

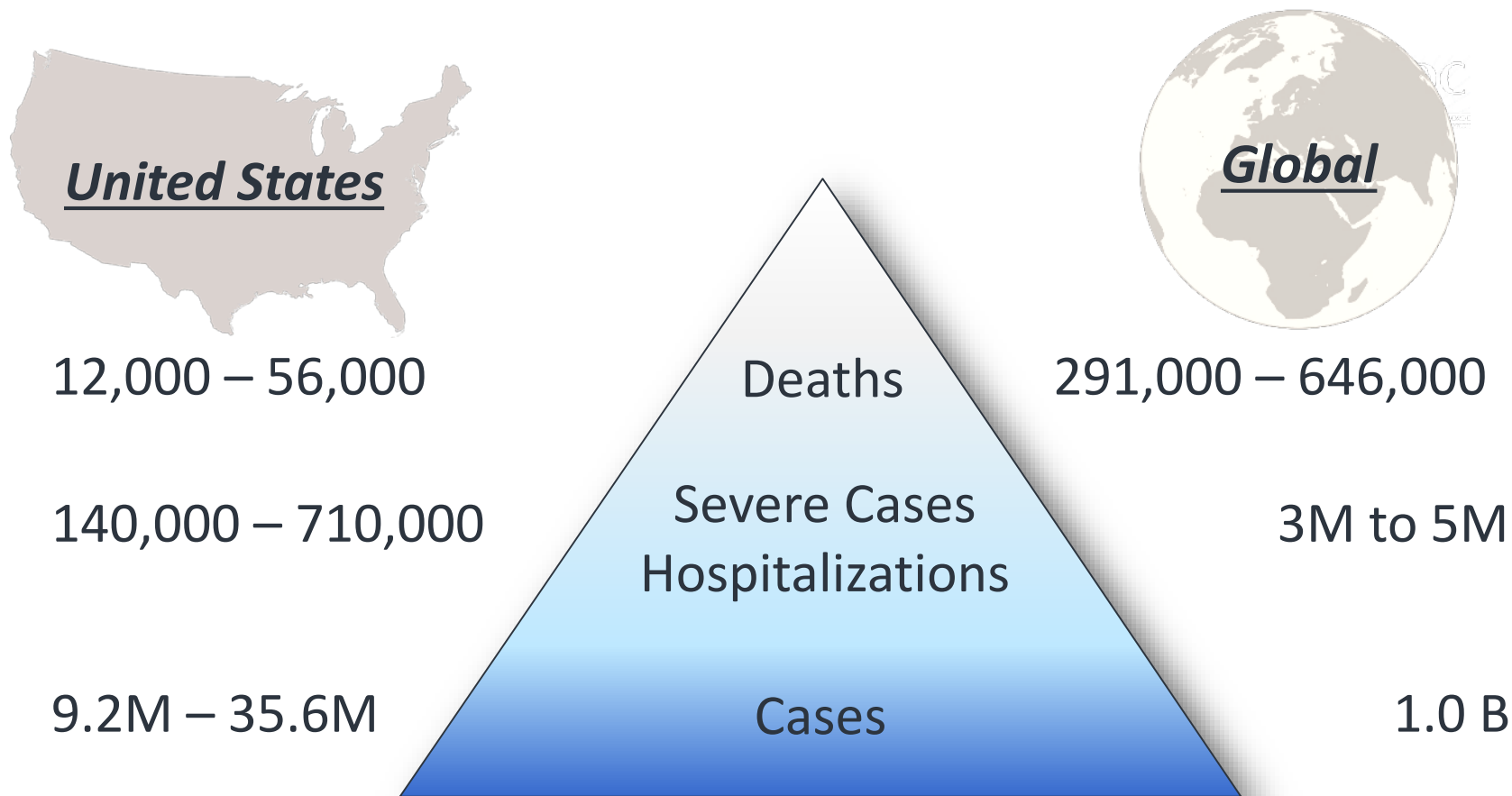
100 Years Since 1918: Are We Ready for the Next Pandemic?

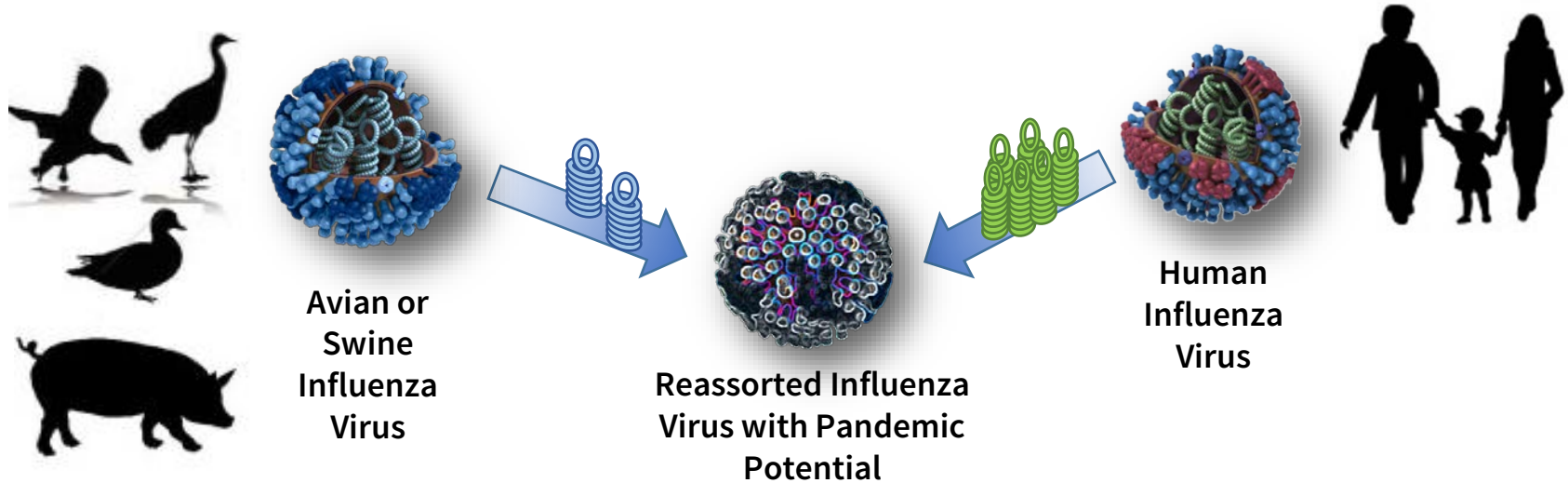
Daniel B. Jernigan, MD MPH
Director, Influenza Division

