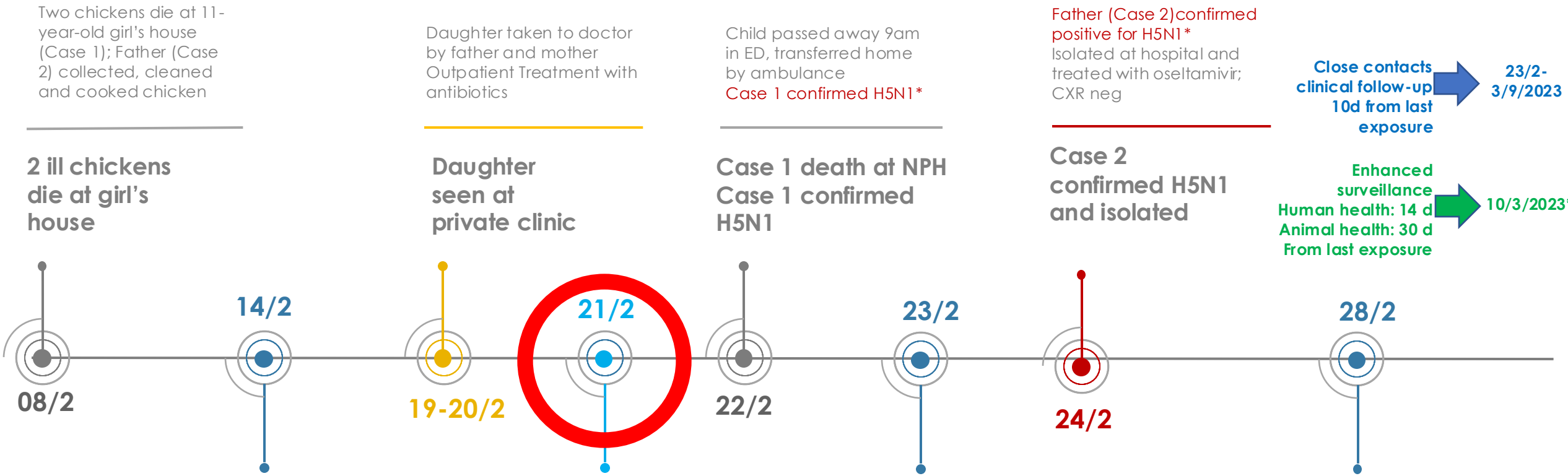

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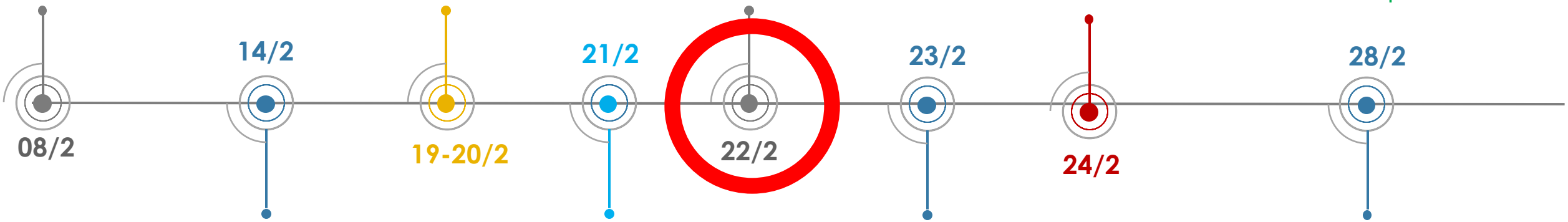

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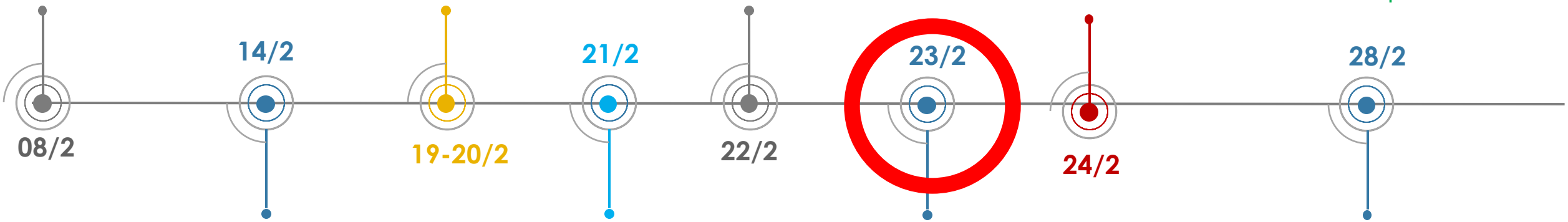

