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Avian Influenza- an animal and human risk

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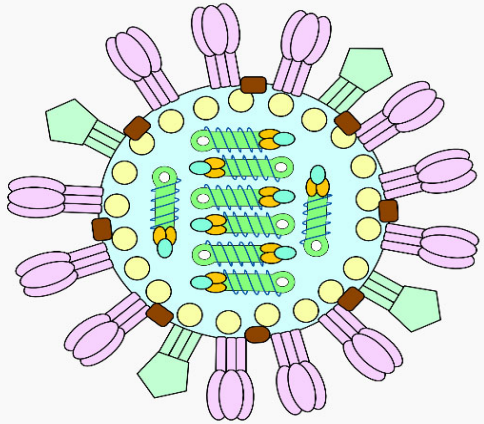
Influenza A virus

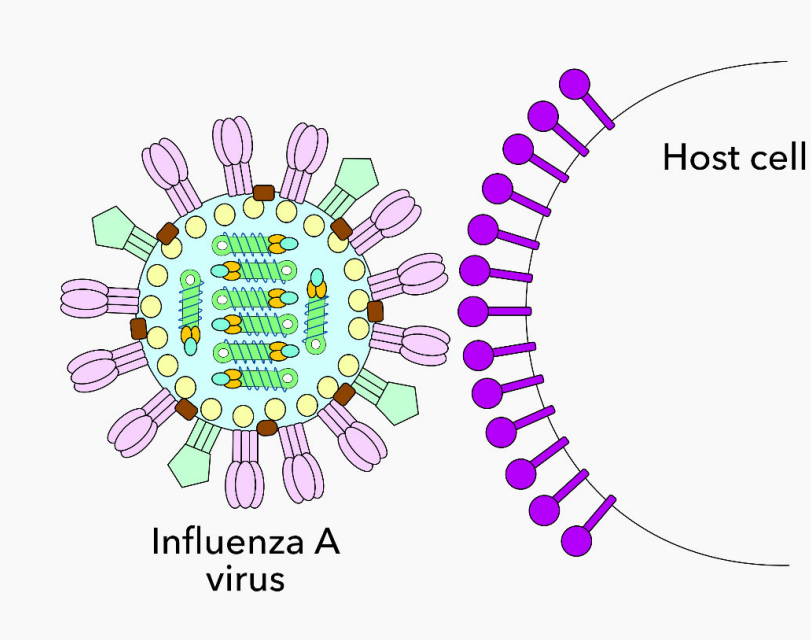


Influenza A virus

- Seasonal epidemics in humans
- Pandemic potential
- Natural reservoir: animals – wild aquatic birds
- Subtypes: surface glycoproteins hemagglutinin (HA) and neuraminidase (NA)
  - Current endemic subtypes : H3N2 and H1N1 in humans and H5N1 in wild birds

Animal-to-human transmission

- Adaptation in the viral lifecycle: replication /polymerase activity, evasion of host responses, assembly
- **Changes in receptor specificity**



