

# **New Hampshire Institute for Local Public Health Practice**



## **Collaborative Initiative Between The City of Manchester Health Department & The New Hampshire Department of Health and Human Services**

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# Influenza Surge Capacity Planning



*City of Manchester  
Department of Health*

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# Influenza Virus

# Influenza Virus

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## What is Influenza?

- Influenza is a contagious respiratory illness caused by influenza viruses
- RNA virus
- Family Orthomyxoviridae.
- 3 types of influenza viruses:
  - Influenza Type A
  - Influenza Type B
  - Influenza Type C

# Influenza Virus Types

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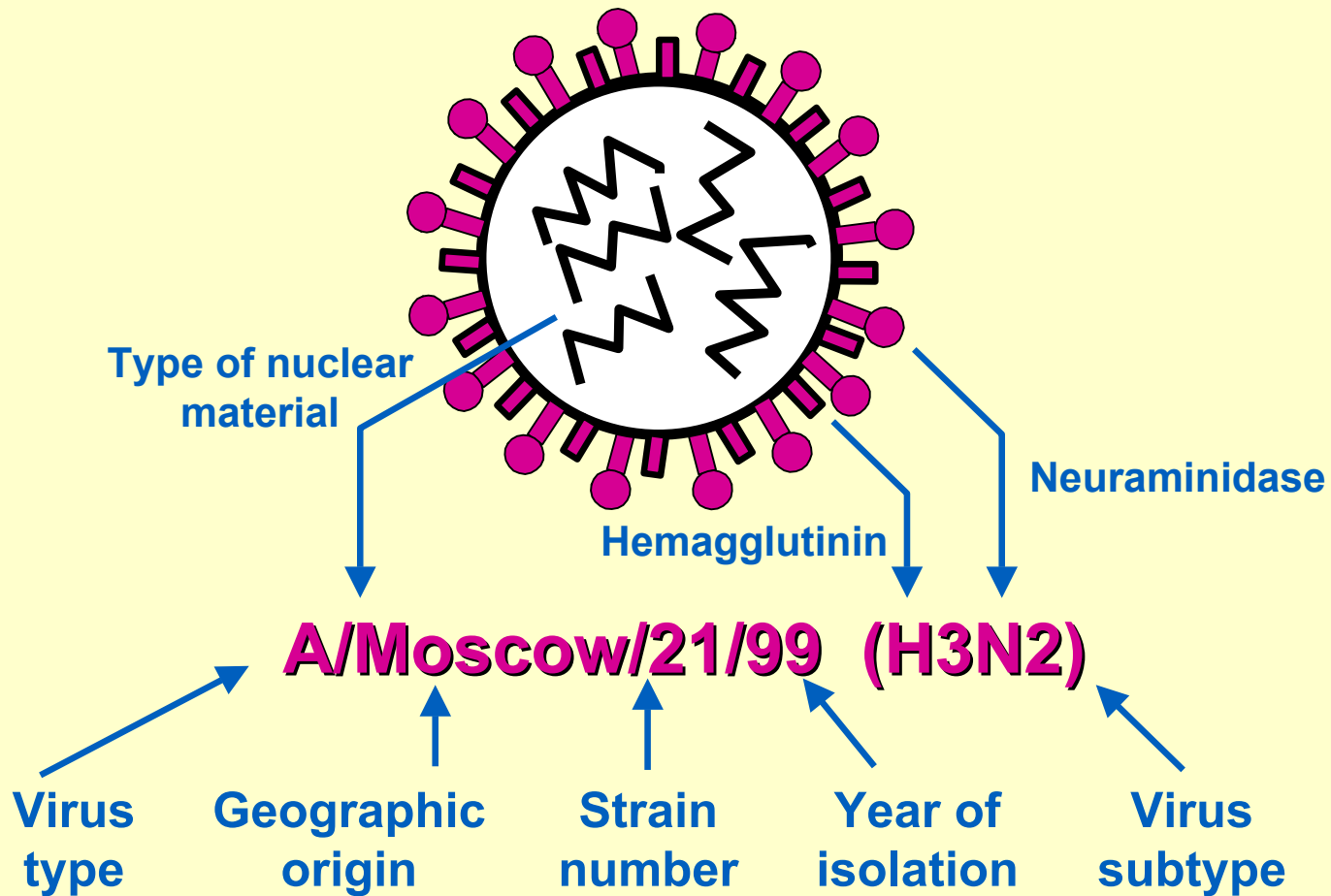
- Type A - moderate to severe illness
  - all age groups affected
  - humans and other animals
- Type B - milder epidemics
  - humans only
  - primarily affects children
- Type C - rarely reported in humans
  - no epidemics

# Influenza Virus

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- Influenza Type A Viruses = divided into subtypes based on two proteins on the surface.
  - Hemagglutinin (H) and Neuraminidase (N)
    - Example: Reported as A(H1N1) and A(H3N2)
- Influenza B Viruses = are not subtyped.

# Influenza Virus Nomenclature



# Influenza Antigenic Changes

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- **Structure of Hemagglutinin (H) and Neuraminidase (N) periodically change:**
  - **Shift**                      Major change in surface proteins,  
**new subtype**  
Exchange of gene segment  
**May result in pandemic**
  - **Drift**                        Minor change in surface proteins,  
**same subtype**  
Point mutations in gene  
**May result in epidemic**



# Examples of Influenza Antigenic Changes

- Antigenic Shift:

- H2N2 circulated in 1957-1967
- H3N2 appeared in 1968 and completely replaced H2N2

- Antigenic Drift:

- 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

# Avian Influenza



# Avian Influenza

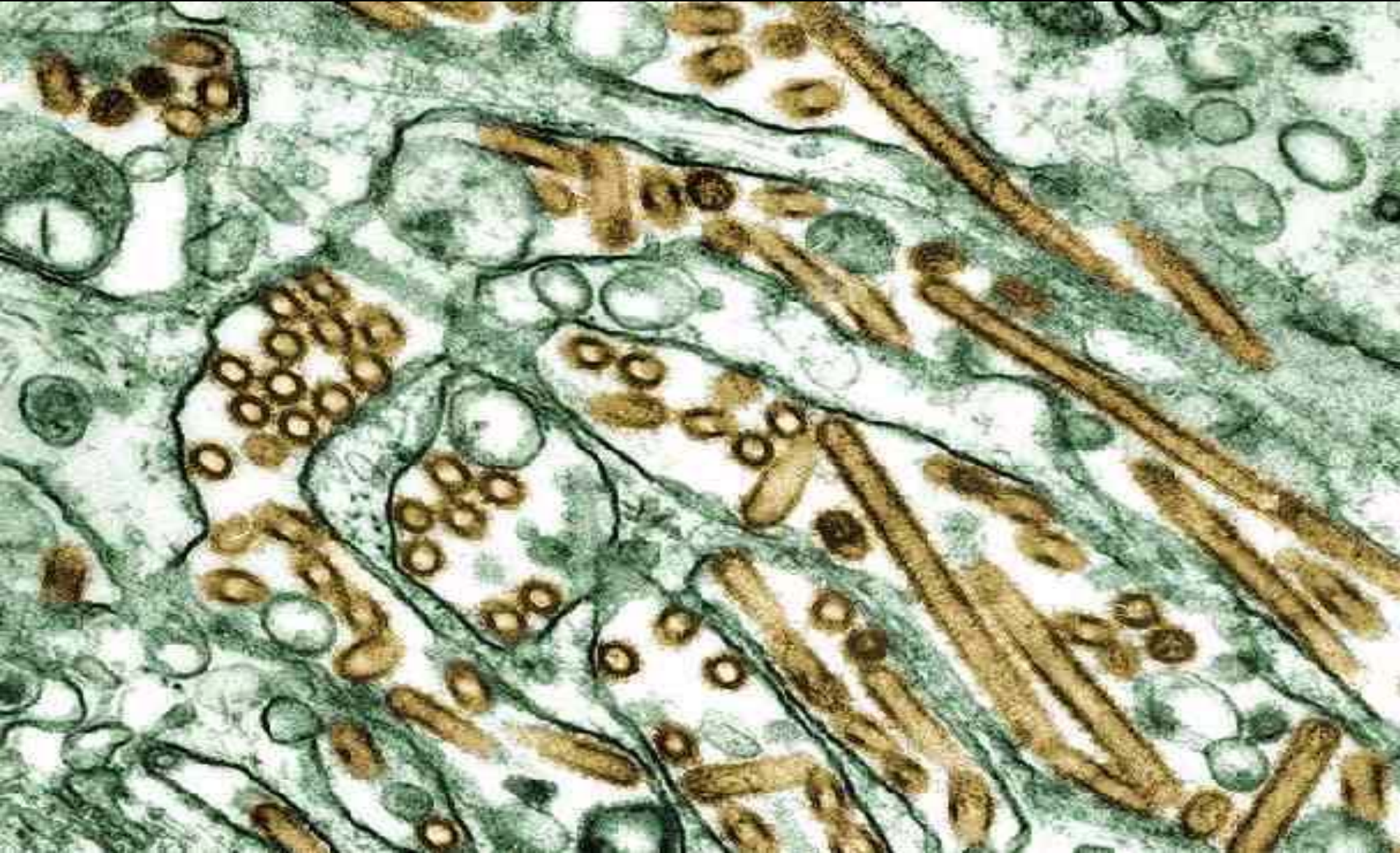
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- **Avian Influenza** is an infectious disease of birds caused by Type A strains of the influenza virus.
- First Identified in Italy more than 100 years ago.
- There are different subtypes of avian influenza viruses.
  - **Within subtypes there are also many different strains.**

