Avian & Pandemic Flu: An Introduction
September 21, 2006

Part I: ABC's of Pandemic Influenza

NC Center for Public Health Preparedness

Webinar Symposium Series on Avian & Pandemic Influenza

ABC's of Pandemic Influenza

Webinar Symposium Series

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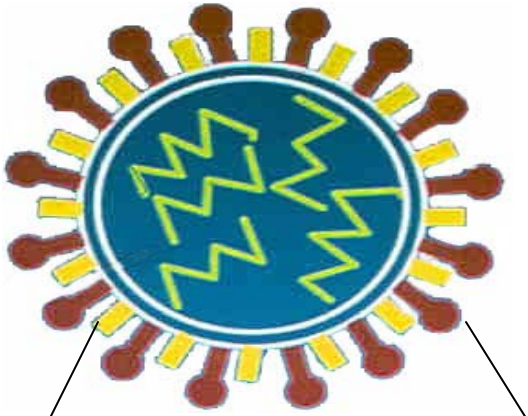
Objectives

- Review the fundamentals of influenza
- Understand history and possible impact of a new influenza pandemic
- Describe the current threat of pandemic influenza and the status of the H5N1 outbreak in humans
- Discuss issues and challenges of interventions to control the spread of pandemic influenza

Influenza Overview

- Types of influenza viruses
  - A
  - B
  - C
- Combination of surface proteins determines subtype of Influenza A
  - H__ N__
  - Hemagglutinin (16 known)
  - Neuraminidase(9 known)

Influenza A Virus Composition



Influenza Antigenic Changes

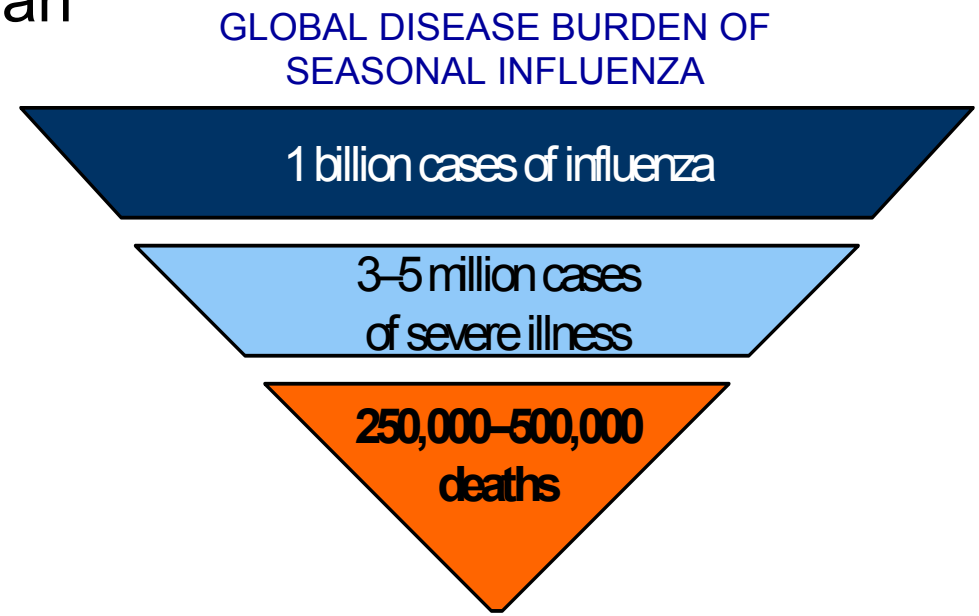
Structure of surface proteins periodically change:

- **Antigenic Drift: Minor change, same subtype**
  - In 1997, A/Wuhan/359/95 (H3N2) virus was dominant
  - A/Sydney/5/97 (H3N2) appeared in late 1997 and became the dominant virus in 1998

- **Antigenic Shift: Major change, new subtype**
  - H2N2 circulated in 1957-67
  - H3N2 appeared in 1968 and replaced H2N2
  - Pandemic potential

Seasonal Influenza

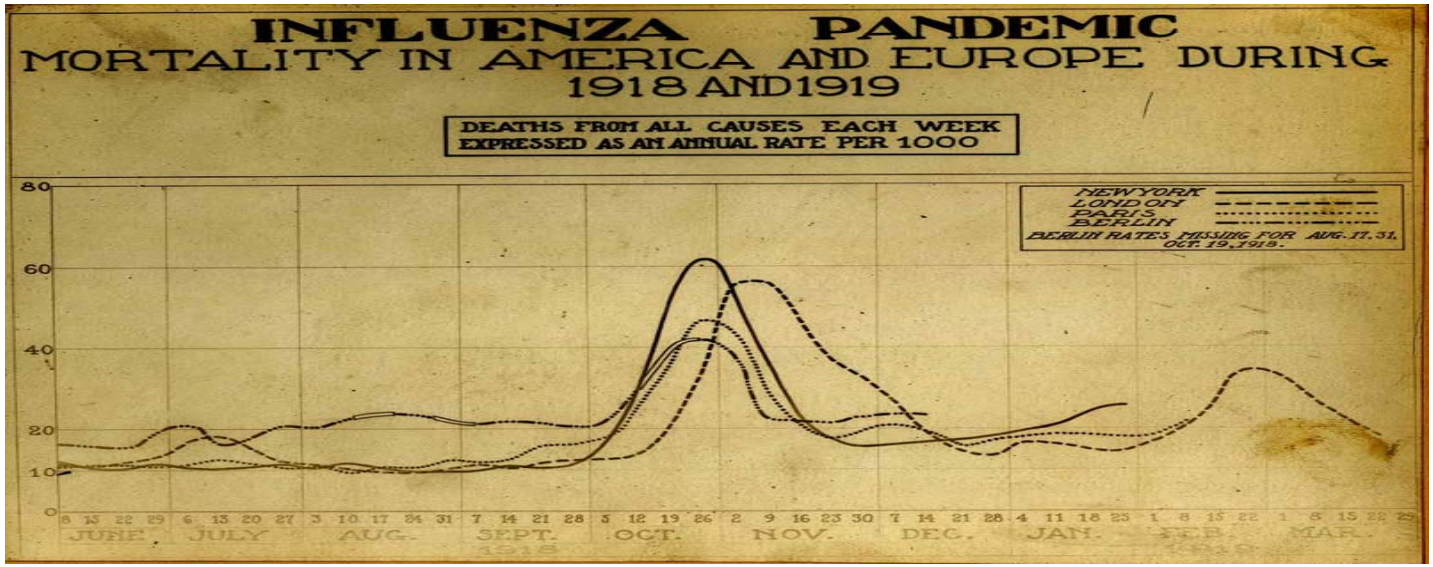
- "The flu" = acute respiratory illness
- Caused by infection with an influenza virus
- Highly contagious
- Seasonal epidemics
  - H1N1
  - H3N2
- Annual impact (U.S.)
  - 36,000 deaths
  - 200,000 hospitalizations