Human receptors

Avian receptors

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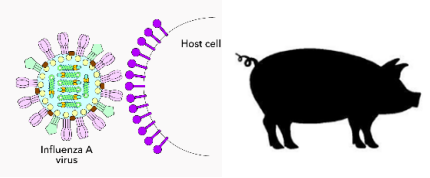
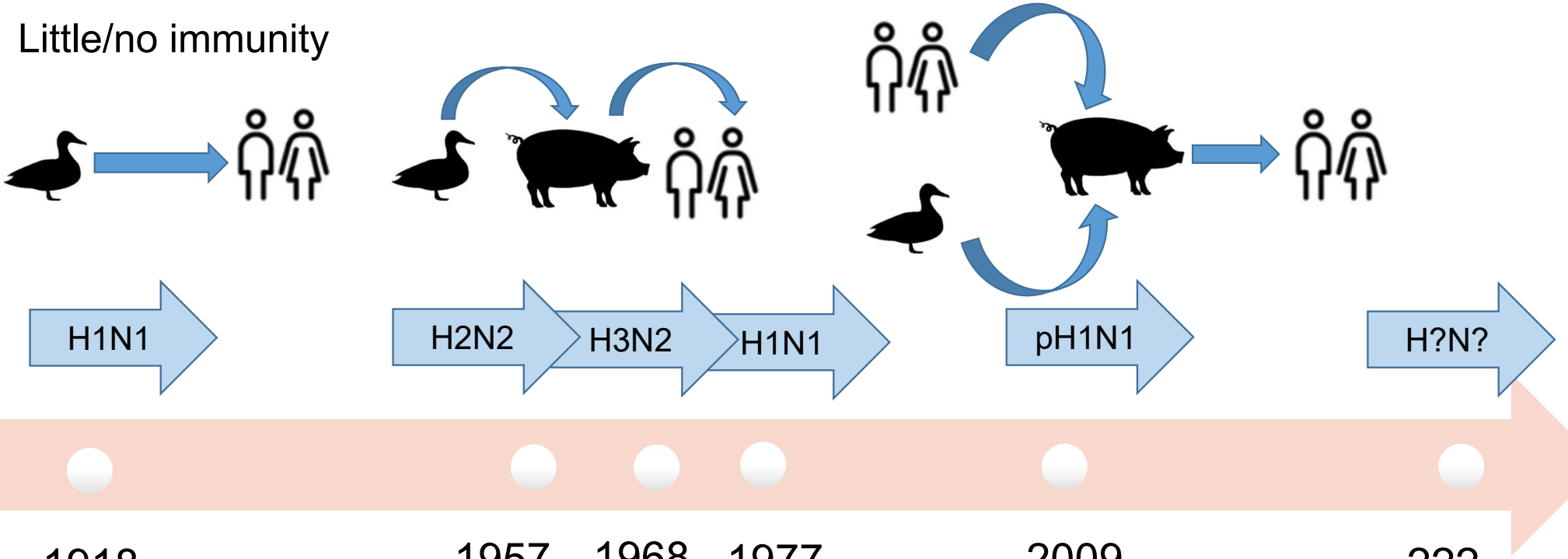
Pandemic influenza



Both human and avian receptors

- Sustained human-to-human transmission
- Little/no immunity



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H5N1 outbreaks in poultry

H5N1 vaccination policy in animals

- Historically vaccination prohibited in EU, CH
- CH: vaccination still prohibited
- 2023: EU allowed vaccination (member state level)
- 2023: France vaccination campaign

  → 50 million vaccinated ducks (foie gras)