# Three Predominant Subtypes

- Influenza A H5
  - Potentially 9 different subtypes.
  - Can be highly pathogenic or low pathogenic.
  - Reported in humans.
- Influenza A H7
  - Potentially 9 different subtypes.
  - Can be highly pathogenic or low pathogenic.
  - Rare in humans - occasionally occurs in individuals in close contact with birds.
- Influenza A H9
  - Potentially 9 different subtypes.
  - Documented only in low pathogenic form.
  - Three H9 infections in humans have been confirmed.

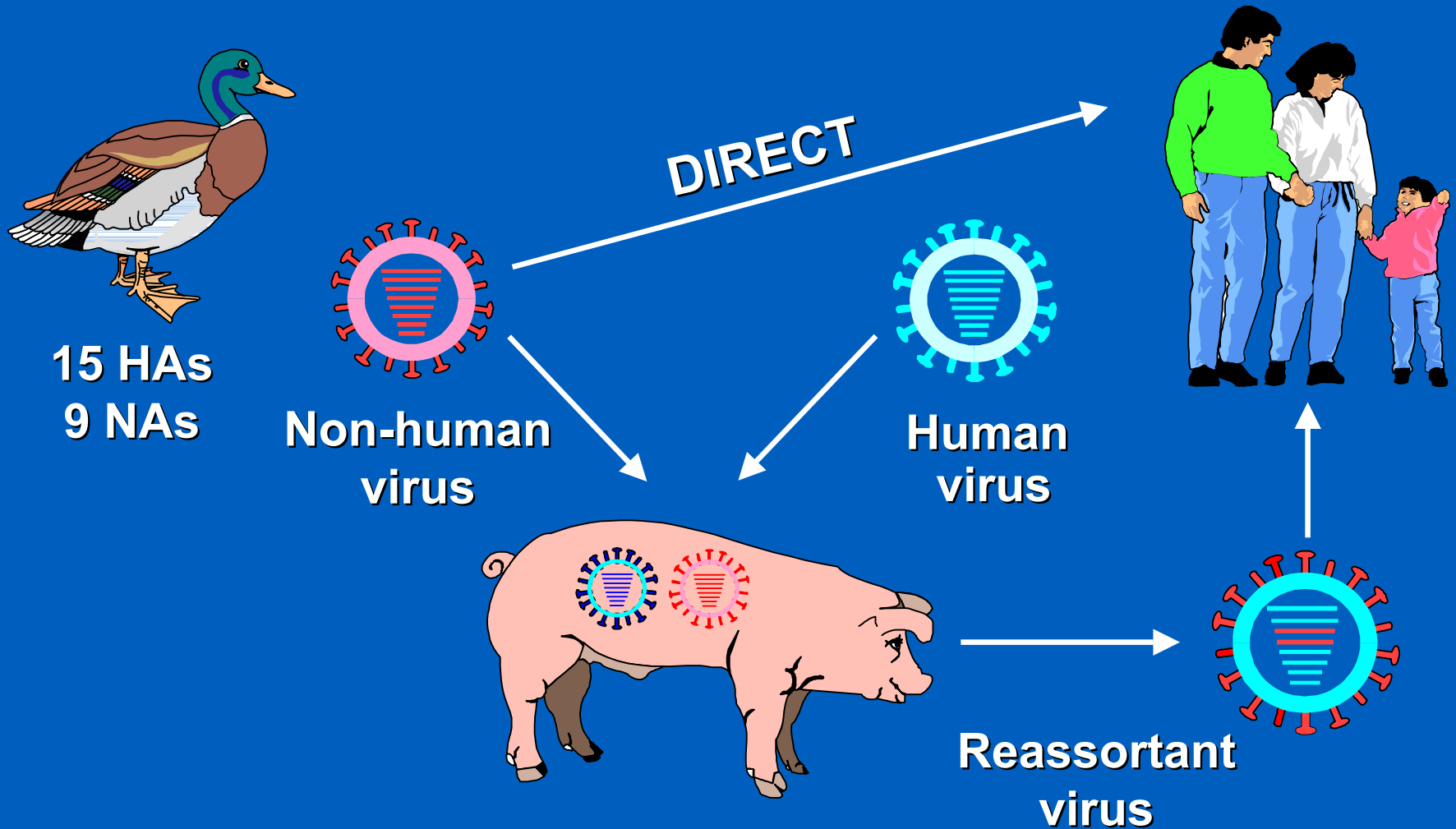
**A H5N1 Viruses (brown in color)  
colorized transmission electron micrograph**



# How is Avian Influenza Transmitted to Humans?

- Avian influenza viruses may be transmitted to humans in two ways:
  - Directly from birds or avian virus-contaminated environments to people.
  - Through an intermediate host (i.e. pigs).

# Mechanisms of Influenza Virus Antigenic “Shift”



# Antigenic Shift and Reassortment

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- **If two different species of viruses infect a person at the same time - species may mix and create a new influenza A virus.**
- **Important concern in avian influenza viruses because a reassortment could result in a virus that may be transmitted from person-to-person.**



# Avian Influenza Symptoms

- Reported symptoms of avian influenza in humans range from mild flu-like symptoms to severe illness or death.
- Common symptoms include:
  - Fever
  - Body Aches
  - Sore Throat
  - Dry Cough



# Avian Influenza Symptoms (cont.)

- Severe illness commonly includes:
  - conjunctivitis
  - pneumonia
  - acute respiratory distress
  - viral pneumonia
  - may result in death
- Severity of illness depends on host resistance factors and pathogenicity of the virus.