Source: www.who.int

Epidemics and Pandemics

- Epidemic: An increase in disease above what is normally expected
- Pandemic: An epidemic that spreads around the world affecting millions of people, across many countries



Seasonal vs. Pandemic Influenza

Seasonal Influenza	Pandemic Influenza
– Results from previously circulated influenza subtypes	– Caused by new influenza subtype (antigenic shift)
– Usually some immunity built up from previous exposures	– Human population lacks any immunity
– Vaccine available each year	– Vaccine not likely to be available
– A public health problem each year	– Appear in the human population rarely and unpredictably

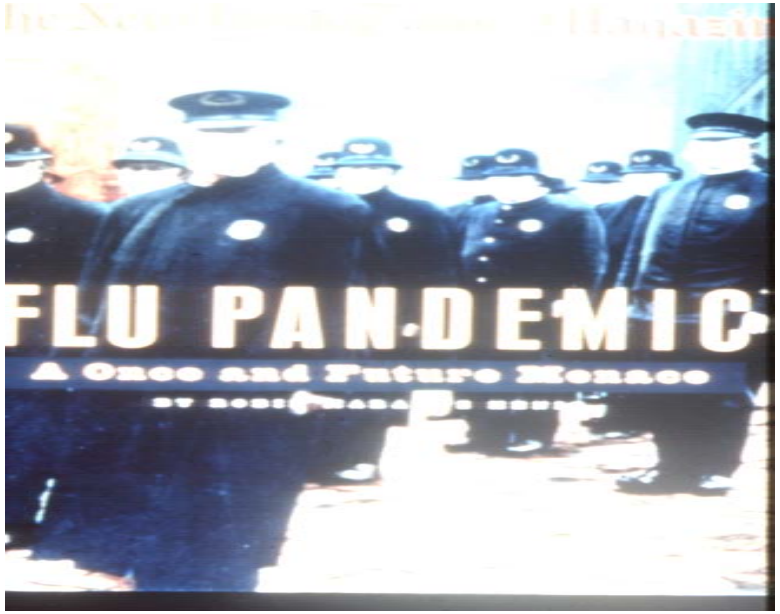
Why The Concern About Pandemic Influenza?

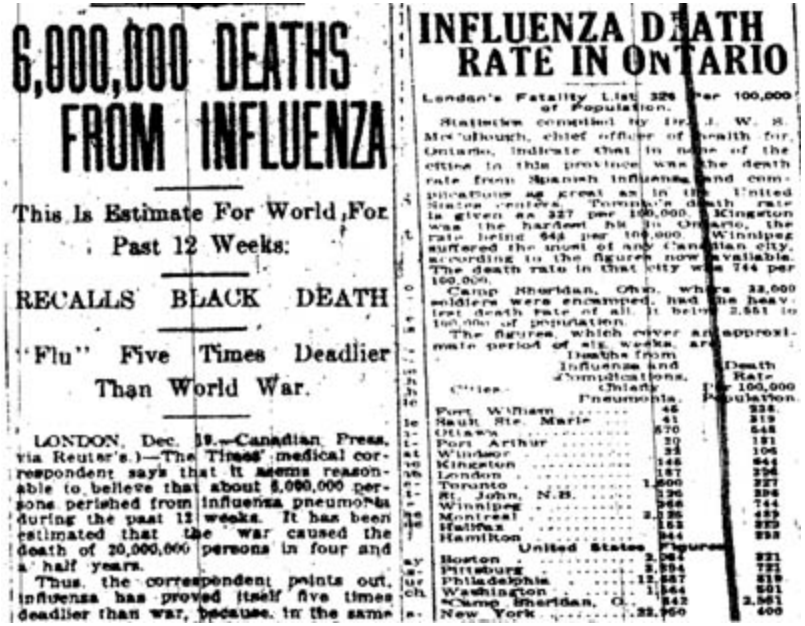
- Influenza pandemics are inevitable
- Can cause:
  - High levels of sickness and death
  - Drastic disruption of critical services
  - Severe economic losses
- There will likely be little warning time between the onset of spread of a pandemic and its appearance in the U.S.