  → trade restrictions

Geographic distribution

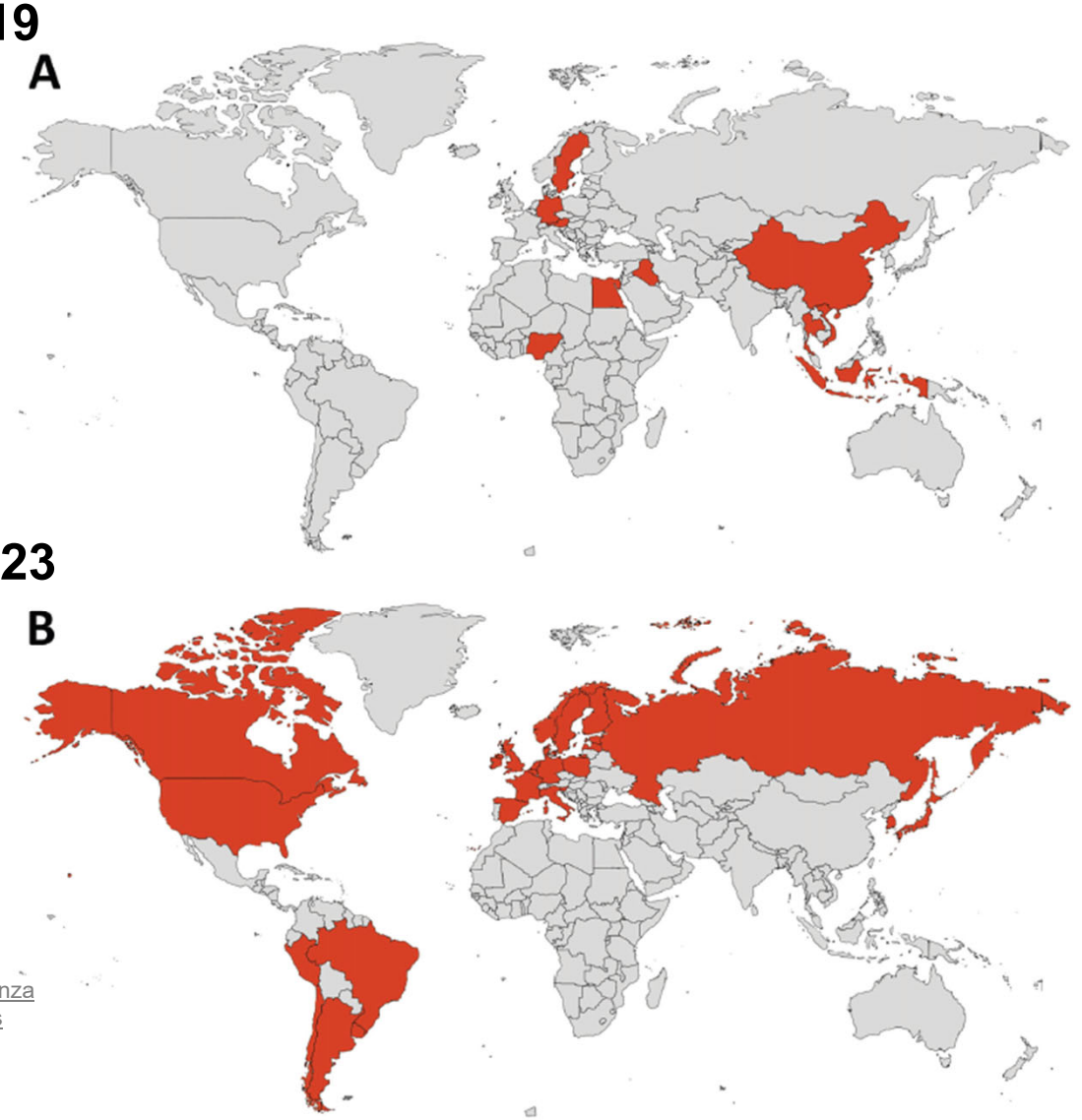

Figure 1. Geographic location of mammal species affected by highly pathogenic influenza virus A(H5N1) in previous waves of infection, 2003–2019 (A), and in the current panzootic, 2020–2023 (B).

Plaza et al., 2024
DOI: https://doi.org/10.3201/eid3003.231098

Figure 1 - Recent Changes in Patterns of Mammal Infection with Highly Pathogenic Avian Influenza A(H5N1) Virus Worldwide - Volume 30, Number 3—March 2024 - Emerging Infectious Diseases journal - CDC

