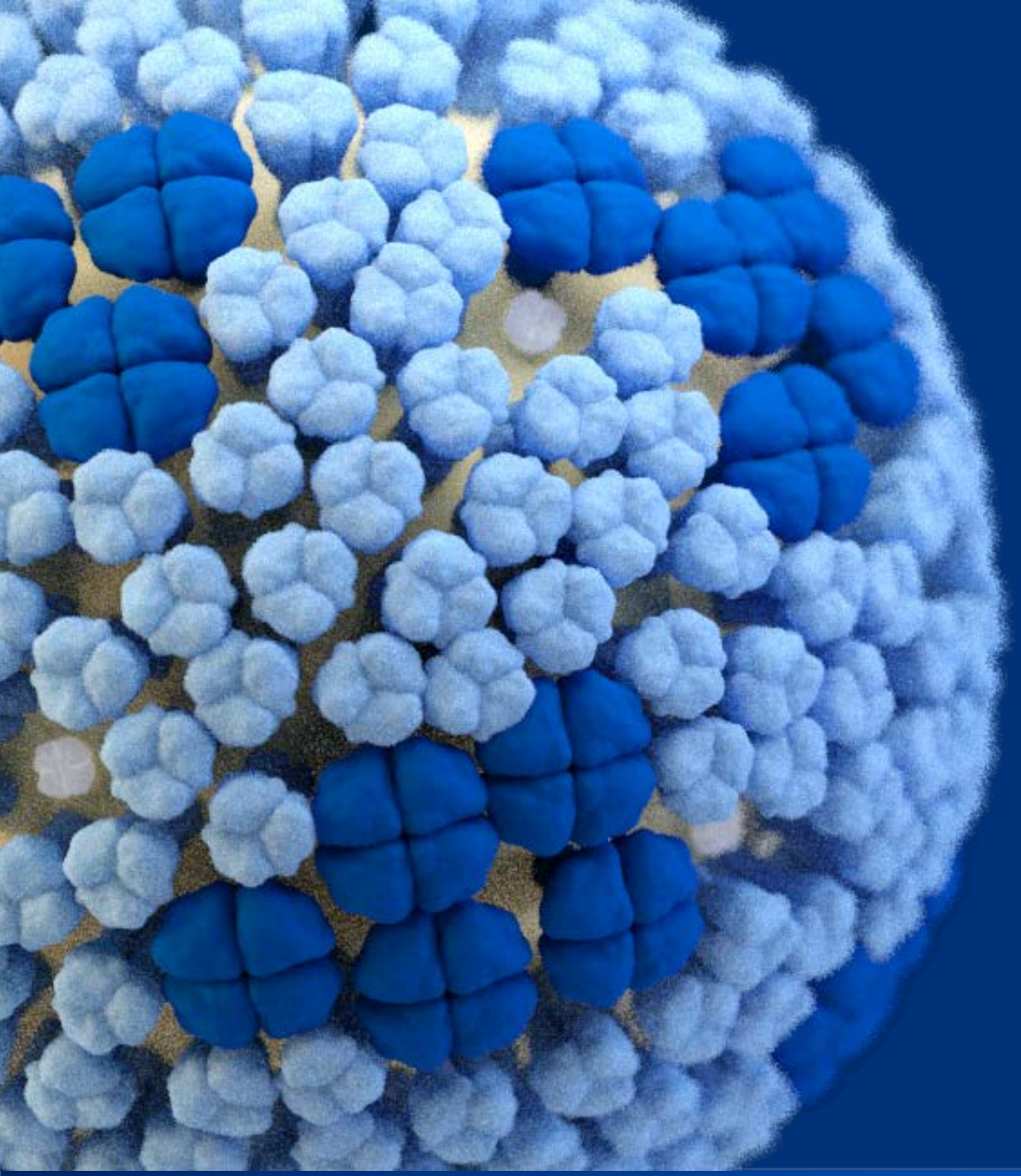

Animal and Zoonotic Influenza

Monitoring and Reporting

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NASPHV Update
09 November 2020