Why The Concern About Pandemic Influenza?

- Outbreaks occur simultaneously in many areas
- Impacts will last for weeks to months
- Pandemics can disproportionately affect younger, working-age people
- Current avian (H5N1) influenza outbreak

1918 Influenza Pandemic ('Spanish Flu')





6,000,000 DEATHS FROM INFLUENZA

This Is Estimate For World For Past 12 Weeks:

RECALLS BLACK DEATH

"Flu" Five Times Deadlier Than World War.

LONDON, Dec. 19.—Canadian Press, via Reuter's.)—The Times' medical correspondent says that it seems reasonable to believe that about 6,000,000 persons perished from influenza pneumonia during the past 12 weeks. It has been estimated that the war caused the death of 20,000,000 persons in four and a half years.

Thus, the correspondent points out, influenza has proved itself five times deadlier than war, because, in the same

INFLUENZA DEATH RATE IN ONTARIO

London's Fatality List 326 per 100,000 of Population.

Statistics compiled by Dr. J. W. S. McCullough, chief officer of health for Ontario, indicate that in none of the cities in this province was the death rate from Spanish influenza and complications as great as in the United States centers. Toronto's death rate is given as 327 per 100,000. Kingston was the hardest hit in Ontario, the rate being 643 per 100,000. Winnipeg suffered the most of any Canadian city, according to the figures now available. The death rate in that city was 744 per 100,000.

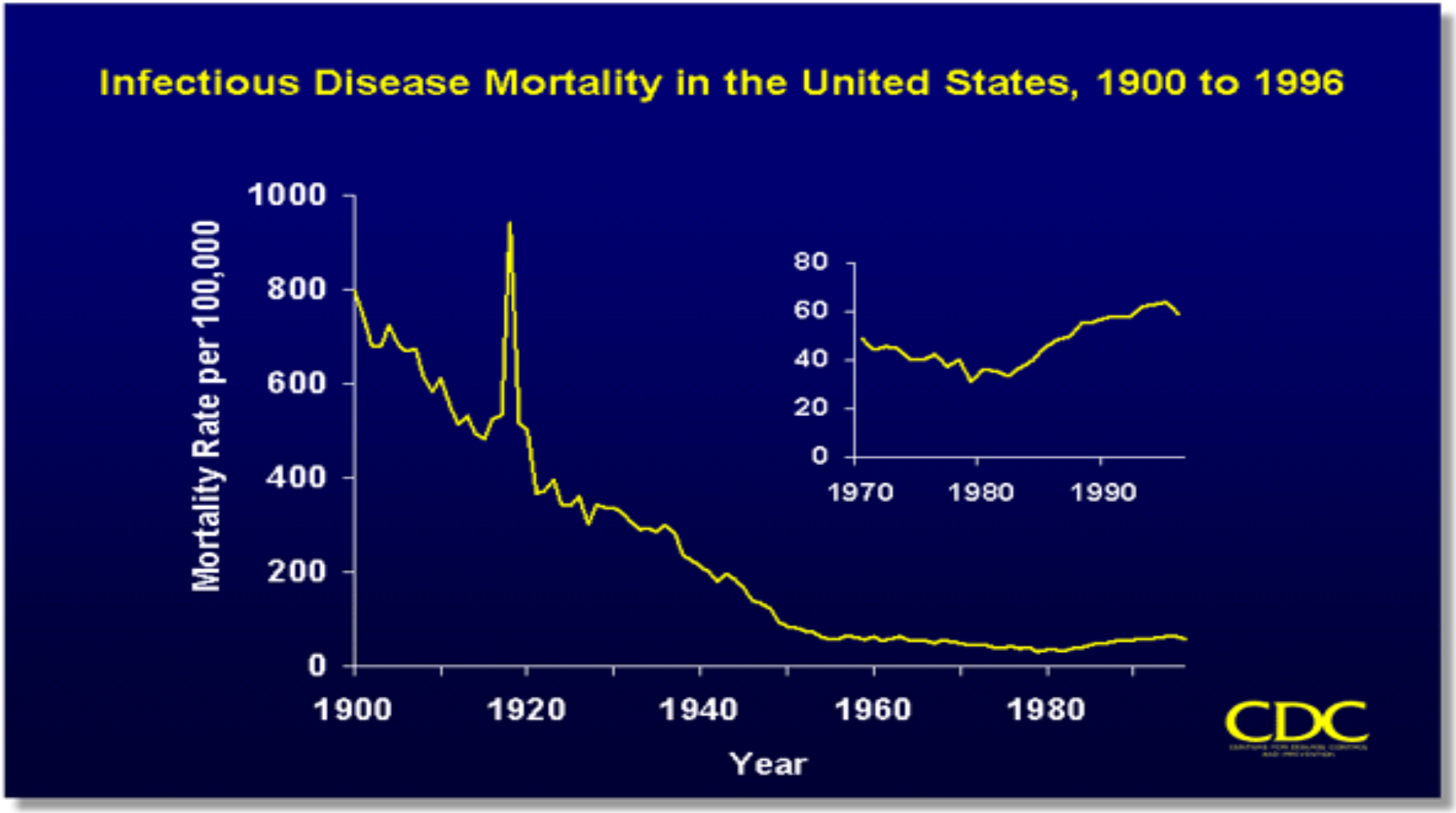
Camp Sheridan, Ohio, where 33,000 soldiers were encamped, had the heaviest death rate of all, it being 2,551 to 100,000 of population.