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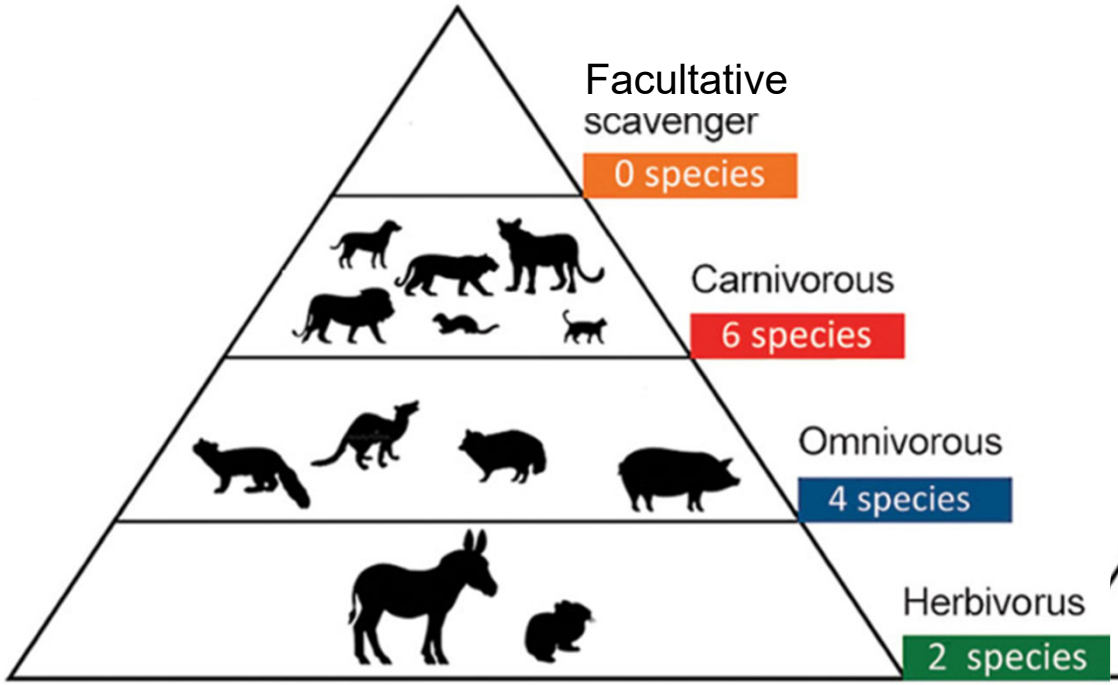
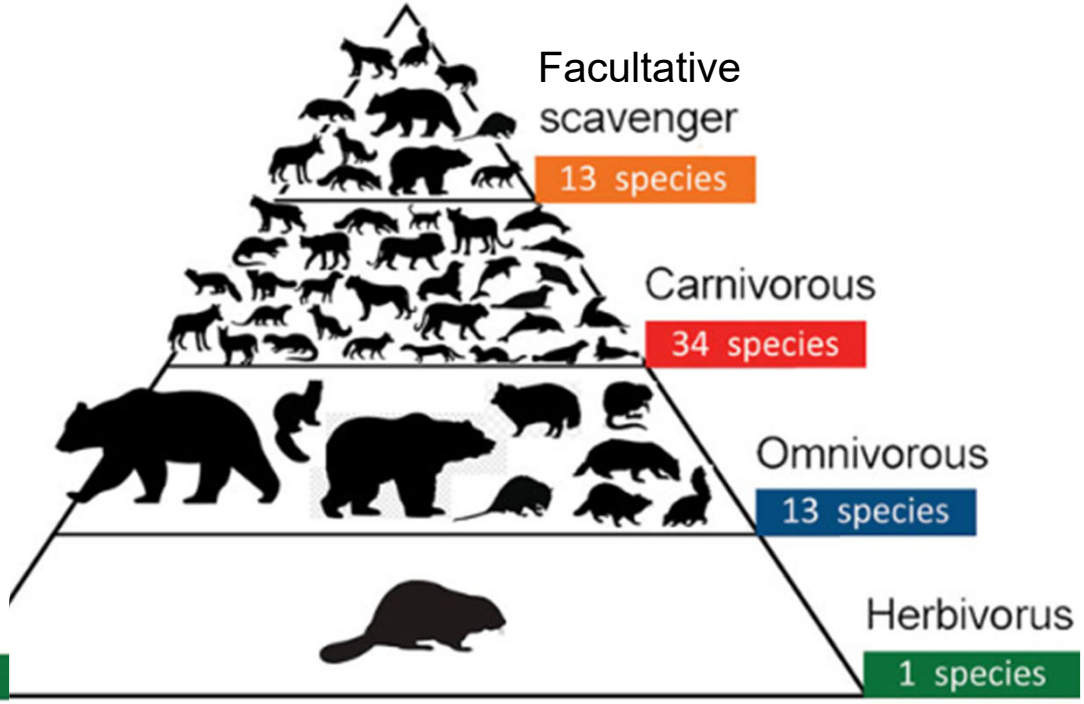
2003-2019



2020-2023



Plaza et al., 2024
DOI: https://doi.org/10.3201/eid3003.231098
Figure 2 - Recent Changes in Patterns of Mammal Infection with Highly Pathogenic Avian Influenza A(H5N1) Virus Worldwide - Volume 30, Number 3—March 2024 - Emerging Infectious Diseases journal – CDC
Figure 3 - Recent Changes in Patterns of Mammal Infection with Highly Pathogenic Avian Influenza A(H5N1) Virus Worldwide - Volume 30, Number 3—March 2024 - Emerging Infectious Diseases journal - CDC

