

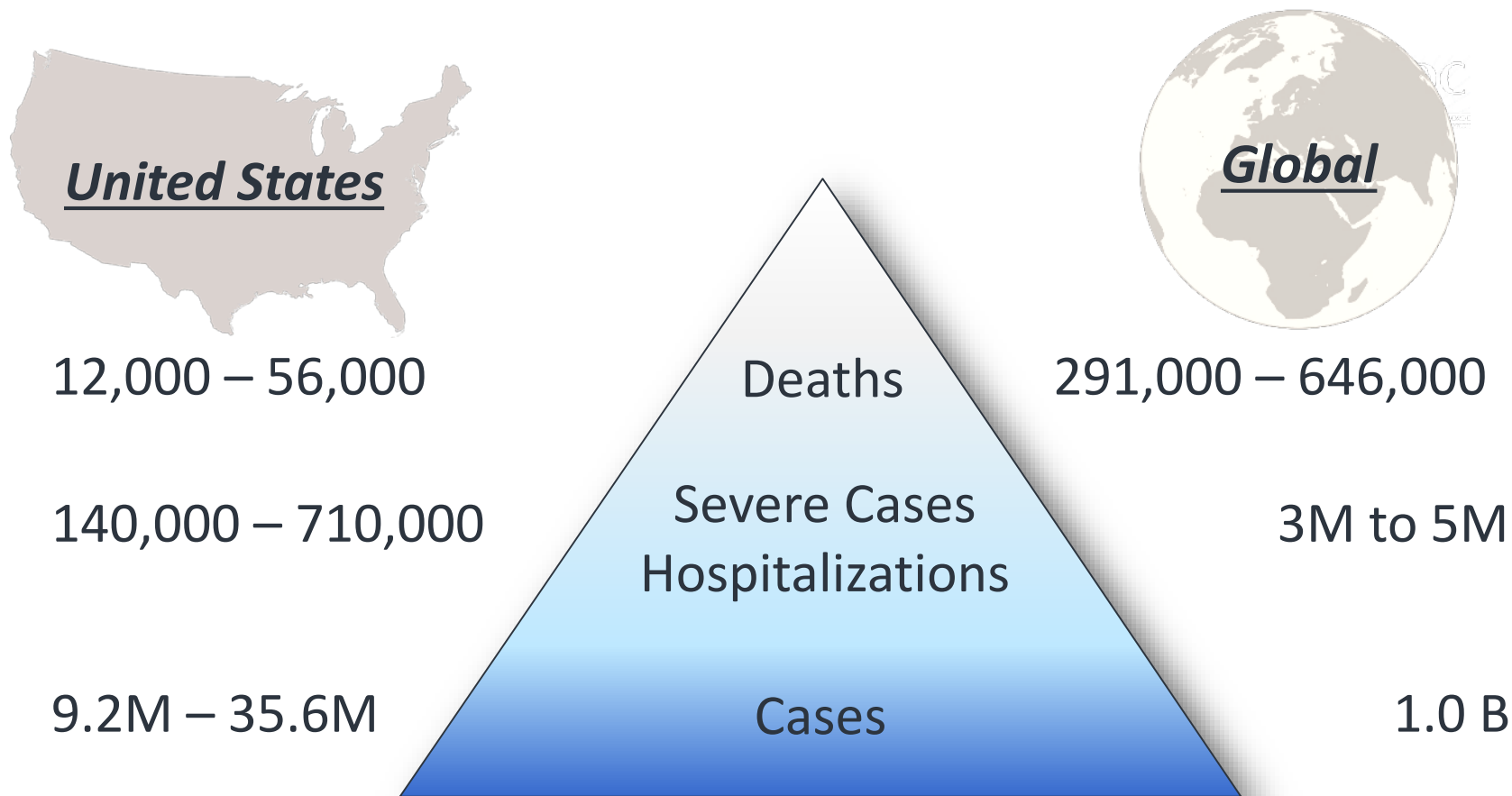
# 100 Years Since 1918: Are We Ready for the Next Pandemic?

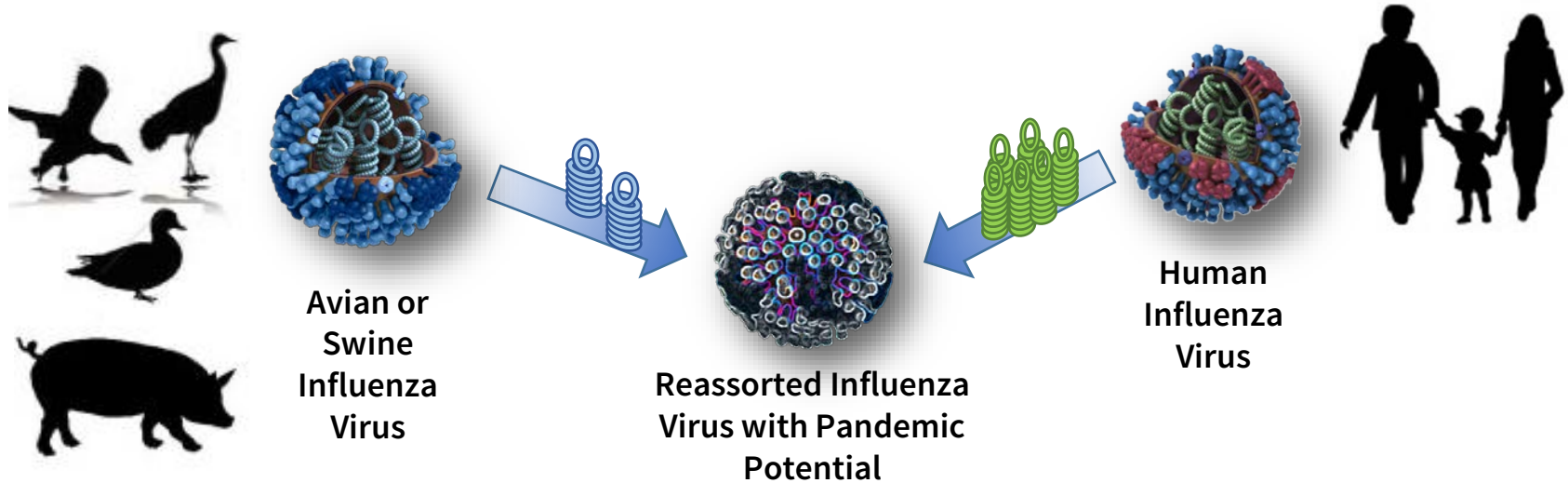
**Daniel B. Jernigan, MD MPH**  
**Director, Influenza Division**

