Coping with Global Influenza: Consequences of Novel-Swine Origin Influenza Epidemic

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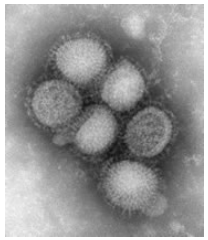


Consequences of Novel Influenzavirus

found in Mexico/USA in April 2008, fast spreading

- **Major public health problem**
  - **Morbidity (high) and mortality (low)**
  - **Overwhelmed medical care systems**
- **Substantial economic impact**
  - **Lost work / school days (billion of $$$$ loss)**
  - **Trade and Commerce disrupted**
    - EU banned imports of pork from México, US and Canada
  - **Travel restrictions impact tourism**
    - Mexican, Canadian tourists quarantined in China
- **Any novel influenza is reportable to WHO under IHR (2005)**
  - **WHO may issue travel restrictions etc**

Introduction: Three types of influenza infections in humans

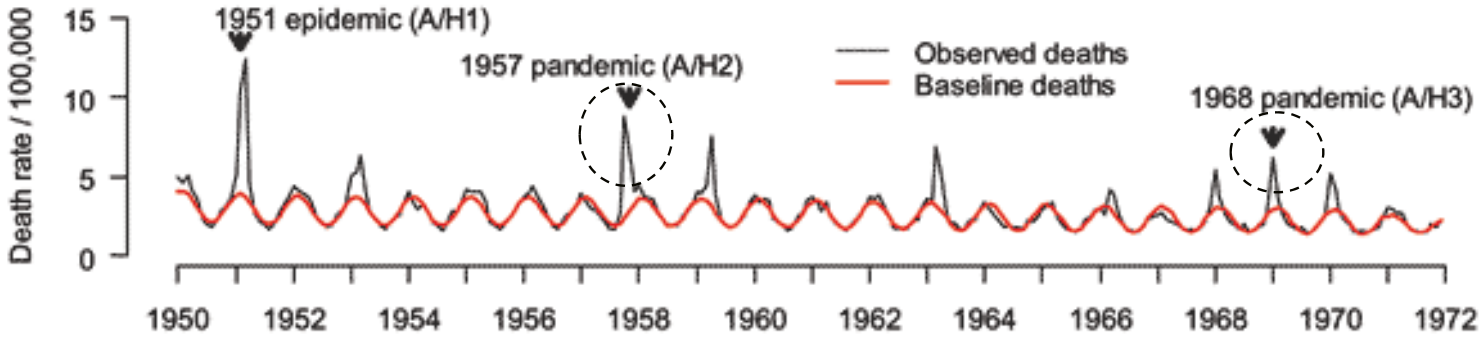
- **Seasonal-human influenza virus.**
  - A contagious respiratory illness caused by influenza viruses
  - Viruses fixed and circulating in the human population-Influenza A (H3N2, H1N1 and B strains. Vaccine formulations change regularly.

- **Pandemic: animal-to-human =>to human-to human**
  - Animal influenza virus adapts and transmits in humans-new subtype
  - Flu that causes a global outbreaks and spread easily from human to human (Spanish flu 1918)
  - ***Currently there is H1N1 in pandemic phase 5***

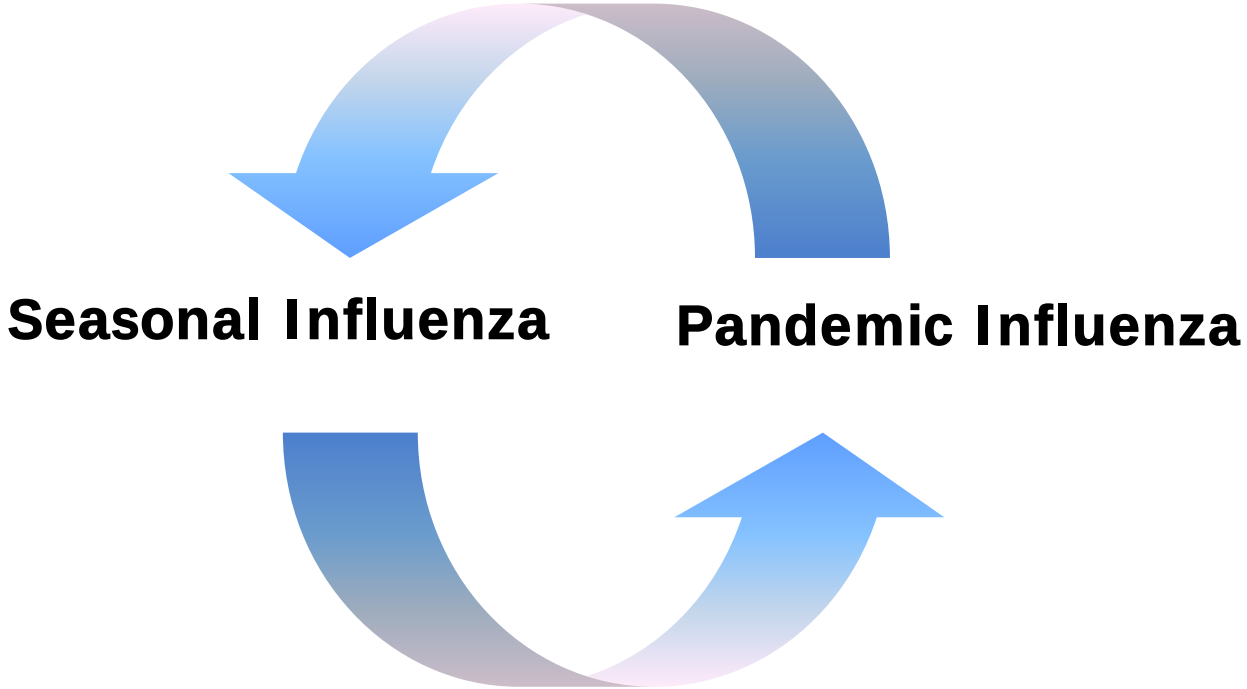
- **Sporadic- animal to human**
  - Animal influenza viruses infectious for humans under special circumstances.
  - Most common Avian and swine
  - Current avian H5N1 infections

Epidemiology Terms

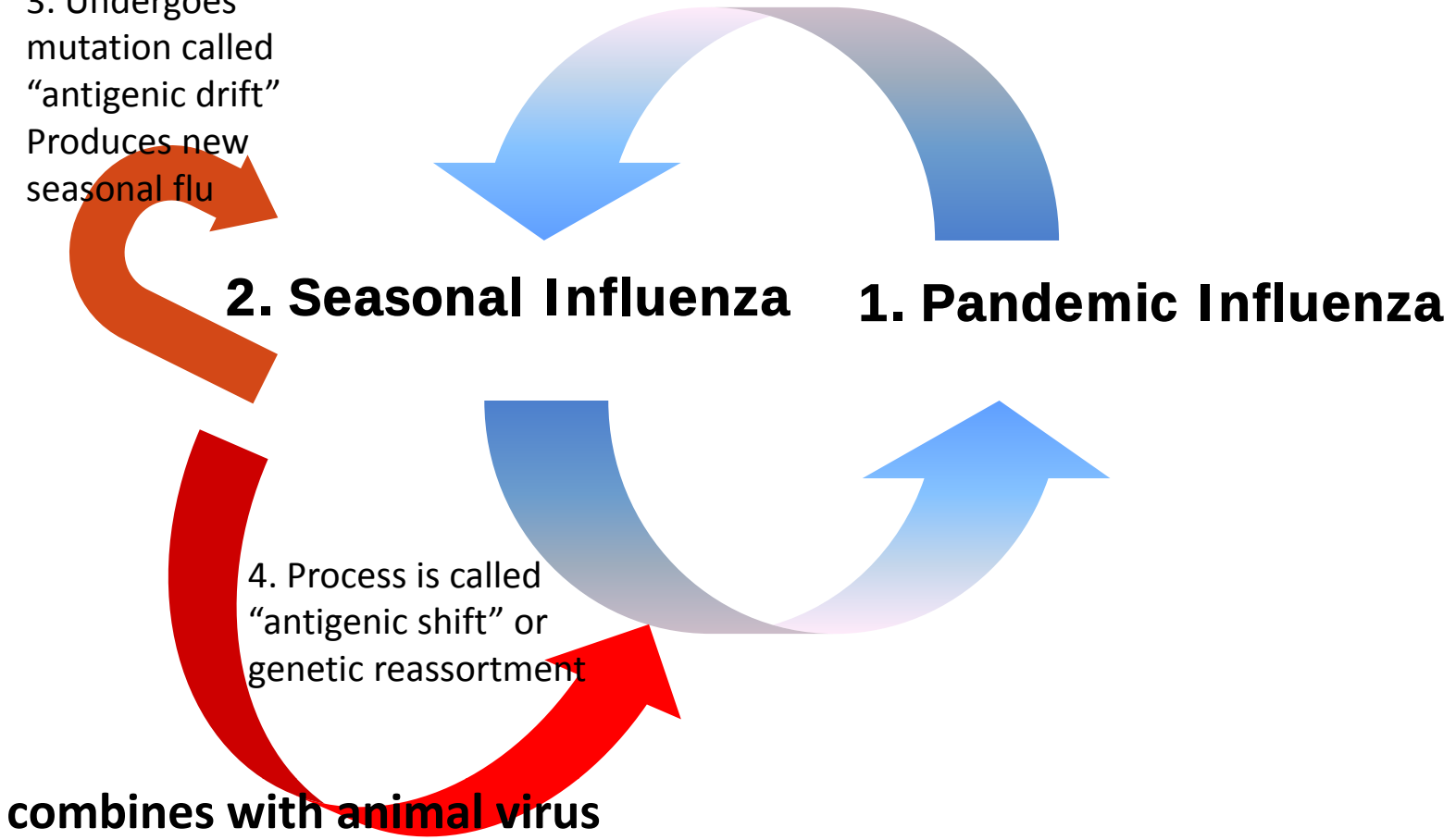
- **Epidemic**
  - When the cases of a disease exceed what is normally expected
- **Pandemic**
  - An epidemic that occurs over a large geographic area, or across the whole world