Centers for Disease Control and Prevention

Today's Agenda

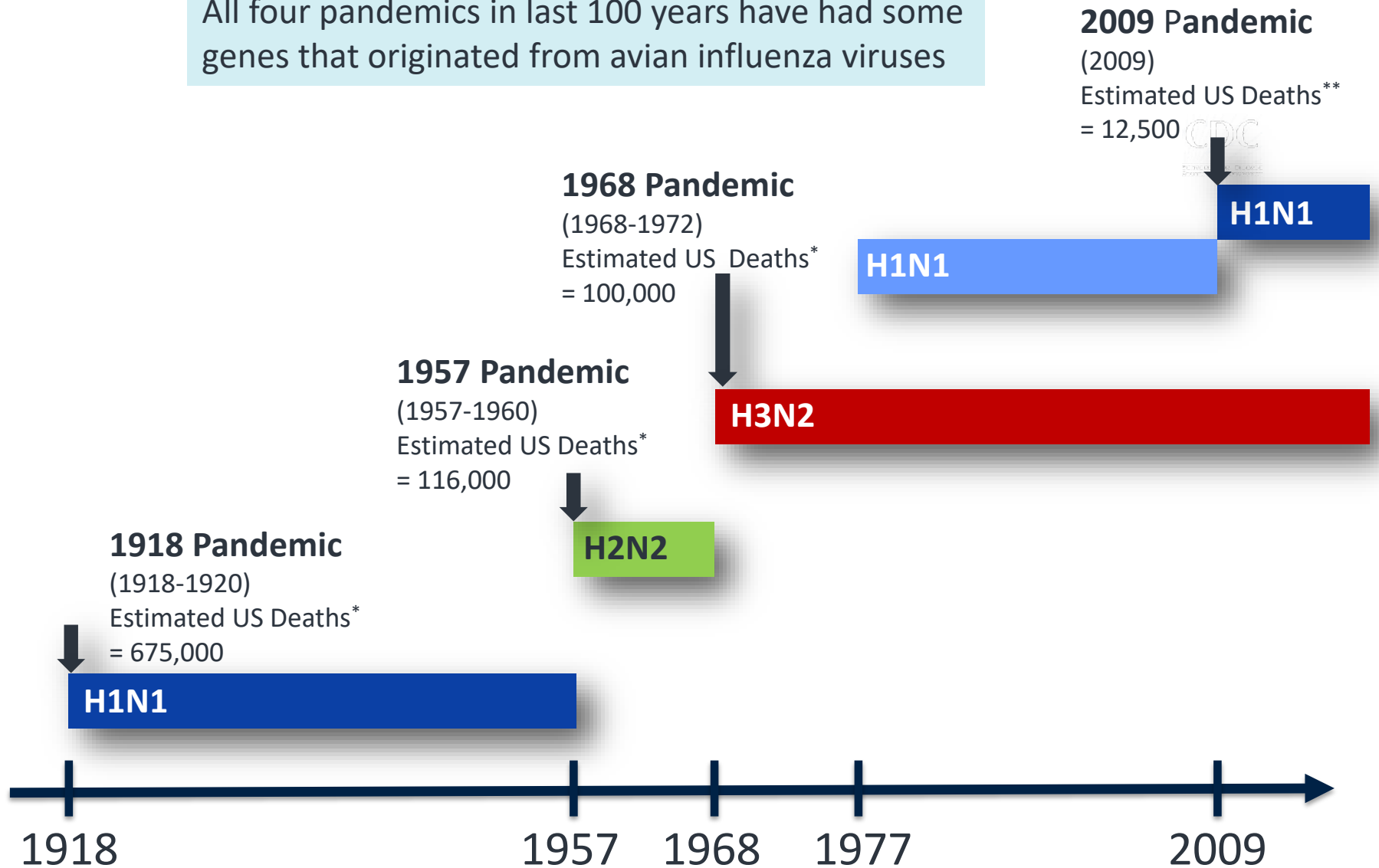
- Remembering the 1918 pandemic
- Reviewing current influenza threats
- Evaluating pandemic readiness
- Gathering input on 1918 commemoration activities





- 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



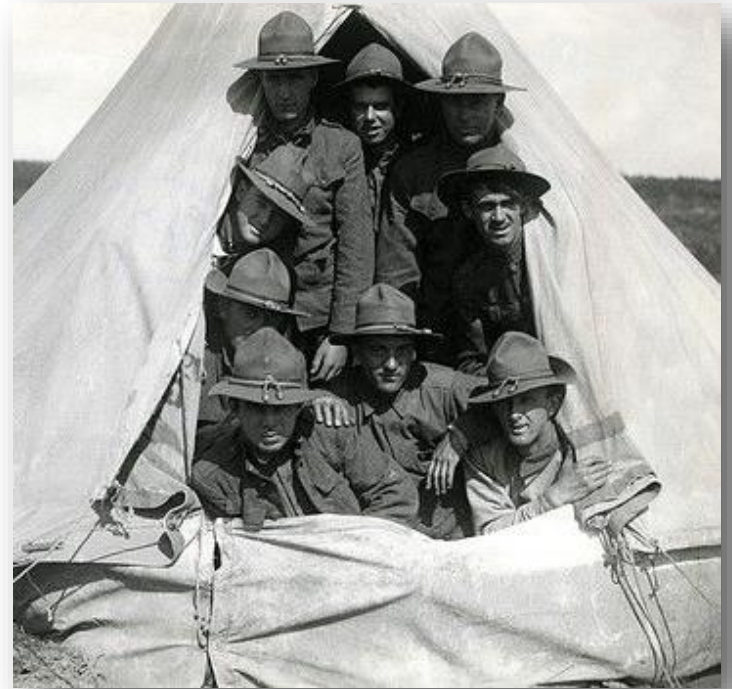
(*Glezen WP. Epidemiol Rev. 1996. **Shrestha SS. Clinical Infectious Diseases 2011.