Influenza Surveillance and Monitoring

- **Human seasonal influenza (WHO)**
  - **Large global burden of disease**
  - **3-5 million severe cases/year**
  - **290,000 – 650,000 deaths/year**

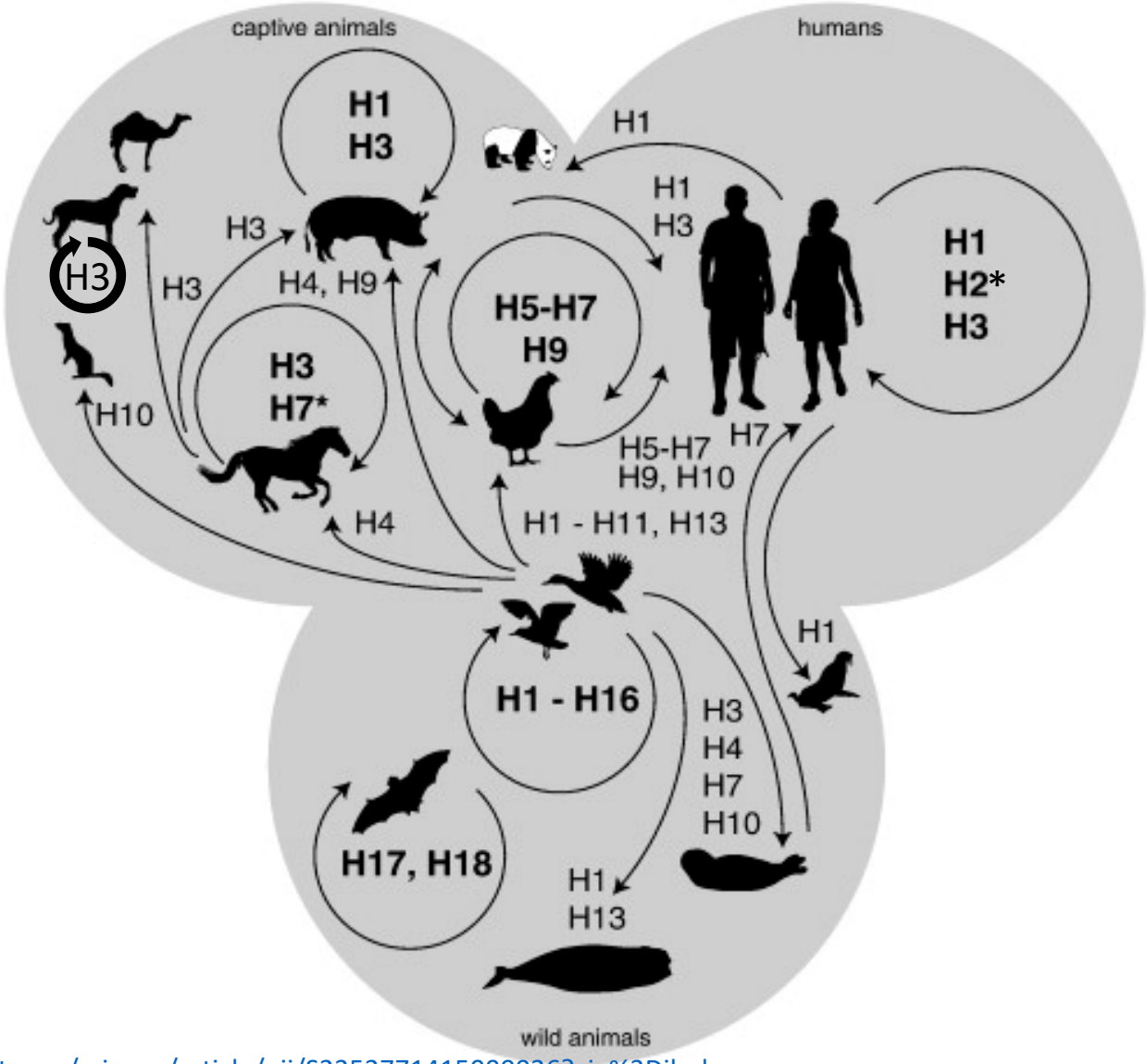
- **Influenza is a vaccine-preventable disease**