Recycling of seasonal and Pandemic Influenza Disease



Recycling of seasonal and Pandemic Influenza Disease

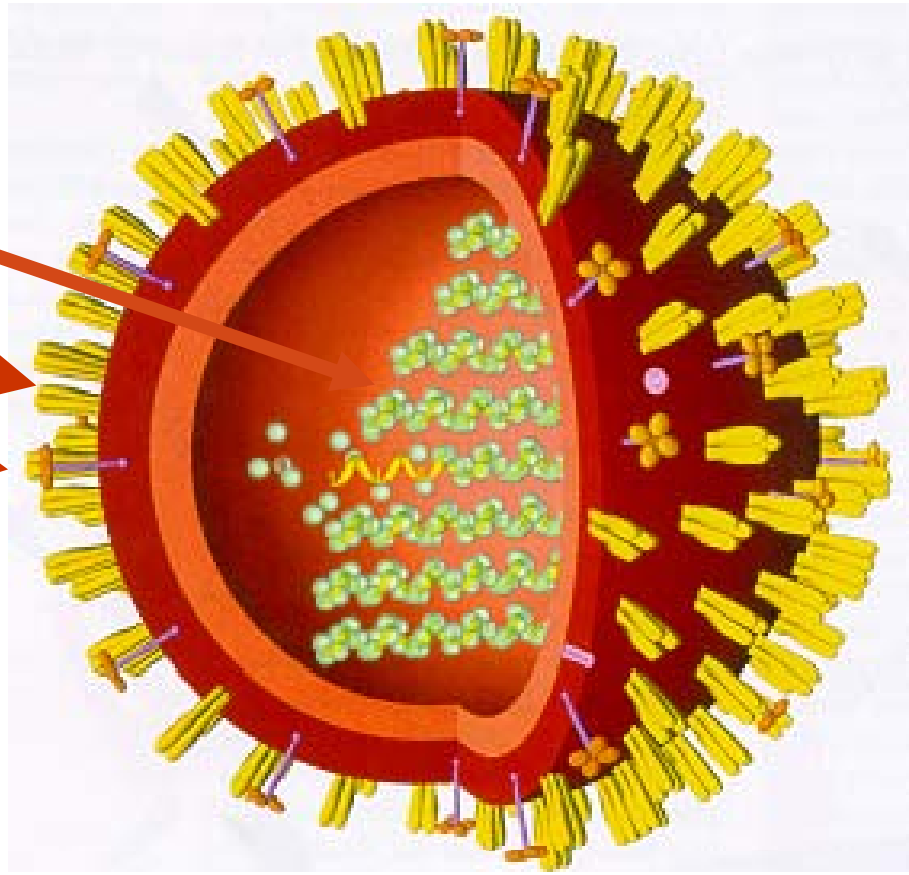


Structure of Influenza A viruses

8 genes (RNA)

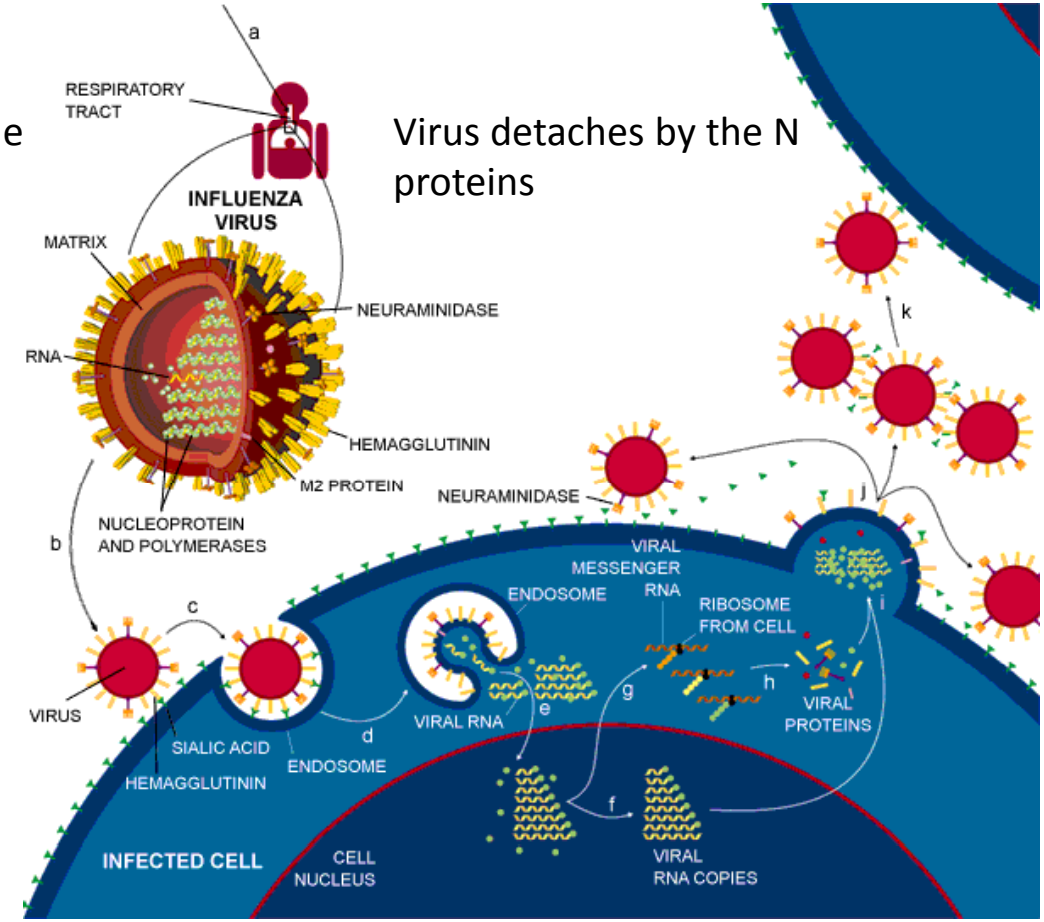
Hemagglutinin (HA)

Neuraminidase (N)



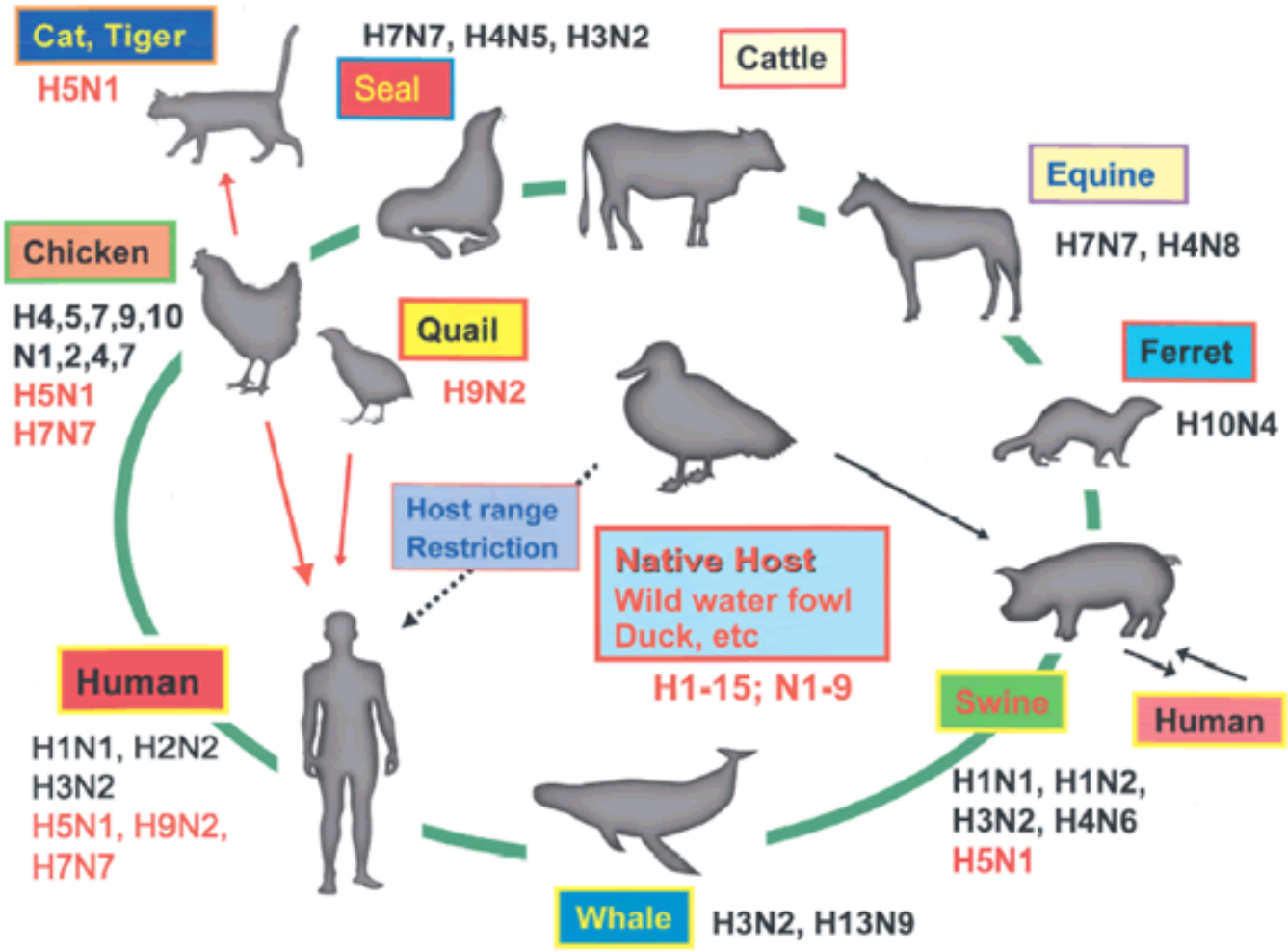
Role of Hemagglutinin (H) and Neuraminidase (N) proteins