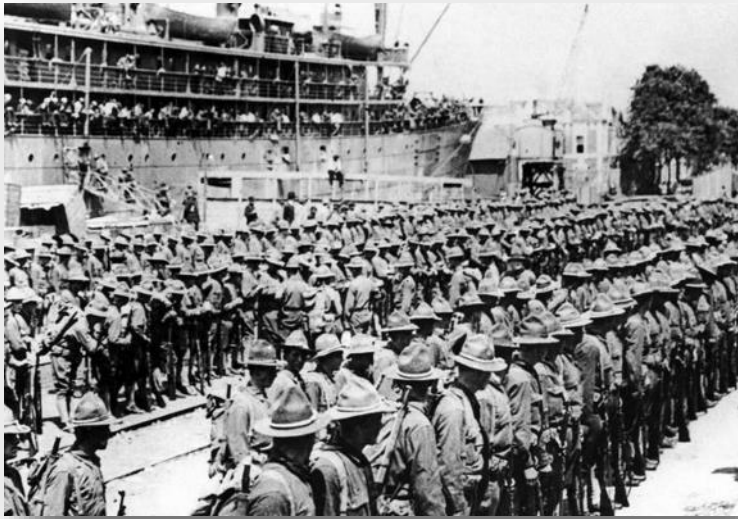
1918 Influenza Pandemic

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/

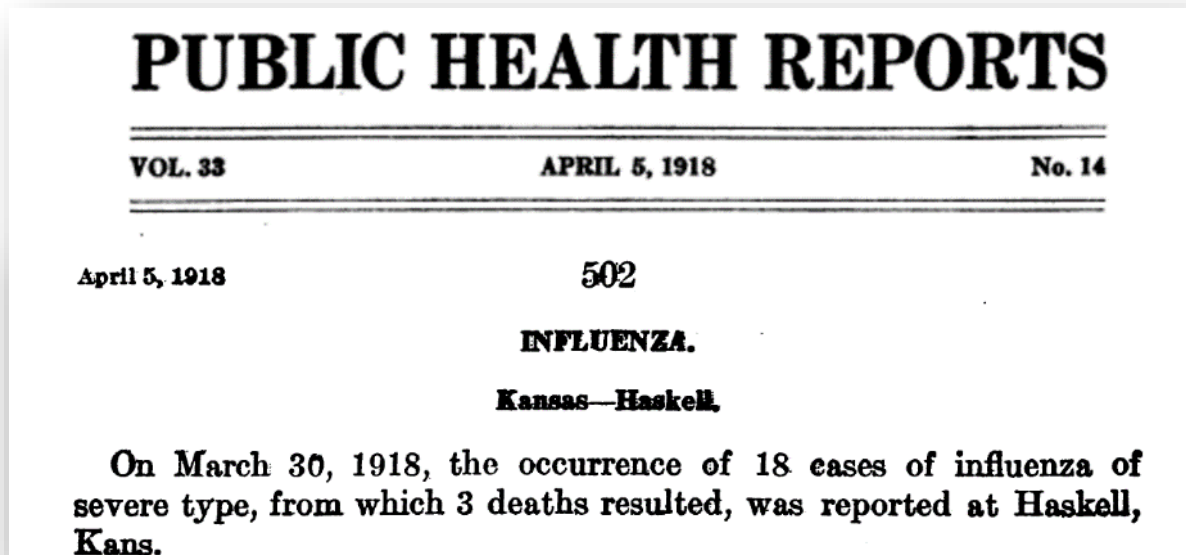
- Massive troop movement
 - From towns to training bases, to Europe
 - 10,000 men shipped to France every day in summer 1918



www.museumsyndicate.com/item.php?item=56784#

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

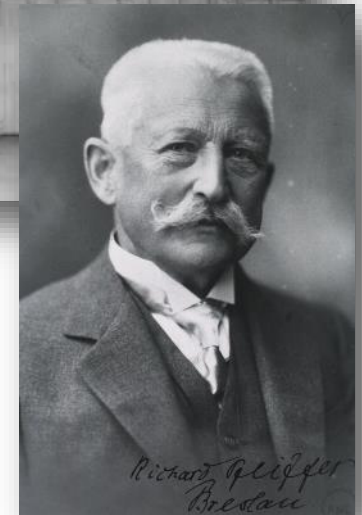
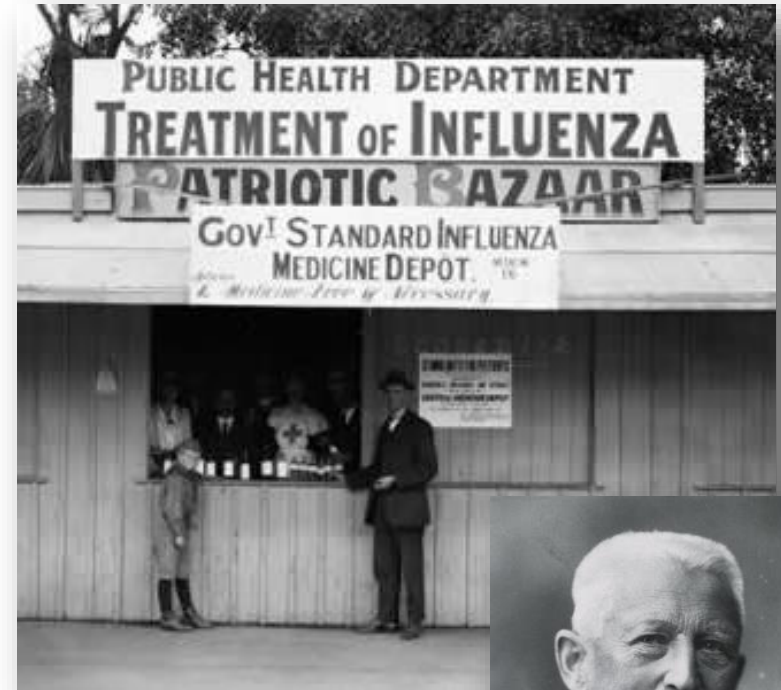
First Published Cases in US Public Health Reports, April 1918



