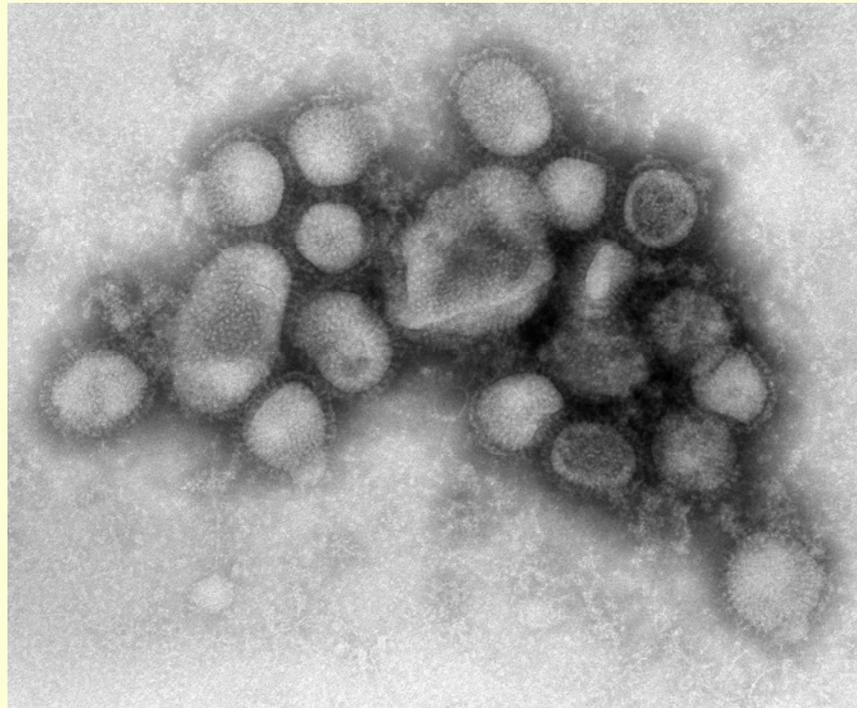
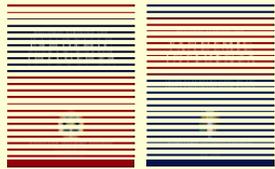


# **Pandemic Influenza Preparedness and Novel (swine) Influenza A/H1N1**



**Caroline C. Johnson, M.D.**  
**Director, Division of Disease Control**  
**Philadelphia Department of Public Health**

# National Pandemic Influenza Planning Landscape in 2006



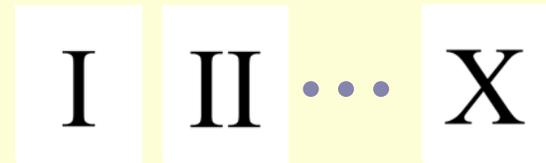
National Strategy and Implementation Plan



Departmental Plans



Component Plans



Federal Region Plans



State, Local, and Urban Area Plans

Private Sector Plans

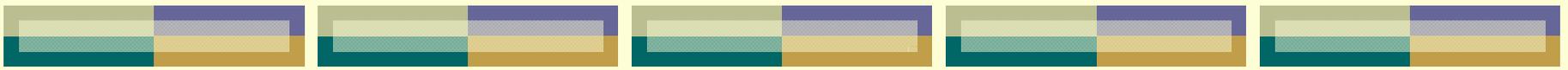
# Eleven Pandemic Planning Elements

Surveillance  
Laboratory Diagnosis  
Healthcare Planning  
Infection Control  
Clinical Guidelines  
Vaccine Distribution and Use  
Antiviral Medication Distribution  
Community Disease Control and Prevention  
Travel Related Risk of Disease  
Public Health Communications  
Workforce Support