Virus attaches by the H proteins

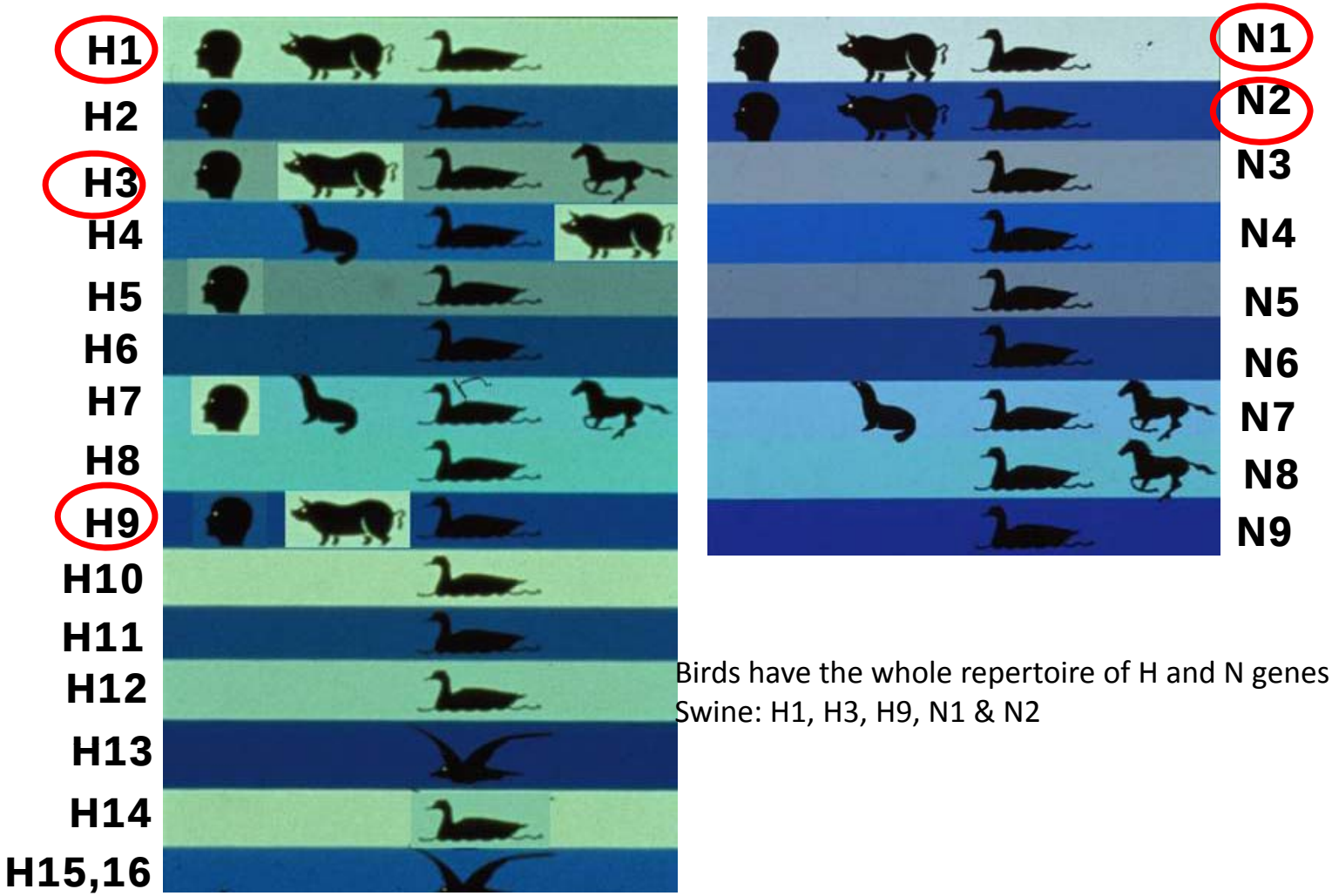


Virus detaches by the N proteins

Ecology of influenza viruses in Nature

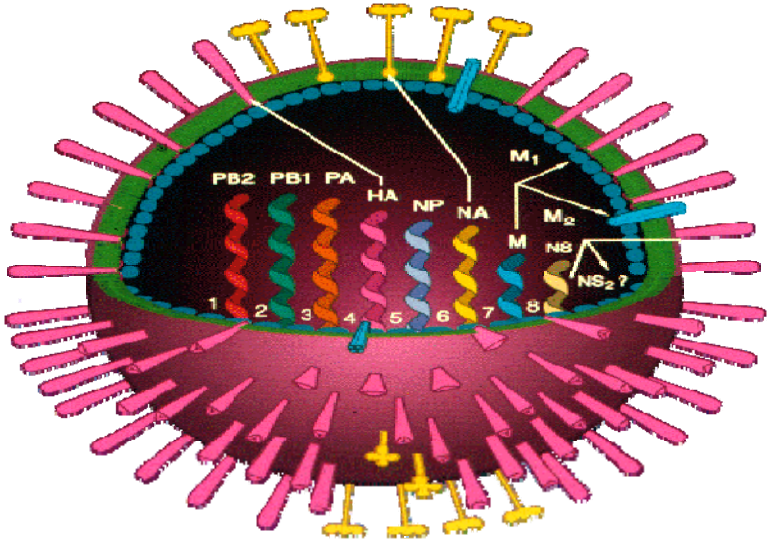


Repertoire of H and N in animals can be used for generation of novel viruses



Birds have the whole repertoire of H and N genes
Swine: H1, H3, H9, N1 & N2

Nomenclature of the 2009 novel human virus of swine origin



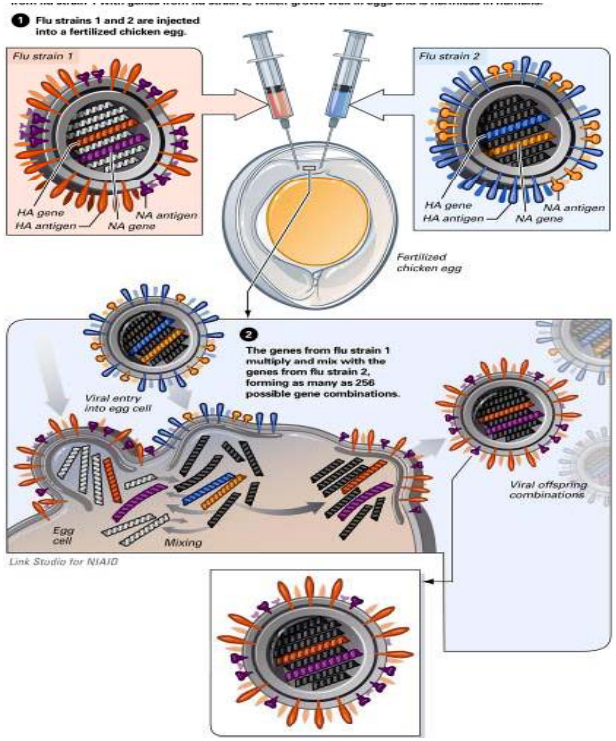
A / California/ 04 / 2009 (H1N1)

- Virus type
- Geographic origin
- Strain number
- Year of Isolation
- Virus subtype

Pandemic generated by genetic reassortment

Reassortment can be generated in the Laboratory
Influenza has 8 segmented genes

Parental influenza one



Parental influenza two

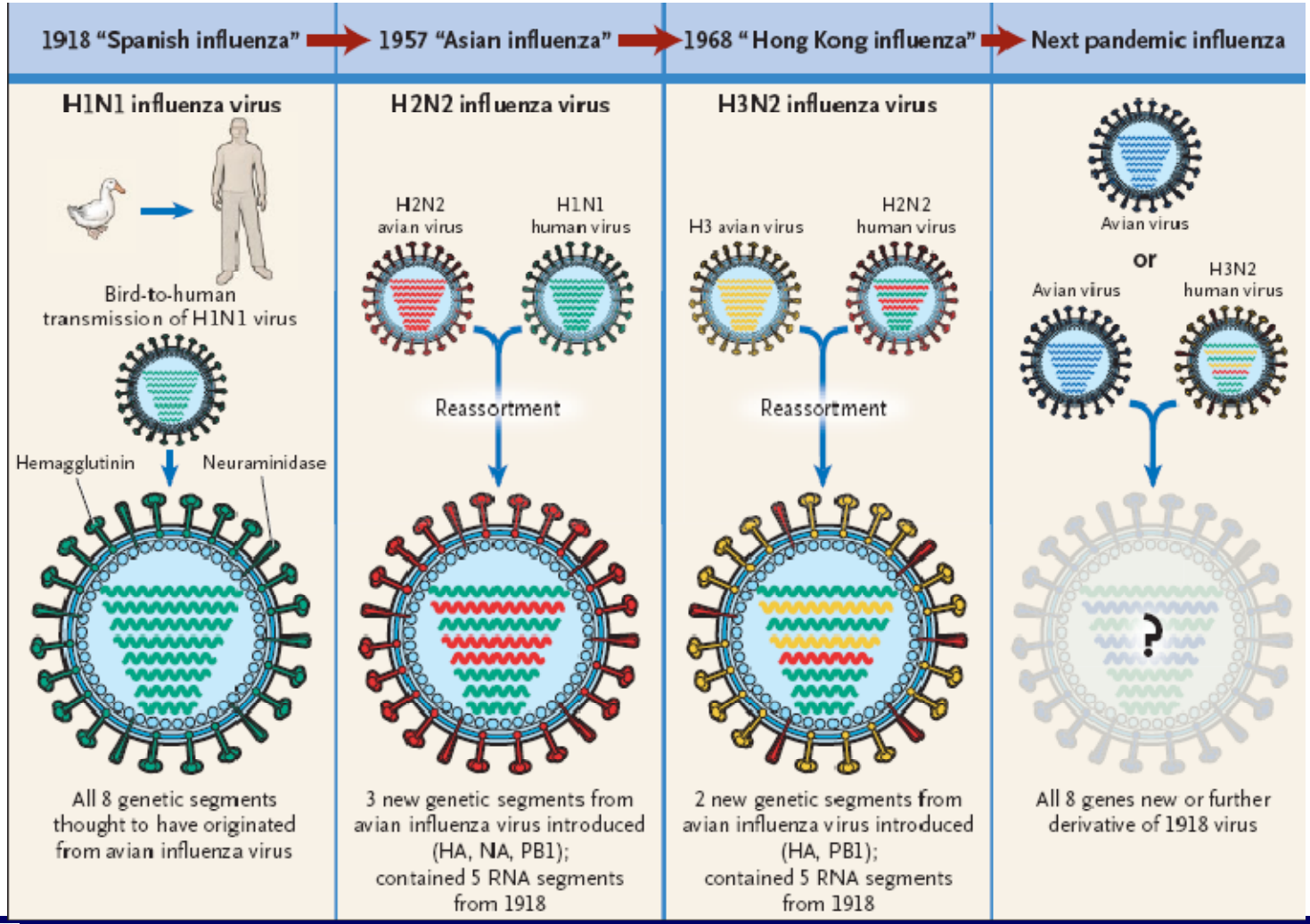
Segmented genes facilitate exchange of genetic materials