- 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

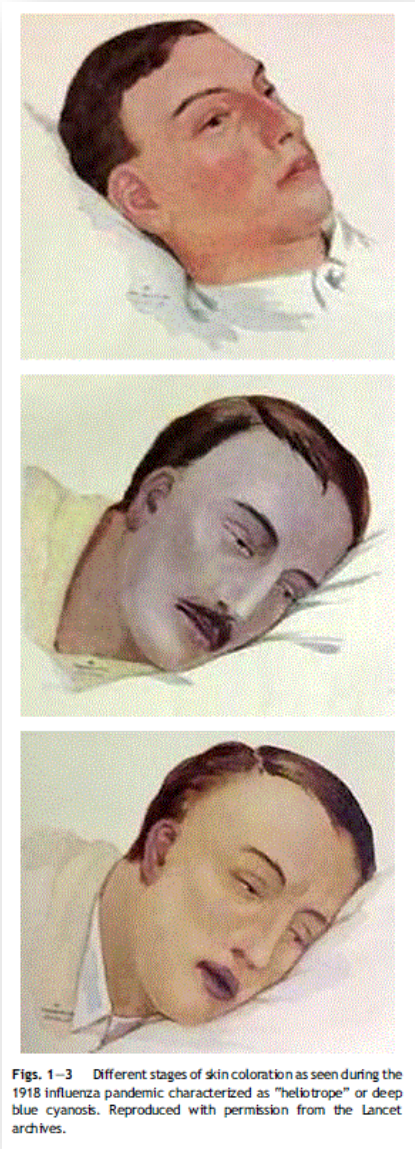
- Causative agent (virus) unknown, no flu treatment or prevention, flu transmission poorly understood
 - Cause of influenza attributed in 1892 by Pfeiffer to be a bacillus – *Haemophilus influenzae*
- Few vaccines:
 - typhoid, cholera, plague
- Only palliative therapies:
 - Aspirin, quinine, opium, ammonium, 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.”

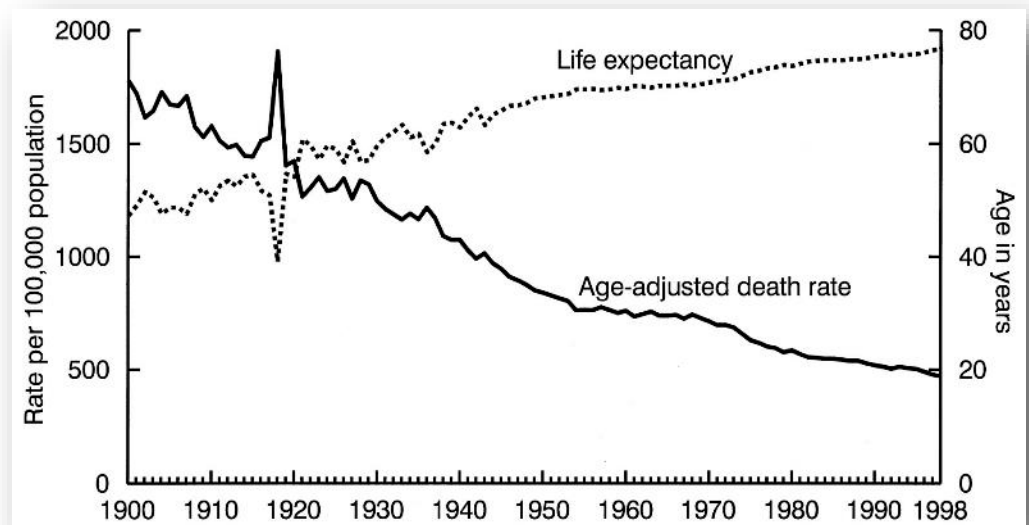
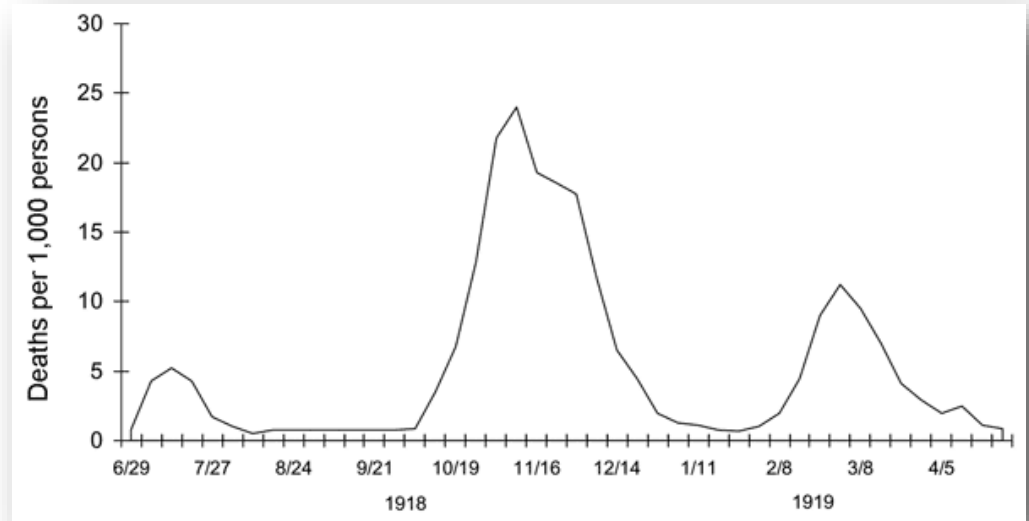


Figs. 1-3 Different stages of skin coloration as seen during the 1918 influenza pandemic characterized as "heliotrope" or deep blue cyanosis. Reproduced with permission from the Lancet archives.