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Objective 2: To actively find additional cases

- Contract tracing
  - Close contacts of both cases were identified through interviews
  - First few days, contacts were swabbed and tested for H5N1,
  - For 10 days, contacts reported symptoms and temperature to investigators. If symptoms were reported, contacts were swabbed and tested for H5N1
  - Results
    - 49 contact (29 village and 20 health care worker NPH)
    - 29/29 villages and 3/20 HCW swabbed
    - 4 had symptoms
      - The father (Case 2) tested positive for H5N1
      - 3 HCW tested negative
    - Other respiratory pathogens are circulating
- Enhanced surveillance
  - At district hospital and clinics all respiratory cases tested for SARS CoV-2, influenza A, influenza B and influenza H5 by PCR
  - Results
    - No increased in ILI or SARI cases
    - 19 people tested, all tested negative for H5

H5N1 Case and Exposure timeline 2023

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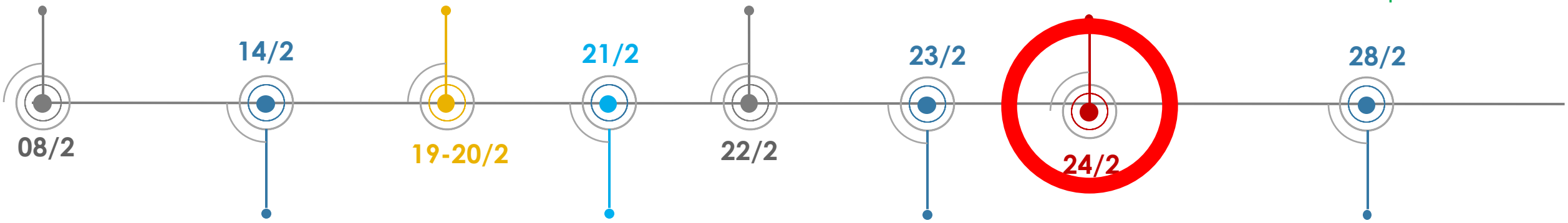

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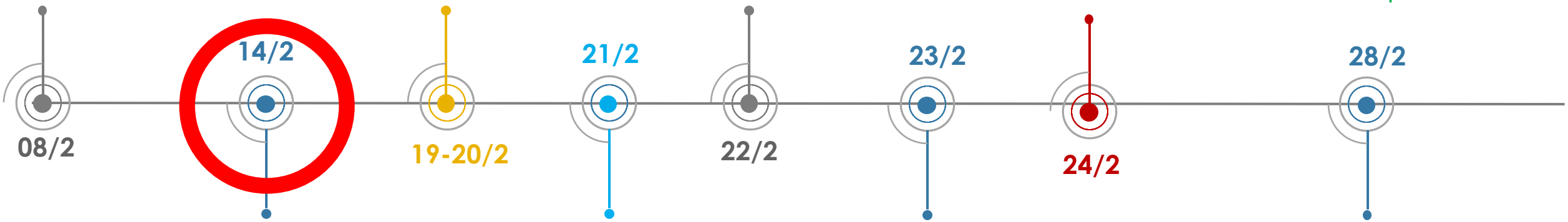

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Objective 3: To see if there is human to human transmission

- Findings supporting lack of person-to-person transmission
  - Two cases had exposure to the same sick and dead poultry
  - Two cases had onset of symptoms on the same day
  - No additional cases identified despite aggressive contact tracing, testing, and enhanced surveillance

Objective 4: To implement control measure including case management

- Isolate ill persons
  - Father isolated in hospital until symptom free and tested negative for H5N1
- Removed dead poultry, culling Mar 2
- Disinfection in the village, school
- Health education in the village
  - Started on Feb 27
  - 91 children and ~40 adults
  - What to do if experiencing signs and symptoms, handling sick and dead poultry