Centers for Disease Control and Prevention

# Today's Agenda

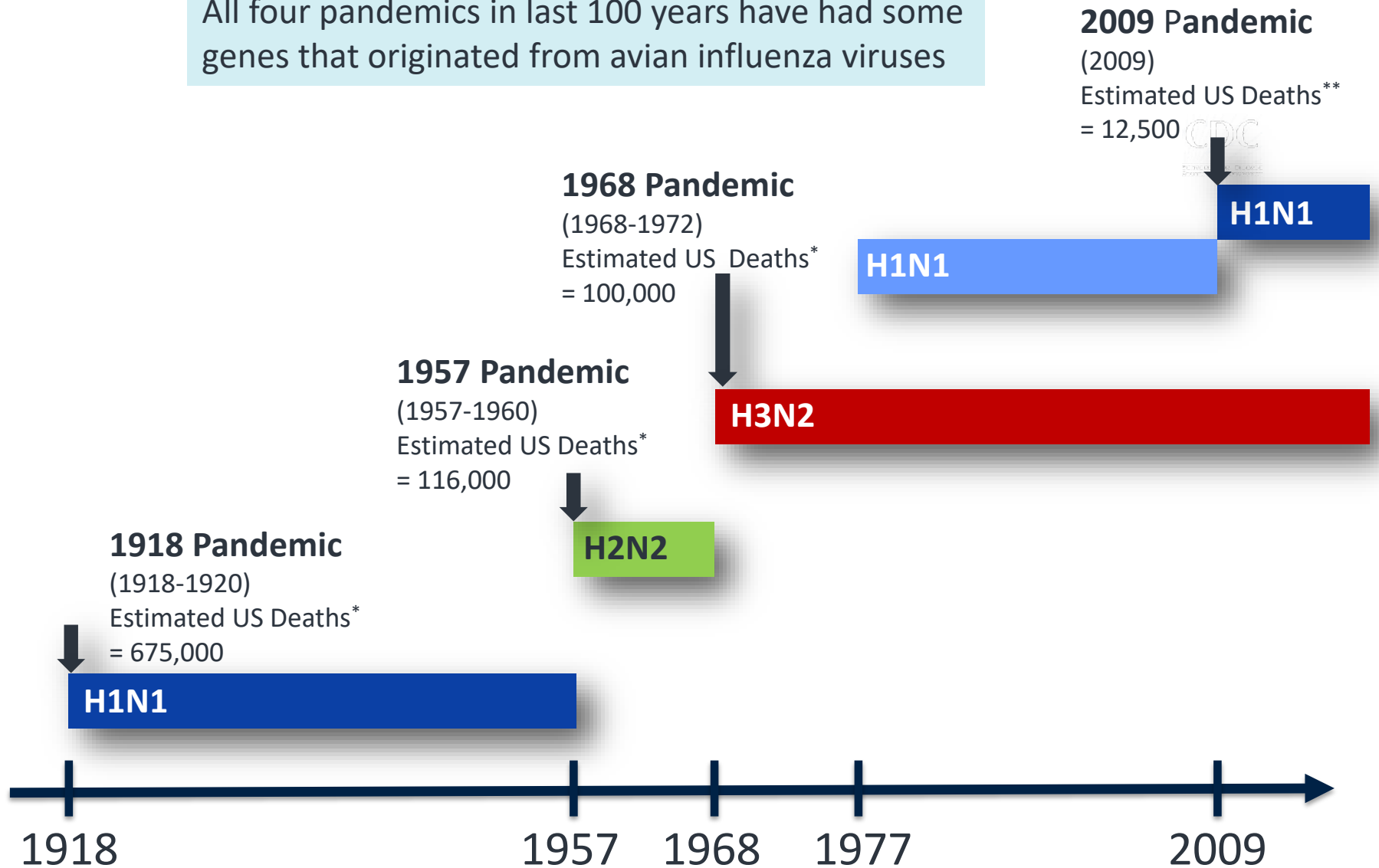
- Remembering the 1918 pandemic
- Reviewing current influenza threats
- Evaluating pandemic readiness
- Gathering input on 1918 commemoration activities





- Human-adapted viruses can arise from reassortment to cause efficient and sustained transmission
- Four pandemics in last 100 years

All four pandemics in last 100 years have had some genes that originated from avian influenza viruses



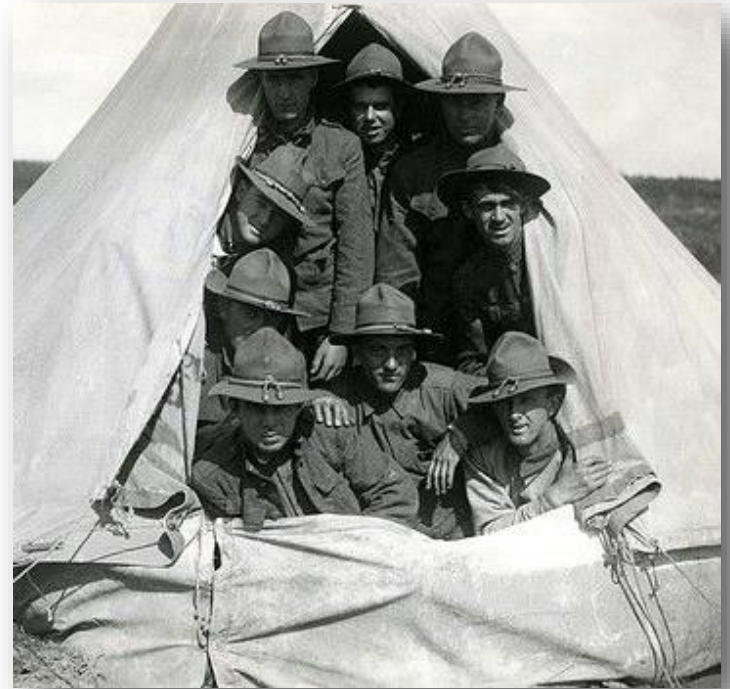
(\*Glezen WP. Epidemiol Rev. 1996. \*\*Shrestha SS. Clinical Infectious Diseases 2011.



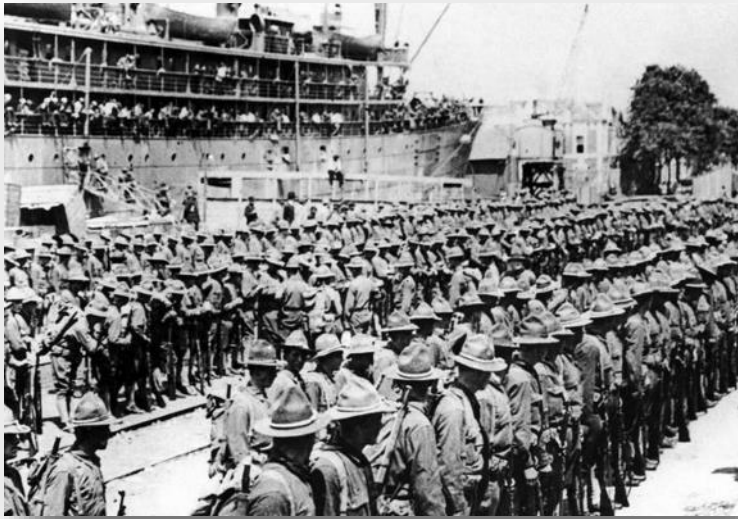
# 1918 Influenza Pandemic

# 1918: Crowding Facilitated Transmission

- Industrialization and war response added to urban overcrowding
- Soldiers in crowded camps
  - >100K in tents in US
  - 1917-18 record cold winter