Segmented genes facilitate exchange of genetic materials

Progeny influenza has genes of both parents: reassortants

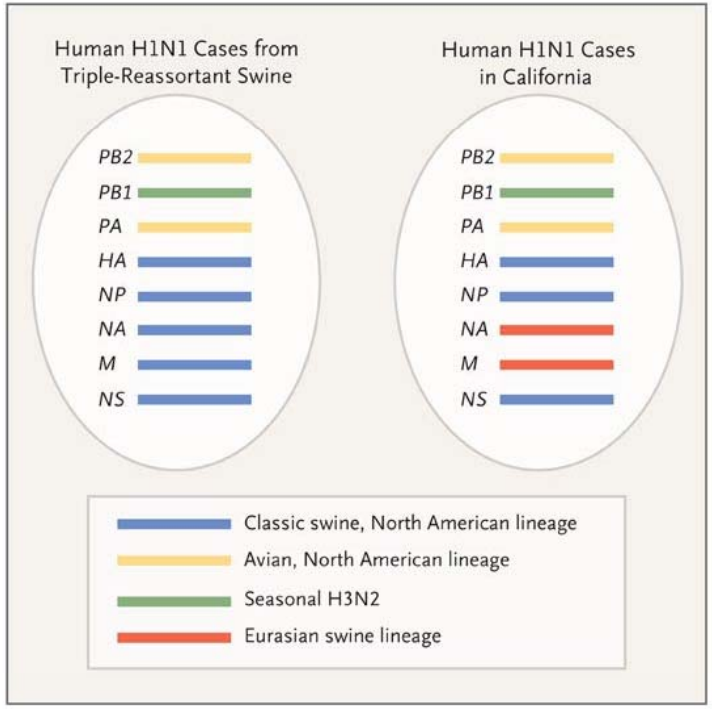
Juxtaposition of susceptible species of animal: Environmental Test tube for breeding novel influenza virus

Generation of Pandemic Influenza Strains from repertoire of influenza genes

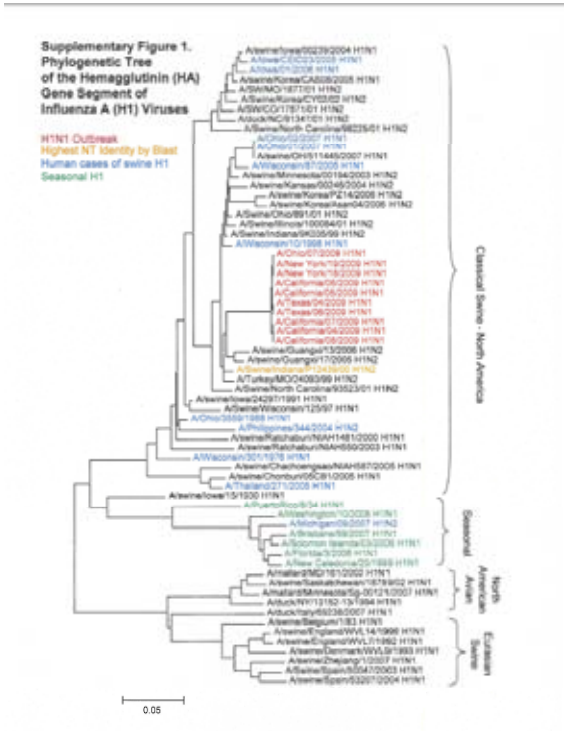


The novel H1N1 virus is a mongrel: will it cause a pandemic?

Triple reassortants: swine, avian, human



The HA gene closer to classical swine



Epidemiology of Novel Swine-origin Influenza A (HIN1) in Humans

The NEW ENGLAND JOURNAL of MEDICINE

Emergence of a Novel Swine-Origin Influenza A (H1N1) Virus in Humans

Novel Swine-Origin Influenza A (H1N1) Virus Investigation Team*

ABSTRACT

BACKGROUND

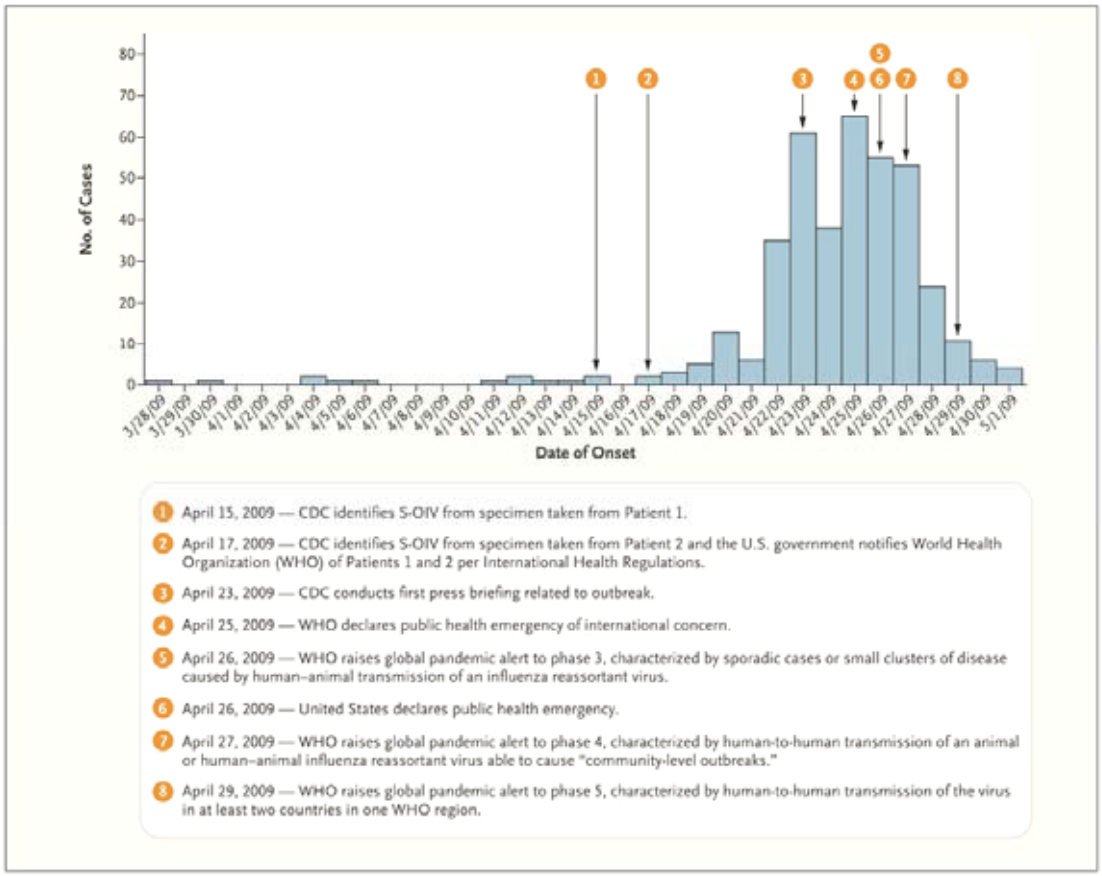
On April 15 and April 17, 2009, novel swine-origin influenza A (H1N1) virus (S-OIV) was identified in specimens obtained from two epidemiologically unlinked patients in the United States. The same strain of the virus was identified in Mexico, Canada, and elsewhere. We describe 642 confirmed cases of human S-OIV infection identified from the rapidly evolving U.S. outbreak.

METHODS

Enhanced surveillance was implemented in the United States for human infection with influenza A viruses that could not be subtyped. Specimens were sent to the Centers for Disease Control and Prevention for real-time reverse-transcriptase–polymerase-chain-reaction confirmatory testing for S-OIV.

The members of the writing group (Fatimah S. Dawood, M.D., Epidemic Intelligence Service, Office of Workforce and Career Development; and Seema Jain, M.D., Lyn Finelli, Dr.P.H., Michael W. Shaw, Ph.D., Stephen Lindstrom, Ph.D., Rebecca J. Garten, Ph.D., Larisa V. Gubareva, M.D., Ph.D., Xiyan Xu, M.D., Carolyn B. Bridges, M.D., and Timothy M. Uyeki, M.D., M.P.H, M.P.P., Influenza Division, National Center for Immunization and Respiratory Diseases — all at the Centers for Disease Control and Prevention, Atlanta) assume responsibility for the overall content and integrity of the article. Address reprint requests to Dr. Dawood

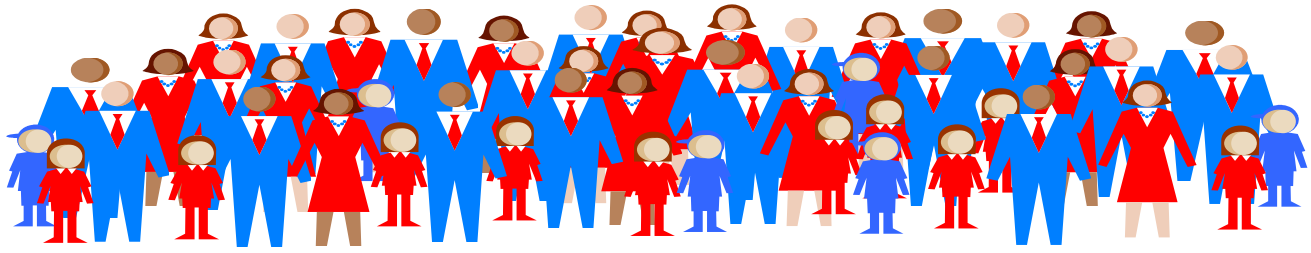
Distribution in Time: Epidemic Curve of Confirmed Novel H1N1 human cases