**PANDEMIC INFLUENZA PREPAREDNESS PLAN**

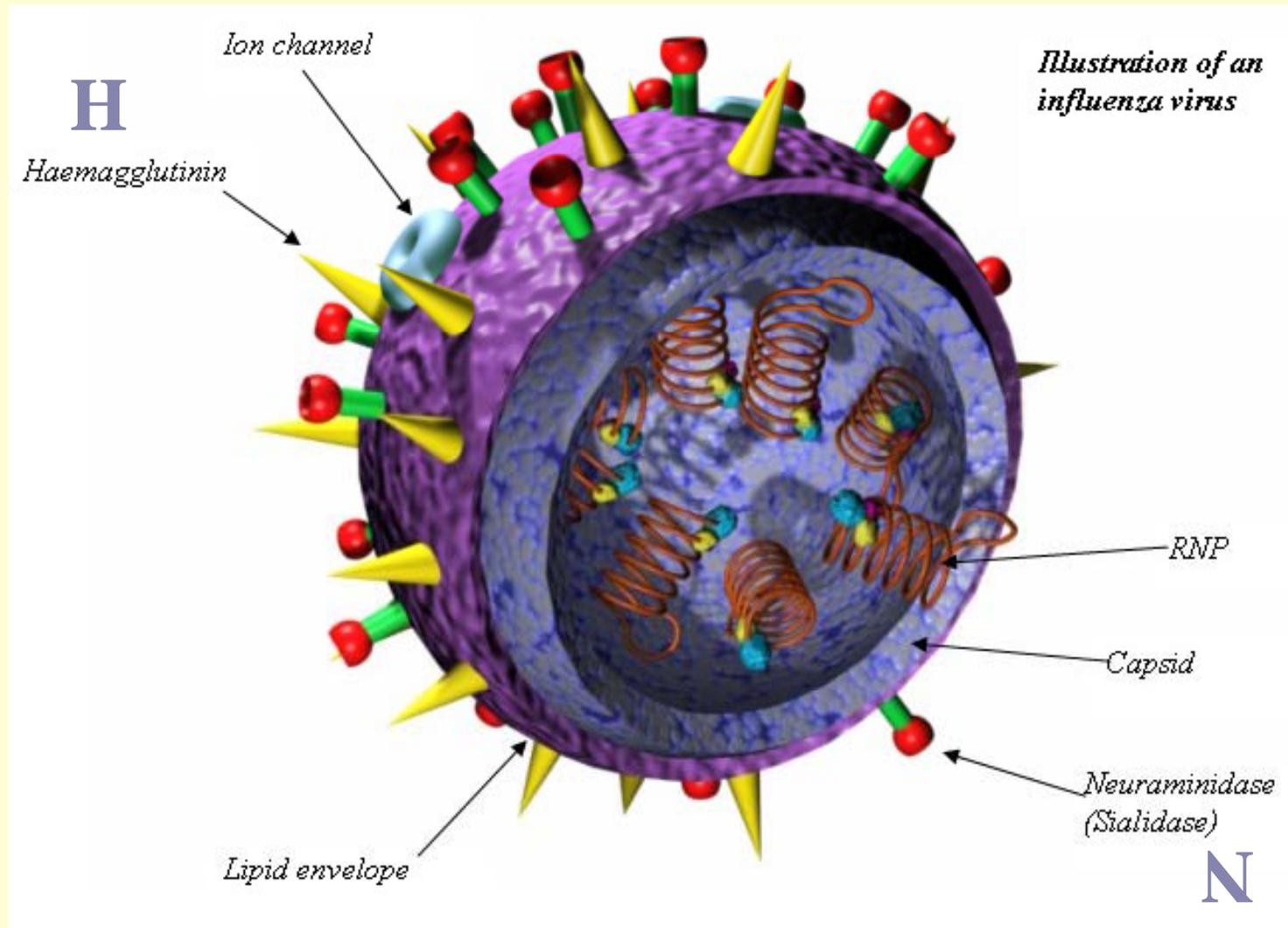
PHILADELPHIA DEPARTMENT OF PUBLIC HEALTH  
REVISED AUGUST 2006

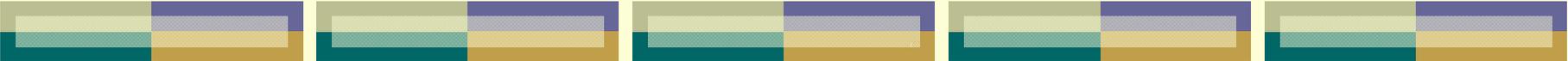


# Characteristics of Influenza Pandemics

- Flu pandemics occur when the virus acquires a new hemagglutinin and/or neuraminidase
  - Because the population has no pre-existing immunity, morbidity and mortality in flu pandemic are high, esp in younger people
  - To cause a pandemic, the flu virus must be able to spread person-to-person easily (e.g., the reproductive index is high)
  - Causes successive waves of infection
- 