# 1918: Wartime Movement Aided Transmission



[www.dailyherald.com/article/20140628/news/140629223/](http://www.dailyherald.com/article/20140628/news/140629223/)

- Massive troop movement
  - From towns to training bases, to Europe
  - 10,000 men shipped to France every day in summer 1918

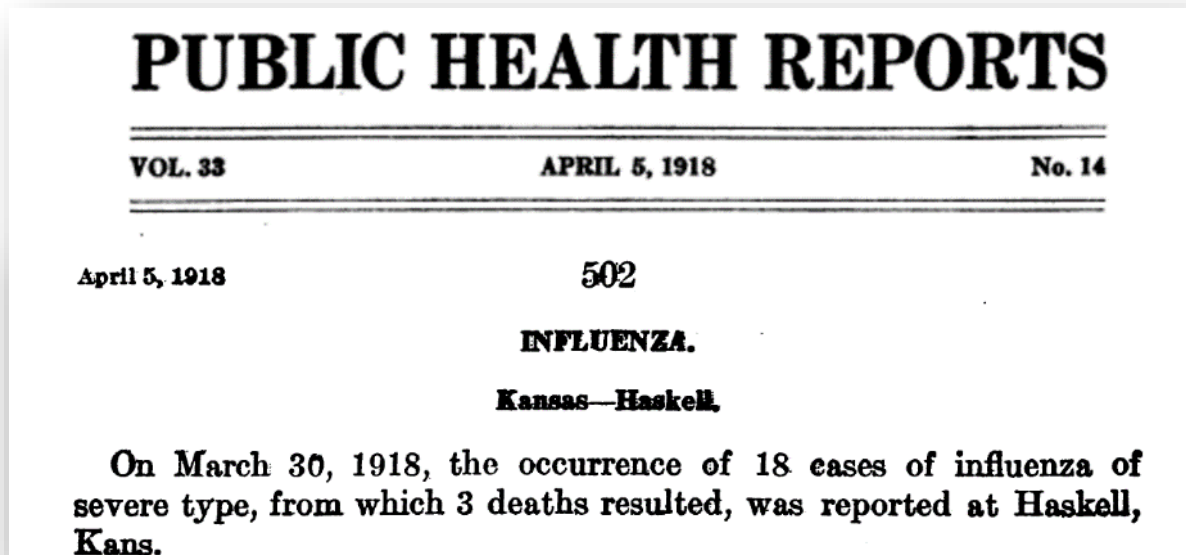


[www.museumsyndicate.com/item.php?item=56784#](http://www.museumsyndicate.com/item.php?item=56784#)

- Unprecedented troop movement allowed infection to move from camp to camp



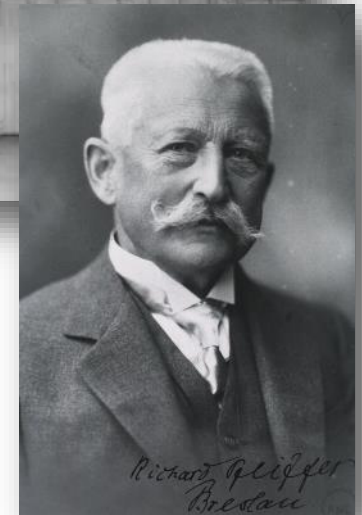
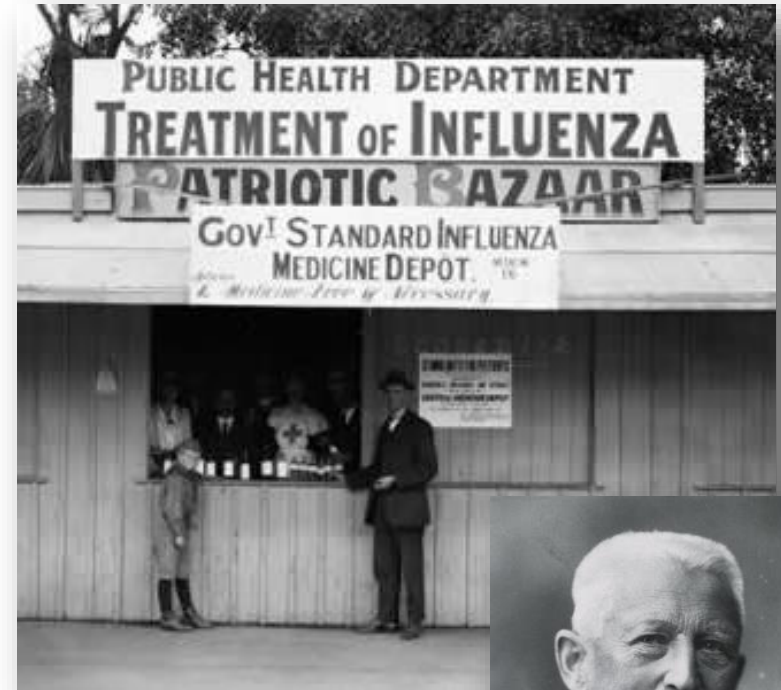
# First Published Cases in US Public Health Reports, April 1918



- Site of emergence purported in Haskell KS in U.S.
- ‘Spanish Flu’ – not because Spain was source, but because Spain was a non-combatant and others refused to admit having cases

# The Dawn of Modern Medicine

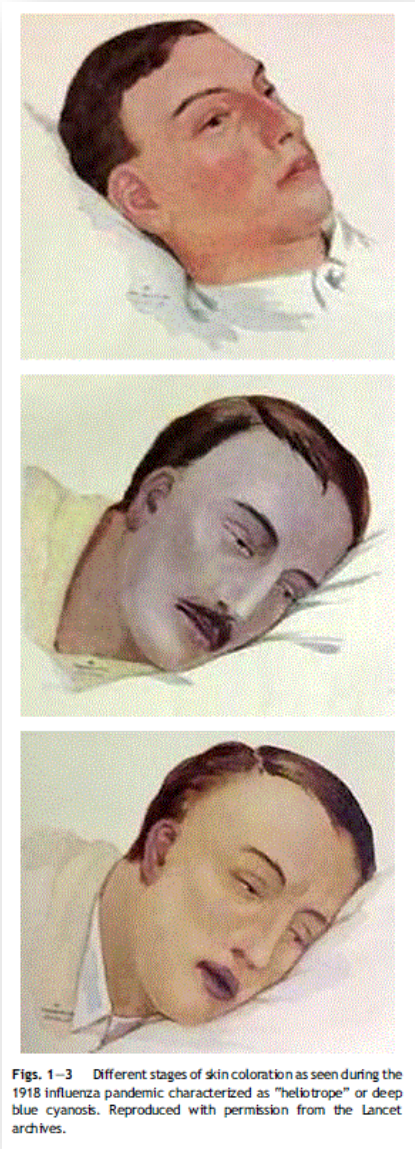
- Causative agent (virus) unknown, no flu treatment or prevention, flu transmission poorly understood
  - Cause of influenza attributed in 1892 by Pfeiffer to be a bacillus – *Haemophilus influenzae*
- Few vaccines:
  - typhoid, cholera, plague
- Only palliative therapies:
  - Aspirin, quinine, opium, ammonium, iodine, turpentine, beef tea
- Severe shortage of medical personnel
  - >30% of physicians working for the military
  - > 9,000 nurses deployed overseas



Pfeiffer

# Signs and Symptoms of 1918 Pandemic

- Classic flu symptoms in most
- Pneumonia in 10-20% of cases
- ‘Purple Death’ often in 24 hrs
  - “They very rapidly develop the most vicious type of pneumonia that has ever been seen.”
  - “Cyanosis extending from their ears and spreading all over the face, until it is hard to distinguish the coloured men from the white.”
  - “It takes special trains to carry away the dead. For several days there were no coffins and the bodies piled up something fierce.”
  - “Bodies stacked in the morgue from floor to ceiling like cord wood.”