# Pandemic Influenza

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# Pandemic Influenza

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- **Pandemic Influenza** = a global outbreak of influenza that occurs when a new influenza A virus emerges among people, spreads, and causes disease worldwide.
- Past influenza pandemics have led to:
  - high levels of morbidity and mortality
  - social disruption
  - economic loss

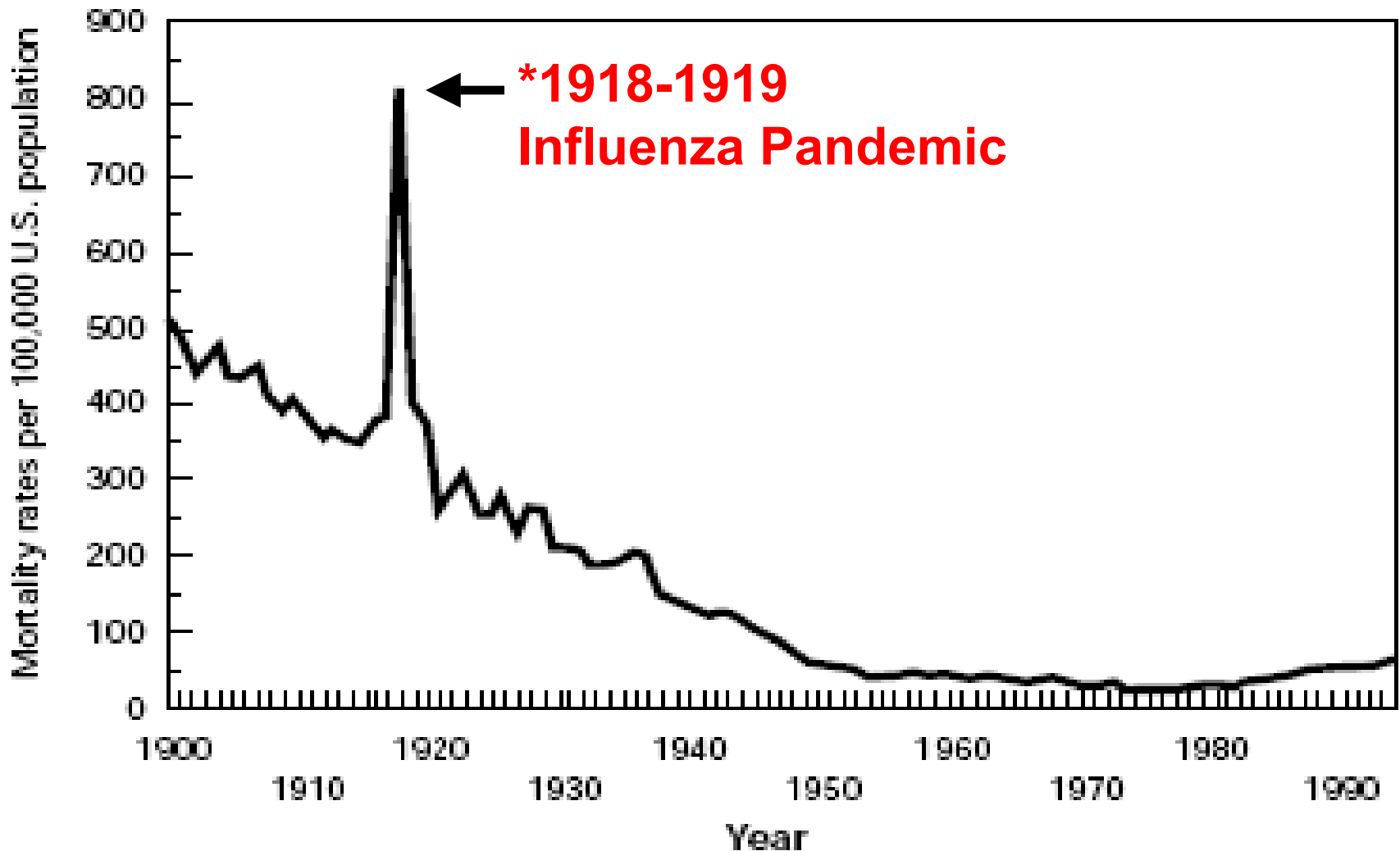
# Pandemic Influenza Outbreaks

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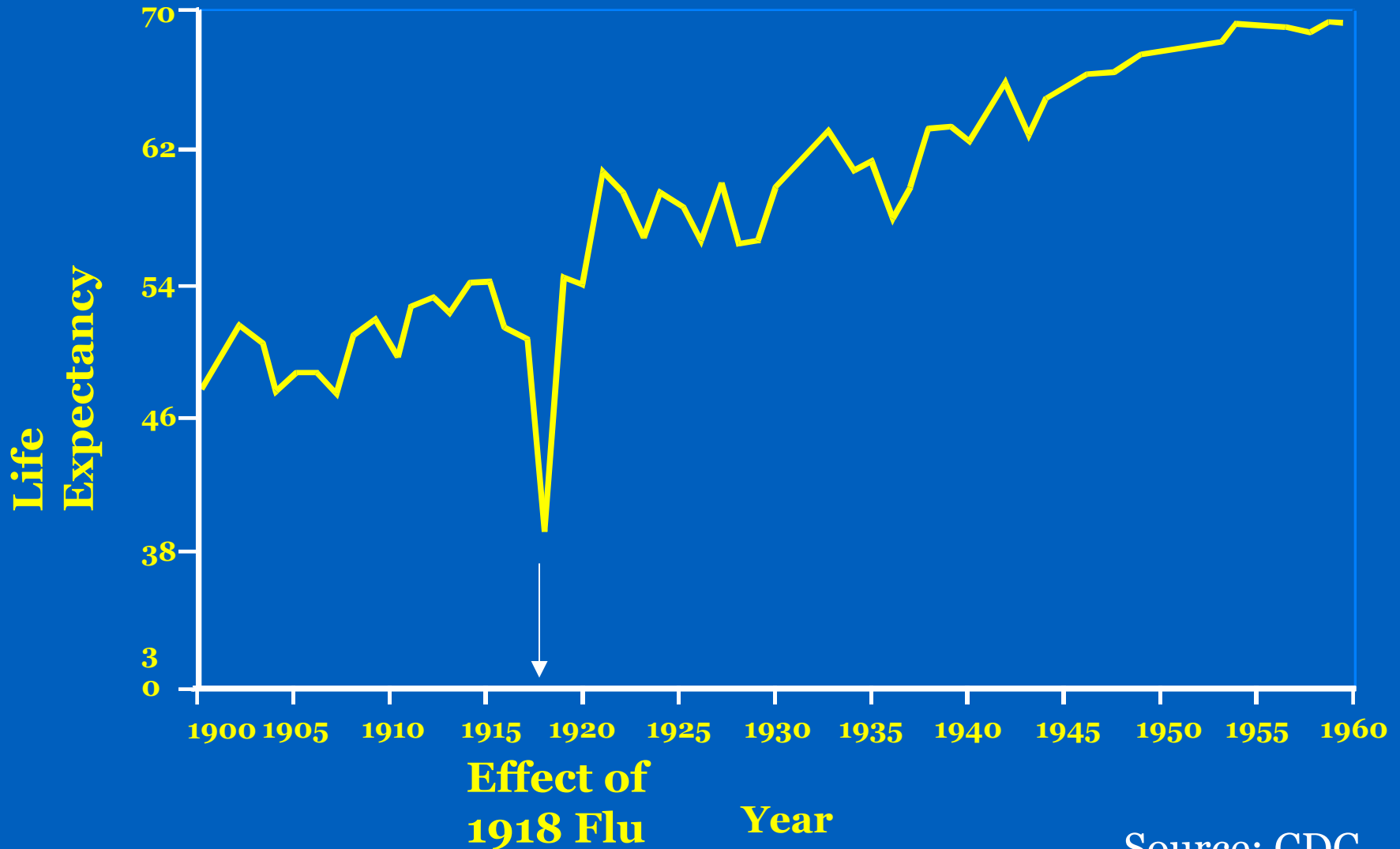
There were three pandemics in the 20th century:

- 1918 -1919, “Spanish flu,” A(H1N1)
  - Highest number of known flu deaths.
    - More than 500,000 deaths in the U.S.
    - 20 million - 50 million deaths worldwide.
  - Nearly half of those who died were young, healthy adults (age 20-40).
    - Orphanages had to be opened.