H5N1 Case and Exposure timeline 2023

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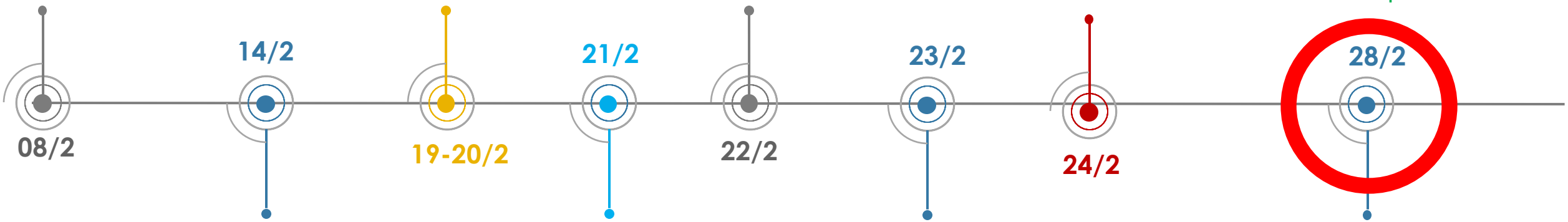

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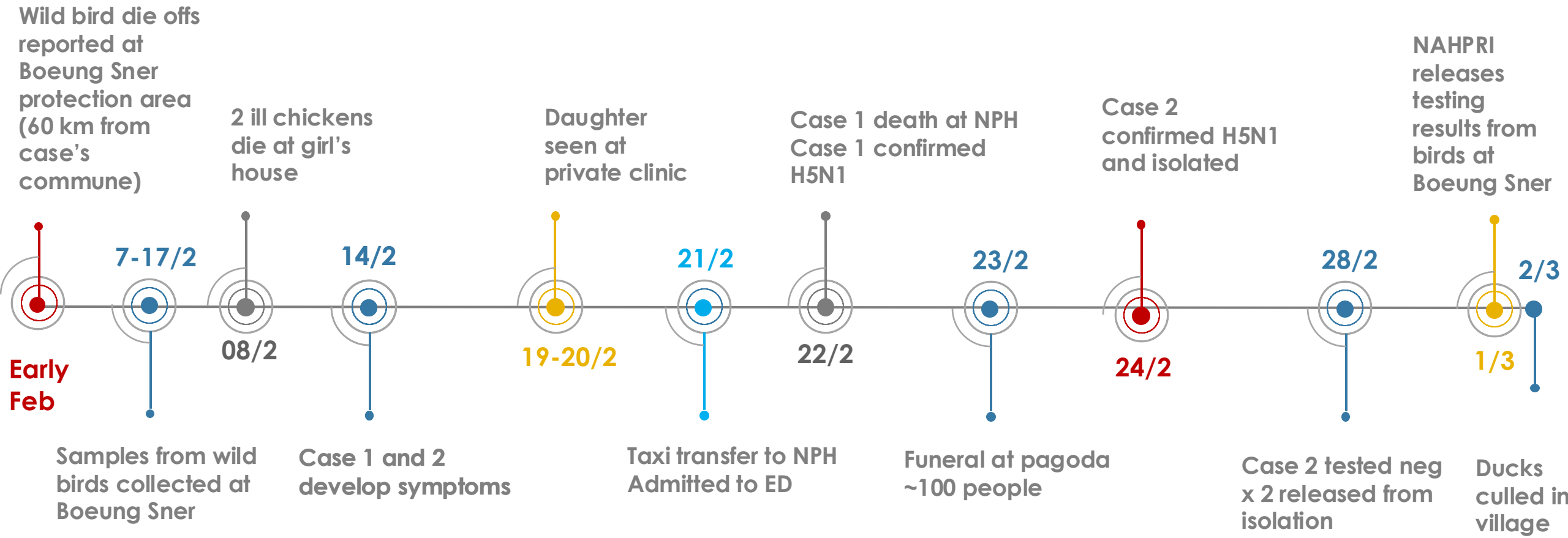