The figures, which cover an approximate period of six weeks, are:

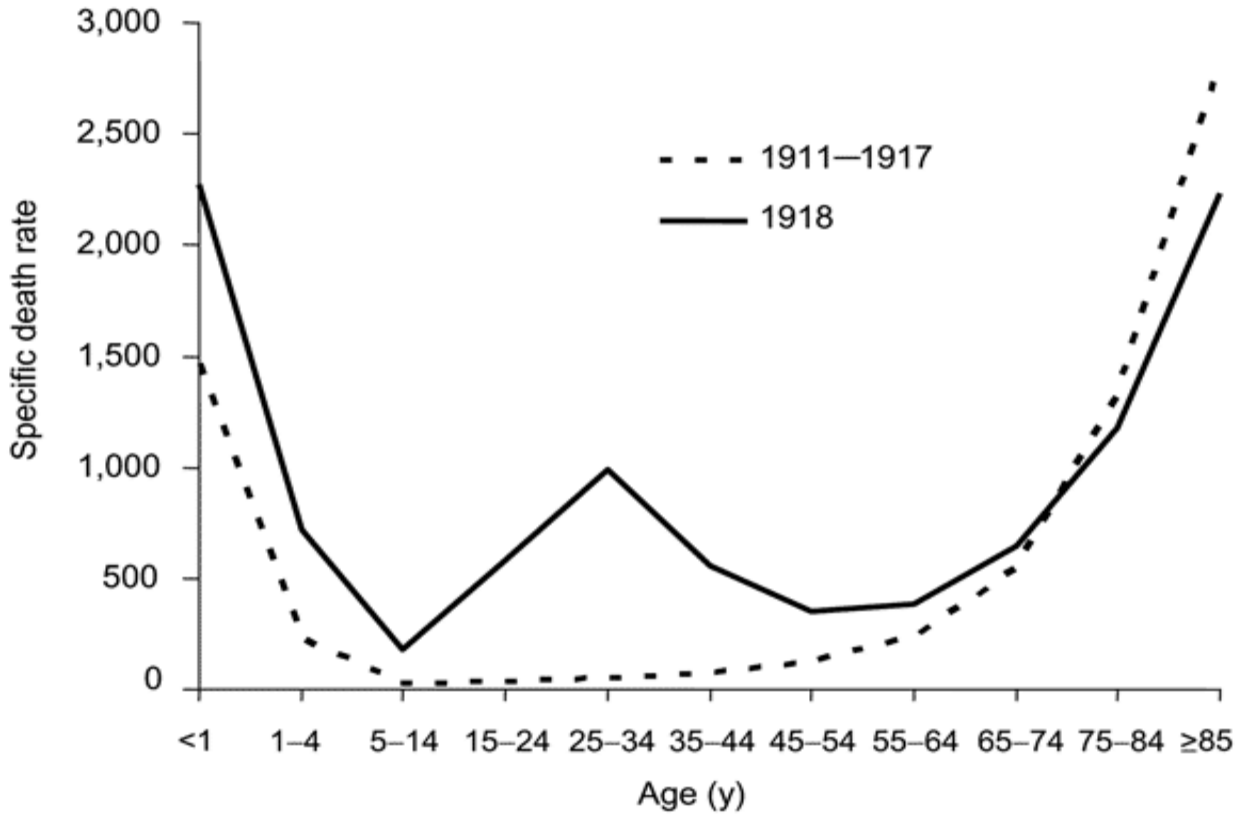
Cities	Deaths from Influenza and Complications, Chiefly Pneumonia.	Death Rate Per 100,000 Population
Port William	46	324
Sault Ste. Marie	41	319
Ottawa	570	548
Port Arthur	32	181
Windsor	33	106
Kingston	146	643
London	187	326
Toronto	1,600	327
St. John, N.B.	136	394
Winnipeg	348	744
Montreal	2,125	499
Halifax	153	373
Hamilton	344	353
United States Figures		
Boston	3,384	321
Pittsburg	3,594	721
Philadelphia	12,887	819
Washington	1,944	501
Camp Sheridan, O.	543	2,551
New York	22,750	400

"The influenza pandemic of 1918-19 killed more humans than any other disease in a period of similar duration in the history of the world." -- *Alfred W. Crosby, historian & author*