Curve: point source with secondary transmission

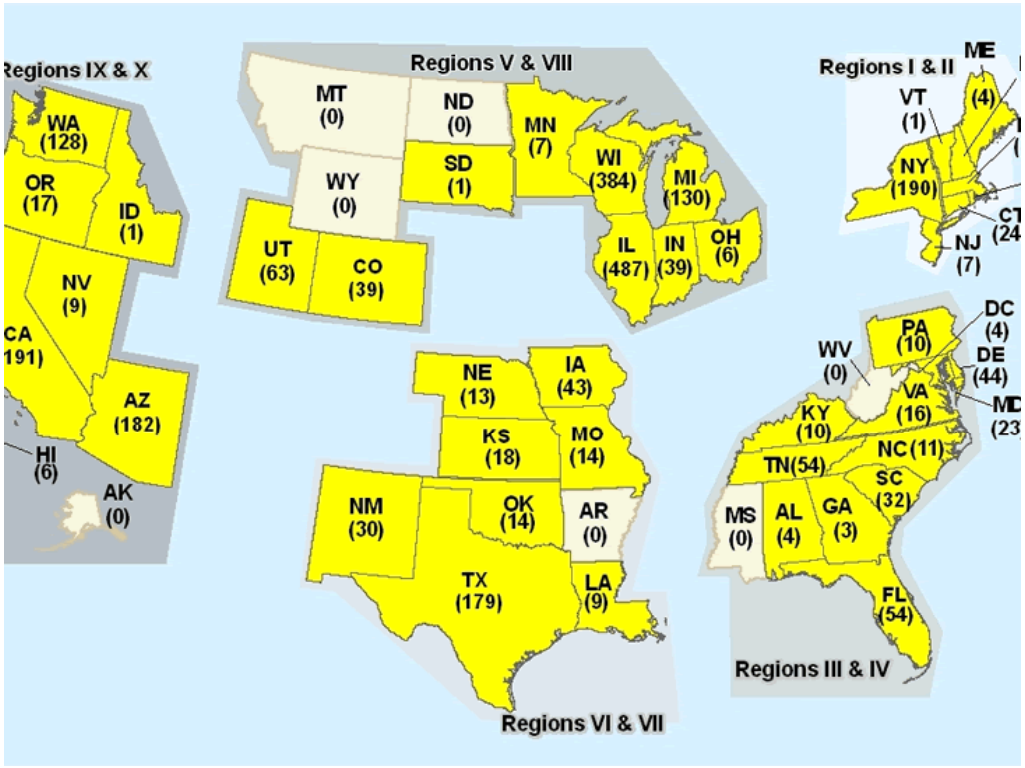
Distribution of novel H1N1 in persons

- Persons with travel history to Mexico within 7 days
- Median age 20 (3 months to 81 years)
- Peak in 10-18 and 19-50 age group
- Equal in Male and female

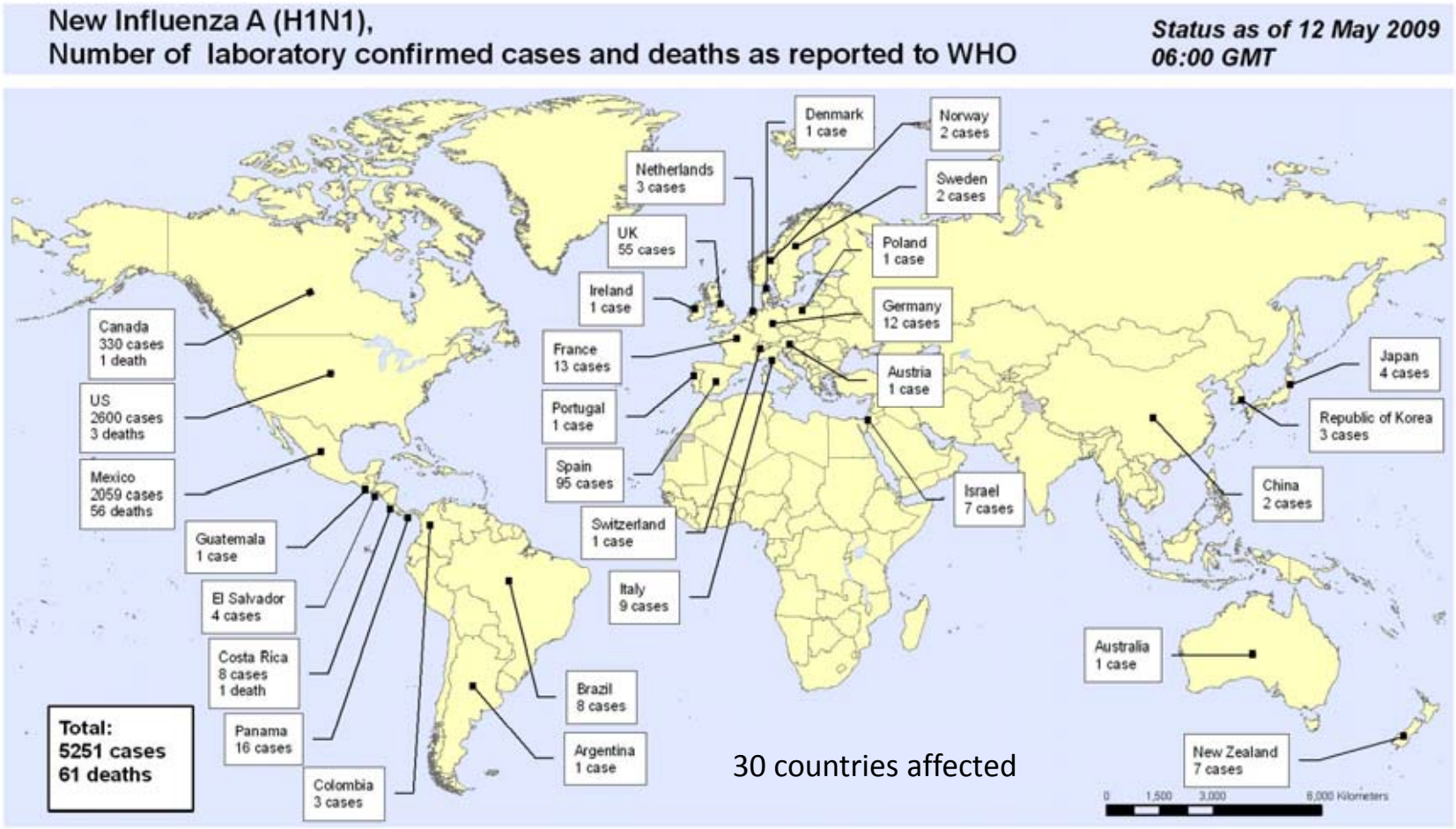


Distribution in Place: Epicenter of novel H1N1 virus

The virus was first detected in Mexico followed by USA



Person-to-person transmission is widespread in US


New Influenza A (H1N1),
Number of laboratory confirmed cases and deaths as reported to WHO
Status as of 12 May 2009
06:00 GMT
Denmark
1 case
Norway
2 cases
Netherlands
3 cases
Sweden
2 cases
UK
55 cases
Poland
1 case
Ireland
1 case
Germany
12 cases
Canada
330 cases
1 death
France
13 cases
Austria
1 case
Japan
4 cases
US
2600 cases
3 deaths
Portugal
1 case
Republic of Korea
3 cases
Mexico
2059 cases
56 deaths
Spain
95 cases
China
2 cases
Israel
7 cases
Guatemala
1 case
Switzerland
1 case
El Salvador
4 cases
Italy
9 cases
Australia
1 case
Costa Rica
8 cases
1 death
Brazil
8 cases
Total:
5251 cases
61 deaths
Panama
16 cases
Argentina
1 case
New Zealand
7 cases
Colombia
3 cases
30 countries affected
0 1,500 3,000 6,000 Kilometers
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.
Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization
World Health Organization
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Map produced: 12 May 2009 06:00 GMT

Groups at Risk for morbidity and mortality with Novel H1N1

Complications same as for seasonal flu (so far)

- Pneumonia, worsening of chronic lung and heart problems, and death

High Risk Groups same as for seasonal flu

- Persons 65 years and older
- Persons with chronic diseases
- Infants between 6 months and 2 years
- Pregnant women
- Nursing home/institutional/ residents & military personnel
- Children on long-term aspirin therapy

Prevention and Control: Novel H1N1 Influenza Virus (same a seasonal flu)

1. Non pharmaceuticals
2. Chemotherapy
3. Vaccines (?)

Transmission of H1N1

- Viral peak shedding in prodrome phase
- Incubation period between 2-7 days
- Contact and Droplet
- Hand to hand
- Droplet nuclei (within 3 feet)
  - Droplets generated by

coughing, talking, sneezing, close contact

Non-pharmaceutical interventions: Decrease Contacts by Social Distancing

- Protect children and teens (México, USA)
  - School closures (dismissals)
  - Reduce children and teen gatherings
- Cancellation of mass gatherings (Mexico)
- Alternatives to face-to-face contact at work
- Increasing distance between people (>3 feet) (Lebanon)
- Effectiveness of these measures in Mexico not assessed