- **Animal and Zoonotic Influenza**
  - **Since 2003, numerous strains of animal influenza viruses have crossed species (zoonosis) and caused occasional illness in humans (novel)**

- **Pandemic Influenza**
  - **Novel influenza viruses can cause sporadic, unpredictable pandemics**
  - **1918 (~50-100 million deaths worldwide); 1957; 1968; 2009**

U.S. Centers for Disease Control and Prevention

Reservoirs and Inter-species Transmission Events of Influenza A Viruses



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

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

H9N2 — *1998-2020*

2003-2020
H5N1
H5Nx

2003-2020
H7N7

2009-2020 (2012)
H1N1(v)
H1N2(v)
H3N2(v)

2009
H1N1
Pandemic

2012-2020
H7N3

2013-2019
H7N9

2013
H6N1
H10N8

2014-2020
H5N6
H5N8

2016
H7N2

Animal Influenza Virus Monitoring: Domestic and International

- **Emergence, impact, and potential zoonoses**
  - **New viruses**
  - **Newly affected species**
  - **Unusual zoonotic events**
  - **New geographic locations**
- **Review and assess pandemic potential of animal and zoonotic influenza viruses globally (IRAT and TIPRA)**
- **Develop technical, informational, and guidance documents related to animal and zoonotic influenza**

- **Monitored Animal Influenza Viruses**
  - **Avian (H5Nx, H7Nx, H9Nx)**
  - **Swine (H1N1, H1N2, H3N2, H3N1)**
  - **Equine (H3N8)**
  - **Canine (H3N2)**
  - **Other outbreaks**

Novel Influenza A Virus Surveillance, Domestic and International

U.S. National Reportable Disease

- Novel Influenza Virus (human infection with animal influenza virus)
- Confirmation at CDC lab
- Investigate case and close contacts with State
- Work with Animal Health Partners (Federal and State) to minimize transmission during animal exhibitions or outbreak responses

Weekly Reports on Domestic and Global Activity

- International collaborations in multiple countries
- Avian influenza A H5, H7, H9 viruses
- Human novel influenza virus reports
- Animal Influenza virus outbreaks