Infectious Disease Mortality in the 20th Century



Characteristics of the 1918 Pandemic
The 'W' Shaped Curve



Emergency hospital, Camp Funston, Kansas 1918

Courtesy of National Museum of Health and Medicine

NIGHT EXTRA

The Seattle Daily Times

CHURCHES, SCHOOLS, SHOWS CLOSED

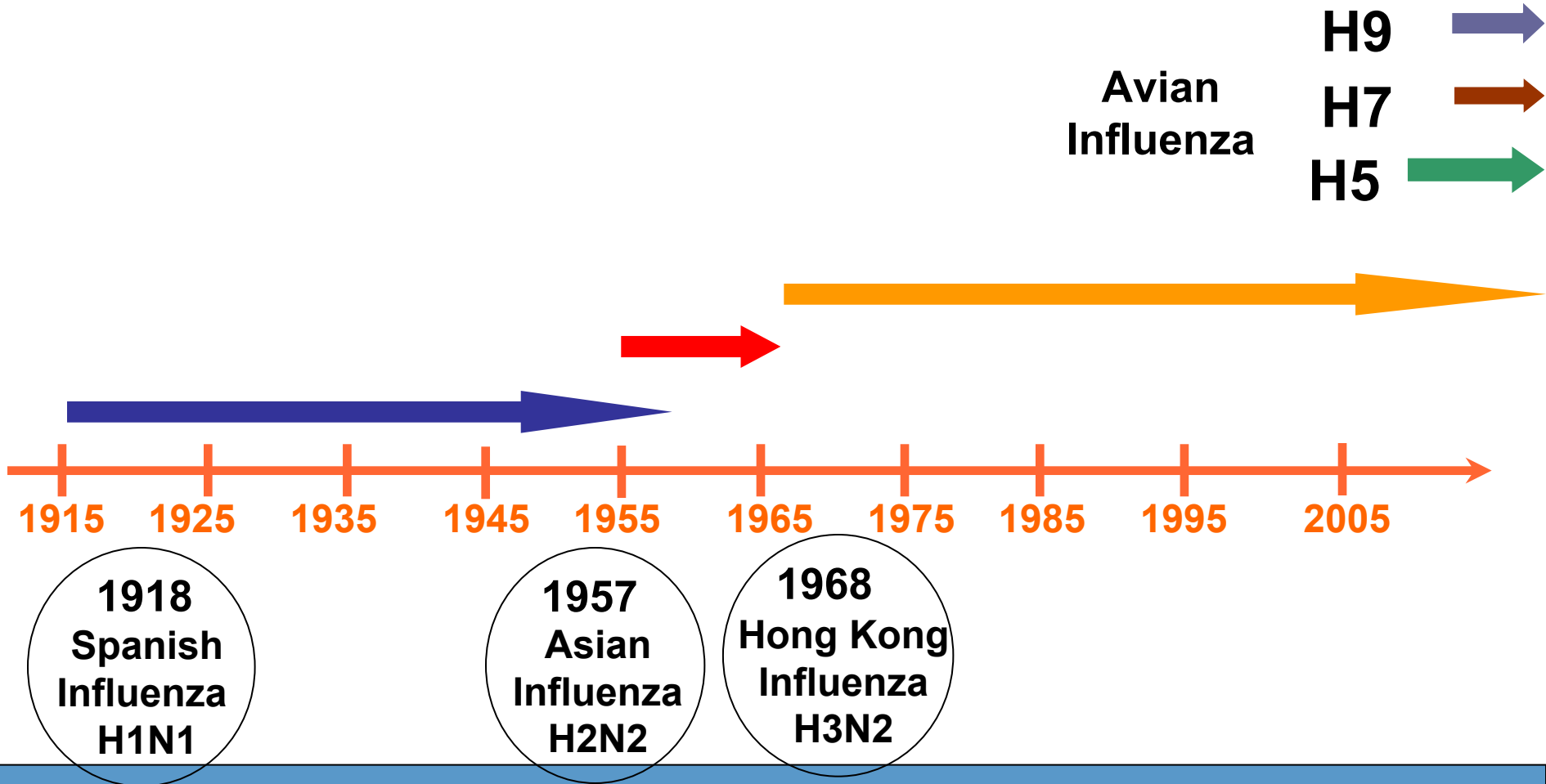
EPIDEMIC PUTS BAN ON ALL PUBLIC ASSEMBLIES