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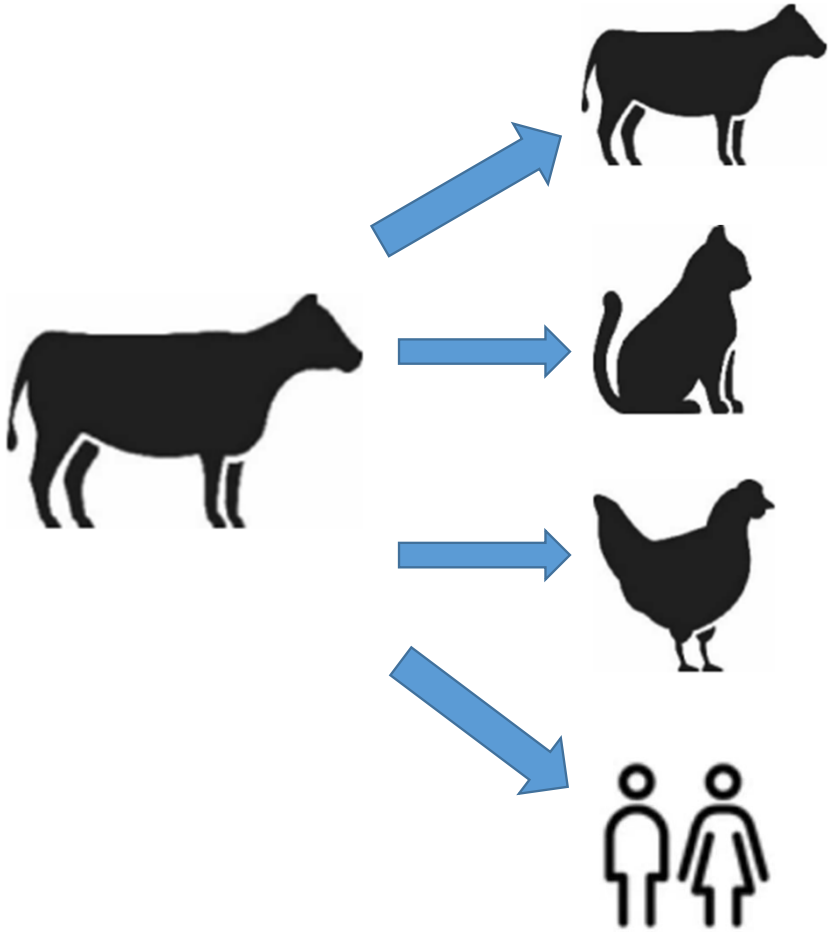
US dairy cattle

- Outbreak March 2024
- 15 states, 612 herds (21.11.2024)
- Single spillover event
- Efficient cow-to-cow transmission



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Current H5N1 Bird Flu Situation in Dairy Cows | Bird Flu | CDC
HPAI Confirmed Cases in Livestock | Animal and Plant Health Inspection Service (usda.gov)

Cattle – novel host to influenza A virus?

- Avian and human receptors
- Upper respiratory tract and udder tissues
- Risk of cows as «mixing vessel» ?
- Cattle: no other influenza A virus circulating

Both human and avian receptors

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Kristensen et al., 2024,The avian and human influenza A virus receptors sialic acid (SA)-α2,3 and SA-α2,6 are widely expressed in the bovine mammary gland | bioRxiv
DOI: https://doi.org/10.1101/2024.05.03.592326

Human avian influenza infections

- Direct/indirect contact to infected animals
- Incubation period 2-5 days

- Asymptomatic infection – conjunctivitis - mild upper respiratory disease- lower respiratory symptoms- severe pneumonia – respiratory failure - encephalitis - death

- Majority H5N1 susceptible to antiviral medications licensed for influenza
- Pre-pandemic vaccine