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

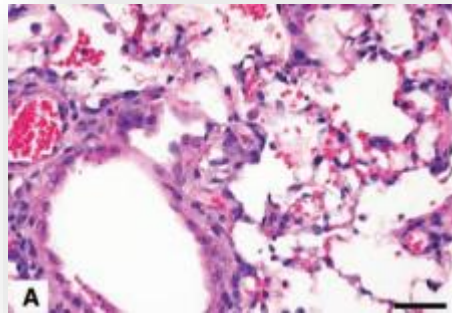


1997

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

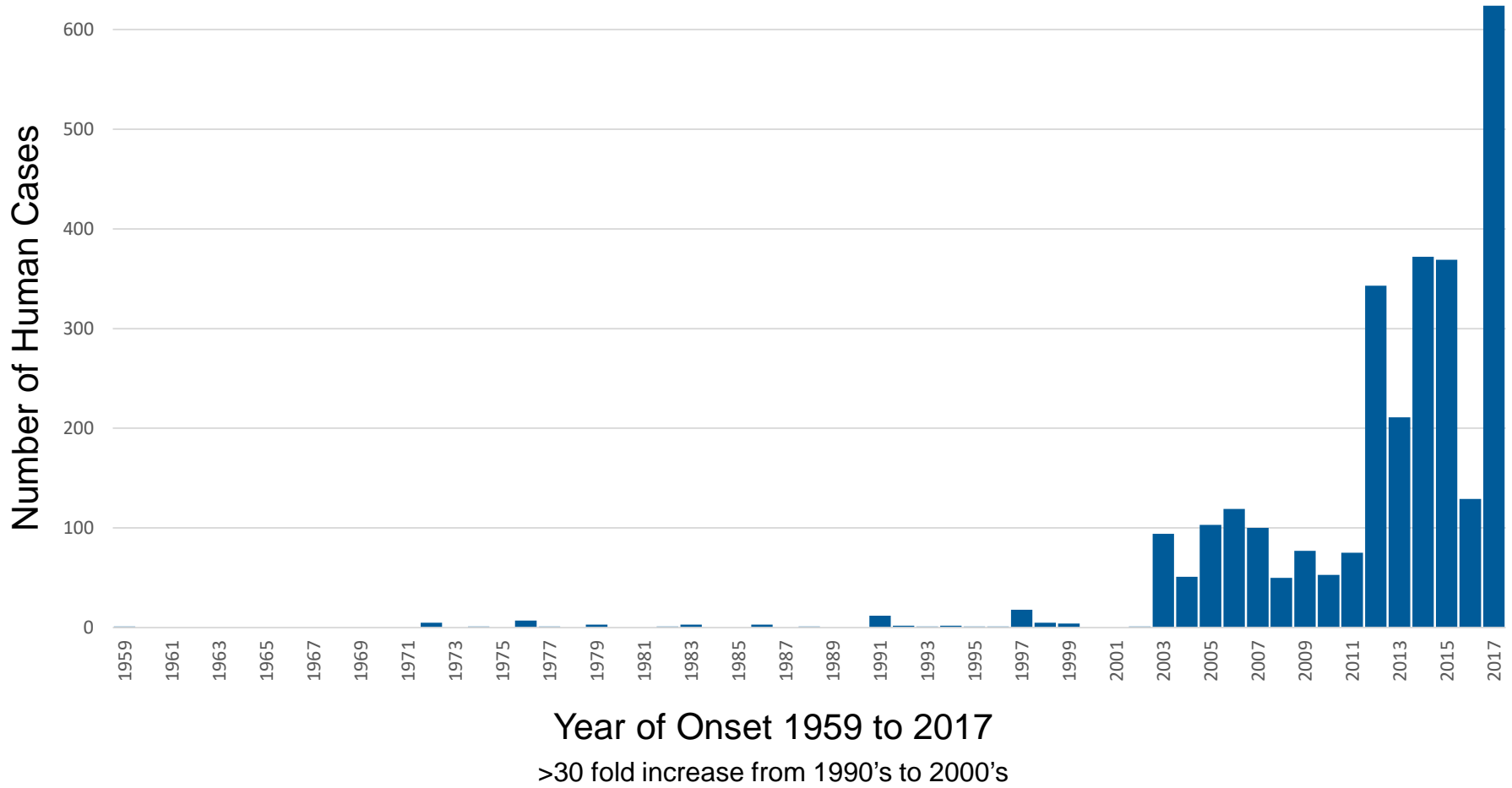


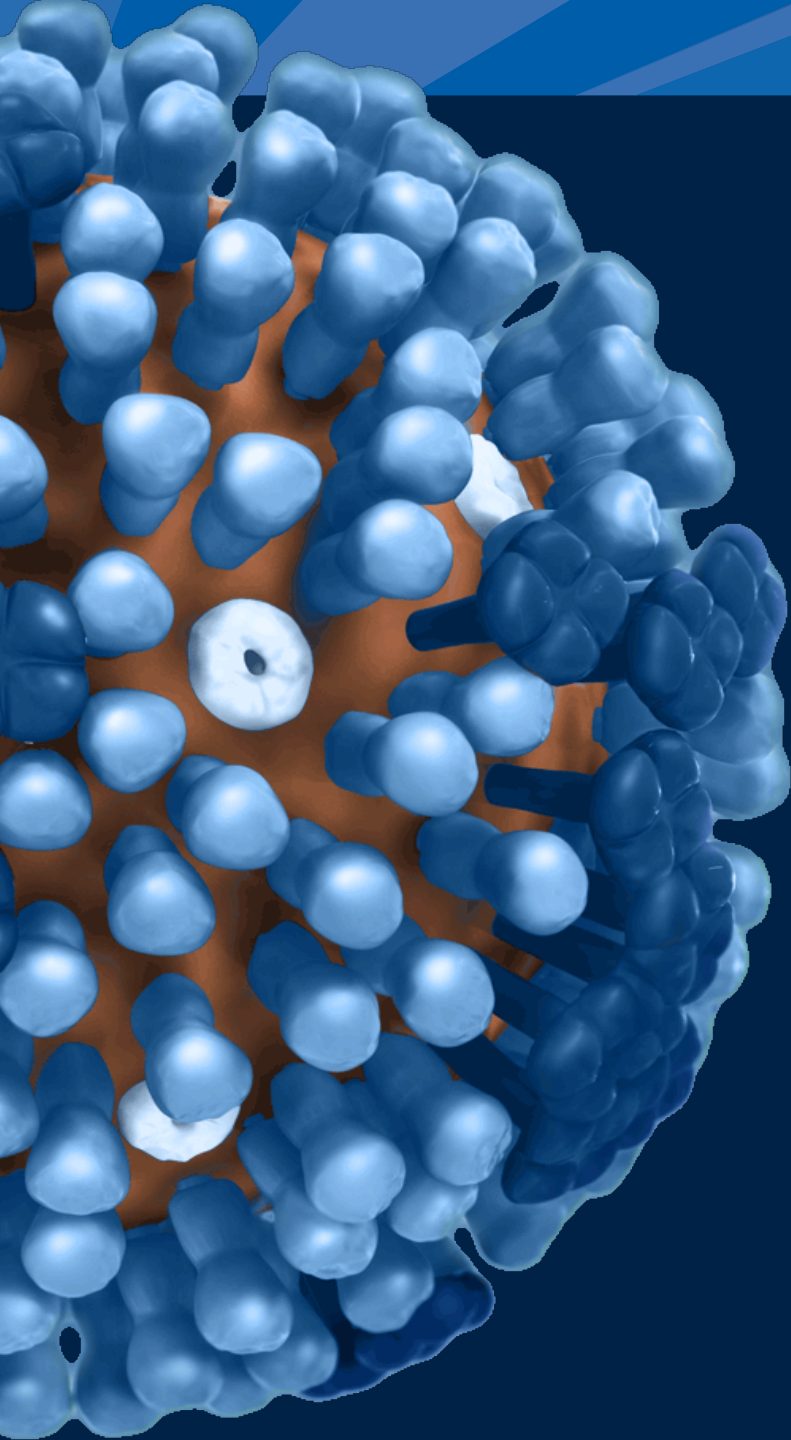
1997

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

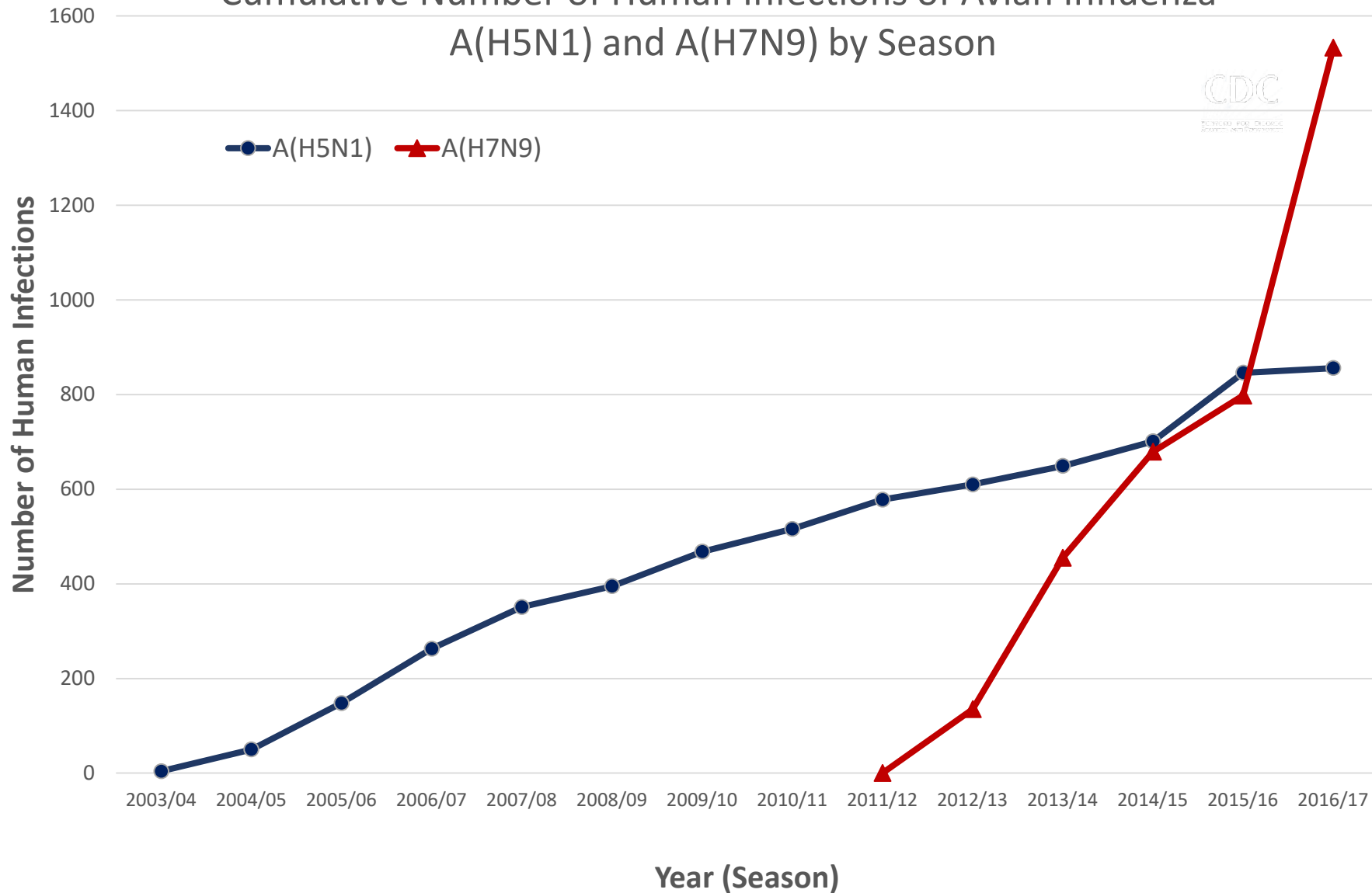
September 8, 2017

**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^{1,2}; Ruiqi Ren, MPH^{2,3}; Liqi Liu, MPH⁴; Carolyn M. Greene, MD⁵; Katherine Roguski, MPH¹; A. Danielle Iuliano, PhD¹; Yunho Jang, PhD¹; Joyce Jones, MS¹; Sharmi Thor, PhD¹; Ying Song, MD⁵; Suizan Zhou, MPH⁵; Susan C. Trock, DVM¹; Vivien Dugan, PhD¹; David E. Wentworth, PhD¹; Min Z. Levine, PhD¹; Timothy M. Uyeki, MD¹; Jacqueline M. Katz, PhD¹; Daniel B. Jernigan, MD¹; Sonja J. Olsen, PhD¹; Alicia M. Fry, MD¹; Eduardo Azziz-Baumgartner, MD¹; C. Todd Davis, PhD¹