SEATTLE TO MAKE FIGHT ON DISEASE

AMERICANS AND FRENCH SMASH FOE

U.S. TROOPS SMASH WAY IN ARGONNE

Timeline of Emergence of Influenza Viruses in Humans

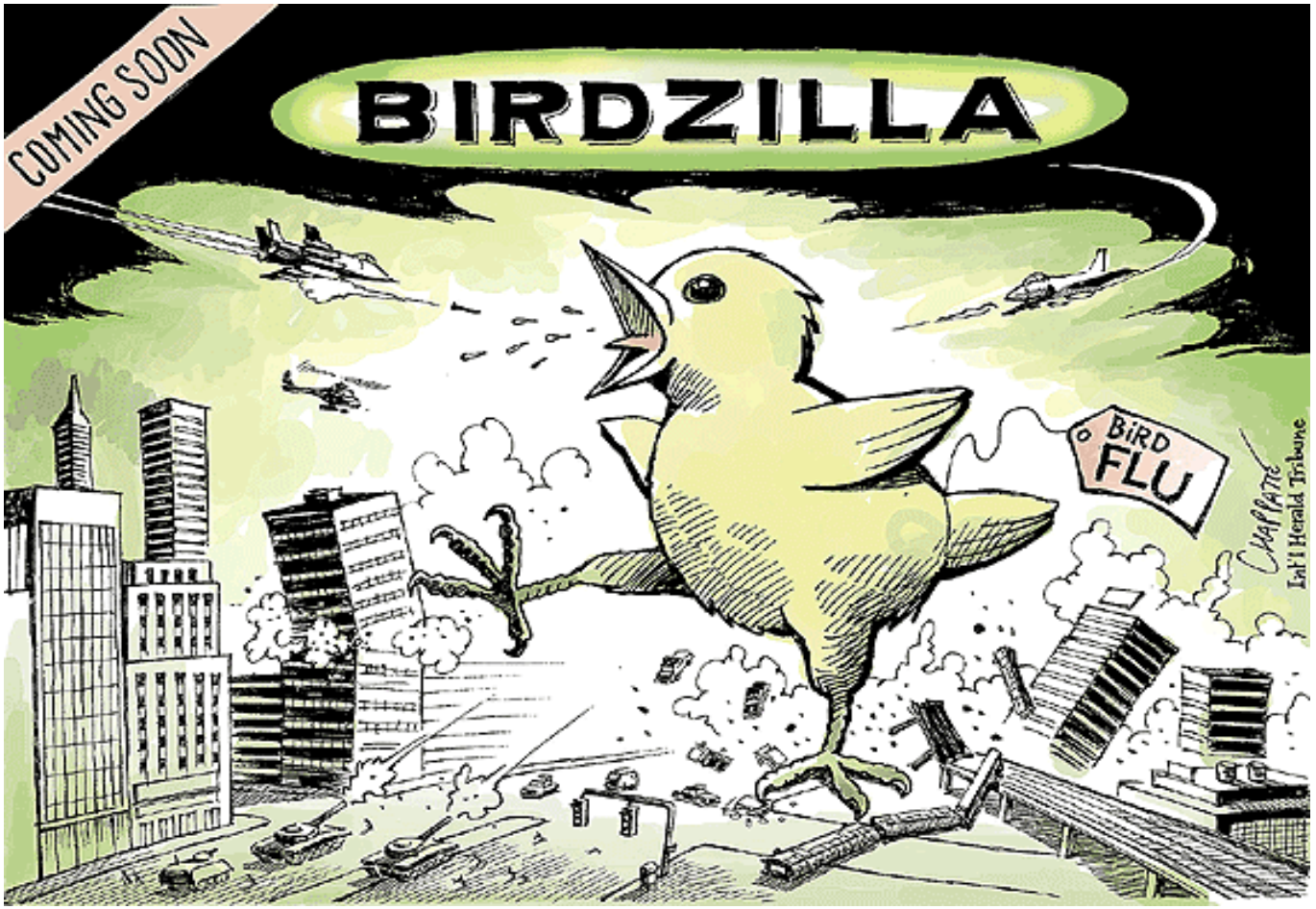


Estimated Impact of a New Influenza Pandemic in the United States

Characteristic	Moderate (1958/68-like)	Severe(1918-like)
Illness	90 million (30%)	90 million (30%)
Outpatient medical care	45 million (50%)	45 million (50%)
Hospitalization	865,000	9,900,000
ICU care	128,750	1,485,000
Mechanical Ventilation	64,975	742,500
Deaths	209,000	1,903,000

From US DHHS Pandemic Influenza Plan

H5N1 Avian Influenza in Humans
"Pandemic Watch"



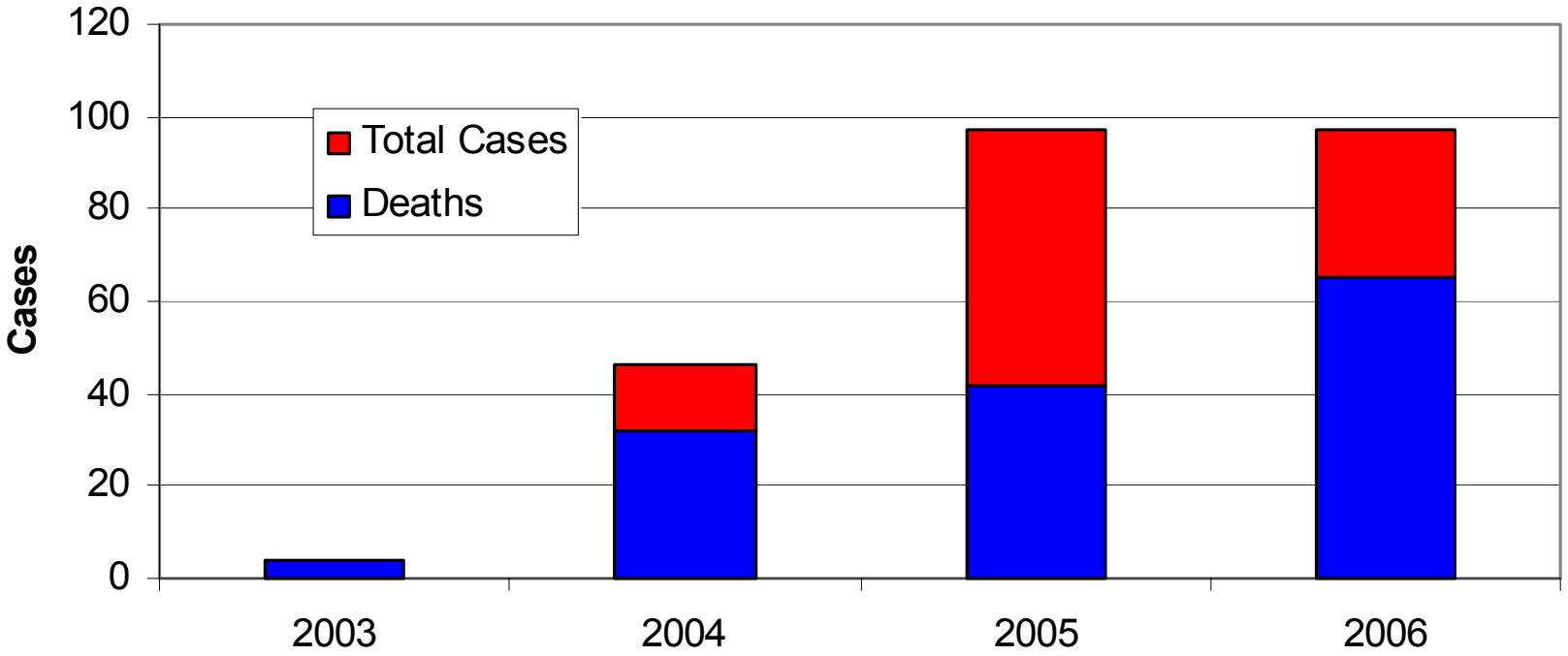
Current Status of Avian Influenza (H5N1) Epidemic in Humans