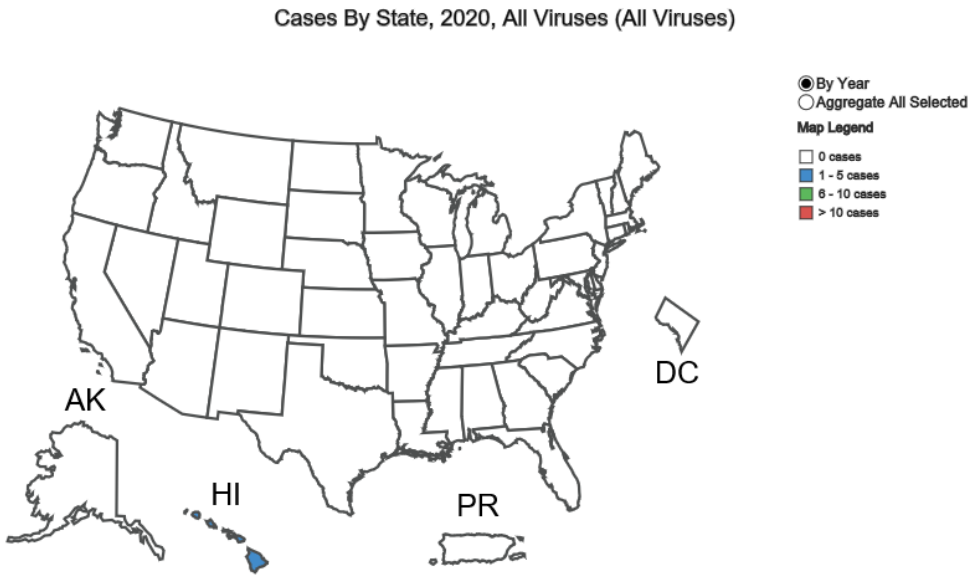
Partner with USDA

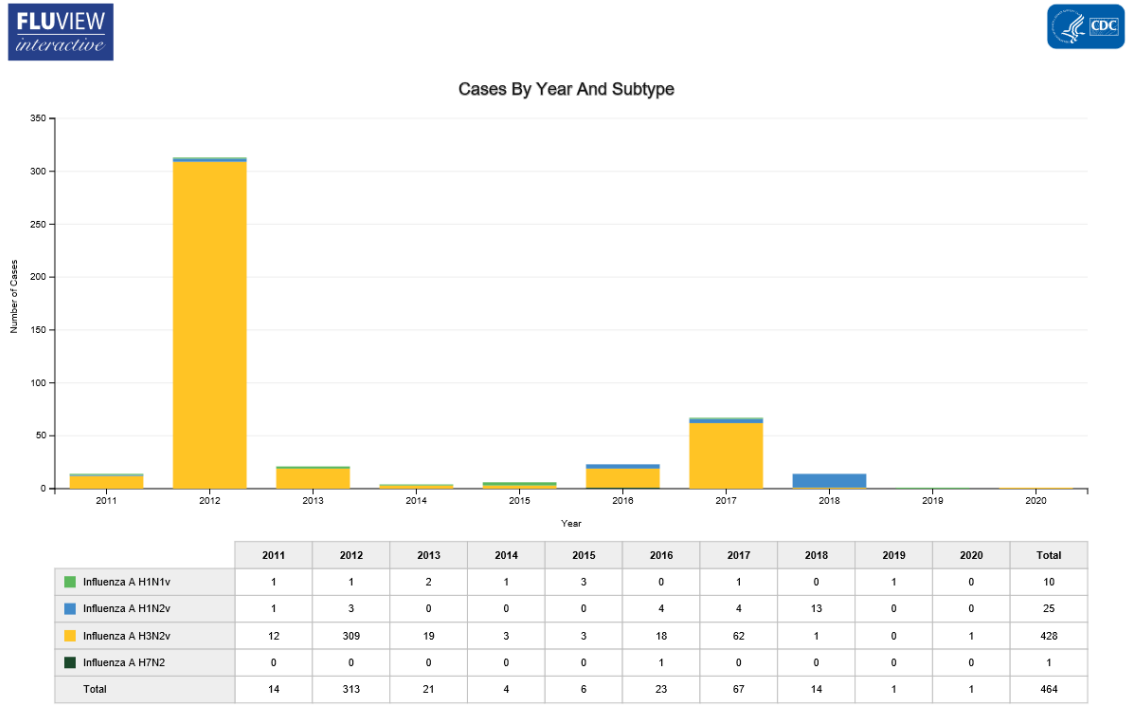
- USDA monitors avian and swine influenza viruses (monitors animal influenza viruses that affect the food supply, not pets, wild birds, etc)
- Partnership to monitor responders potentially exposed during avian influenza outbreak responses

Virologic Characterization

- Novel influenza viruses received from multiple partner sources
- Candidate Vaccine Virus development consideration
- Rick Assessment potential of Animal and Novel Influenza A viruses (IRAT)

Summary: Novel Influenza Virus Infections, USA, 2020





	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Influenza A H1N1v	1	1	2	1	3	0	1	0	1	0	10
Influenza A H1N2v	1	3	0	0	0	4	4	13	0	0	25
Influenza A H3N2v	12	309	19	3	3	18	62	1	0	1	428
Influenza A H7N2	0	0	0	0	0	1	0	0	0	0	1
Total	14	313	21	4	6	23	67	14	1	1	464