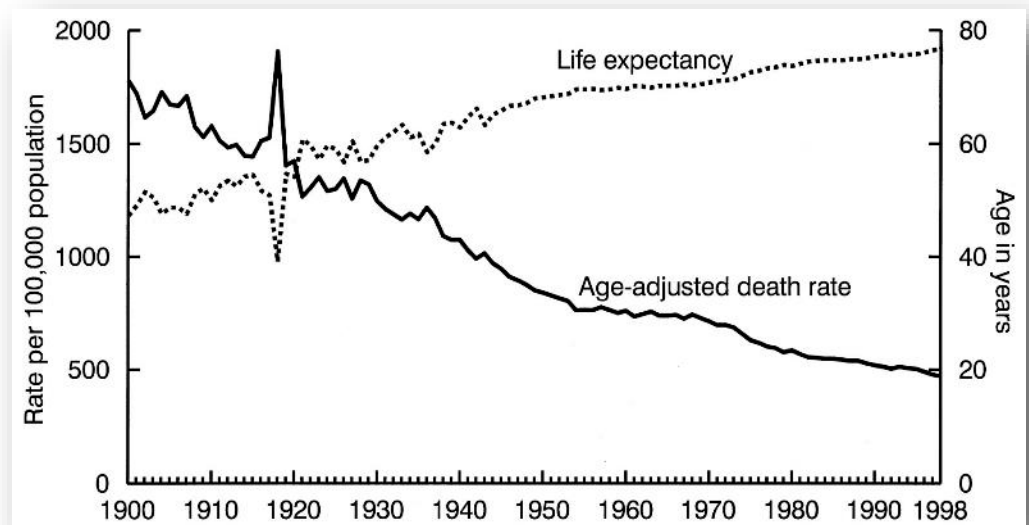
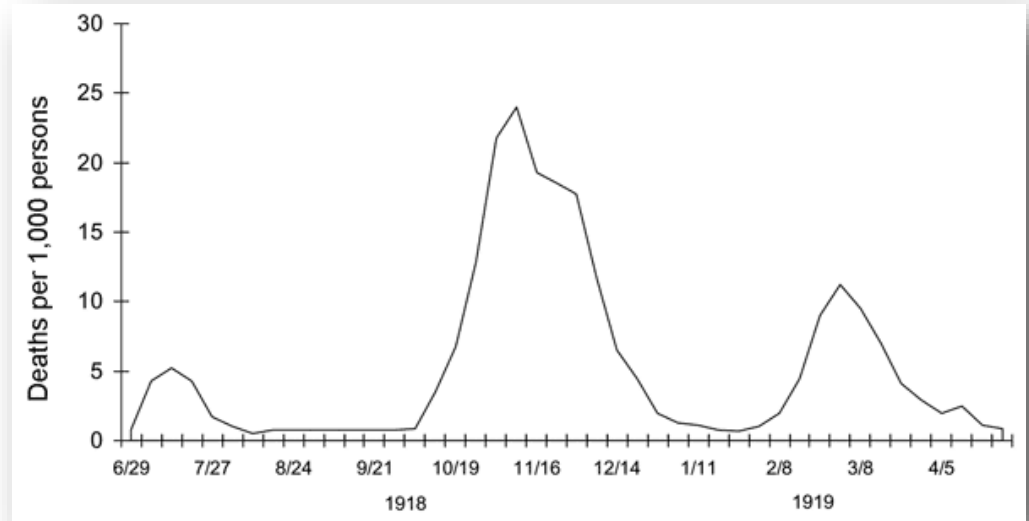


Figs. 1-3 Different stages of skin coloration as seen during the 1918 influenza pandemic characterized as "heliotrope" or deep blue cyanosis. Reproduced with permission from the Lancet archives.

Shanks 2015

# Fatality of 1918 Flu

- Three pandemic waves with high fatality
- Estimated 50M deaths globally
- Five times the military losses of WWI
- Depressed overall average life expectancy by 12 years





**1951**

Johan Hultin at permafrost gravesite, Brevig Mission AK



**1951**

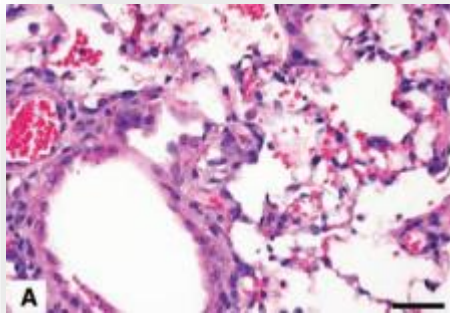
Hultin unable to grow live 1918 virus in lab



**1997**

Hultin returns to gravesite for frozen lung tissue

## The 1918 Influenza Virus



**2005**

CDC shows 1918 virus causes severe pneumonia in mice and identifies the genes responsible for high virulence