- Began in 2003 in SE Asia but is spreading to other parts of the world
- 247 human cases and 144 deaths (as of September 14, 2006) in ten countries
  - Case Fatality Rate: ~ 58%

H5N1 Influenza Cases, 2003-2006

Source: WHO and OIE (World Organization for Animal Health), 9/7/2006

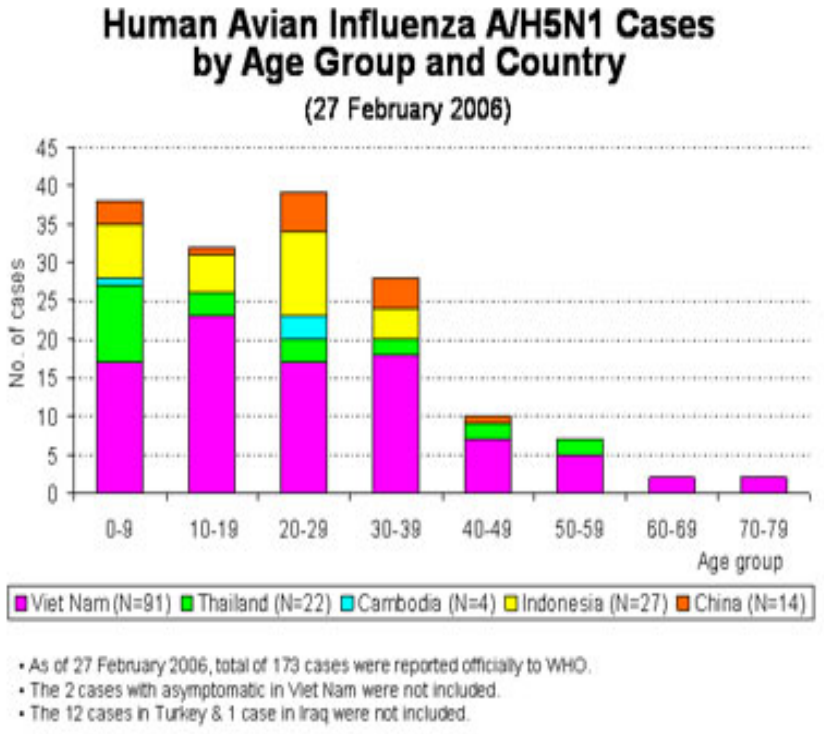
Reported Human Cases of H5N1 Influenza*



*** Cases reported to WHO as of September 11, 2006**

Avian Influenza (H5N1) in Humans by Age

- **In contrast to seasonal influenza, most H5N1 cases have occurred in previously healthy children and young adults**



Transmission of Avian Influenza (H5N1)

- Mostly avian-to-human transmission
  - Direct contact with sick/dead poultry
  - Few cases: consumed uncooked duck blood
  - No known cases from eating cooked poultry
- Limited probable human-to-human transmission (e.g., Indonesia in 2006 and Thailand in 2004)
- No evidence of sustained or efficient human-to-human spread

H5N1 Avian Influenza: A Coming Pandemic?

- H5N1 avian influenza virus has attained two of three attributes required for a **pandemic:**

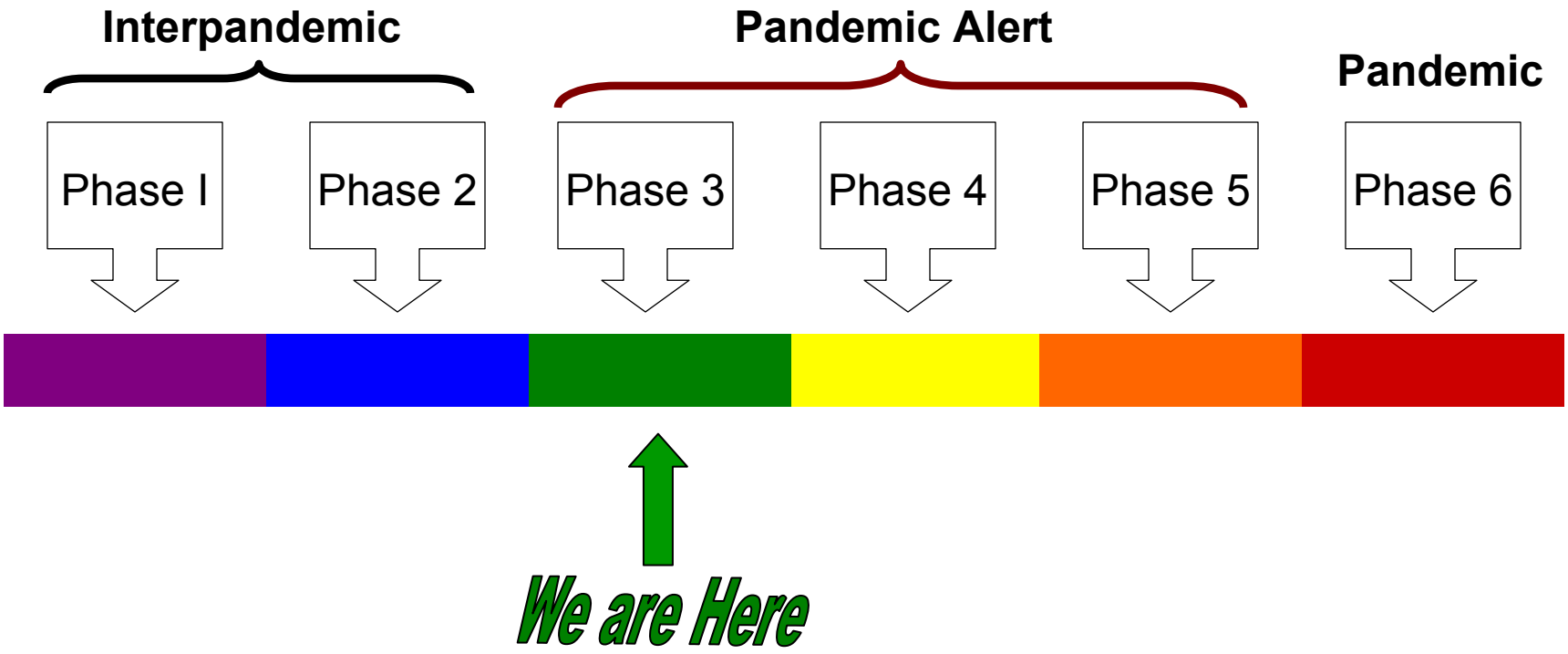
  √ Emergence of a new human influenza A subtype