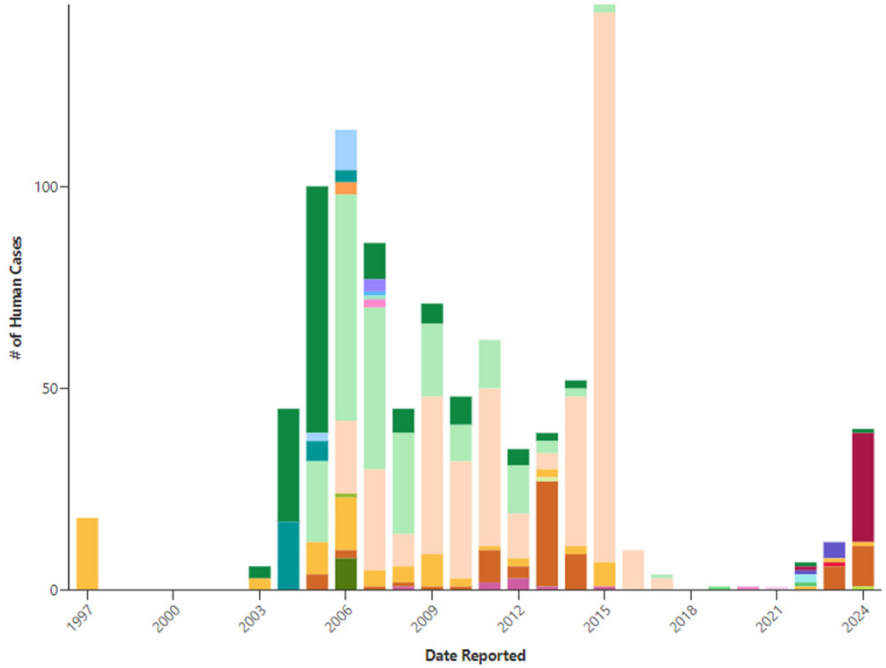
Interim Guidance on the Use of Antiviral Medications for Treatment of Human Infections with Novel Influenza A Viruses Associated with Severe Human Disease | Bird Flu | CDC

H5N1 human cases

- Worldwide: since 2003
  - 896 laboratory confirmed H5N1 cases from 24 countries
  - 463 fatal cases - case-fatality rate 52%

Countries

- Australia
- Bangladesh
- Canada
- China
- Ecuador
- India
- Iraq
- Myanmar
- Nigeria
- Spain
- Turkey
- United States
- Azerbaijan
- Cambodia
- Chile
- Djibouti
- Egypt
- Indonesia
- Laos
- Nepal
- Pakistan
- Thailand
- United Kingdom
- Vietnam



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https://cdn.who.int/media/docs/default-source/wpro---documents/emergency/surveillance/avian-influenza/ai_20240913.pdf?sfvrsn=5f006f99_141
https://www.cdc.gov/bird-flu/situation-summary/index.html
https://www.cdc.gov/bird-flu/php/avian-flu-summary/chart-epi-curve-ah5n1.html

H5N1 human cases

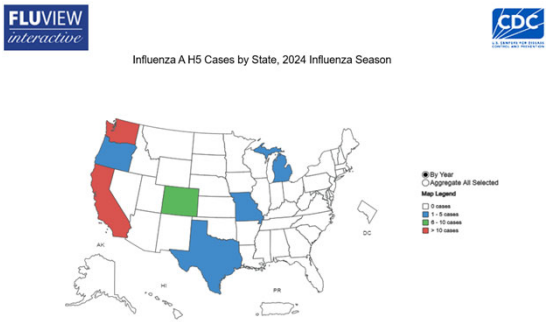
- USA: 56 reported human cases since 2022

22 cases

32 cases

unknown exposure source

2 cases



- Canada: 1 case- teenager

- EU/EEA: **no** laboratory confirmed symptomatic human infection reported since 2020