# Influenza Virus Structure





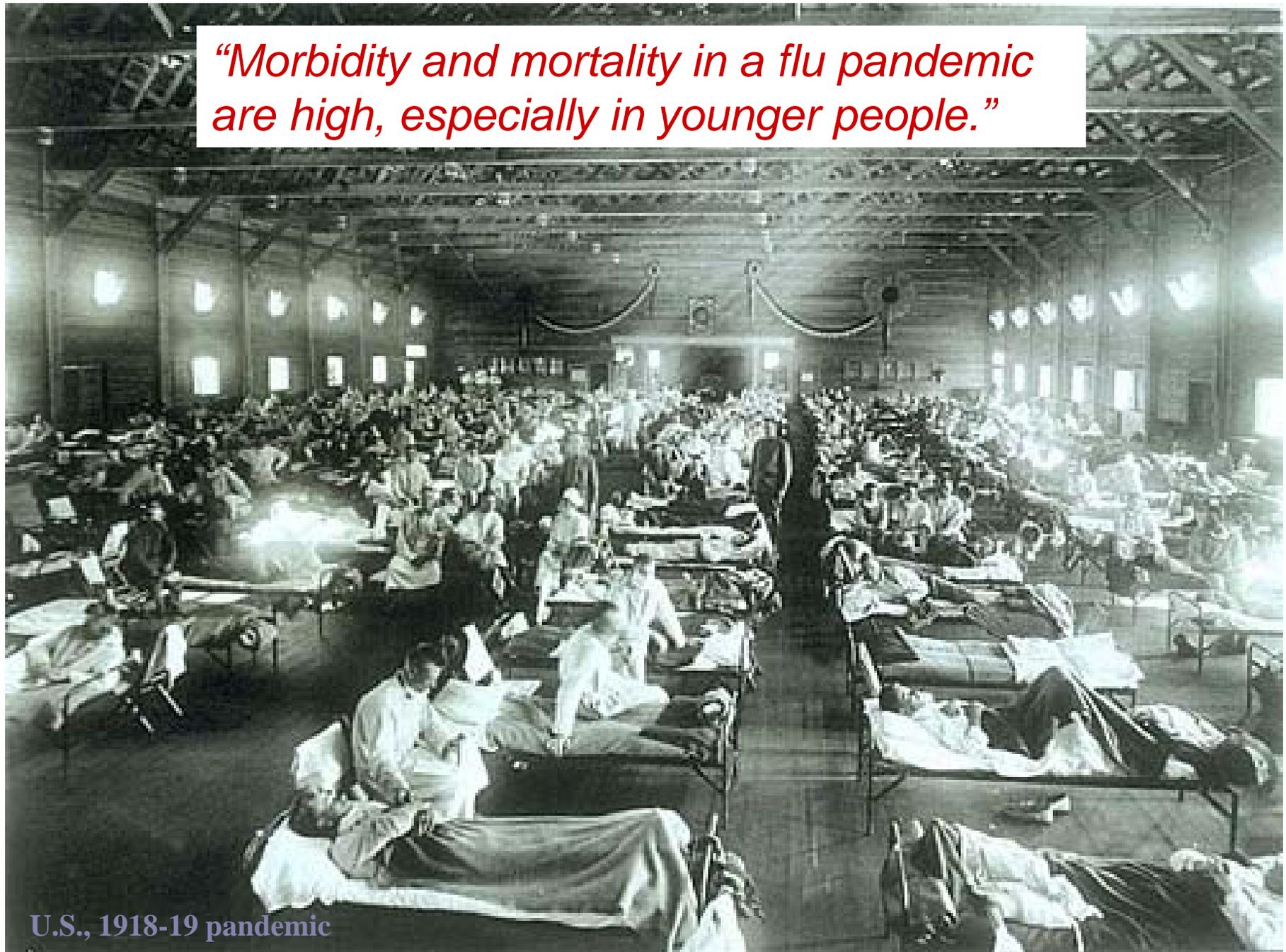
# Influenza Virus

- Antigenic drift – yearly
- Antigenic shift – periodic
- Reassortment – uncommon  
(genes for hemagglutinin and neuraminidase are on different strands of RNA)

*“Flu pandemics occur when the virus acquires a new hemagglutinin and/or neuraminidase”*