Infection Control Measures to Decrease Transmission

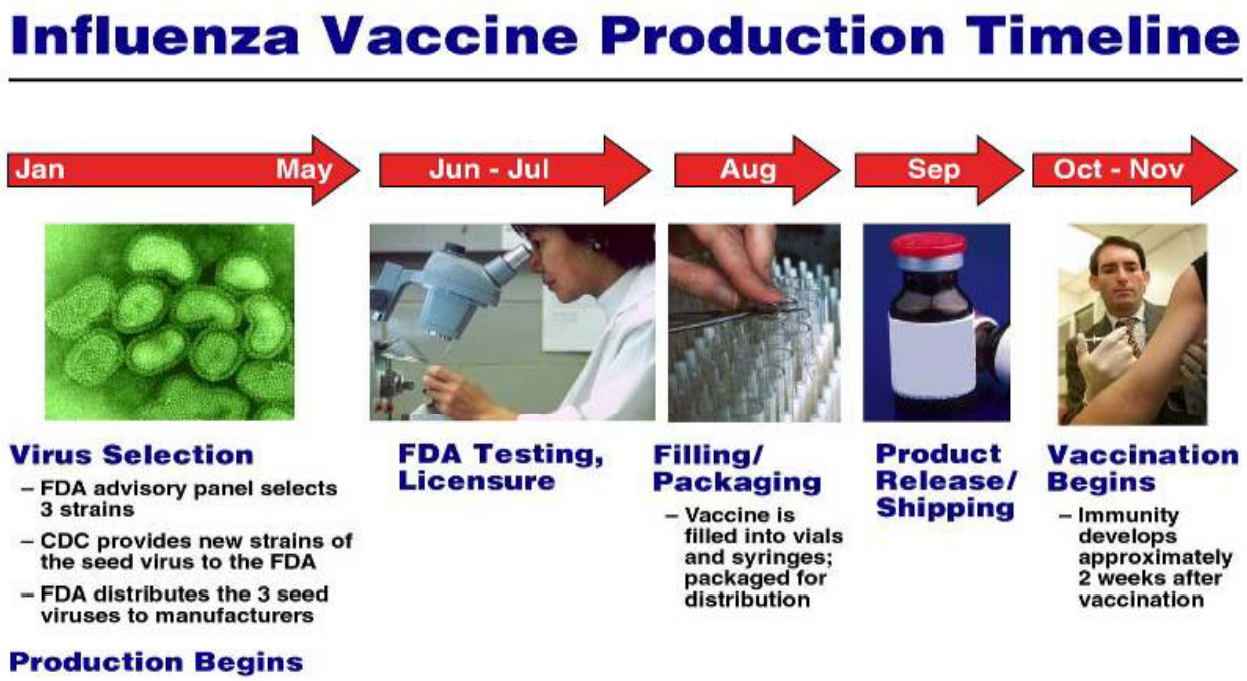
- Hand hygiene
- Facemasks
- Cough etiquette
- Sick people stay home (isolation)
- Perhaps stay home if have an ill household member (voluntary home quarantine)
- Environmental cleaning

Use of Tamiflu for treating H1N1

- the novel H1N1 is sensitive to Tamiflu
- Widespread use may lead to Resistance to Tamiflu
- limited supply for global market if pandemic starts
- Limited surge capacity for mass production/licensing etc
- Price beyond most health care budget
- Limitation for containing an established epidemic
- Recommended for preempting the initial stage of the epidemic

75 mg, twice daily for 5 days

Current Seasonal Influenza Vaccine Production Timeline: 6 - 9 months



Manufacturers must see profitable market to make novel H1N1 vaccine
Currently making seasonal vaccine

Critical Assessment of Pandemic Potential: Novel H1N1 Influenza Virus

Major Challenges in Applying the Risk Analysis Paradigm to influenza

Uncertain art to predict a pandemic

Alternative Approach Use Precautionary Principle to implement the zero- risk policy

Implication of wrong risk analysis:

- Raise unnecessary fears
- Waste scare resources
- Ignore important Problem

Accurate Representation of Uncertainties

Compute scenarios of best estimates and worst estimates based on past pandemics

Why are we concerned with pandemic?

1918: “Spanish Flu”

40-50 million deaths

H1N1

1957: “Asian Flu”

1-4 million deaths

H2N2

1968: “Hong Kong Flu”

>1 million deaths

H3N2

20th century major influenza epidemics

Grim Images of "helplessness" in 1918 Pandemic

Emergency influenza hospital

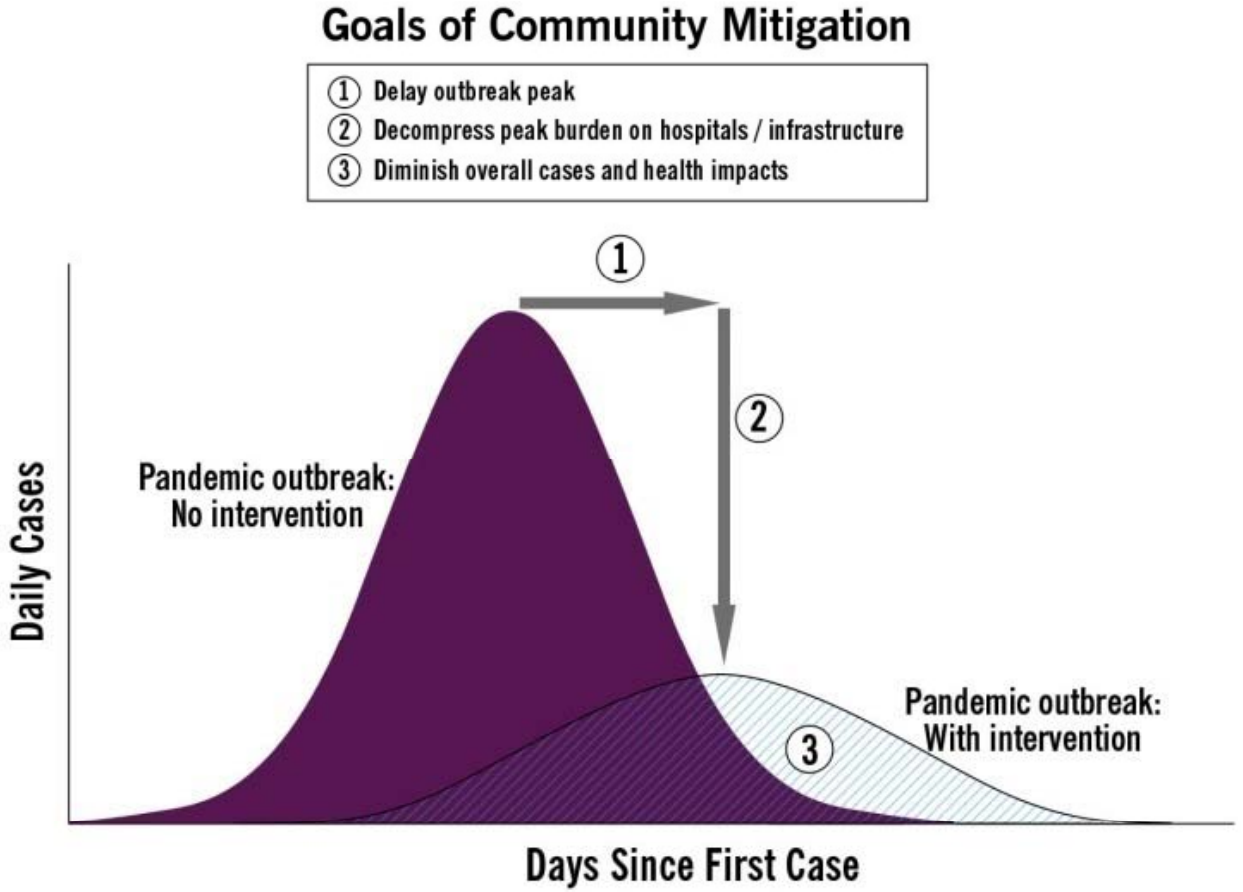
Alternating Heads of Beds and Masks, Supposed Preventives

Minimizing contagion by use of masks

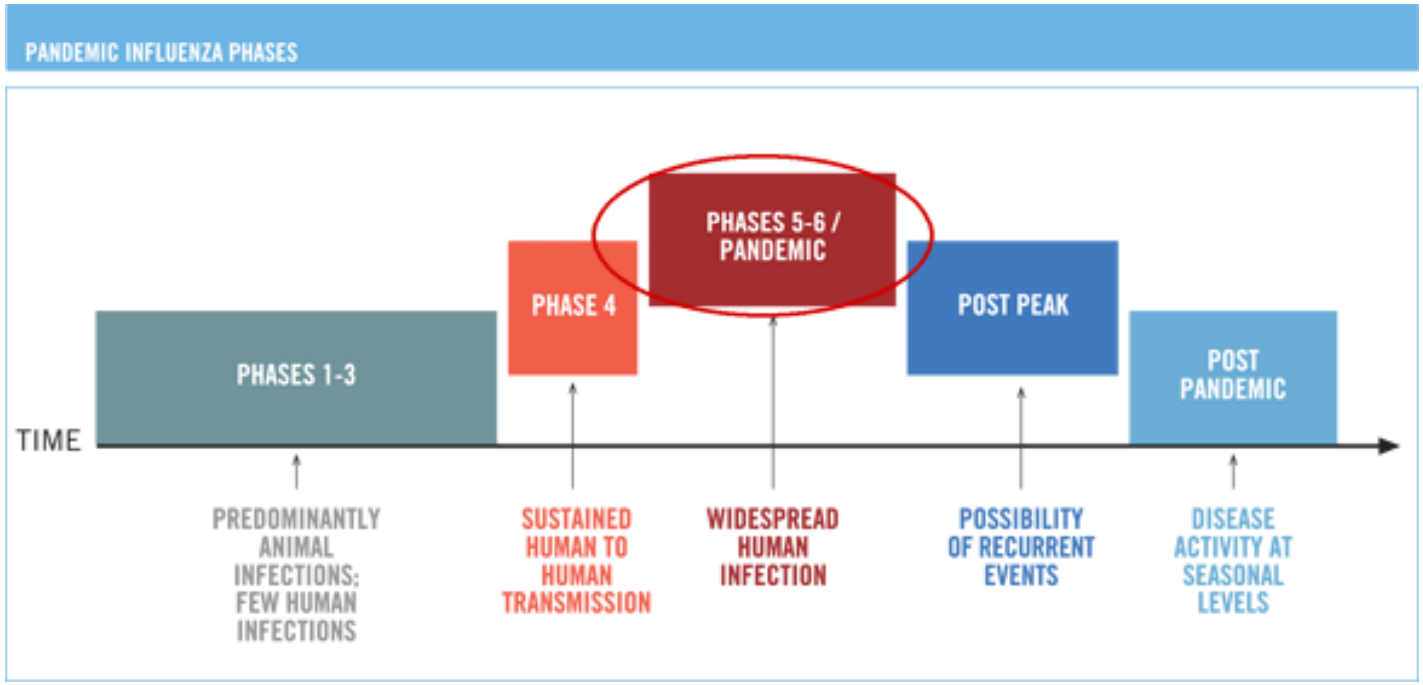
Two Red Cross nurses treat a patient during the influenza pandemic of 1918. Photo courtesy Library of Congress.