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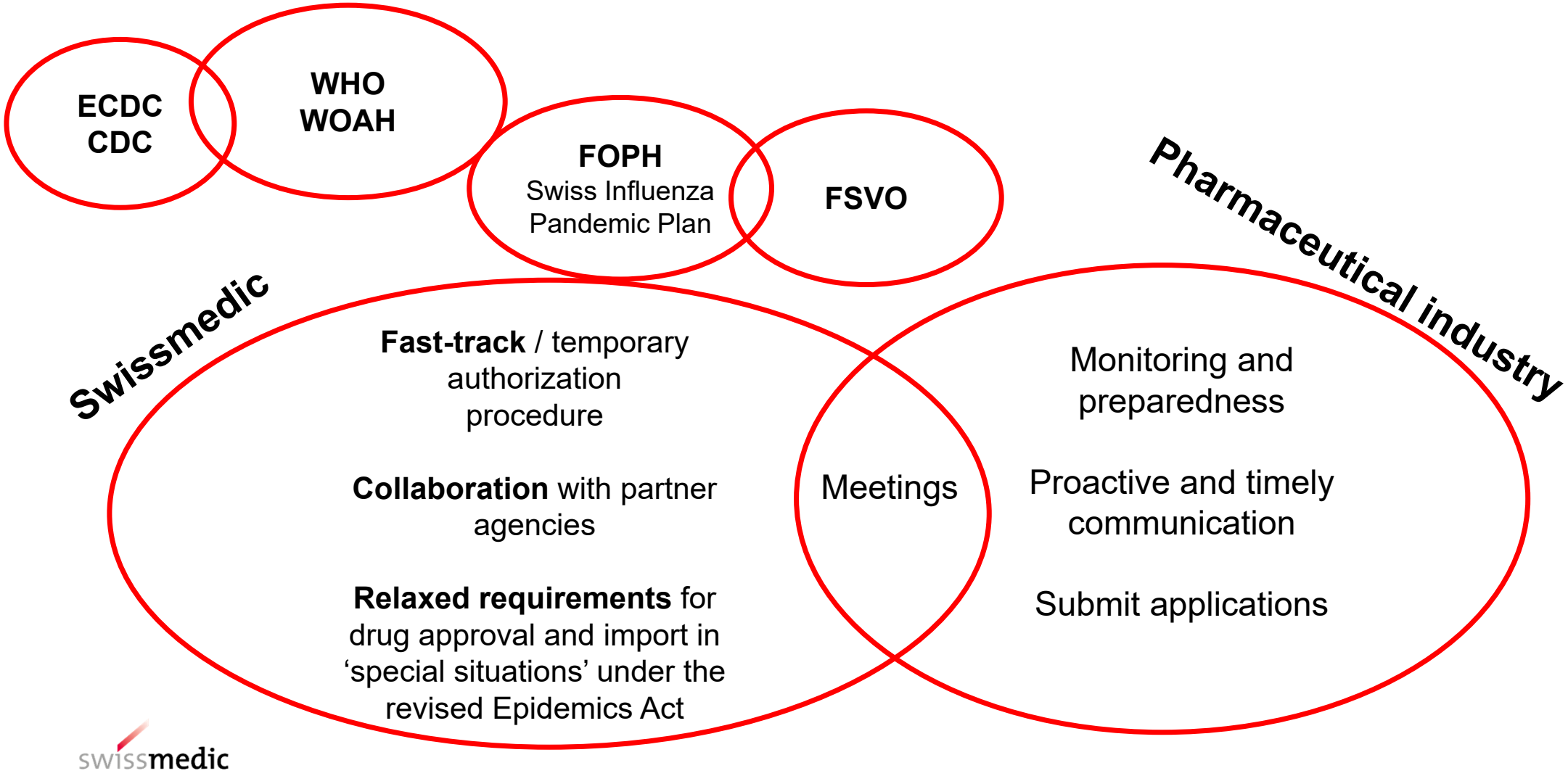
https://www.cdc.gov/bird-flu/situation-summary/index.html
Public health situation for avian influenza A(H5) viruses (europa.eu)
Communicable disease threats report, 16-22 November 2024, week 47 2024-WCP-0060 Draft.docx

Pandemic preparedness



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H5N1 avian influenza- an animal and human risk

- Several other species other than birds
- Can cause severe disease in humans
- Transmission to humans is rare
- Poorly adapted to humans
- Global public health risk of influenza H5N1 currently low → dynamic situation requiring close monitoring