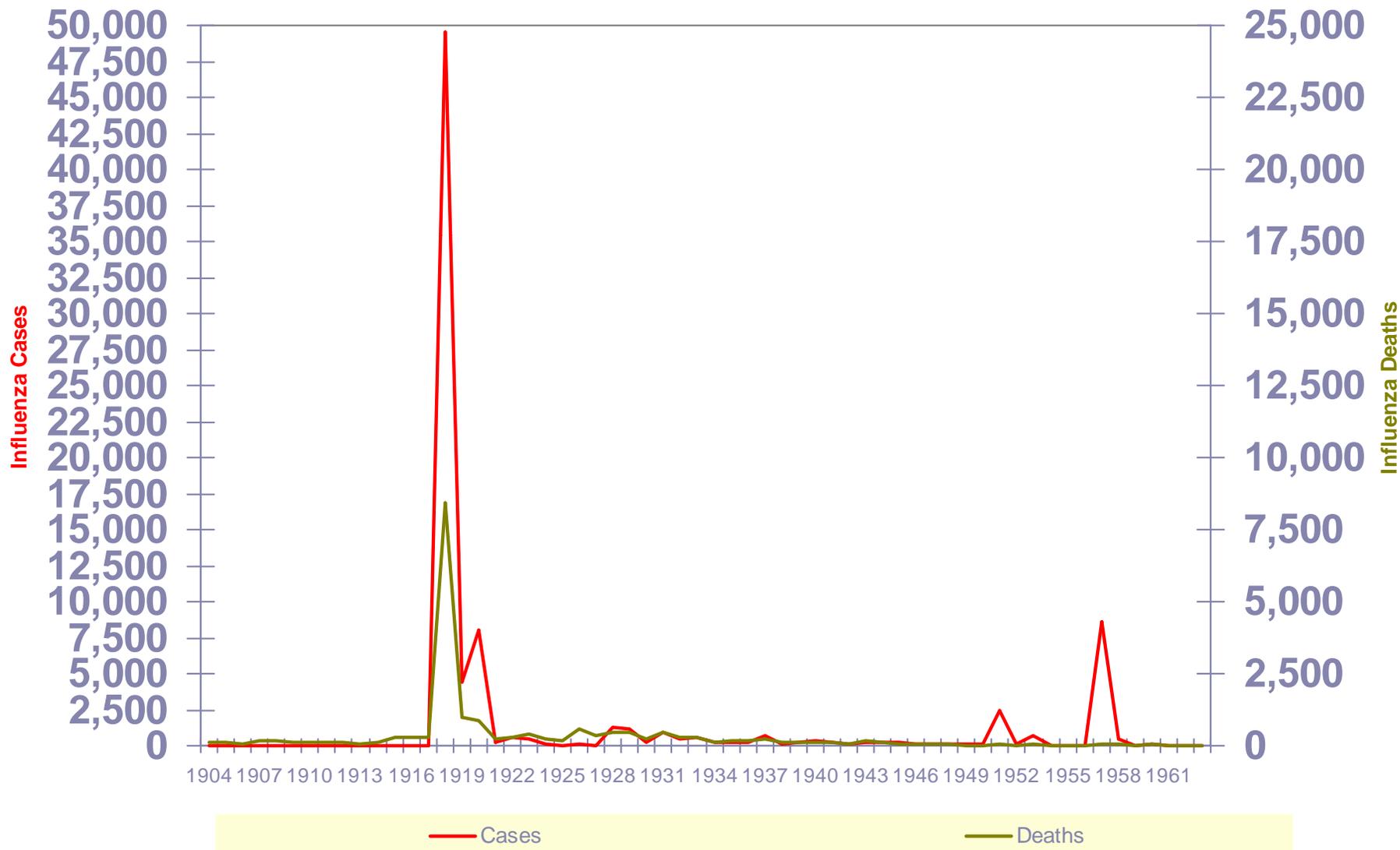


*“Morbidity and mortality in a flu pandemic are high, especially in younger people.”*



U.S., 1918-19 pandemic

# Influenza Cases and Deaths, 1904 to 1963: *Philadelphia Surveillance Data*



*“To cause a pandemic, the flu virus must be able to spread person-to-person easily (e.g., the reproductive index is high)”*