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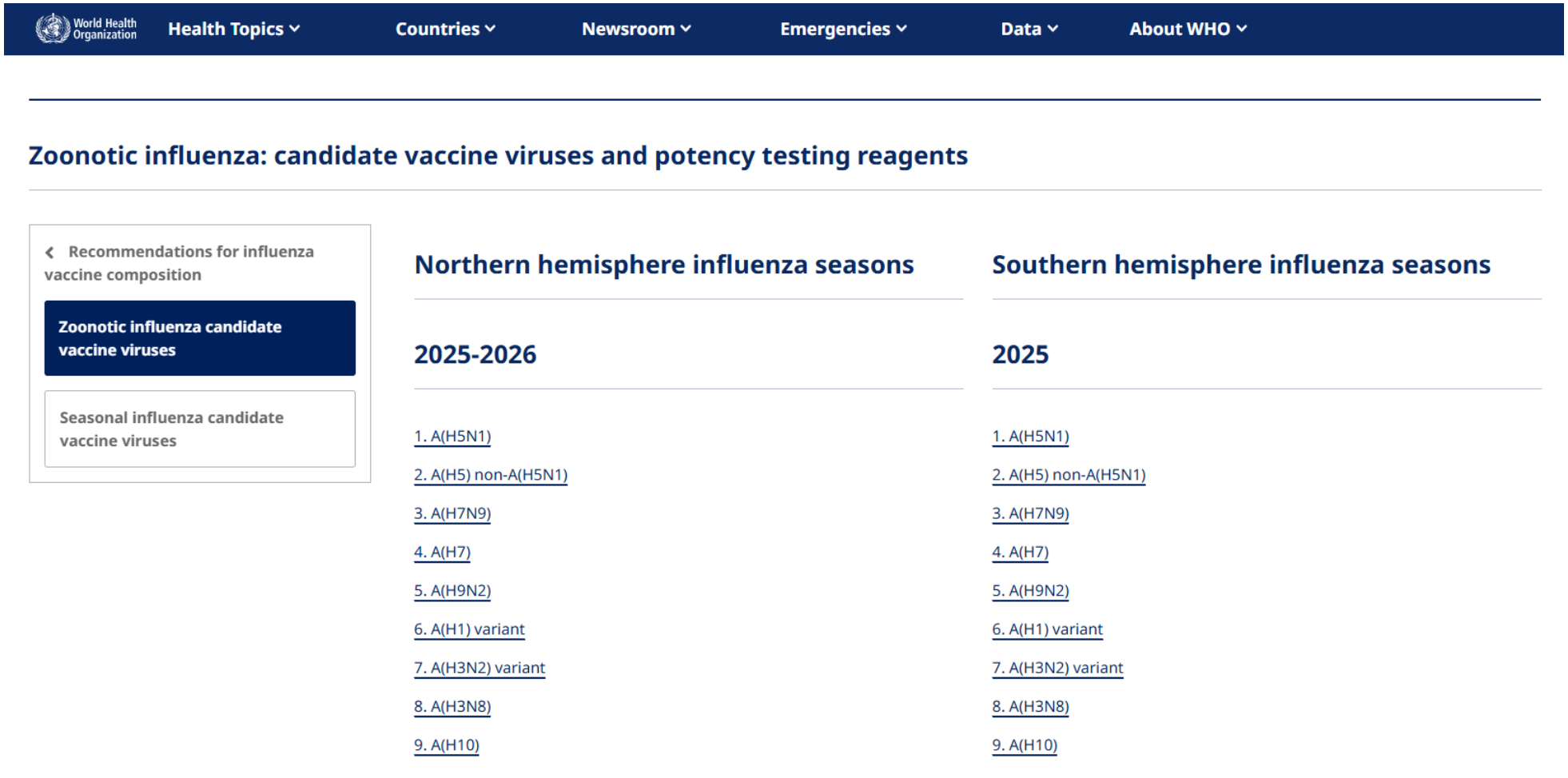
Findings of the Investigation

- Two human cases of H5N1 clade 2.3.2.1c with exposure to poultry, and no indication of human to human spread
  - This clade has been circulating in poultry and wildlife in Cambodia for many years
  - Different clade than the one spreading among wild birds and poultry in the U.S. (clade 2.3.4.4b)
- No additional cases were identified from follow up of close contacts and enhanced surveillance for influenza-like illness in the village

- Recommendations
  - Continue to ensure good quality severe acute respiratory infection surveillance
  - Educate health care providers and locals on avian influenza
- CDC lab engaged with Institut Pasteur du Cambodge to receive isolated virus specimens from the cases for additional studies

