

INFLUENZA PREDICTABILITY

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Objectives

- Discuss potential candidate viruses for the 2010-2011 influenza season.
- Review the variability of influenza viruses related to:
 - Virulence
 - Antigenicity
 - Timing of emergence

Continuing Education

- ❖ Requirements for successful completion:
 - Complete registration form
 - Sign In
 - Attend entire educational activity
 - Complete evaluation

Continuing Education Disclosures

❖ **Commercial Support**

- This educational activity received no commercial support.

❖ **Disclosure of Conflict of Interest**

- The planning committee members have disclosed no conflict of interest.
- Dr. Glezen is the study chair of the Central Texas Field Trial supported by an investigator-initiated grant funded by MedImmune Vaccines.

❖ **Non-Endorsement Statement**

- Accredited status does not imply endorsement by the Department of State Health Services, Continuing Education Services, Texas Medical Association, or American Nurses Credentialing Center of any commercial products displayed in conjunction with an activity.

❖ **Off Label Use**

- If applicable, speakers will clearly delineate any off label use of FDA drugs or devices.

Acute Respiratory Disease Hospitalizations

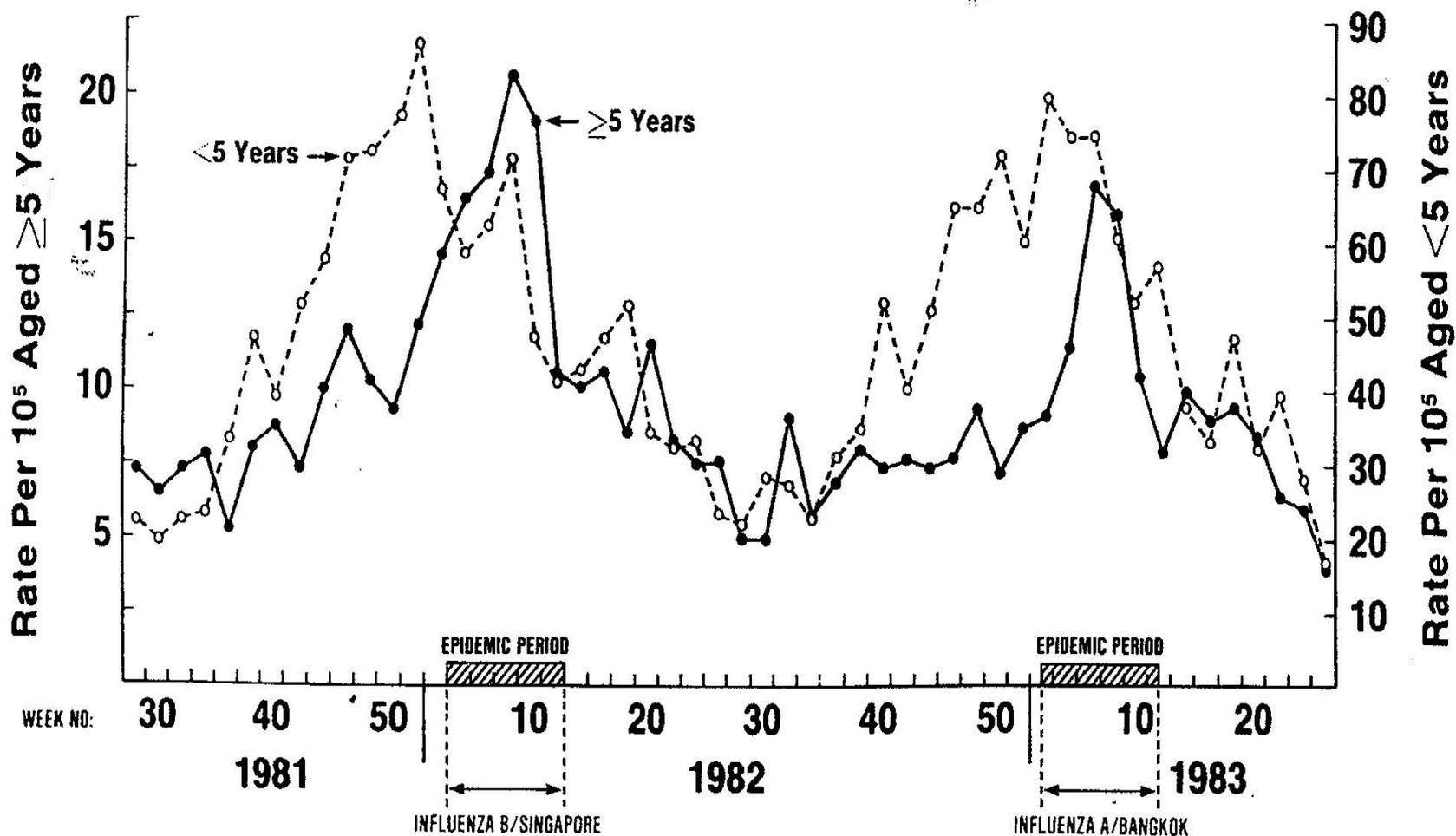
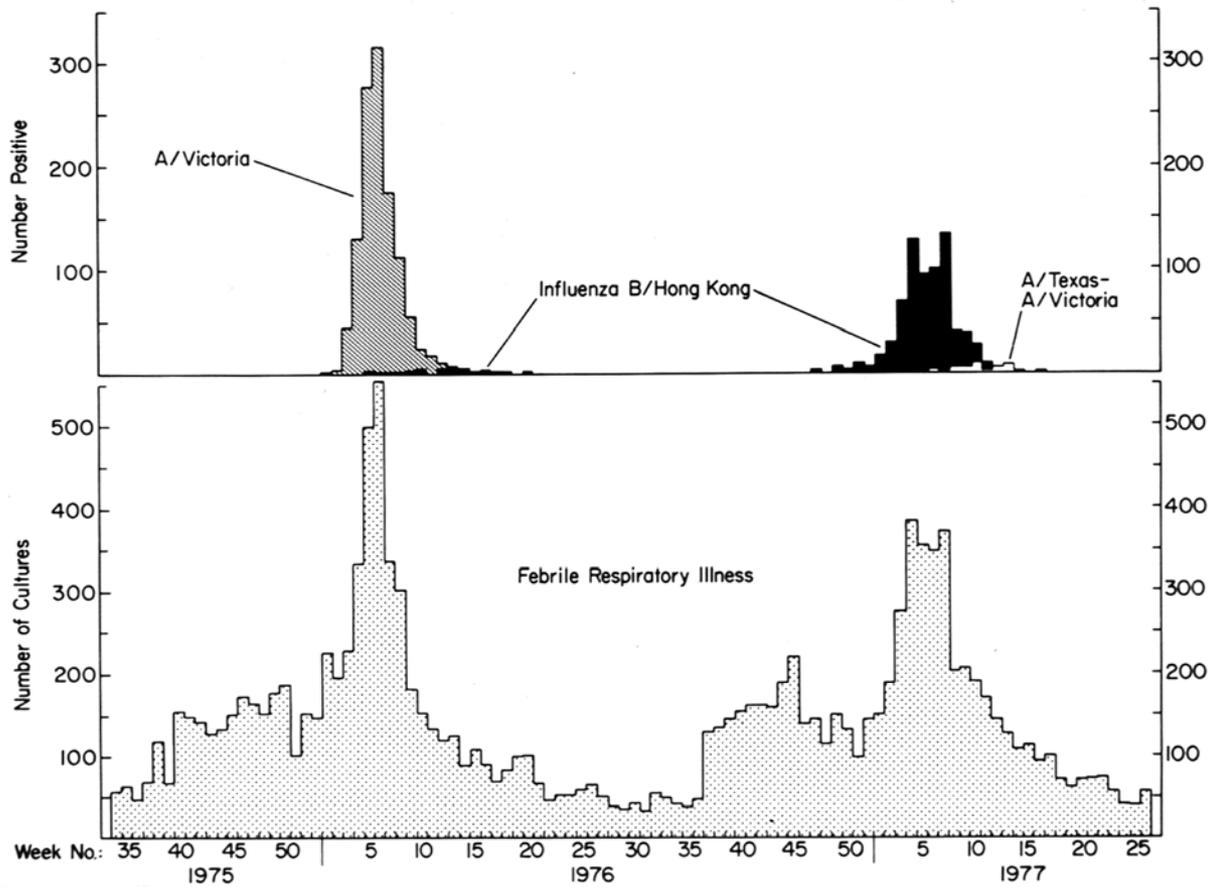
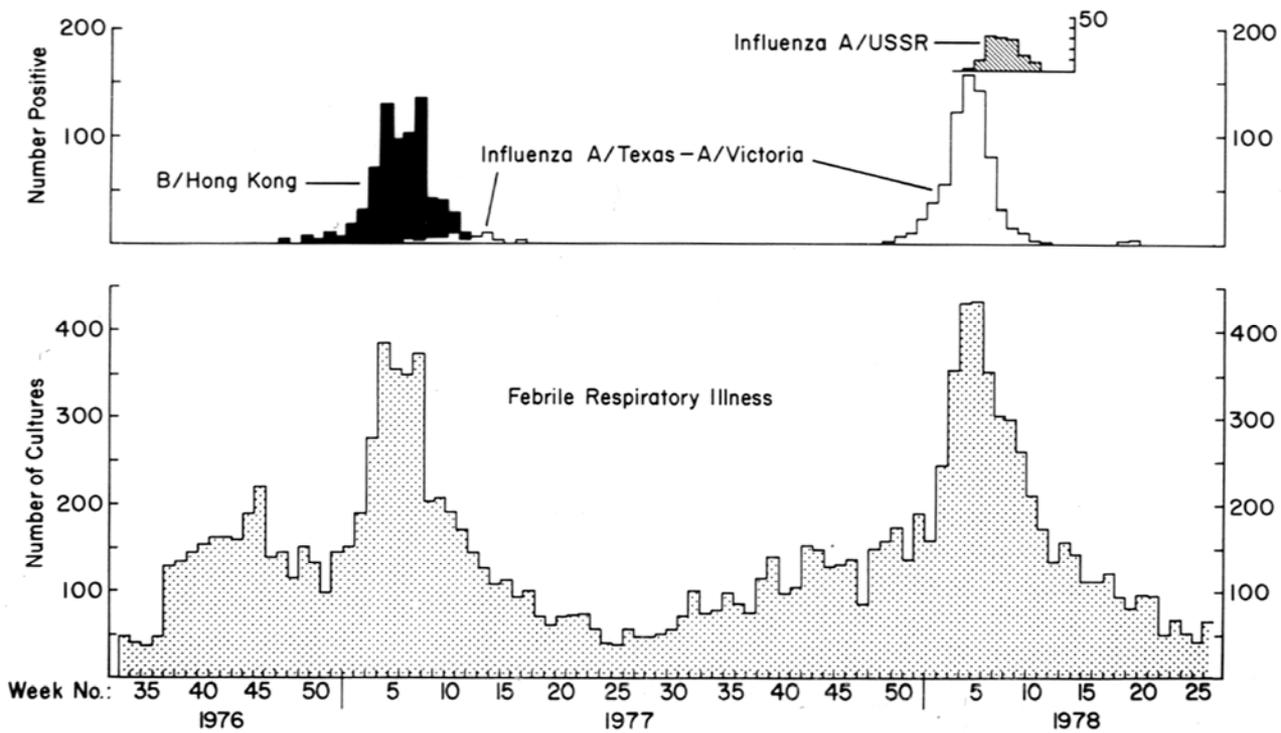