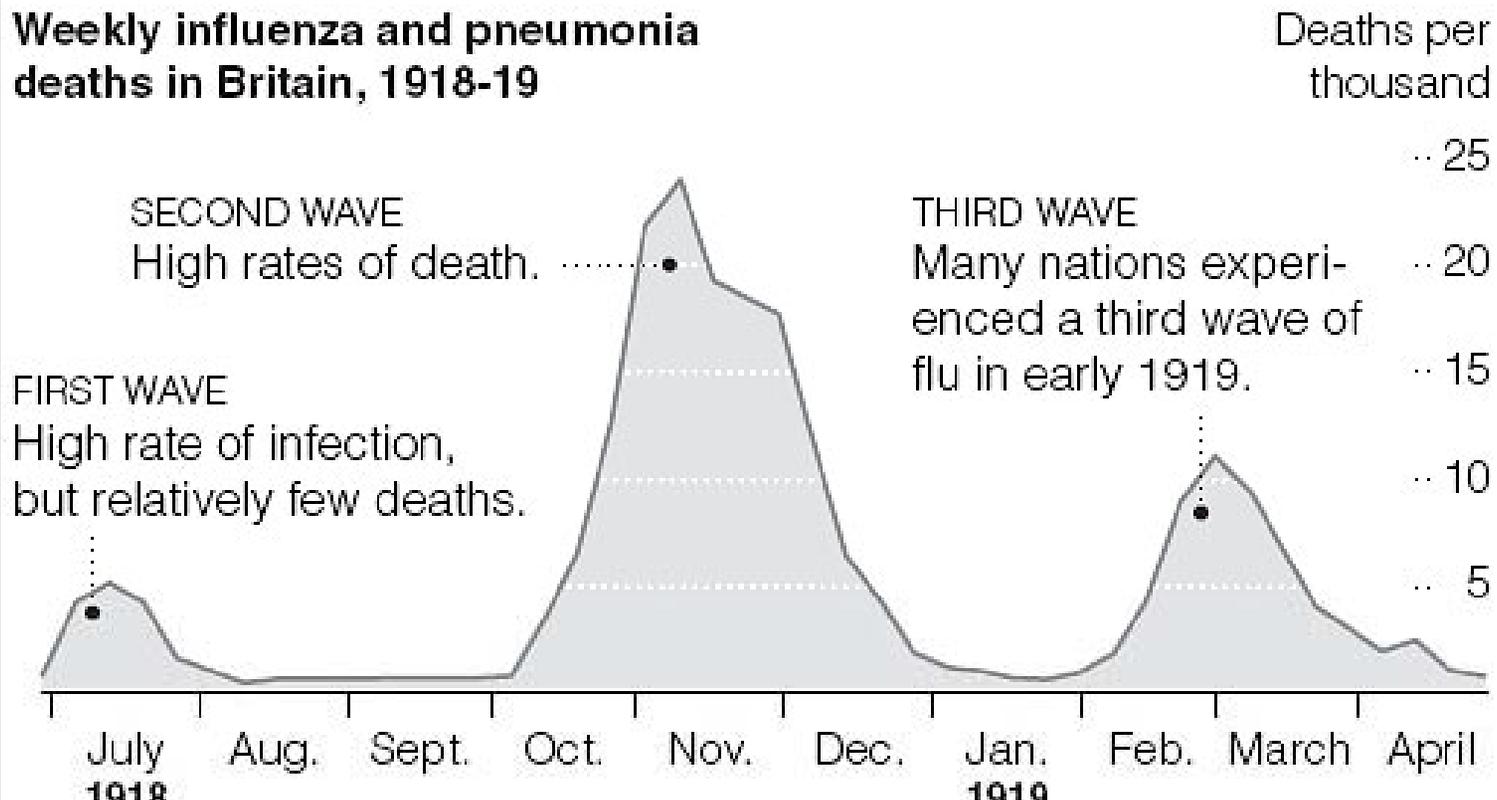


- Reproductive number is # of new flu cases attributable to a single source flu case
- With seasonal flu, # usually = 1.3
- In pandemic, # will reach 2-5

## The 1918 Pandemic

The influenza pandemic of 1918 spread across Europe, Asia and North America in three distinct but uneven waves, and was fatal for about 2 percent of those who caught it. Global data is incomplete, but death rates in Britain hint at the severity of the three waves.

### Weekly influenza and pneumonia deaths in Britain, 1918-19



*“A pandemic causes successive waves of infection.”*



2006

NEWLY ARRIVED  
TOURIST  
FROM...



ASIN 09  
MOUTH OF  
THE GODS



# Did We Get It Wrong?

*(not really)*

- Many animals, including humans, get infected with influenza viruses
- Influenza viruses generally stick with one species or another.
- Hallmark of influenza viruses is ability to undergo constant & dramatic change.