  √ The emerging virus causes serious disease in humans

  AND

  X Virus has the ability to efficiently transmit from human to human

WHO Phases of a Pandemic



Responding to an Influenza Pandemic

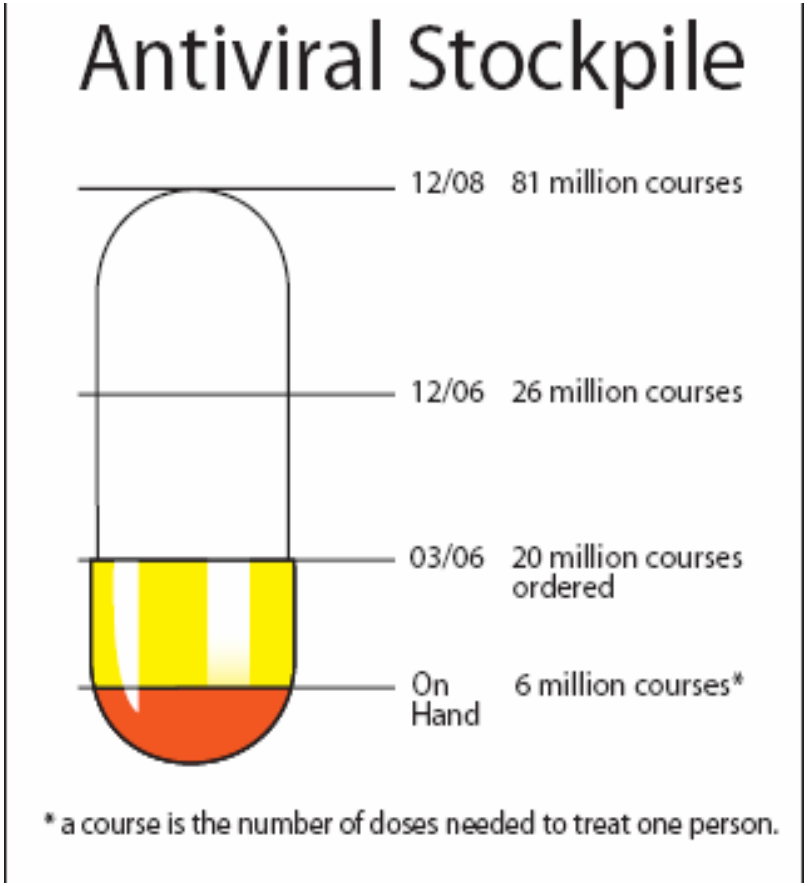
- Pharmaceutical Interventions
  - Vaccine
  - Antivirals
- Non-Pharmaceutical Interventions

Pandemic Response Human Vaccines

- Current Issues/Challenges
  - Requires pandemic strain for optimal protection
  - Production limited by egg-based technology
  - May take 6-8 months to produce following emergence of new virus
  - Need for prioritization due to anticipated shortages
  - US funding (1 billion dollars) for development of H5N1 vaccines using cell-based technology

Pandemic Response
Antiviral Drugs

- Uses
  - Prophylaxis
  - Treatment
- Current Issues/Challenges
  - May not be effective for pandemic strain
  - Limited supply
  - Need for prioritization (among risk groups and prophylaxis versus treatment)
  - Use for Rx over prophylaxis



Pandemic Response Non-Pharmaceutical Interventions: Quarantine

- Used in SARS epidemic
- Challenges
  - Short incubation period for influenza
  - A large proportion of infections are asymptomatic
- Could potentially slow onset of a pandemic before sustained human-to-human transmission has been established

Pandemic Response
Other Non-Pharm. Interventions

- Education to encourage prompt self-diagnosis
- Public health information (risks, risk avoidance, advice on universal hygiene behavior)
- Respiratory & hand hygiene
- Face masks for symptomatic persons
- Isolation precautions
- Social distancing

Summary

- Influenza virus strains evolve rapidly and can develop into novel virus with pandemic potential
- Influenza pandemics have caused high morbidity and mortality in the past (e.g., 1918 pandemic)
- H5N1 avian influenza is currently spreading through birds with occasional outbreaks among humans
- While there is evidence of rare human to human transmission, sustained transmission has not occurred
- There are public health interventions available to control a new influenza pandemic but each has challenges.

Online Resources

- www.who.int
- www.cdc.gov
- www.pandemicflu.gov

- www.sph.unc.edu/nccphp/