1 novel influenza virus reported to CDC, 2020

- **Swine; no avian**
- **A(H3N2)v virus (Hawaii [1])**

CDC: https://gis.cdc.gov/grasp/fluview/Novel_Influenza.html

Influenza A Viruses in Animals and Humans, USA, 2020

- **Avian Influenza Virus**
  - **Reportable disease in poultry and in humans (no reported human infections in US)**
  - **AIV in US, typically low path and occasional high path domestic poultry outbreaks**
  - **In 2020, HPAI H7N3 reported in turkeys in 1 state, LPAI H7N3 reported in turkeys in 2 states**
- **Swine Influenza Virus**
  - **Not a reportable disease in swine; reportable in humans (1 human infection in HI in 2020)**
  - **APHIS tracks voluntary SIV surveillance in swine; provides annual reports of diverse SIVs in US swine**
- **Equine Influenza Virus**
  - **Reportable disease in horses and in humans (no reported human infections in US)**
  - **EIV H3N8 cases in horses in US annually, not always reported**
- **Canine Influenza Virus**
  - **Not a reportable disease in dogs; reportable in humans (no known human infections to date)**
  - **H3N2 positive samples in dogs (and FluA unsubtypable) reported by the Canine Influenza Virus Surveillance Network**

- **CDC IRAT 2020: risk assessment of animal influenza viruses**
  - **3 viruses assessed in 2019; 1 virus assessed in 2020; 20 viruses assessed since 2011**

Avian Influenza Virus Novel Human and Animal Reports, International, 2020

- **H5Nx**
  - **Human: AIV H5Nx**
    - **1 human infection with H5N1 reported by Laos**
  - **Animal: ~24 countries reporting ~605 bird/poultry outbreaks (LPAI & HPAI): H5Nx, H5N1, H5N2, H5N3, H5N5, H5N6, H5N8**
- **H7Nx**
  - **Human: AIV H7N9**
    - **0 human infection with HPAI H7N9**
  - **Animal: AIV H7N9**
    - **0 outbreaks; positive environmental samples**
  - **Other Animal AIV H7: ~25 bird/poultry outbreaks (LPAI & HPAI) reported in 5 countries: H7Nx, H7N1, H7N3, H7N6, H7N7**
- **H9Nx**
  - **Human: AIV H9Nx**
    - **1 human infection with H9N2 reported by Hong Kong SAR**
    - **1 human infection with H9N2 reported by Senegal (onset 2019)**
    - **5 human infections with H9N2 reported by China (16 infections in 2019 by retrospective report published, later redacted)**
  - **Animal: numerous H9N2 publications (LPAI H9 not reportable by OIE)**

- **WHO TIPRA 2020: avian influenza H5N1 clade 2.3.2.1c virus risk assessment**

Swine Influenza Virus Novel Report, International, 2020

- **China reported five human infections with H1N1v (2010, 2012, 2015, 2016, 2019)**
  - **IRAT scoring of G4 EA SIV H1N1**
- **Germany reported one human infection with H1N1v**
- **Brazil reported one human infection with H1N2v**
- **USA reported one human infection with H3N2v**
  - **Interest in genome with LAIV swine vaccine reassortants**
- **Canada reported one human infection with H1N2v**