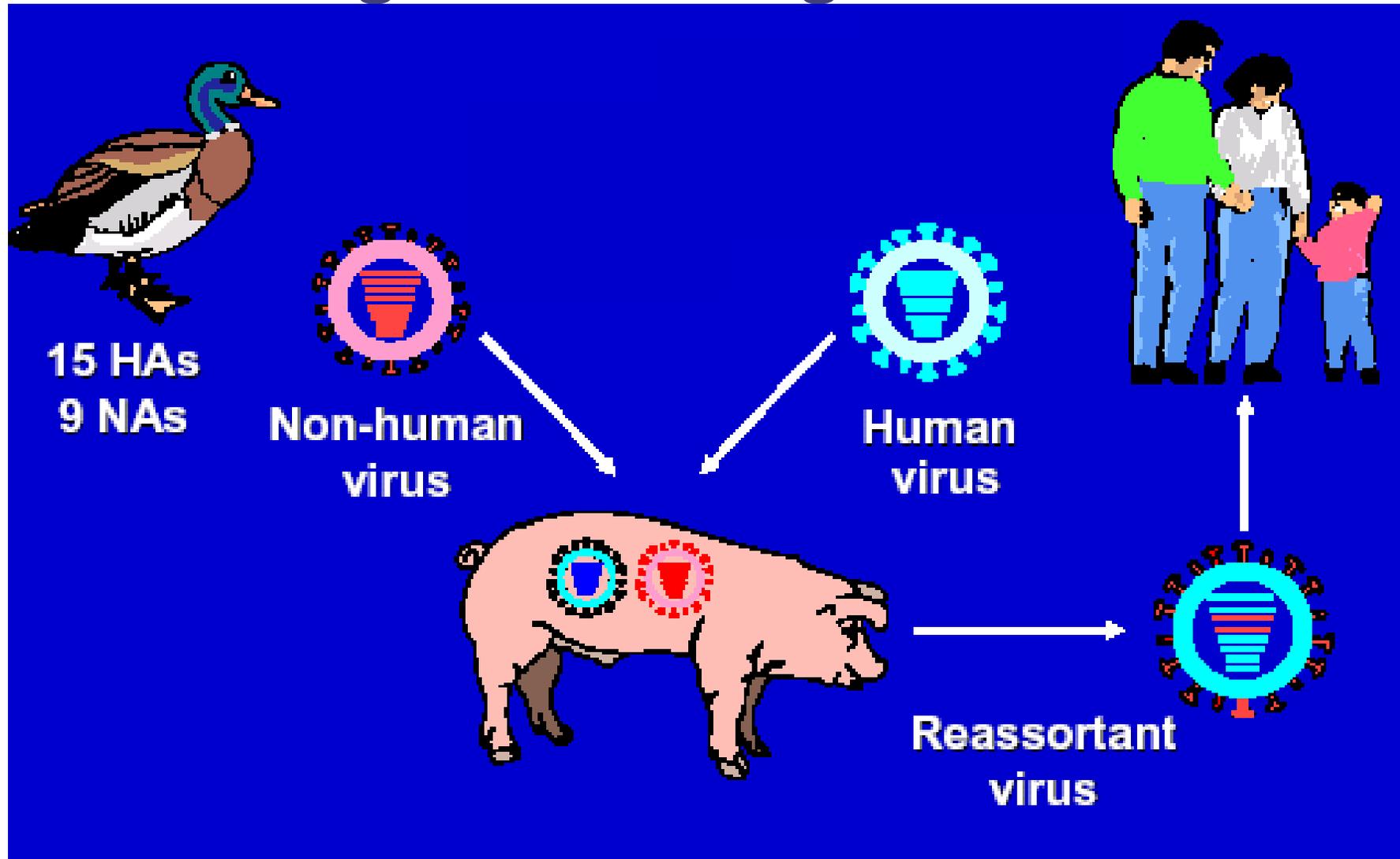


# Host Range of Influenza A Virus

- Humans: “traditionally” H1, H2, H3
- Birds: all assortments of HA
- Pigs: range including H1, H2, H3, H5
- Horses: H3, H7
- Marine Mammals: H3, H4, H7, H13
- Other species: e.g. mice in lab; tigers!; dogs



# Pigs as “Mixing Vessel”

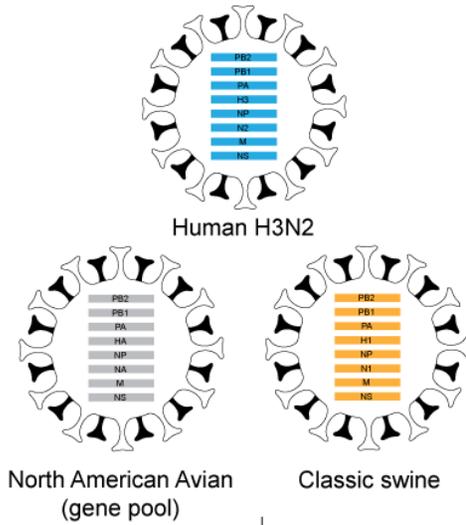


Adapted from Keiji Fukuda, CDC, presentation to *ICEID 2004*



# Novel H1N1 Influenza Virus ("Swine Flu")

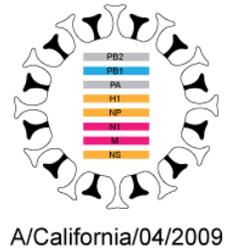
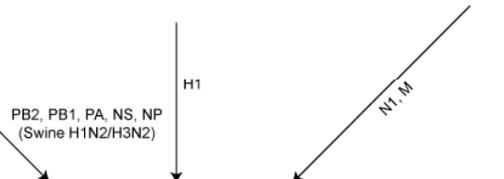
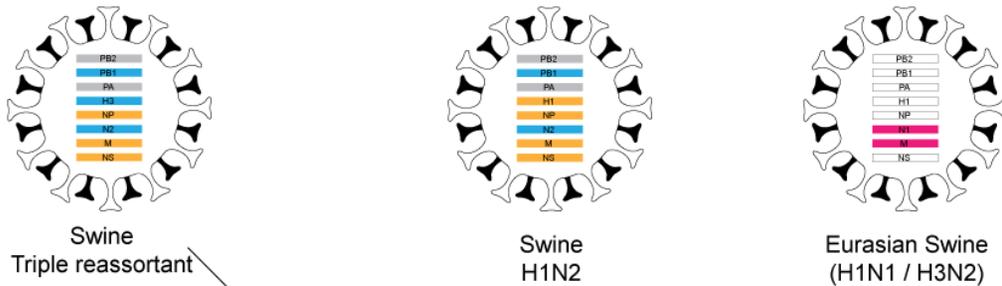
- The current swine flu is a genetic combination of influenza viruses that has never been seen before (part swine, part bird, part human).
- 



### Emergence pathway

PB2	- North American Avian	-> North American Swine (H1N2/H3N2)	-> A/California/04/2009
PB1	- Human H3N2	-> North American Swine (H1N2/H3N2)	-> A/California/04/2009
PA	- North American Avian	-> North American Swine (H1N2/H3N2)	-> A/California/04/2009
H1	- Classic swine	-> North American Swine (H1N2)	-> A/California/04/2009
NP	- Classic swine	-> North American Swine (H1N2/H3N2)	-> A/California/04/2009
N1	- Eurasian Avian	-> Eurasian swine	-> A/California/04/2009
M	- Eurasian Avian	-> Eurasian swine	-> A/California/04/2009
NS	- Classic swine	-> North American Swine (H1N2/H3N2)	-> A/California/04/2009

Genes derived from human H3N2 viruses have been circulating in pigs in North America atleast for the past 20 years (Zhou et al 1999).