# Trends in Deaths Caused by Infectious Diseases, U.S., 1900-1994



# U.S. Life Expectancy 1900-1960



Source: CDC

# Pandemic Influenza Outbreaks (cont.)

- 1918 -1919, “Spanish flu,” A(H1N1) - (cont.):
  - The 1918 flu claimed most of its victims (20-50 million) in only four months.
    - **Compared to Smallpox and Measles that killed ~90 million people BUT over four centuries.**
  - Deaths occurred from complications but also during the first few days of infection (48 hours).
    - **Some people descended from apparently robust health to death’s door in an hour.**



# Influenza 1918

**This epidemic hit the military bases and soldiers first. Then, spread to civilian populations.**

**More people died than in all the wars of this century combined.**

# Height of the Influenza Pandemic Camp Funston, Kansas



# Pandemic Influenza Outbreaks (cont.)

- 1918 -1919, “Spanish flu,” A(H1N1) - (cont.):
  - Pregnant women suffered high rates of miscarriage and premature labor.
    - 41% of these women who prematurely lost their babies also died from the flu.
  - Lungs removed from victims were hideously transformed - essentially patients died by drowning.
    - Dense, heavy, the alveoli saturated with bloody fluid.

# Pandemic Influenza Outbreaks (cont.)

- 1957-1958, “Asian flu,” A(H2N2)
  - First identified in China in late February 1957.
  - Spread to the U.S. by June 1957.
  - Caused 70,000 deaths in the U.S.
- 1968-1969, “Hong Kong flu,” A(H3N2)
  - First identified in Hong Kong in early 1968
  - Caused ~34,000 deaths in the U.S.
  - Type A(H3N2) viruses still circulate today.
- Both of these pandemics were the result of the reassortment of a human virus with an avian influenza virus.

# **Avian Influenza H5N1**

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**Current Threat of a Pandemic**

# Avian Influenza H5N1

- A novel influenza virus subtype identified first in the 1990's in birds.
- Highly pathogenic variant now is in multiple countries' bird populations.
- First human cases identified in 1997.



Photo From CDC

## 1997 H5N1 Outbreak, Hong Kong

- Primary risk factor for H5N1 infection:  
*Exposure to poultry in week before illness*
- Rapid destruction (3 days) of Hong Kong's entire poultry population, ~1.5 million birds, reduced opportunities for further direct transmission to humans.
  - May have averted a pandemic.



# Current Phase of Alert

## WHO global influenza preparedness plan

Inter-pandemic phase New virus in animals, no human cases	Low risk of human cases	1
	Higher risk of human cases	2
Pandemic alert New virus causes human cases	No or very limited human-to-human transmission	3
	Evidence of increased human-to-human transmission	4
	Evidence of significant human-to-human transmission	5
Pandemic	Efficient and sustained human-to-human transmission	6



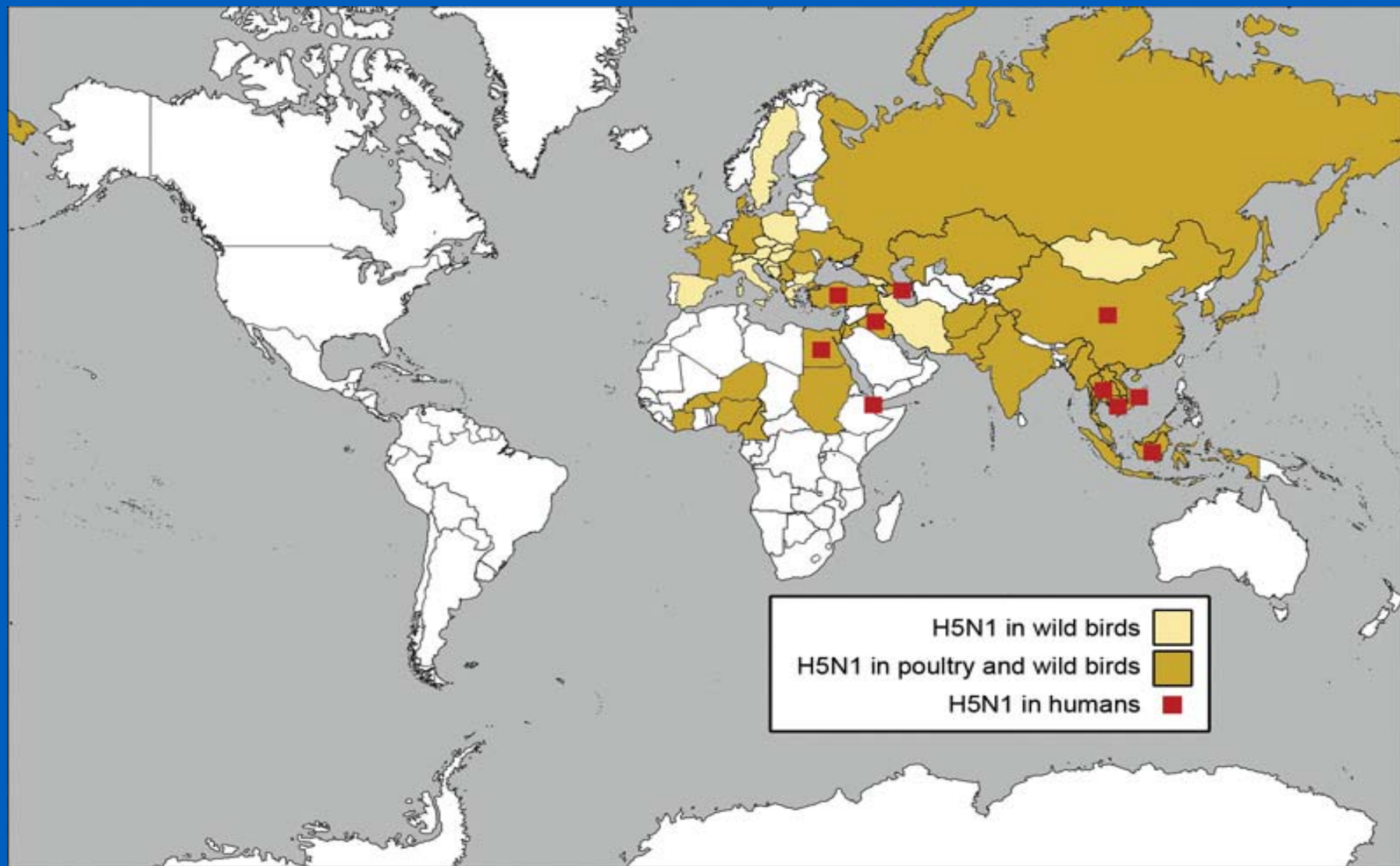
# Updated Information

- H5N1 as of July 20, 2006: 231 human cases resulting in 133 deaths worldwide.