Zoonotic influenza: candidate vaccine viruses



Phylogenetic analysis of HA genes from Cambodia 2.3.2.1e human viruses

Mature HA1	A/duck/Vietnam/NCVD-1584/2012	A/Cambodia/NPH230032/2023	A/Cambodia/KSH230332/2023	A/Cambodia/24020179/2024_H5N1	A/Cambodia/24020155/2024_H5N1	A/Cambodia/24070331/2024	A/Cambodia/i0125001G/2024	A/Cambodia/SVH240441/2024	A/Cambodia/KSH240409/2024	A/Vietnam/KhanhhoaRV1-005/2024	annotation
15	Q	K									
28	H	Q	Q	Q	Q	Q	Q	Q	Q	Q	
71	T		I	I	I	I	I	I	I	I	
86	A	V									
88	D										
94	N	S									
97	D								N		
120	D	N		N	N	N	N	N	N	N	
121	S										
134	A	T									
140	N								S		Antigenic site A
154	D	N		N	N			N	N	N	Antigenic site B
155	N										Antigenic site B
163	G	D	D	D	D	D	D	D	D	D	
183	D										Antigenic site B
188	T										Antigenic site B
189	R		K	K	K	K	K	K	N	K	Antigenic site B
195	T									S	
212	K	R									
217	S	P	P	P	P	P	P	P	P	P	
223	S								R		Antigenic site D
257	V	I									
269	V		A	A	A	A	A	A	A	A	
270	E	K	Q	Q	Q	Q	Q	Q	Q	Q	
#aadiff		12	7	9	9	8	8	9	12	10	vs A/duck/Vietnam/NCVD-1584/2012

Cambodia 2.3.2.1e human viruses showed reduced cross-reactivity

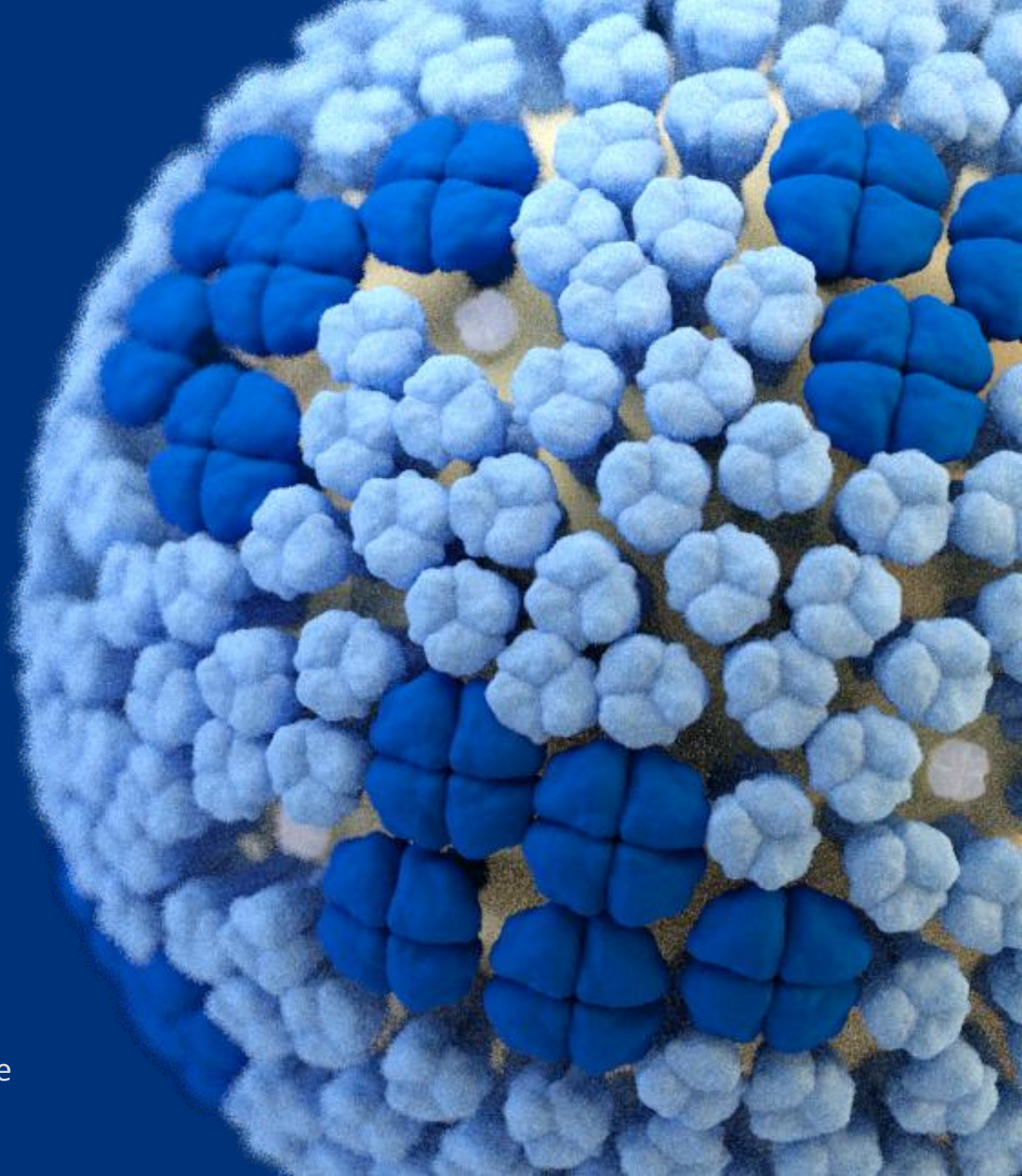
Table 2. Haemagglutination inhibition assay of A(H5) clade 2.3.2.1e viruses