[tree.bio.ed.ac.uk/groups/influenza/wiki/aea97/Phylogenetic\\_analysis\\_and\\_reassortment.htm](http://tree.bio.ed.ac.uk/groups/influenza/wiki/aea97/Phylogenetic_analysis_and_reassortment.htm)

The N1 and M gene are derived from Eurasian avian viruses. These genes have been circulating in pigs in Europe since the late 1970s/early 1980s (Sholtissek et al. 1983, 1993). The genes of avian origin have also been detected in pigs in Asia since 1993 (Guan et al. 1996).

# Is swine flu the next pandemic?



# Triggers for Implementation of Mitigation Strategies by Pandemic Severity Index and U.S. Government Stages

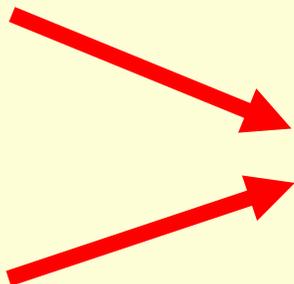
Pandemic Severity Index	WHO Phase 6, U.S. Government Stage 3*	WHO Phase 6, U.S. Government Stage 4†  and First human case in United States	WHO Phase 6, U.S. Government Stage 5§  and First laboratory-confirmed cluster in State or region¶
	1	Alert	Standby
2 and 3	Alert	Standby	Activate
4 and 5	Standby***	Standby/Activate ¶¶	Activate

**Alert:** Notification of critical systems and personnel of their impending activation.

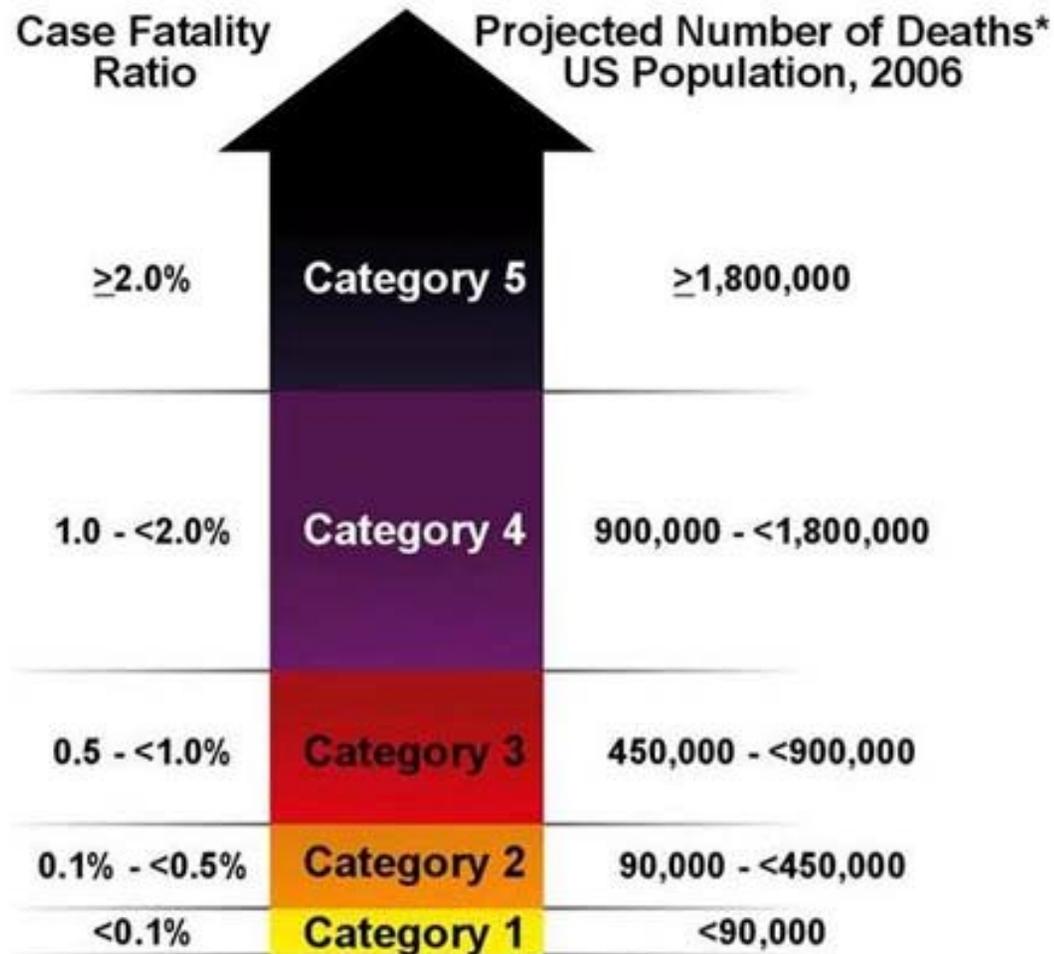
**Standby:** Initiate decision-making processes for imminent activation, including mobilization of resources and personnel.