Country	2003		2004		2005		2006		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Azerbaijan	0	0	0	0	0	0	8	5	8	5
Cambodia	0	0	0	0	4	4	2	2	6	6
China	0	0	0	0	8	5	11	7	19	12
Djibouti	0	0	0	0	0	0	1	0	1	0
Egypt	0	0	0	0	0	0	14	6	14	6
Indonesia	0	0	0	0	17	11	37	31	54	42
Iraq	0	0	0	0	0	0	2	2	2	2
Thailand	0	0	17	12	5	2	0	0	22	14
Turkey	0	0	0	0	0	0	12	4	12	4
Viet Nam	3	3	29	20	61	19	0	0	93	42
<b>Total</b>	<b>3</b>	<b>3</b>	<b>46</b>	<b>32</b>	<b>95</b>	<b>41</b>	<b>87</b>	<b>57</b>	<b>231</b>	<b>133</b>

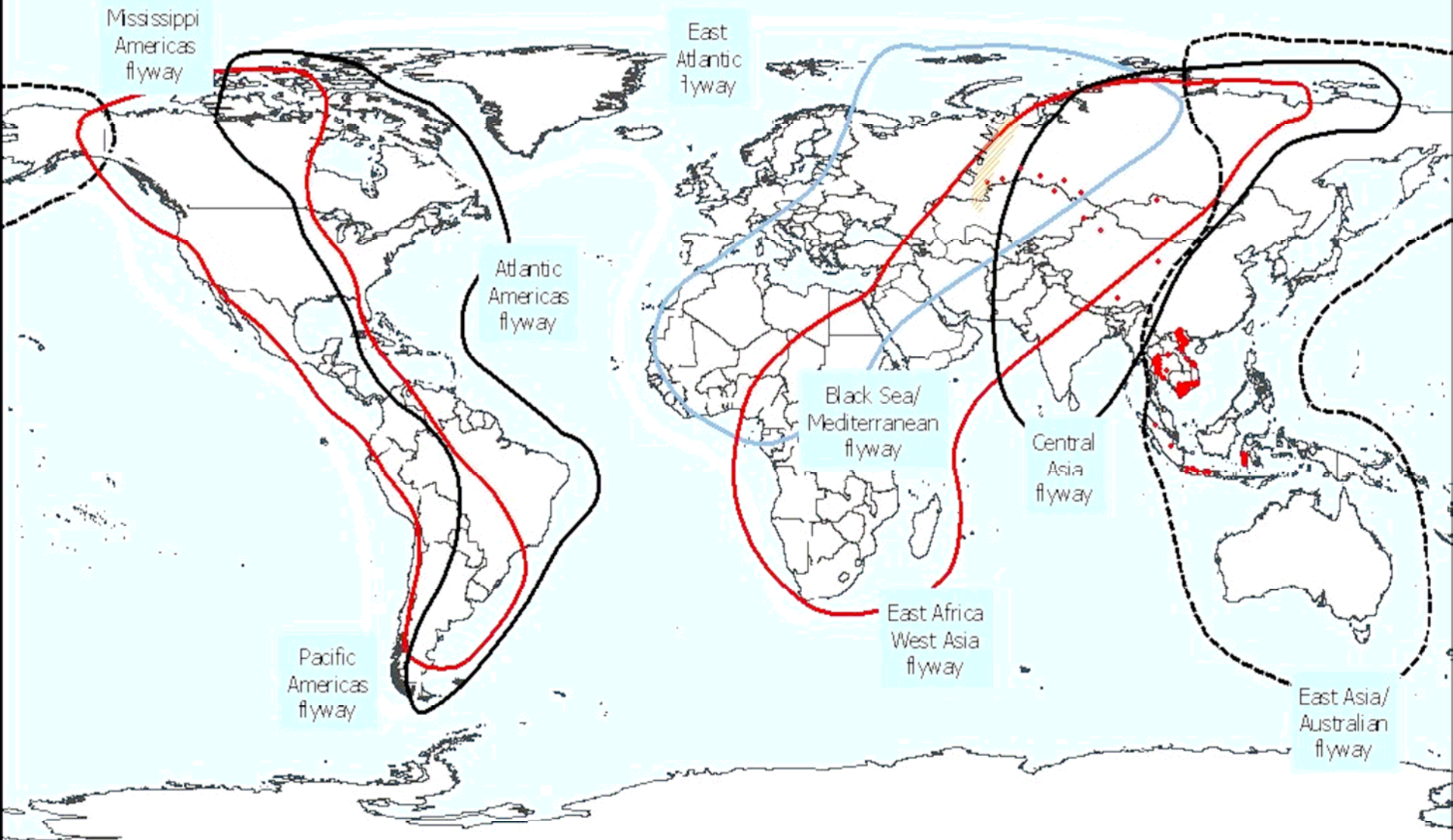
Total number of cases includes number of deaths.  
WHO reports only laboratory-confirmed cases.

# Current Outbreaks: Nations with Confirmed Cases of H5N1 Avian Influenza as of July 7, 2006



# H5N1 outbreaks in 2005 and major flyways of migratory birds

Situation on 30 August 2005



• Districts with H5N1 Outbreaks since January 2005

Sources: AI outbreaks: OIE, FAO and Government sources.  
Flyways: Wetlands International