**2004**

Tumpey at CDC rescues 1918 virus in high containment lab

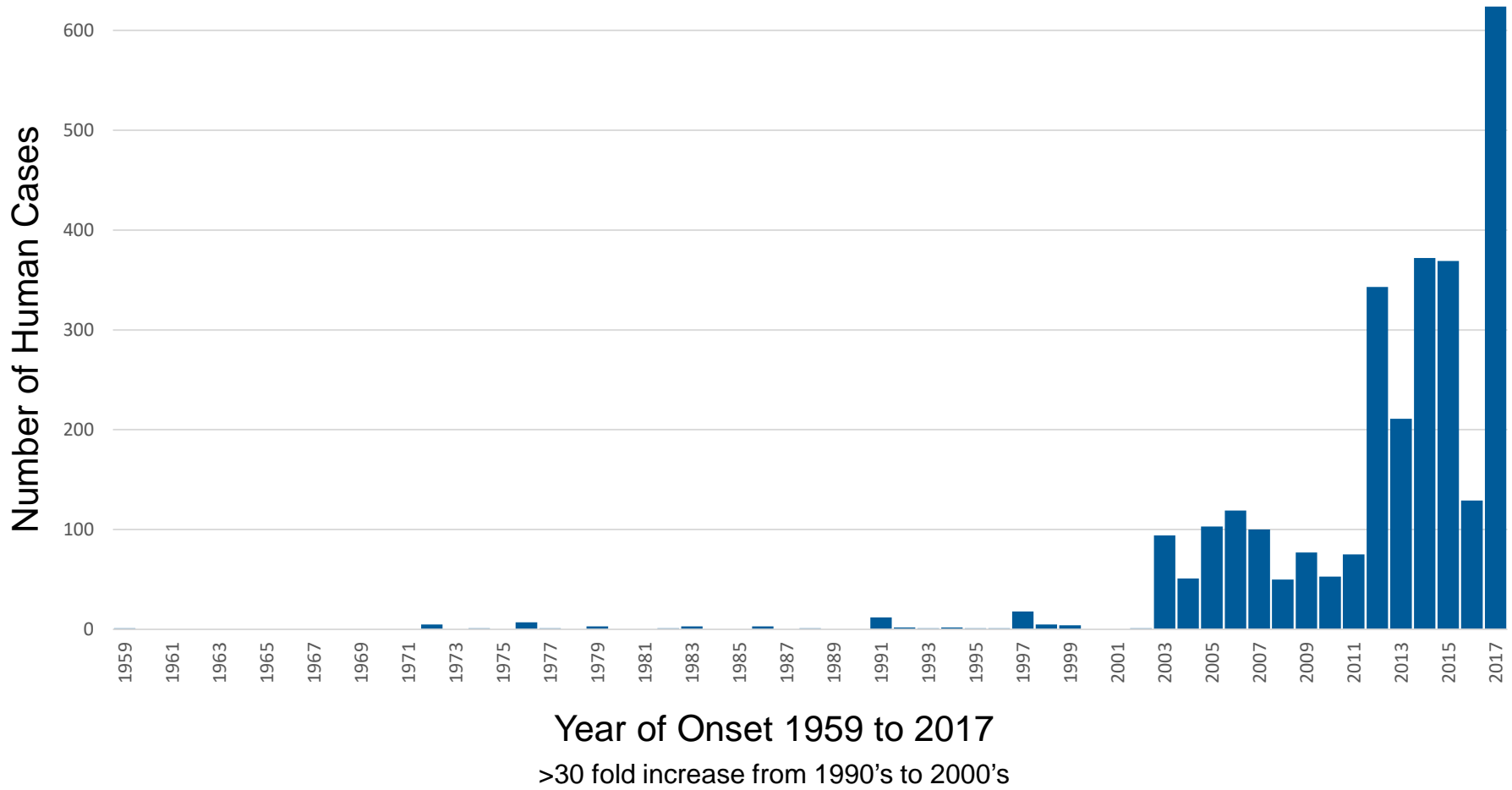


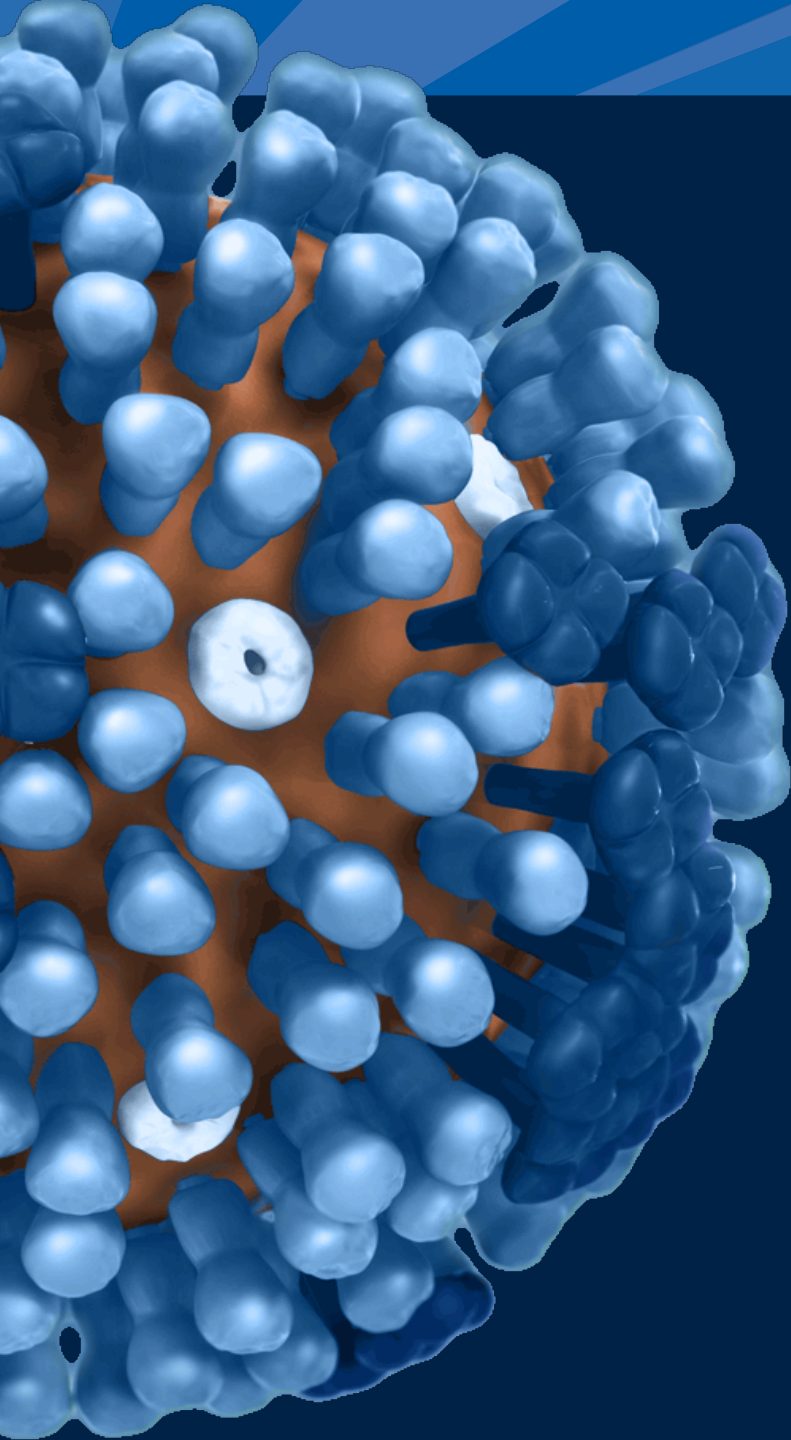
**1997**

Taubenberger at AFIP begins sequencing the 1918 virus genes

# Novel Influenza Infection Reports are Increasing

Human Cases of Reported Novel Influenza A Infection, 1959-2017  
Includes Avian H4, H5, H6, H7, H9, H10 & Swine H1, H3 (not H1N1pdm09)