Gaps in Animal Influenza Prevention

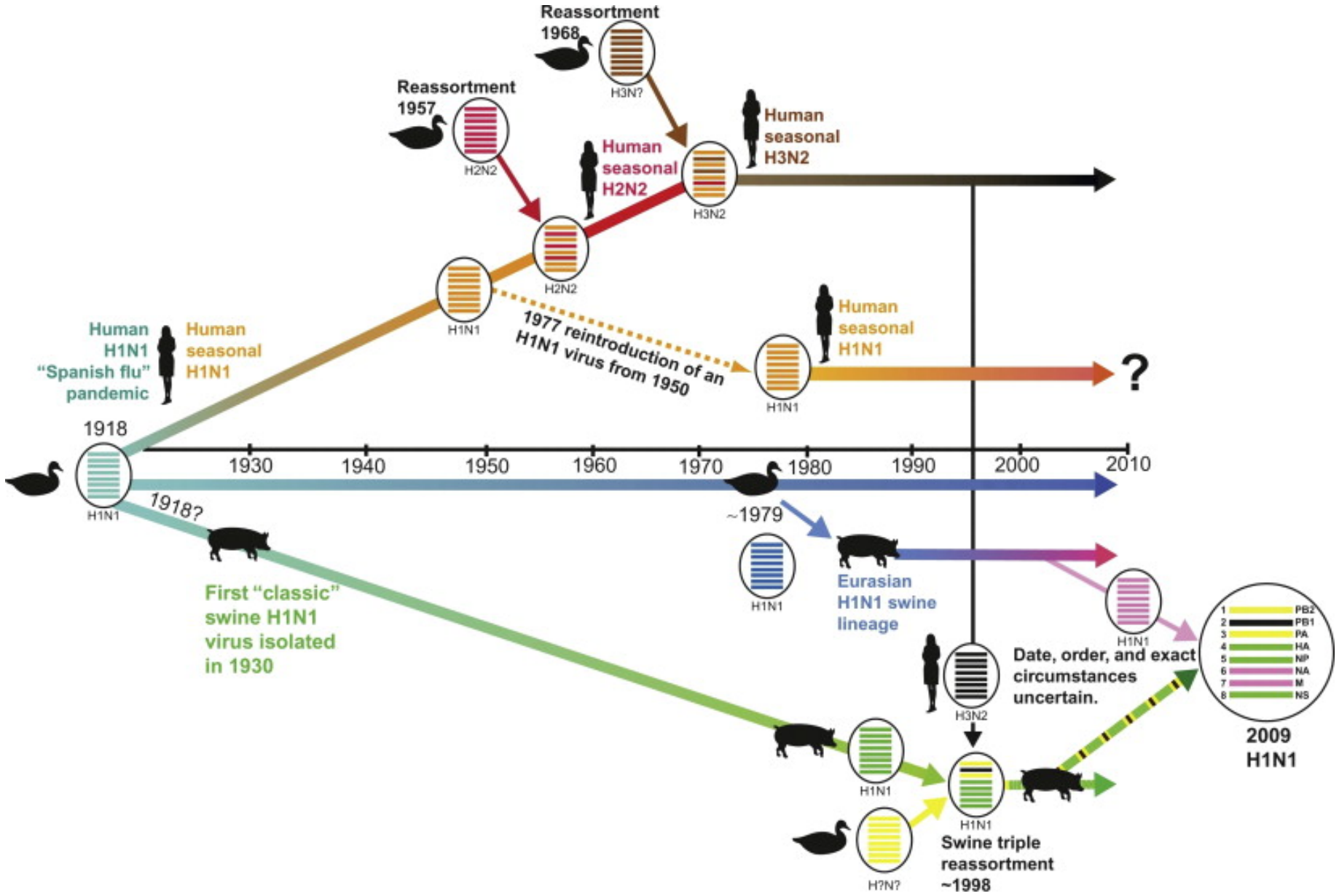
- Regional and Global surveillance and reporting
  - Influenza viruses in animal species reportable and not reportable to OIE
  - In countries that are resource-limited
- Animal Influenza virus detection and virus sharing
  - Other avian influenza viruses, such as H9 (H5 and H7 information good)
  - Low path AIV (any subtype) causing domestic poultry severe morbidity or mortality
    - only H5 and H7 are OIE reportable
  - Swine influenza internationally (not OIE reportable)
  - Equine (OIE reportable) and Canine (not OIE reportable) influenza internationally
- Animal Influenza virus characterization
  - Especially regarding adaptations necessary for sustainable transmission to other species, including humans
- Challenges in prevention of pandemic influenza
  - Knowledge related to Viruses, Hosts, and Environments
  - When to remove an infected host population
  - When to vaccinate the host population with intent to alter the virus ecology/evolution

Impact on Human Health of Animal/Zoonotic (Novel) Influenza Virus Prevention and Control