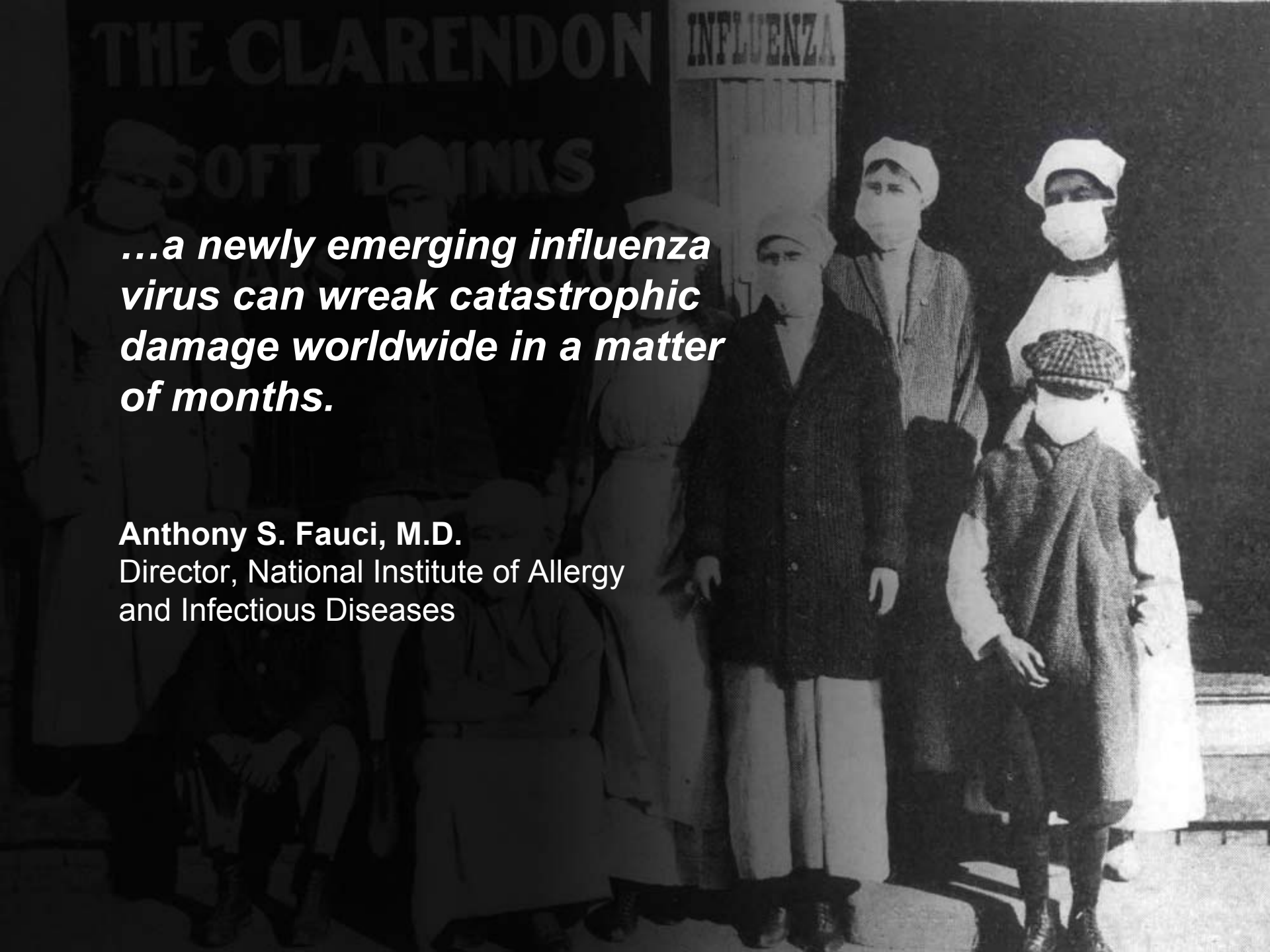


# Why Are We Talking About Pandemic Flu Planning?



***...a newly emerging influenza virus can wreak catastrophic damage worldwide in a matter of months.***

**Anthony S. Fauci, M.D.**  
Director, National Institute of Allergy  
and Infectious Diseases



# Pandemic Impact in the U.S.

- Modeling Studies Suggest:
  - In the absence of any control measures (vaccination or drugs), it has been estimated that in the United States a “medium–level” pandemic could cause:
    - 89,000 to 207,000 deaths
    - 314,000 and 734,000 hospitalizations
    - 18 to 42 million outpatient visits
    - Another 20 to 47 million people being sick
    - Between 15% and 35% of the U.S. population could be affected by an influenza pandemic, and the economic impact could range between \$71.3 and \$166.5 billion.

# Pandemic Impact

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**Consequences will effect all organizations:**

- **Extreme staffing shortages (30%).**
- **Overwhelming demand for services (health care, first responders).**
- **Limited supplies (transportation disrupted).**
- **Reduced reliability in communications, power, water, fuel availability, transportation service.**
- **Reduced reliability on contractor services (maintenance and repair).**

# Planning Assumptions

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- **Illness will spread quickly and globally.**
- **Vaccine will be non-existent or very limited for 6 to 8 months – antivirals will be very limited.**
- **The health care delivery system will be completely overwhelmed – restructuring and prioritization of services will be necessary.**



# Planning Assumptions

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- **Alternate facilities will be needed to:**
  - **Conduct triage of ill people**
  - **Provide a supportive care environment for patients**
  - **Temporarily store bodies**
- **Health care workers and EMS responders may face staff shortages exceeding 30%.**
- **Significant disruptions of critical infrastructure, first response systems, and social services may occur.**

# Planning Assumptions

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- **Social distancing strategies aimed at slowing the spread of disease may be implemented.**
- **Local Emergency Management Plans will be activated directing the management of non-medical information and non-medical resources.**
- **Mutual aid between localities will be limited or unavailable.**

**...Pandemic planning must occur at  
all levels of government  
all sectors of society.**

**...We must develop a nationwide system of plans  
integrated to address the shared threat.**



# Health Care System Preparedness



# Preparing for Pandemic Influenza

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- **Severe Pandemic = Mass Casualty Event**
- **Extreme stress on healthcare system:**
  - **Overwhelmed capacity**
  - **Limited resources**
  - **Ongoing critical care needs**
  - **All sectors impacted**
  - **Weeks to months in duration and global in scope**
- **Need a new way for the health care system to organize and maintain an effective response.**

# Many risks are unknown.

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- **Knowledge of actual pandemic strain**
  - ? “Worst” case (based on 1968 pandemic):
    - ? 35% attack rate of general population
    - ? 600/100,000 hospitalization rates
    - ? Case fatality only 0.4%
  - **Age groups most affected**
  - **Lethality**
  - **Sensitivity to antivirals**
- **Availability of vaccine & antivirals**

# **7 Key Elements for Hospital Surge Capacity Planning**

- (1.) Bed Availability**
- (2.) Staffing Issues**
- (3.) Infection Control Measures**
- (4.) Occupational Medicine**
- (5.) Other Equipment Issues**
- (6.) Discharge Planning**
- (7.) Financial Planning**

# Key Elements For Surge Capacity Planning

## 1. HOSPITAL BED AVAILABILITY

### Critical Benchmark #2-1: Surge Capacity: Beds

Establish a system that allows the triage, treatment and initial stabilization of 500 adult and pediatric patients per 1,000,000 awardee jurisdiction (1:2000), above the current daily staffed bed capacity, with acute illnesses or trauma requiring hospitalization from a chemical, biological, radiological, nuclear or explosive (CBRN&E) incident.

Awardee	Population	Surge beds/Patients	Current Daily Capacity	% Increase
State A	5,595,211	2,798	19,257	15%
State B	11,353,140	5,677	33,310	17%
State C	20,851,820	10,426	56,354	19%

*Example not actual or current data*

From “National Bioterrorism Hospital Preparedness Program Continuation Guidance FY 2004” Published May 2004 U.S.DHHS



# Key Elements For Surge Capacity Planning

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## 1. HOSPITAL BED AVAILABILITY (Cont.)

- “Surge beds” available?
- All “surge beds” are not created equal.
  - oxygen
  - suction
  - type of bed
  - isolation

# Key Elements For Surge Capacity Planning

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## 1. HOSPITAL BED AVAILABILITY (Cont.)

- Medical Beds
- Adult ICU Beds
- Pediatric Beds and ICU capacity
- ER beds

# Key Elements For Surge Capacity Planning

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## 2. STAFFING ISSUES

- **30% of staff may be ill or not at work**
  - **Identify key roles both in administration and in clinical aspects.**
  - **Cross-training persons may be helpful ahead of a pandemic.**
  - **Identify new ways to stratify patients and prioritize who must be seen when.**

# Key Elements For Surge Capacity Planning

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## 3. INFECTION CONTROL MEASURES

- Cohorting of patients and staff may be a key method to help increase capacity and to help prevent healthcare acquired influenza.
- Isolation and quarantine.
- Active surveillance of staff, patients, and family members of patients may be advised.

# Key Elements For Surge Capacity Planning

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## 4. OCCUPATIONAL MEDICINE - PROTECTING STAFF

- Prioritization of staff for vaccine and antivirals may be required.
- Staff family protection may become an issue.
- Protective equipment availability and fit-testing are important aspects to look at ahead of time.
- Stress reduction will be important.

# Key Elements For Surge Capacity Planning

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## 5. OTHER EQUIPMENT & SUPPLY CONCERNS

- Ventilators (in hospitals)
- Antivirals
- Antibacterials
- Other meds
- Oxygen & O2 delivery systems
- Gloves/ Masks
- Security?

# Key Elements For Surge Capacity Planning

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## 6. DISCHARGE PLANNING

- Long-term care facility and hospital capacity likely will be overwhelmed.
- Decisions on “early discharge” may be required.

# Key Elements For Surge Capacity Planning

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## 7. FINANCIAL PLANNING

- **Compensation of staff may be more complex if overtime is required for weeks on end.**



# Surge Capacity Planning

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**Example from Manchester HSA**

# Estimates For Manchester HSA

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**“Best” Case  
“Maximums”**  
(6 week period)