			Post-infection ferret antisera		
Reference antigens	**Subtype**	**Clade**	**SJ001**	**duck/VN/ 1584**	**NIBRG-301**
SJ001 (A/duck/Bangladesh/19097/2013-like)	H5N1	2.3.2.1a	**80**	80	160
A/duck/Viet Nam/NCVD-1584/2012	H5N1	2.3.2.1e	20	**80**	160
NIBRG-301 (A/duck/Viet Nam/NCVD-1584/2012)	H5N1	2.3.2.1e	80	160	**640**
Test antigens					
A/Cambodia/24020155/2024 (January 2024)	H5N1	2.3.2.1e	<10	40	80
A/Cambodia/24020179/2024 (February 2024)	H5N1	2.3.2.1e	<10	20	80
A/Cambodia/SVH240441/2024 (July 2024)	H5N1	2.3.2.1e	<10	20	40
A/Viet Nam/Khanh Hoa/RV1-005/2024 x PR8	H5N1	2.3.2.1e	<10	20	80

Clade 2.3.2.1 A(H5) Candidate Vaccine Virus Development

Candidate vaccine viruses	Subtype	Clade	Availability
SJRG-166615, A/common magpie/Hong Kong/5052/2007	H5N1	2.3.2.1	Yes
IDCDC-RG30, A/Hubei/1/2010-like	H5N1	2.3.2.1a	Yes
SJ007, A/duck/Bangladesh/19097/2013	H5N1	2.3.2.1a	Yes
IDCDC-RG63A, A/duck/Bangladesh/17D1012/2018-like	H5N1	2.3.2.1a	Yes
SJ003, A/barn swallow/Hong Kong/D10-1161/2010	H5N1	2.3.2.1b	Yes
NIBRG-301, A/duck/Vietnam/NCVD-1584/2012	H5N1	2.3.2.1e	Yes
SJ009, A/chicken/Guiyang/1153/2016	H5N1	2.3.2.1d	Yes
IDCDC-RG75A, A/chicken/Ghana/20/2015-like	H5N1	2.3.2.1f	pending
A/Cambodia/SVH240441/2024-like	H5N1	2.3.2.1e	pending
A/Victoria/149/2024-like	H5N1	2.3.2.1a	pending

Thank you



"The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of [the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry]."

Antiviral Treatment

- **Oseltamivir treatment is recommended as soon as possible for patients who are suspected, probable or confirmed cases of A(H5N1)**
  - Current HPAI A(H5N1) clade 2.3.4.4b viruses are generally susceptible to oseltamivir and other FDA-approved antivirals for seasonal influenza
  - **Observational studies suggest survival benefit with early initiation of oseltamivir treatment compared to no treatment or later initiation of treatment**
- No data for baloxavir treatment of A(H5N1) patients, optimal dosing and duration are unknown

Adisamito J Infect Dis 2010; Adisamito J Infect Dis 2011; Kandun Lancet 2008; Liem Clin Infect Dis 2009; Yu PLoS ONE 2008

Antiviral Treatment For Clinically Mild Illness

- **If A(H5N1) virus infection is suspected:**
  - **Start empiric antiviral treatment with Oseltamivir as soon as possible** (while awaiting testing results)
  - **Recommend home isolation for mild illness, notify local and state public health for testing, monitoring and follow-up as soon as possible**
  - **If A(H5N1) virus infection is confirmed: home isolation**
    - Consider: until clinically improved or repeat respiratory specimens are negative for influenza

Antiviral Post-Exposure Prophylaxis

- **Post-exposure antiviral prophylaxis**
  - If A(H5N1) virus infection is confirmed, **household and other close contacts are recommended to receive Oseltamivir at treatment dosing as soon as possible** (twice daily x 5 days; longer duration for ongoing exposures)
    - » **Monitor for any illness signs/symptoms x 10 days after the last exposure**
    - » **Offer to persons with high-risk exposures to infected animals**