- **Limited human infections with animal influenza viruses annually**
  - **Primarily avian H5N1, H7N9, H9N2**
  - **Also avian H5N6, H6N1, H7N2, H7N3, H7N4, H7N7, H10N7, H10N8**
  - **Also swine H1N1v, H1N2v, H3N2v**
- **Occasional increase in human morbidity and mortality with various zoonotic influenza subtypes**
  - **Avian H5N1 (2003-2019): 860 / 455 (53%)**
    - **intervention in poultry vaccination and population control; environment biosecurity; industry and consumer education**
  - **Avian H7N9 (2016-2019): 1568 / 614 (39%)**
    - **intervention in poultry vaccination and population control; environment biosecurity; industry and consumer education**
  - **Avian H9N2 (1998-2019): 50 / 1 (2%)**
  - **Swine H3N2v (2011-2019): 427 infections, 1 death (0.23%)**
- **Greatest impact is the prevention of potential influenza pandemic**
  - **1918 H1N1 (avian): globally, ~500,000,000 infections / ~50-100 million deaths (US: ~675,000)**
  - **1957 H2N2 (avian, human): globally, ~1,100,000 deaths (US: ~116,000)**
  - **1968 H3N2 (avian, human): globally, ~1,000,000 deaths (US: ~100,000)**
  - **2009 H1N1 (swine, avian, human): globally, ~152,000-575,000 deaths (US: ~61,000,000 / ~12,500)**
- **Average annual human seasonal influenza burden estimates**
  - **globally, ~290,000-650,000 deaths (US: ~40,000,000 infections / 48,800 deaths)**
  - **Human influenza vaccine-preventable with varying effectiveness (novel influenza - candidate vaccine virus)**

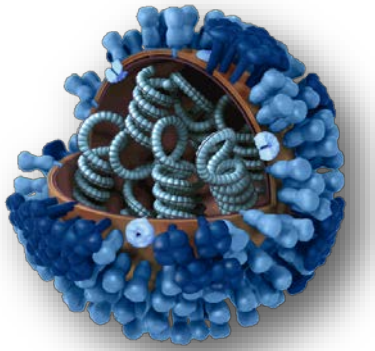
Sources: CDC and WHO

Complex Path to a Pandemic: 2009 Influenza A(H1N1) Virus

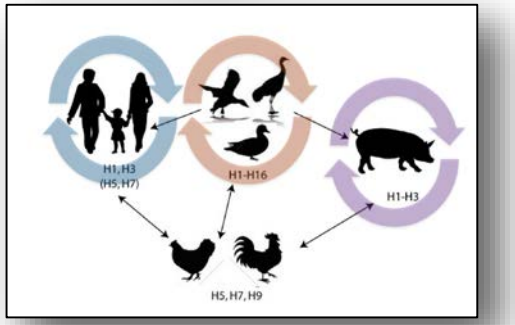


Summary:

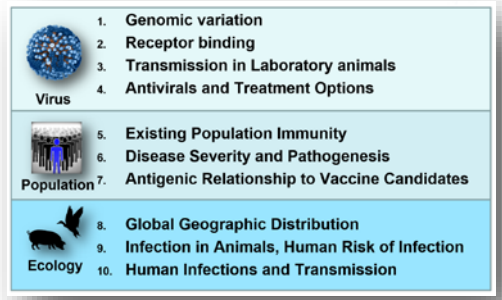
- **Influenza viruses are constantly changing in animals and humans, requiring ongoing surveillance and frequent vaccine virus changes**

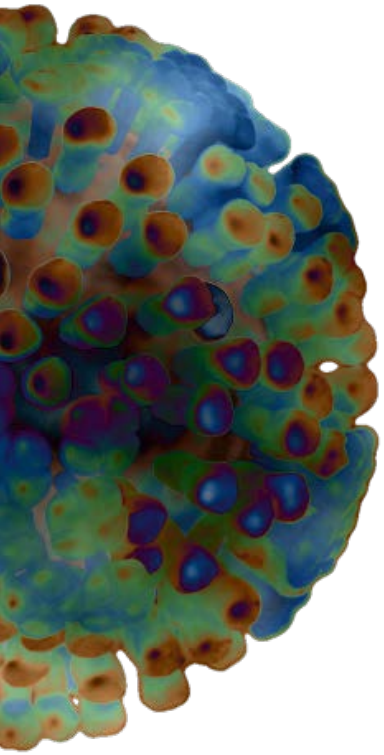


- **Path from animal flu to zoonotic flu to novel flu to pandemic flu is complex and often is the result of multiple virus changes in birds, swine, and humans**



- **Number of emerging novel influenza viruses is increasing, requiring ongoing laboratory and epidemiologic investigations for risk assessments**





Thank you!
Questions?

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For more information, contact CDC
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