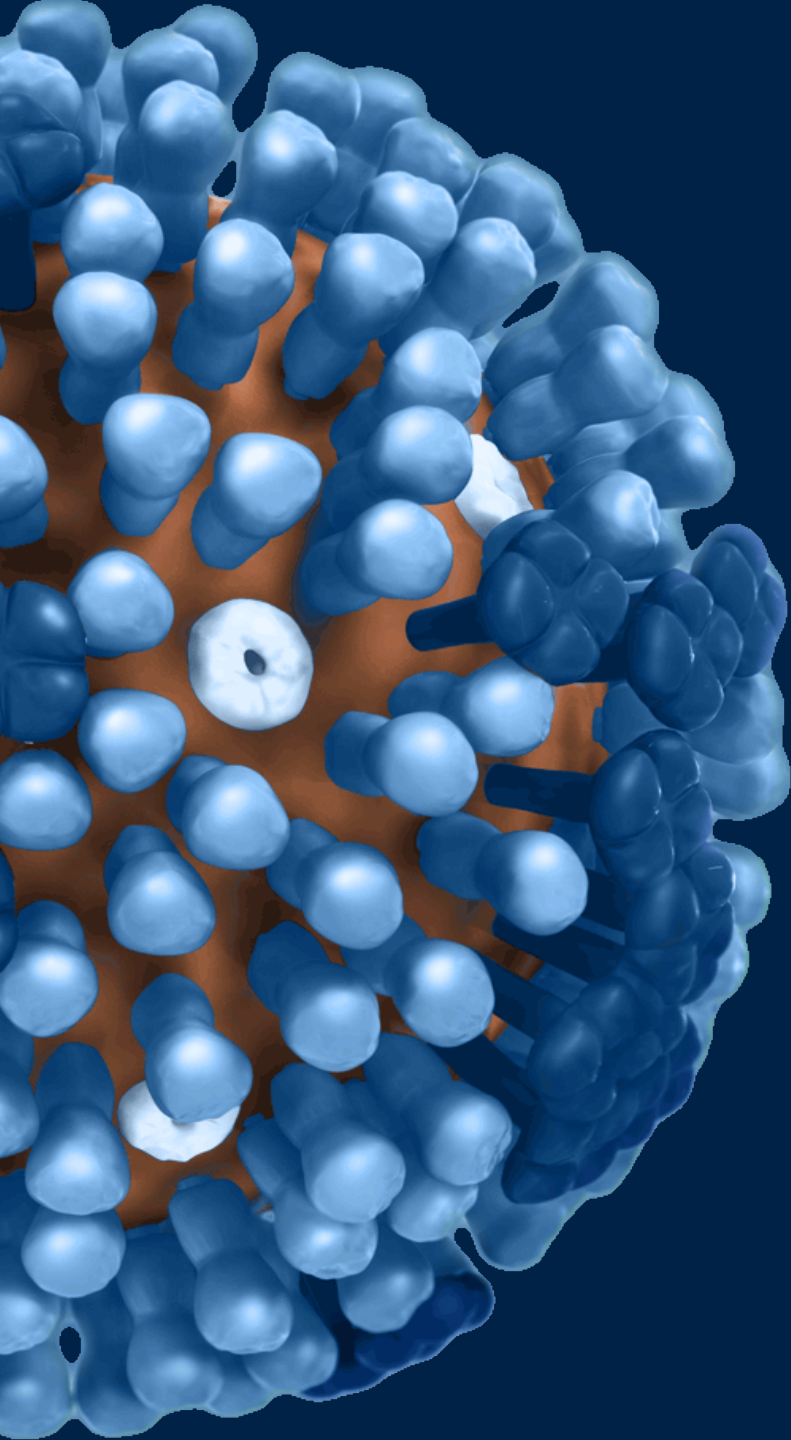
Cumulative Number of Human Infections of Avian Influenza A(H5N1) and A(H7N9) by Season



- Severe human infections
 - 90% developed pneumonia
 - 70% admitted to ICU
 - 40% died
- Clusters of infection
 - 35 reported but **no** sustained human-to-human transmission
- 5th 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?

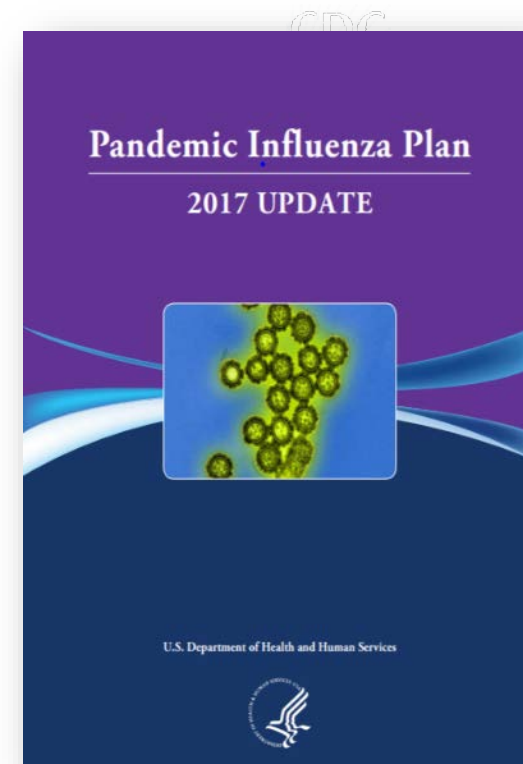
- World more crowded, more connected, and the worlds of humans and animals are increasingly converging
- If 1918 pandemic were to occur today, it could result in tens of millions deaths
 - Infection in 20-30% of global population
- Potential disruption of transportation and supply chains
 - Food, Energy, 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