**Activate:** Implementation of the community mitigation strategy.

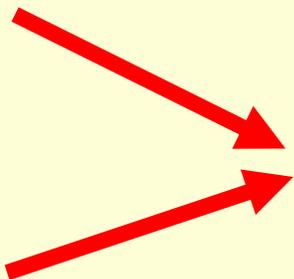
WHO Phases		Federal Government Response Stages	
<b>INTER-PANDEMIC PERIOD</b>			
1	No new influenza virus subtypes have been detected in humans. An influenza virus subtype that has caused human infection may be present in animals. If present in animals, the risk of human disease is considered to be low.	0	New domestic animal outbreak in at-risk country
2	No new influenza virus subtypes have been detected in humans. However, a circulating animal influenza virus subtype poses a substantial risk of human disease.		
<b>PANDEMIC ALERT PERIOD</b>			
3	Human infection(s) with a new subtype, but no human-to-human spread, or at most rare instances of spread to a close contact.	0	New domestic animal outbreak in at-risk country
		1	Suspected human outbreak overseas
4	Small cluster(s) with limited human-to-human transmission but spread is highly localized, suggesting that the virus is not well adapted to humans.	2	Confirmed human outbreak overseas
5	Larger cluster(s) but human-to-human spread still localized, suggesting that the virus is becoming increasingly better adapted to humans, but may not yet be fully transmissible (substantial pandemic risk).		
<b>PANDEMIC PERIOD</b>			
6	Pandemic phase: increased and sustained transmission in general population.	3	Widespread human outbreaks in multiple locations overseas
		4	First human case in North America
		5	Spread throughout United States
		6	Recovery and preparation for subsequent waves

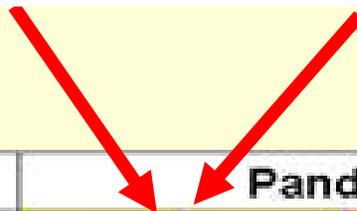


# Pandemic Severity Index

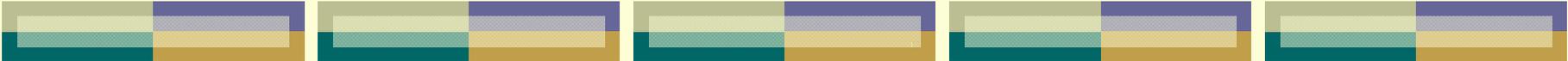


\*Assumes 30% illness rate  
and unmitigated pandemic  
without interventions





Interventions* by Setting	Pandemic Severity Index		
	1	2 and 3	4 and 5
<b>Home</b> <b>Voluntary isolation</b> of ill at home (adults and children); combine with use of antiviral treatment as available and indicated	Recommend †§	Recommend †§	Recommend †§
<b>Voluntary quarantine</b> of household members in homes with ill persons¶ (adults and children); consider combining with antiviral prophylaxis if effective, feasible, and quantities sufficient	Generally not recommended	Consider **	Recommend **
<b>School</b> <b>Child social distancing</b> -dismissal of students from schools and school based activities, and closure of child care programs -reduce out-of school social contacts and community mixing	Generally not recommended	Consider: ≤4 weeks ††	Recommend: ≤12 weeks §§
<b>Workplace / Community</b> <b>Adult social distancing</b> -decrease number of social contacts (e.g., encourage teleconferences, alternatives to face-to-face meetings) -increase distance between persons (e.g., reduce density in public transit, workplace) -modify, postpone, or cancel selected public gatherings to promote social distance (e.g., stadium events, theater performances) -modify work place schedules and practices (e.g., telework, staggered shifts)	Generally not recommended	Consider	Recommend
	Generally not recommended	Consider	Recommend
	Generally not recommended	Consider	Recommend
	Generally not recommended	Consider	Recommend



# Characteristics of Influenza Pandemics

- Flu pandemics occur when the virus acquires a new hemagglutinin and/or neuraminidase  
✓
  - Because the population has no pre-existing immunity, morbidity and mortality in flu pandemic are high, esp in younger people  
✓ / ?
  - To cause a pandemic, the flu virus must be able to spread person-to-person easily (e.g., the reproductive index is high)  
✓ / ?
  - Causes successive waves of infection  
?
- 

AHHHHHHH!!!  
SWINE FLU!!!

IT'S NICE  
TO BE SCARED  
SENSELESS  
BY SOMETHING  
BESIDES THE  
ECONOMY.