Overcrowded make shift shelters

Pandemics must be quelled in the beginning stage



WHO uses “ precautionary principle” by declaring phase 5



WHO web-site lumps phase 5/6: but phase 5 and 6 differ in epidemiology

A tale of two candidate pandemic virus

H5N1 (avian)

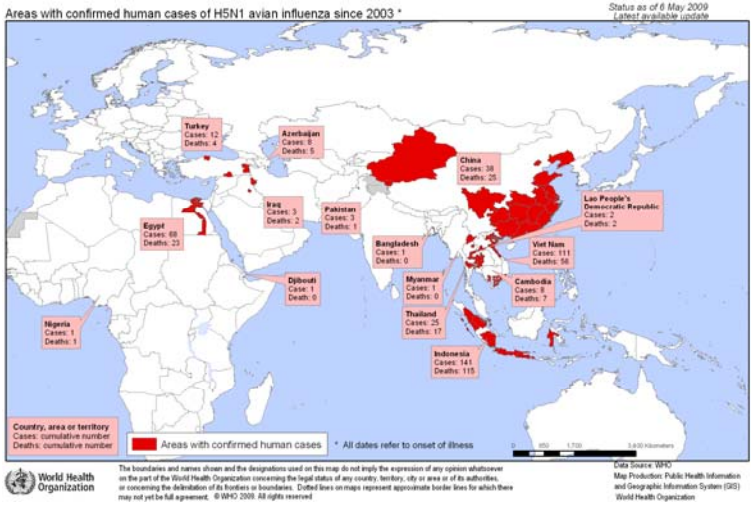
- Animal origin
- Predominant in developing world
- High mortality
- Has vaccine ready
- Virus is evolving into new clades

H1N1 (novel of swine-origin)

- Animal origin
- Confined to Western Hemispheres
- Low mortality
- No vaccine
- Genetically too soon to predict

The two candidates occupy different niches

Global distribution of avian flu



Global distribution of novel flu

Epidemiologic signatures of past pandemic influenza

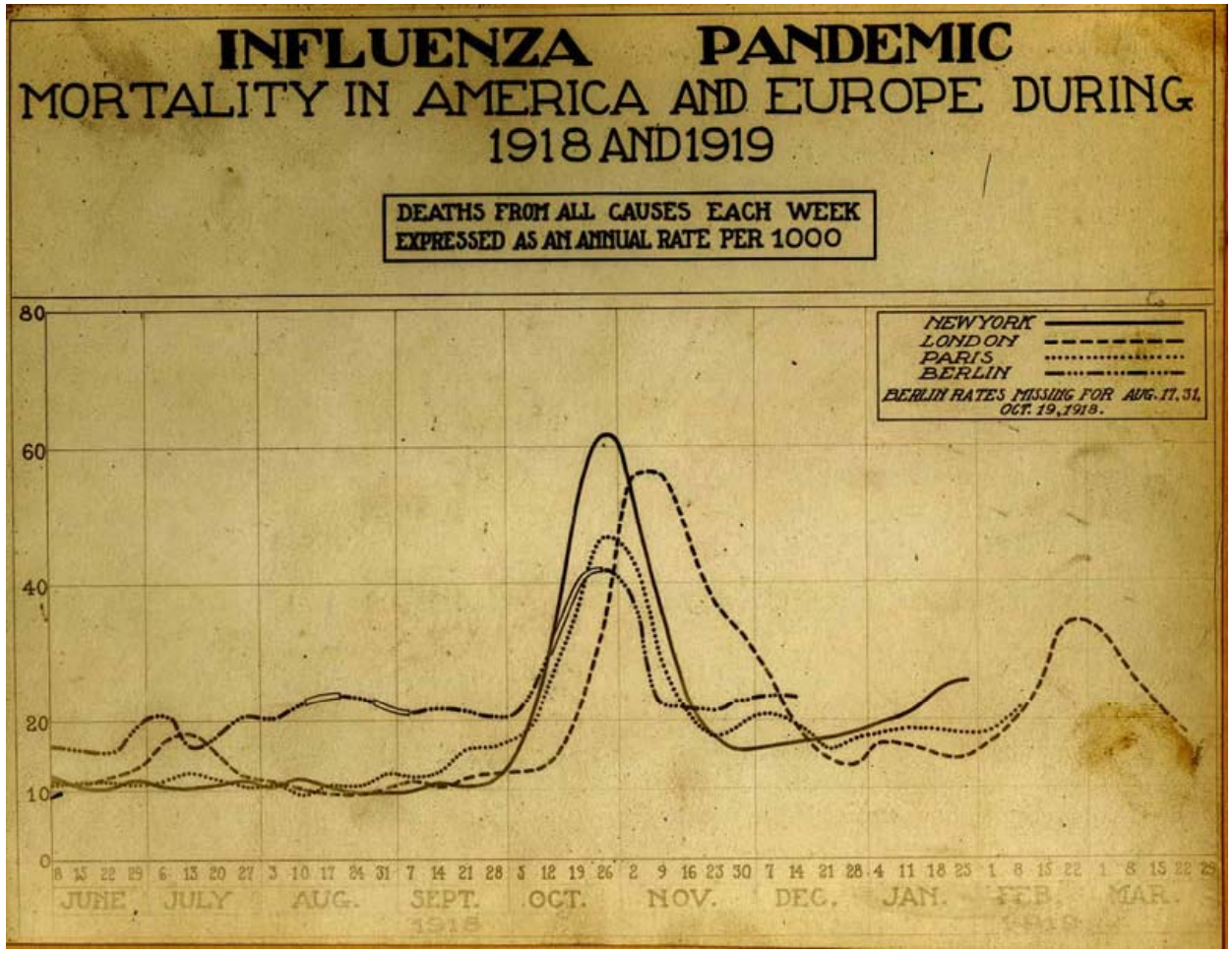
Past Pandemic viruses

- Higher death in younger age
- More transmissible than seasonal
- Regional differences in epidemic
- Shift in virological clades
- Strikes in “non-flu” season
- Successive pandemic waves

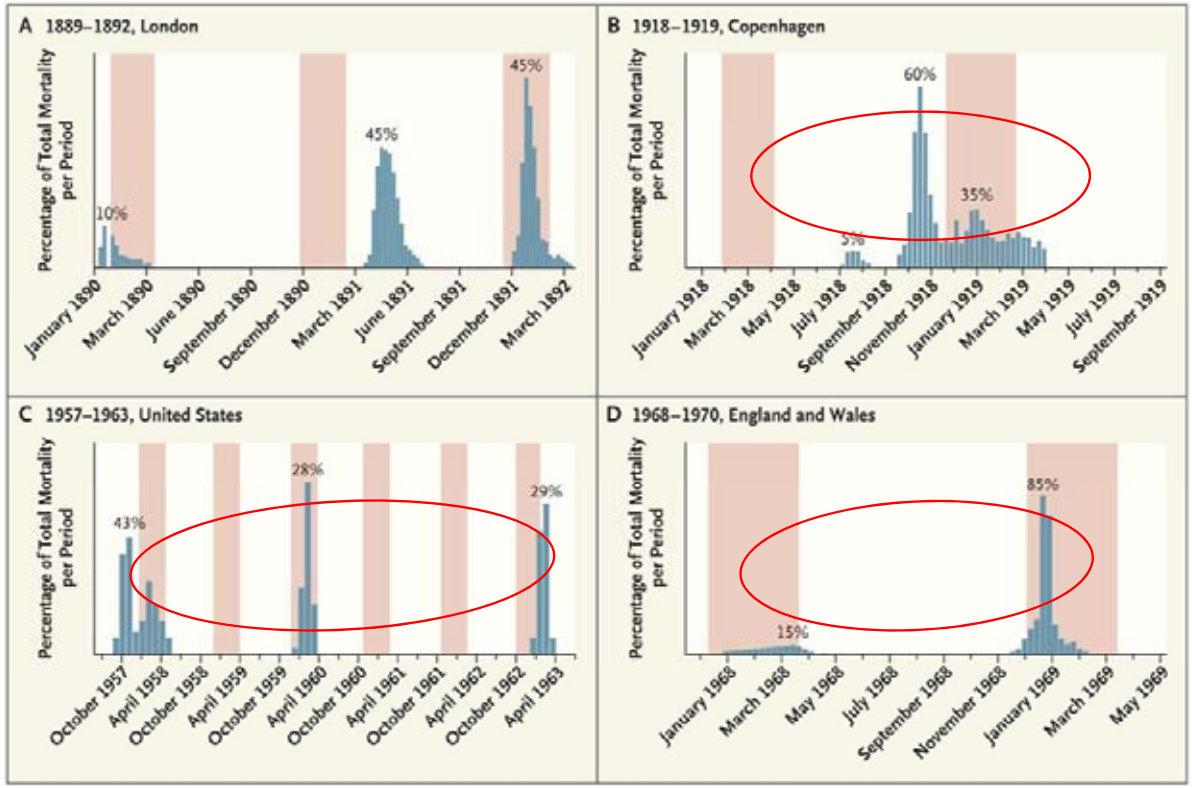
‘Candidate’ novel H1N1

- Not seen yet
- Not definite: (?surveillance)
- More severe in Mexico only
- No sign yet
- Just about
- Need to monitor

Weekly Mortality Record from US Public Health Service



"Epidemiologic Signatures" of past Influenza Pandemics



3 winter waves in 5 years

Mild in Summer, severe in Winter

First Mild wave
Second severe wave

Some points for consideration

- Over reactions: swine vaccine in 1976: Gerald Ford
- Manifestation of Rye syndrome in vaccinees
- 1918 conditions of environmental and health conditions are different than 2009 but jet age has come