467 total admits

116 total deaths

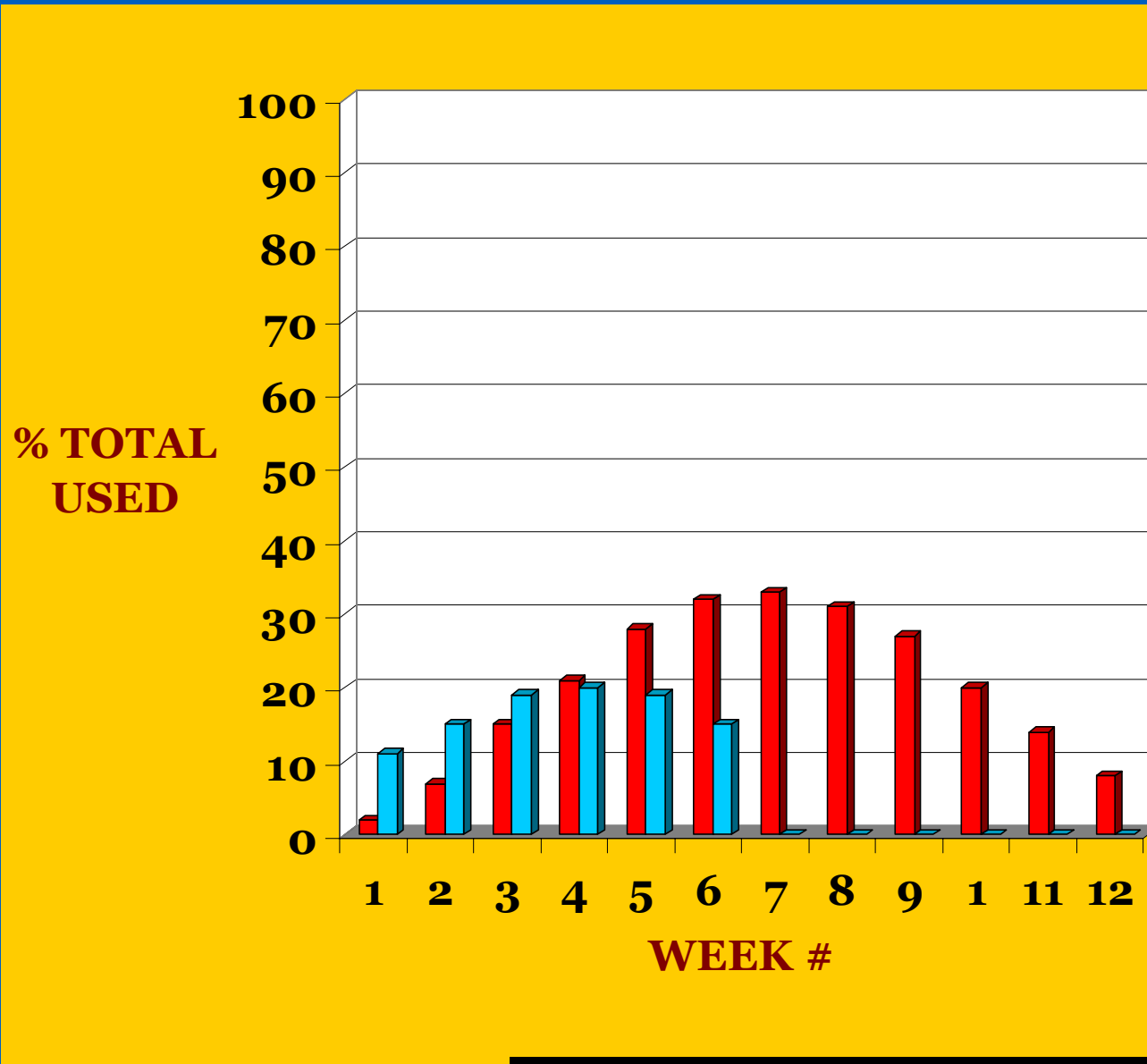
**“Worst” Case  
“Maximums”**  
(12 week period)