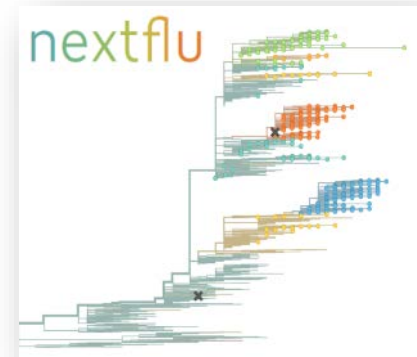
- Gaps

- 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



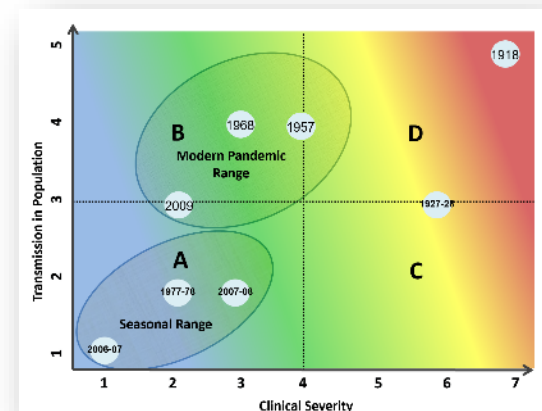
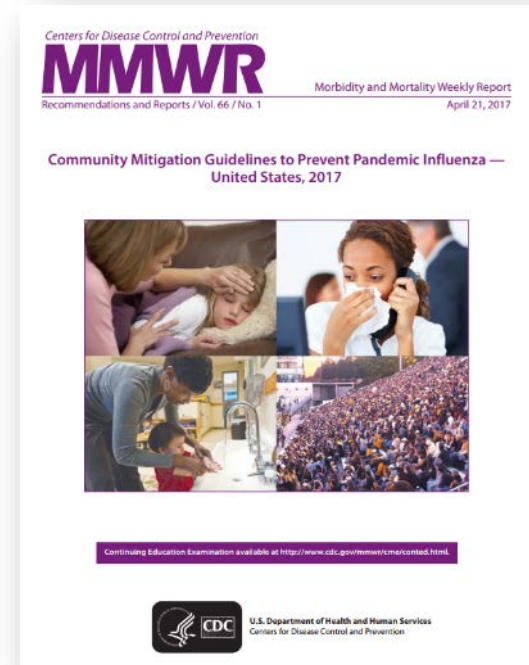
- Strengths

- Better tools for responding to a pandemic

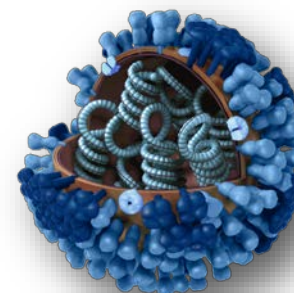
- Severity Assessment Framework
- Community Mitigation Guidance for use of non-pharmaceutical interventions

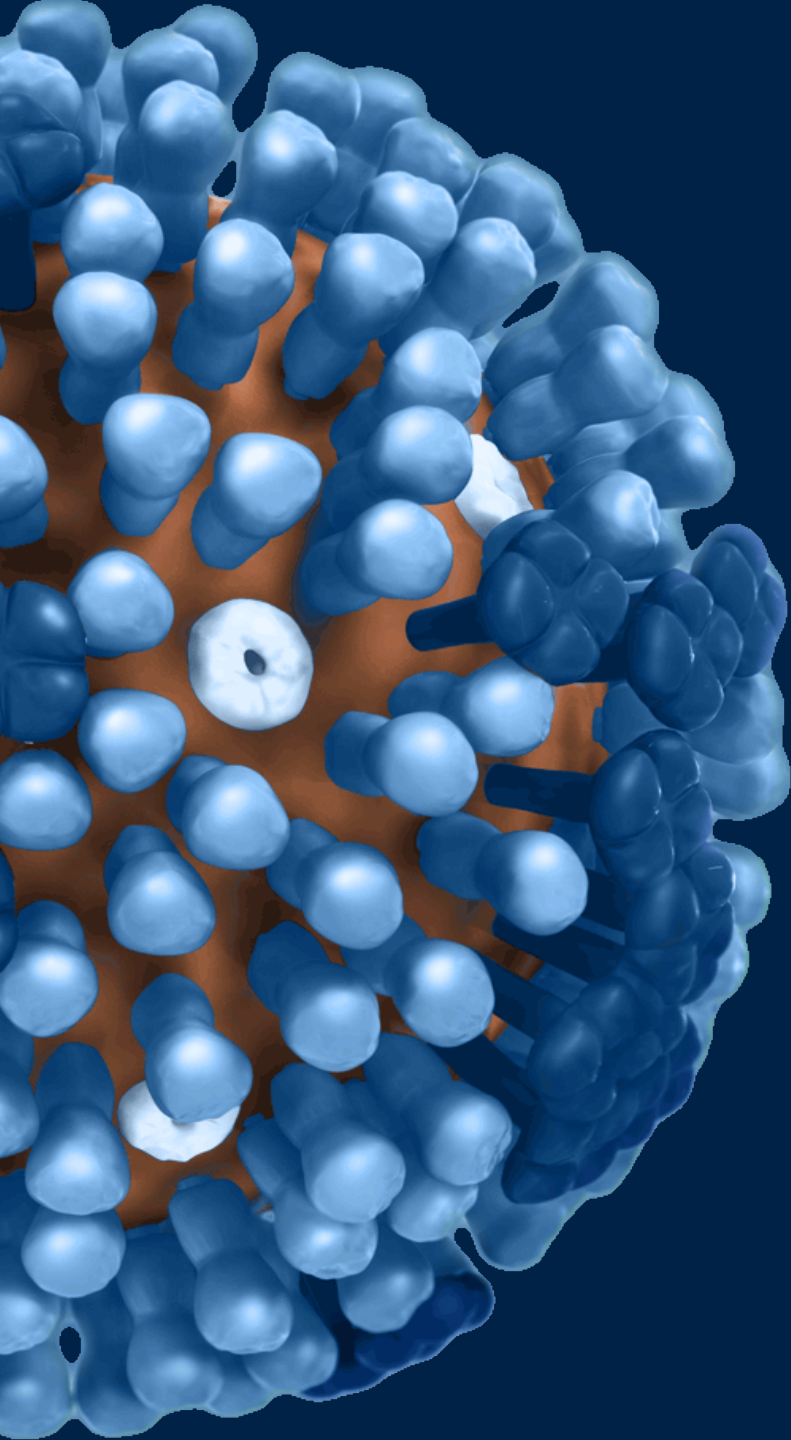
- Gaps

- 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

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!