# Avian Influenza A(H7N9) in Asia

Centers for Disease Control and Prevention

**MMWR**

Weekly / Vol. 66 / No. 35

Morbidity and Mortality Weekly Report

September 8, 2017

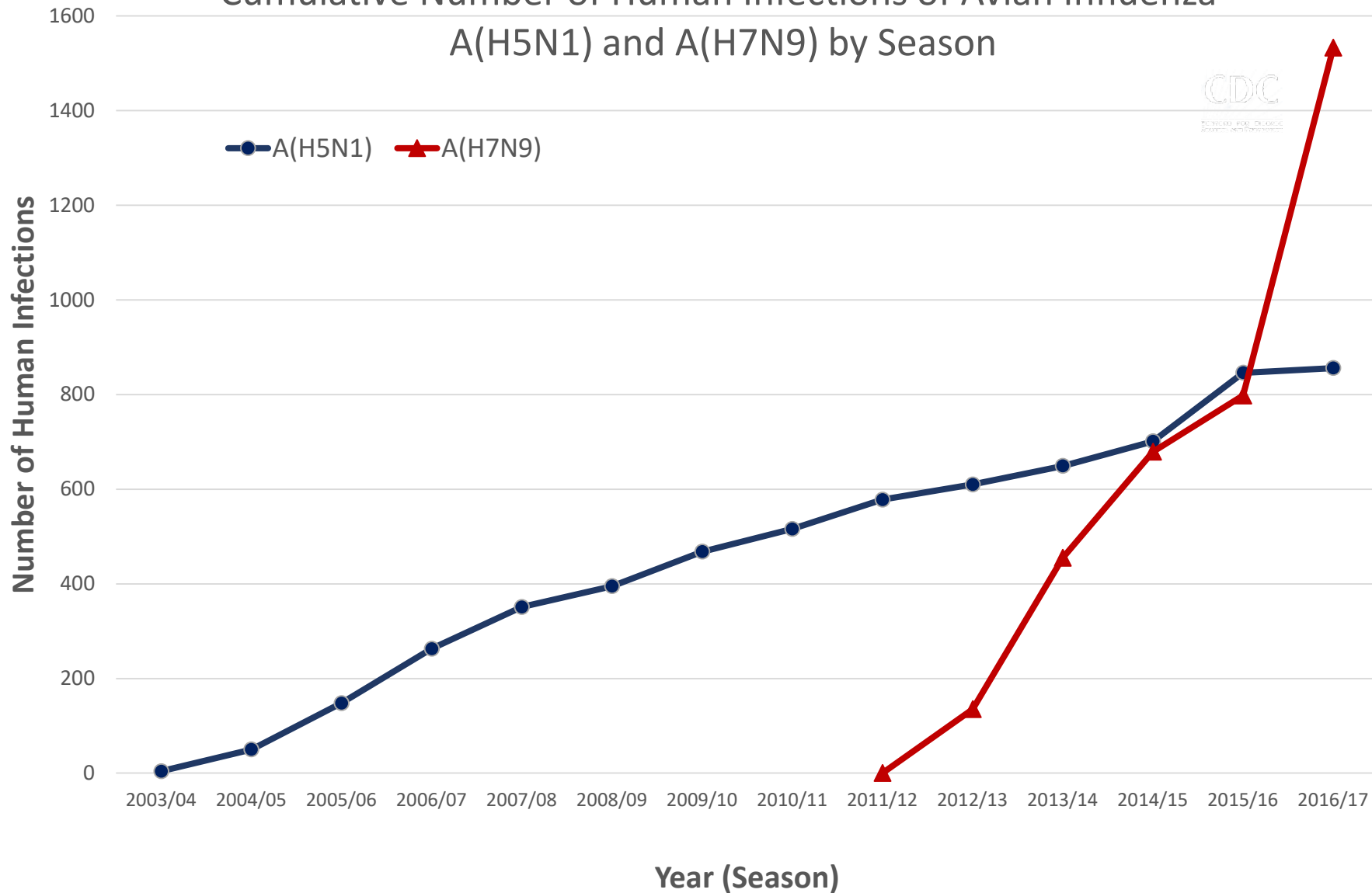
**Update: Increase in Human Infections with  
Novel Asian Lineage Avian Influenza A(H7N9) Viruses During the  
Fifth Epidemic — China, October 1, 2016–August 7, 2017**

James C. Kile, DVM<sup>1,2</sup>; Ruiqi Ren, MPH<sup>2,3</sup>; Liqi Liu, MPH<sup>4</sup>; Carolyn M. Greene, MD<sup>5</sup>; Katherine Roguski, MPH<sup>1</sup>; A. Danielle Iuliano, PhD<sup>1</sup>; Yunho Jang, PhD<sup>1</sup>; Joyce Jones, MS<sup>1</sup>; Sharmi Thor, PhD<sup>1</sup>; Ying Song, MD<sup>5</sup>; Suizan Zhou, MPH<sup>5</sup>; Susan C. Trock, DVM<sup>1</sup>; Vivien Dugan, PhD<sup>1</sup>; David E. Wentworth, PhD<sup>1</sup>; Min Z. Levine, PhD<sup>1</sup>; Timothy M. Uyeki, MD<sup>1</sup>; Jacqueline M. Katz, PhD<sup>1</sup>; Daniel B. Jernigan, MD<sup>1</sup>; Sonja J. Olsen, PhD<sup>1</sup>; Alicia M. Fry, MD<sup>1</sup>; Eduardo Azziz-Baumgartner, MD<sup>1</sup>; C. Todd Davis, PhD<sup>1</sup>





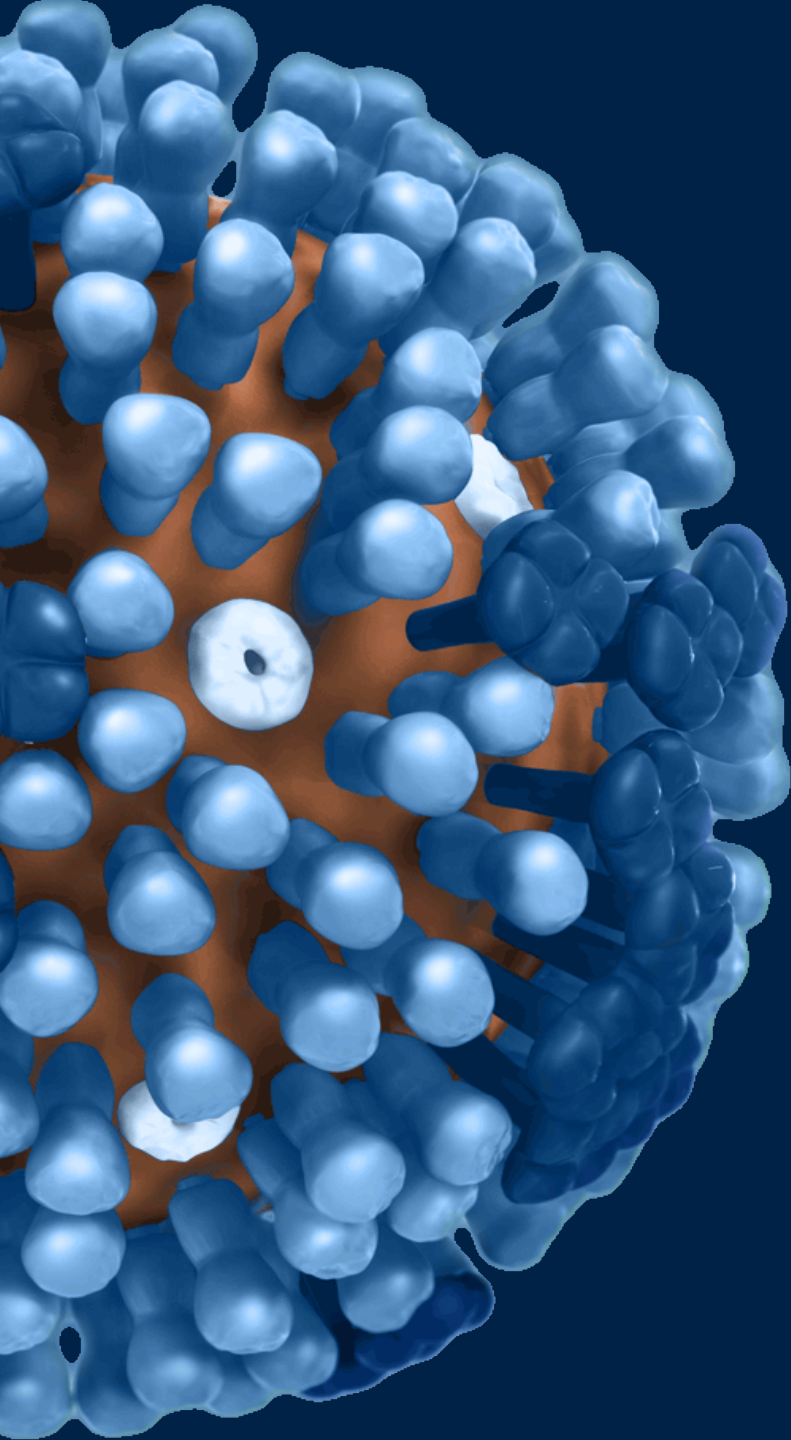
## Cumulative Number of Human Infections of Avian Influenza A(H5N1) and A(H7N9) by Season