1090 total admits

270 total deaths

# *ESTIMATED %BEDS USED FOR FLU PATIENTS*

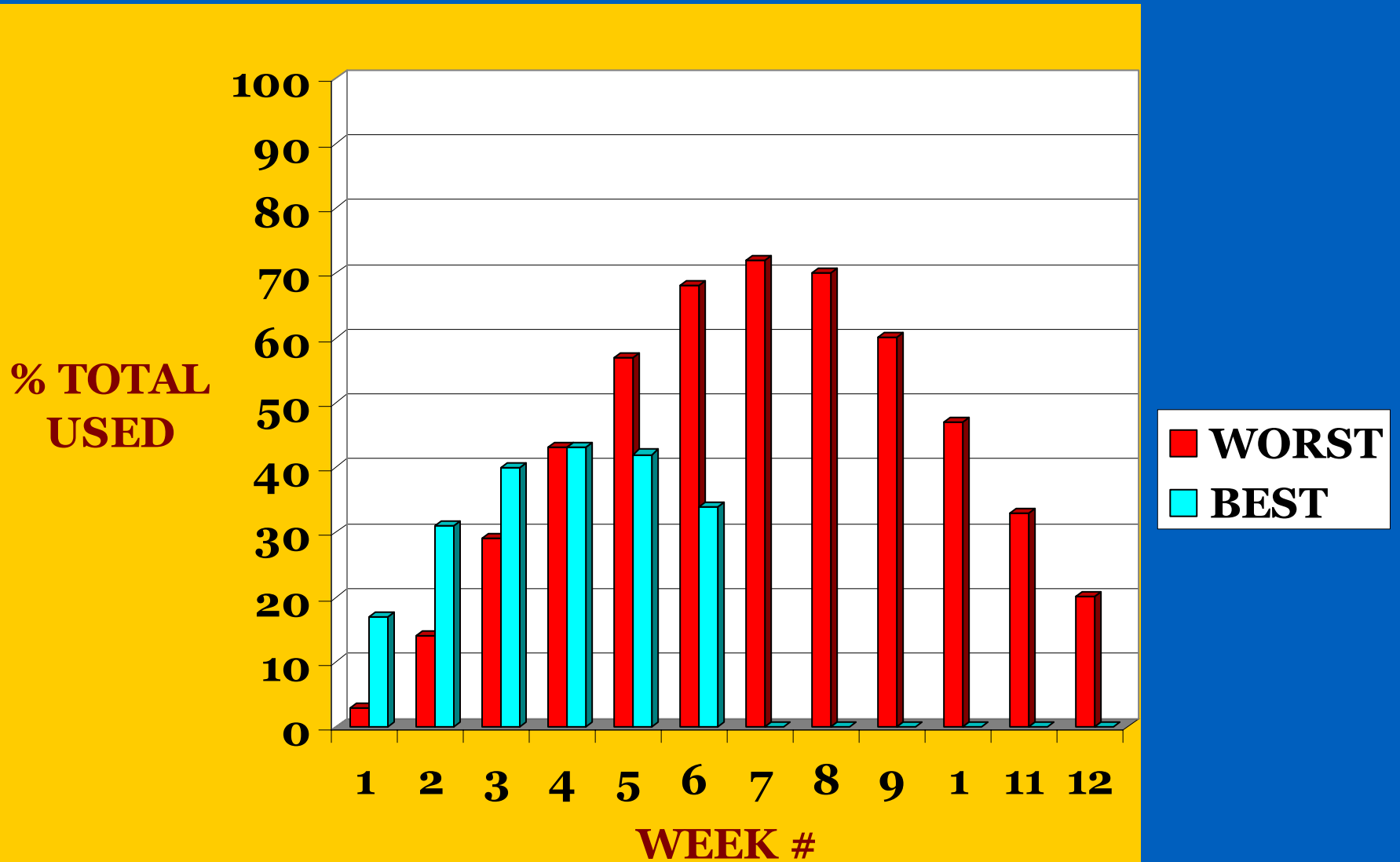
## *TOTAL MANCHESTER H.S.A.*



\* Based on 1968 pandemic using FluSurge 1.0

# ESTIMATED % ICU BEDS USED FOR FLU PATIENTS

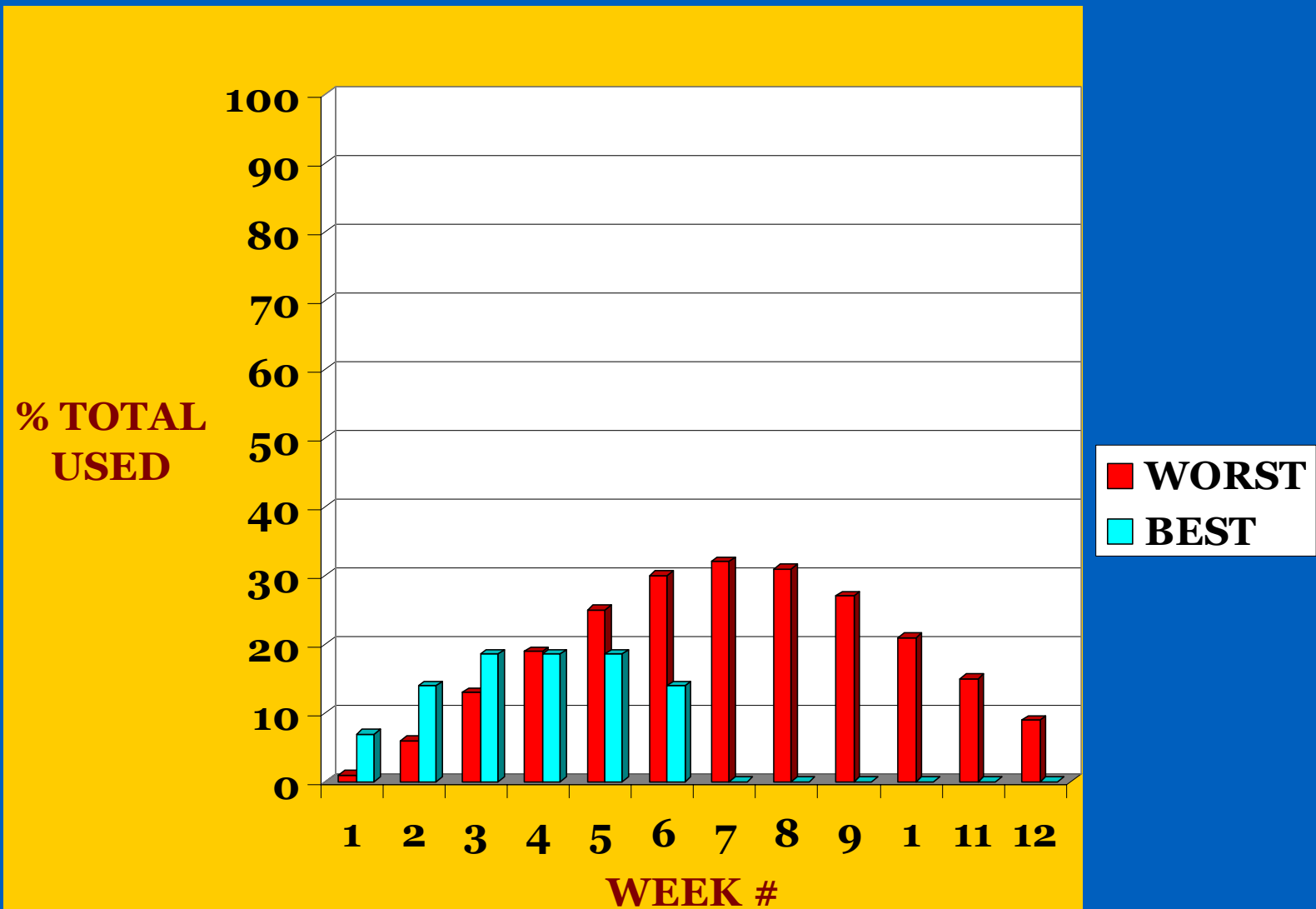
## TOTAL MANCHESTER H.S.A.



\* Based on 1968 pandemic using FluSurge 1.0

# ESTIMATED % VENTILATORS USED FOR FLU PATIENTS

## TOTAL MANCHESTER H.S.A.



\* Based on 1968 pandemic using FluSurge 1.0

# Resources

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**Surge Capacity Planning**

# Resources - Surge Capacity Planning

- **FluSurge** = a spreadsheet-based model which provides hospital administrators and public health officials estimates of the surge in demand for hospital-based services during the next influenza pandemic.
  - <http://www.cdc.gov/flu/flusurge.htm>
- **FluAid** = a test version of software created by programmers at the CDC. It is designed to assist state and local level planners in preparing for the next influenza pandemic by providing estimates of potential impact specific to their locality.
  - <http://www2a.cdc.gov/od/fluid/default.htm>

# Public Health Role in Pandemic Planning

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# Public Health Goals in a Pandemic: Protecting the Public's Health

- Limit death and illness.
- Preserve continuity of essential government and business functions.
- Minimize social disruption.
- Minimize economic losses.

# Public Health's Role in a Pandemic

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- **Disease Tracking and Control**
- **Environmental health response**
- **Health System Coordination**
- **Mass fatality response**
- **Communications**
- **Laboratory services**

# Pandemic Impact: Infrastructure

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- **Significant disruption of transportation, commerce, utilities, public safety and communications.**
- **Limited to no assistance from State and Federal governments due to nation-wide impact.**

# Pandemic Preparedness Means:

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- **Decision-making and coordination, including communication between responders.**
- **Surveillance: Recognition & reporting of cases, monitoring impact on community.**
- **Vaccine and antiviral drug management.**

# **Pandemic Preparedness Means:**

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- **Healthcare delivery system preparedness.**
- **Maintenance of essential community services:  
Continuity of Government, Business  
Continuity.**
- **Implementation of social distancing measures.**
- **Public education and communication.**

# Essential Partnerships for Preparedness

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- Hospitals and Health Care Providers, including Home Health Care Agencies
- First Responders / Infrastructure Agencies
- Elected Officials and Government Partners
- Businesses
- Faith-based & Community-based Organizations
- Schools, including Colleges/Universities
- Child Care and Pre-Schools

# Local Preparedness Planning

- Focus on Pandemic Influenza Preparedness Planning.
  - **State and Local Pandemic Influenza Planning Checklist**
- Engage/educate partners to assist them with preparedness efforts.
  - **Checklists**
- Educate/empower the public – what can they do to help prevent the spread of disease and prepare for an influenza pandemic.
  - **Create a consistent message – utilize existing resources (i.e. Individual/Families Checklist)**
  - **Focus on simple prevention measures – hand hygiene and cough etiquette, importance of vaccination, stay home when sick, etc.**
  - **Social distancing messages - keep your distance to 3 feet, hand shaking practices.**

# Local Preparedness Planning (cont.)

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- **Enhance capacity to communicate information to the public.**
  - **Utilize various methods of communication (i.e. public access TV, newspaper, internet/web postings, presentations/community forums, etc.)**
  - **Important Considerations (i.e. special populations, other barriers to effective communication)**
  - **Work with the Media (i.e. Media Checklist)**
- **Develop capacity to rapidly vaccinate large populations.**
- **Identify social distancing measures.**
  - **May have to limit group gatherings (i.e. schools, entertainment activities)**



# Resources

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**Pandemic Influenza Planning**

# Resources – Preparedness Planning

- **Pandemicflu.gov** = One-stop access to U.S. Government avian and pandemic flu information. Preparedness Checklists.
  - <http://www.pandemicflu.gov>
- **World Health Organization** = WHO is coordinating the global response to human cases of H5N1 avian influenza and monitoring the corresponding threat of an influenza pandemic. Information on this page tracks the evolving situation and provides access to both technical guidelines and information useful for the general public.
  - [http://www.who.int/csr/disease/avian\\_influenza/en/](http://www.who.int/csr/disease/avian_influenza/en/)
- **NH DHHS Avian Flu Site**
  - <http://www.dhhs.nh.gov/DHHS/CDCS/Avian+Flu/default.htm>

## **Some of the slides in this presentation were provided by:**

- ‘Manchester HSA Flu Surge Capacity Planning’ presentation; Lisa Carlson, MD, MPH; Medical Director - Manchester Health Department.
- ‘Virginia Pandemic Influenza Summit’ presentation; Greater Richmond Convention Center (March 23, 2006).
- ‘Business Forum on Pandemic Flu’ presentation; Seattle & King County Public Health (October 3, 2005).