Blame jet-setter humans, not pigs, for latest outbreak

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By ALAN ZAREMBO

and KAREN KAPLAN

Los Angeles Times

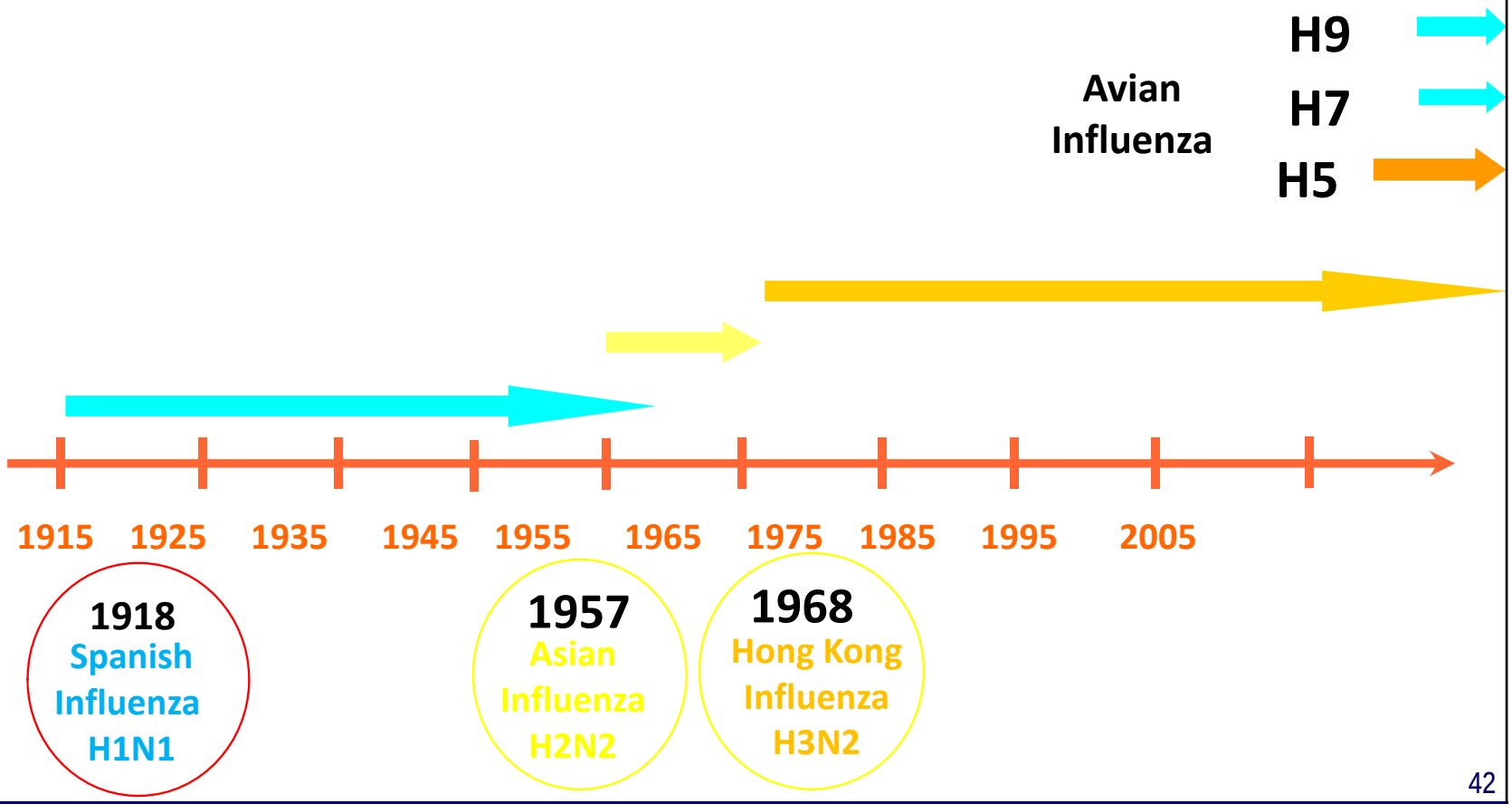
It looked like an open-and-shut case.

More than half the genes in the H1N1 virus behind

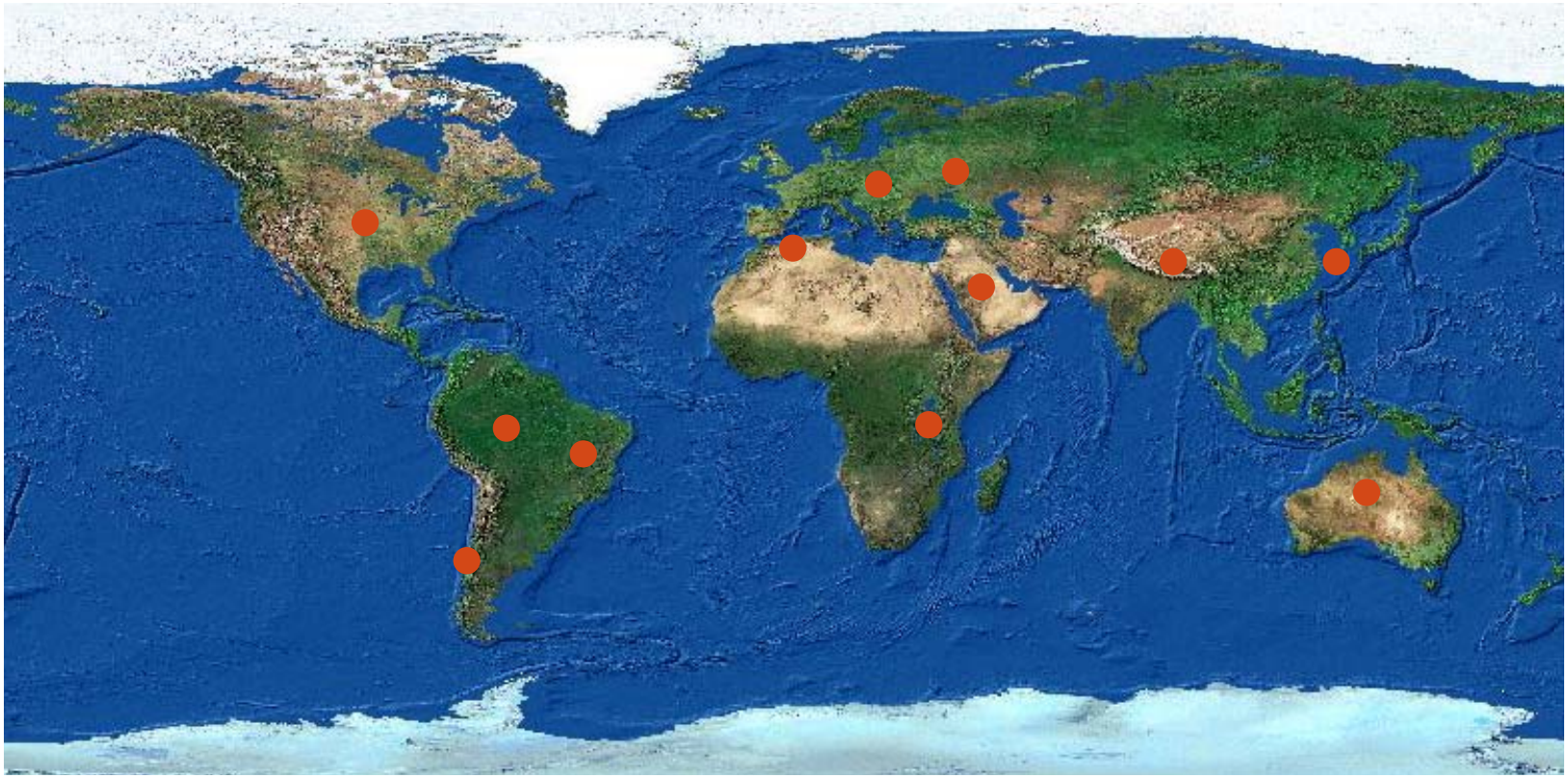
Risk Analysis for Mauritius

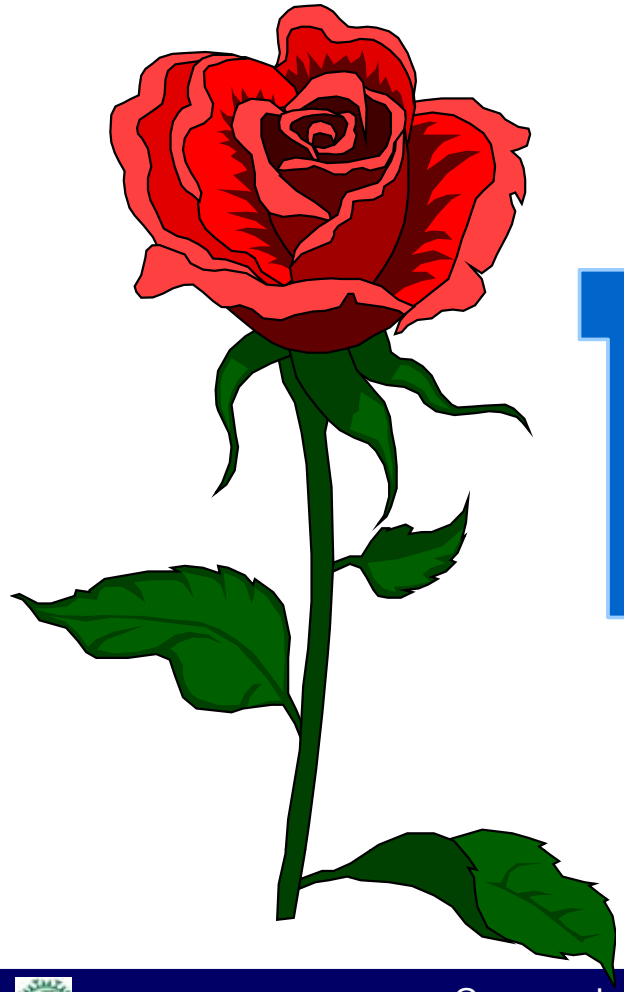
- **Risk may be lower or may be higher than global risks**
- **Lower risk than the world**
  - **Insularity protects from outside viruses**
  - **Disruption of air travel may spare Mauritius**
- **Higher risk than the world**
  - **Pandemic may quickly spread in the island**
  - **Tourism and trade may be negatively affected**
  - **Diagnostic reagents and essential drugs may be unavailable**

A Pandemic is due: When and which virus?



Continue Surveillance for Influenza variant viruses!





Thank You