- Severe human infections
  - 90% developed pneumonia
  - 70% admitted to ICU
  - 40% died
- Clusters of infection
  - 35 reported but **no** sustained human-to-human transmission
- 5<sup>th</sup> wave viruses changed
  - Increased cases and geographic spread
  - Genetic drift requiring new vaccine development
  - Subset of viruses now highly pathogenic in poultry



H7N9 patient in Hubei province, 2017. STAT.



# The Next Pandemic: Are We Ready?

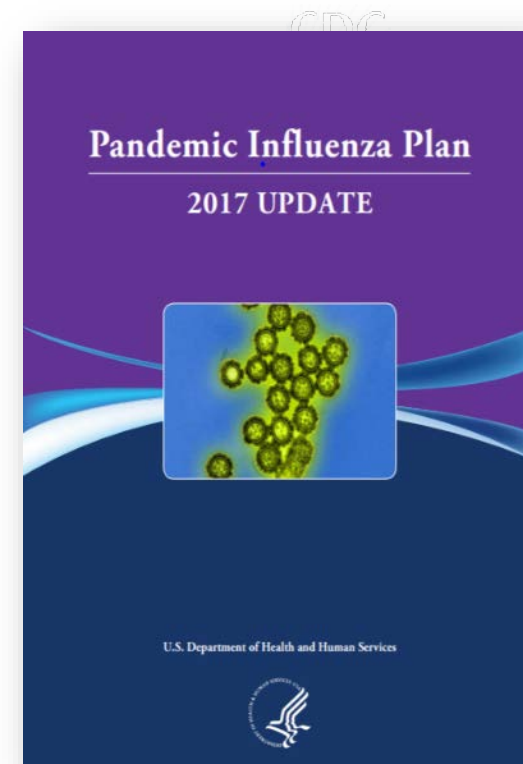
- World more crowded, more connected, and the worlds of humans and animals are increasingly converging
- If 1918 pandemic were to occur today, it could result in tens of millions deaths
  - Infection in 20-30% of global population
- Potential disruption of transportation and supply chains
  - Food, Energy, Medical Supplies
- Potential disruption of healthcare services
- Potential high economic costs
  - \$181B estimated for pan flu pandemic\*
  - SARS cost \$30 billion in only 4 months



\* [HHS Pandemic Influenza Plan 2017 Update](#)

## 2017 HHS Pandemic Influenza Plan

- Surveillance, Epidemiology, and Laboratory Activities
- Community Mitigation Measures
- Medical Countermeasures: Diagnostic Devices, Vaccines, Therapeutics, and Respiratory Devices
- Health Care System Preparedness and Response Activities
- Communications and Public Outreach
- Scientific Infrastructure and Preparedness
- Domestic and International Response Policy, Incident Management and Global Partnerships and Capacity Building



- Strengths

- Expanded global surveillance and reagent distribution for flu
- Greatly improved domestic flu surveillance
- Next-generation sequencing at CDC of all flu viruses received



- Gaps

- Inadequate surveillance in birds and swine
- ‘Data Deserts’ in Africa and many developing countries



- Strengths

- Antivirals

- Increased availability of antivirals
      - Oseltamivir, Zanamivir, Peramivir, Laninamivir
    - Stockpiles maintained in some countries for use in emergency



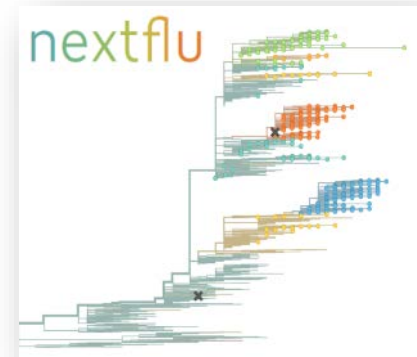
- Gaps

- Need better performing antivirals
  - Need reusable respiratory protective devices and better ventilator access
  - Healthcare system could get overwhelmed in a severe pandemic



- Strengths

- Improved virologic forecasting
- New vaccine technologies available
  - Synthetic biology for making vaccine viruses
  - Cell-grown vaccines
  - Recombinant protein vaccines
- More manufacturing capacity available
- New programs for introducing vaccine for low- & mid-income countries



- Gaps

- Takes too long to have vaccine available for pandemic response
- Need better current vaccines as we work toward a truly “universal” vaccine



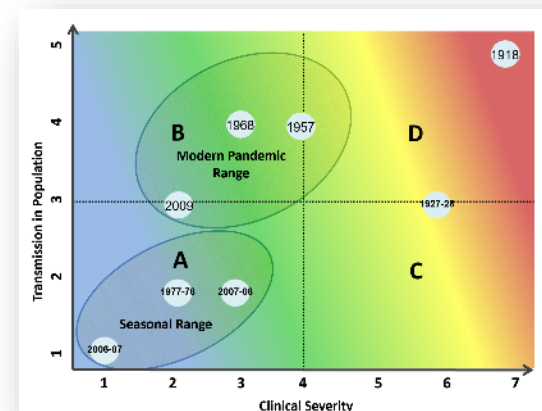
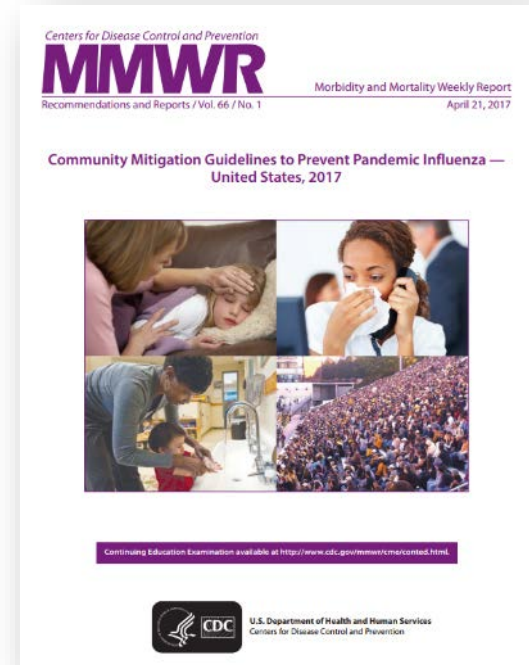


- Strengths

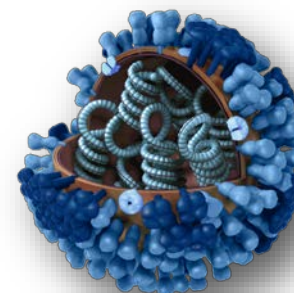
- Better tools for responding to a pandemic
  - Severity Assessment Framework
  - Community Mitigation Guidance for use of non-pharmaceutical interventions

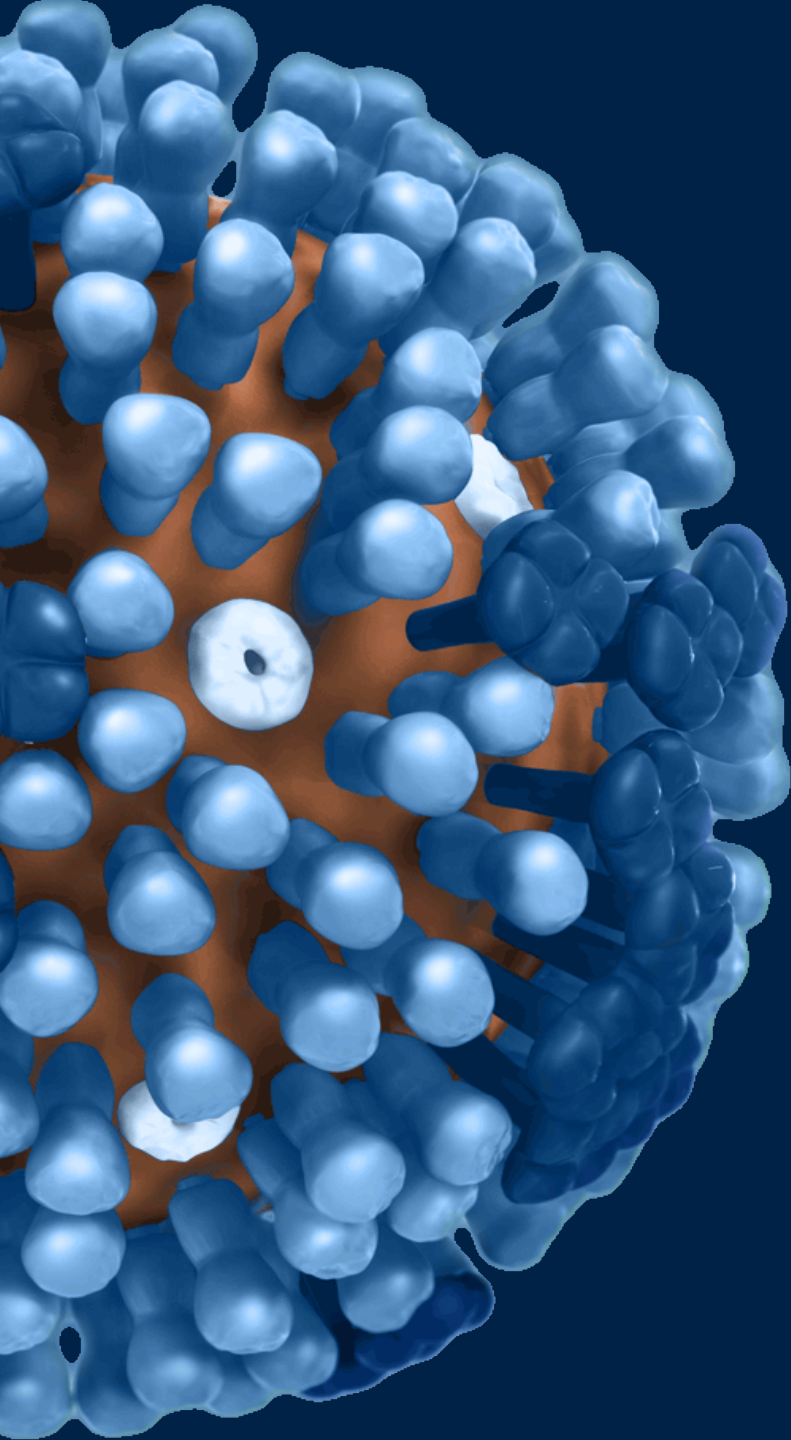
- Gaps

- Most countries do not have robust pandemic plans and very few exercise response efforts
- Only a third of all countries are prepared to meet Global Health Security / WHO readiness targets



- Influenza viruses are constantly changing, requiring ongoing surveillance and frequent vaccine virus changes
- Pandemics vary in severity
  - 1918 pandemic was exceptionally severe
  - A similar pandemic today would cause significant illness and death
- Number of detected emerging novel influenza viruses is increasing, requiring ongoing laboratory and epidemiologic investigations for risk assessments
- Efforts to improve pandemic readiness and response are underway, however, many gaps remain





# Commemoration Objectives & Resources

# Communication Objectives

- Underscore continued threat of pandemic influenza
- Highlight public health achievements in influenza preparedness and response
- Identify pandemic flu preparedness gaps, areas in need of further investment
- Empower people to act in order to decrease their risk of seasonal and pandemic influenza
  - Importance of vaccination
  - Know the actions they can take to protect their health in the event of a pandemic (i.e., personal, organizational, and community)

# What Can Partners Do?

- Use 1918 commemoration as a platform for collective public health preparedness messaging
- How
  - **Communication:** collaborate with CDC and each other on creative communications activities
  - **Events:** incorporate 1918 messaging into conferences, meetings, press events, etc.
  - **Other creative ideas:** share with us and we'll help spread the word

# Resources for Partners

- 1918 commemoration web page
- Master key points
- Infographics
- Digital timeline (1918 to present)
- Support for your ideas on how to commemorate with communications, events, or in other ways
  - CDC examples of activities include:
    - Hosting a 1918 Symposium with Emory University, Rollins School of Public Health
    - Integrating 1918 into conferences, presentations, plenary sessions, and publications

# Share your ideas: [1918flu@cdc.gov](mailto:1918flu@cdc.gov)

Contact us with:

- Follow-up questions
- Your 1918 events to add to our calendar
- Requests for CDC support, such as:
  - Assistance connecting with other partners
  - Communication resources
  - Commemoration event assistance

*Start the conversation - we look forward to engaging with you!*