Figure 3. Rates of hospitalizations with acute respiratory disease for children less than five years of age and for persons five years and older in Harris County (Houston), Texas, 1981-1983.

– Influenza Herald Wave, 1976

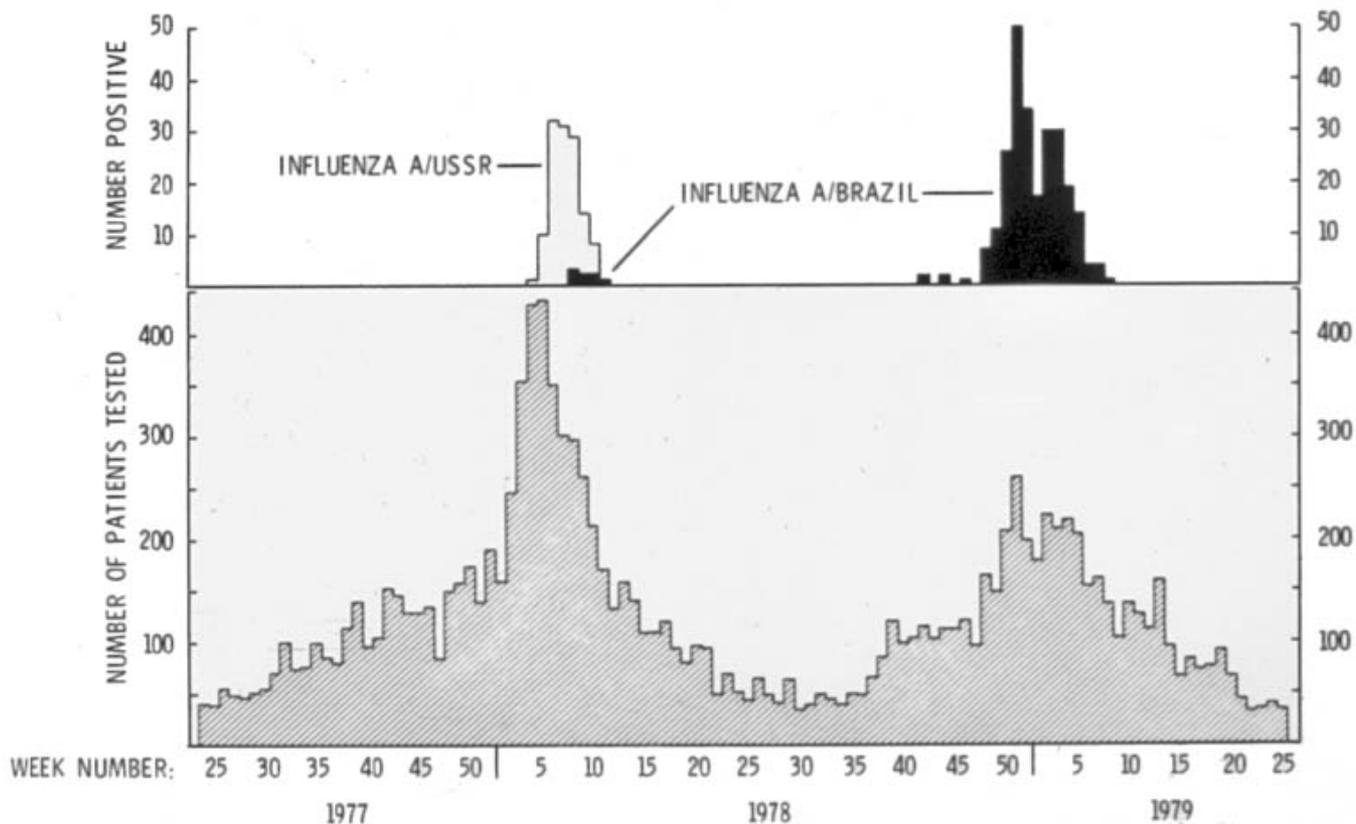


NUMBER OF PATIENTS WITH FEBRILE RESPIRATORY ILLNESSES AND NUMBER POSITIVE FOR INFLUENZA VIRUSES WITH INFLUENZA A/TEXAS HERALD WAVE, HOUSTON, 1976-78



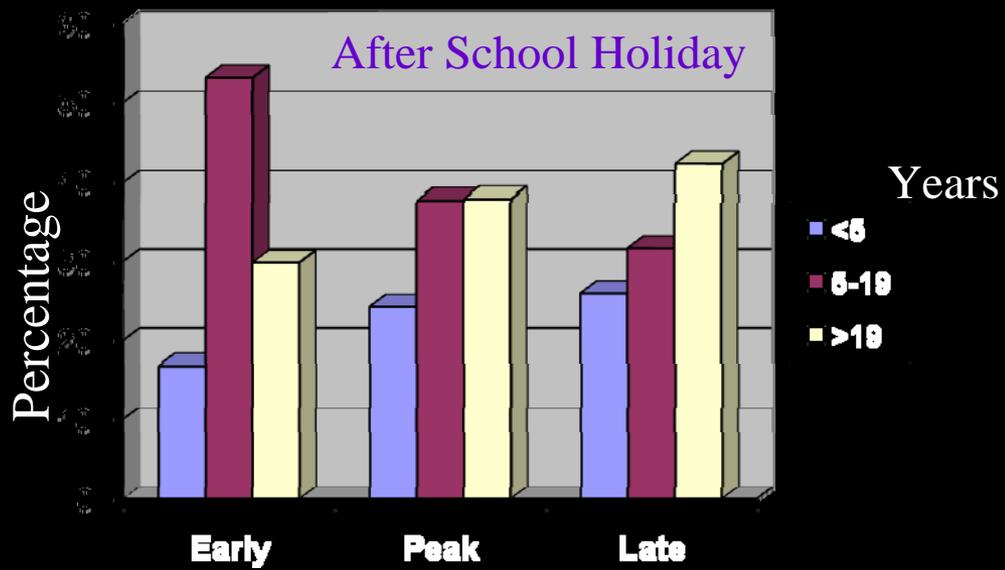
NUMBER OF PERSONS WITH RESPIRATORY ILLNESSES AND NUMBER WITH INFLUENZA A/USSR AND A/BRAZIL INFECTIONS

HOUSTON, 1977 - 1979

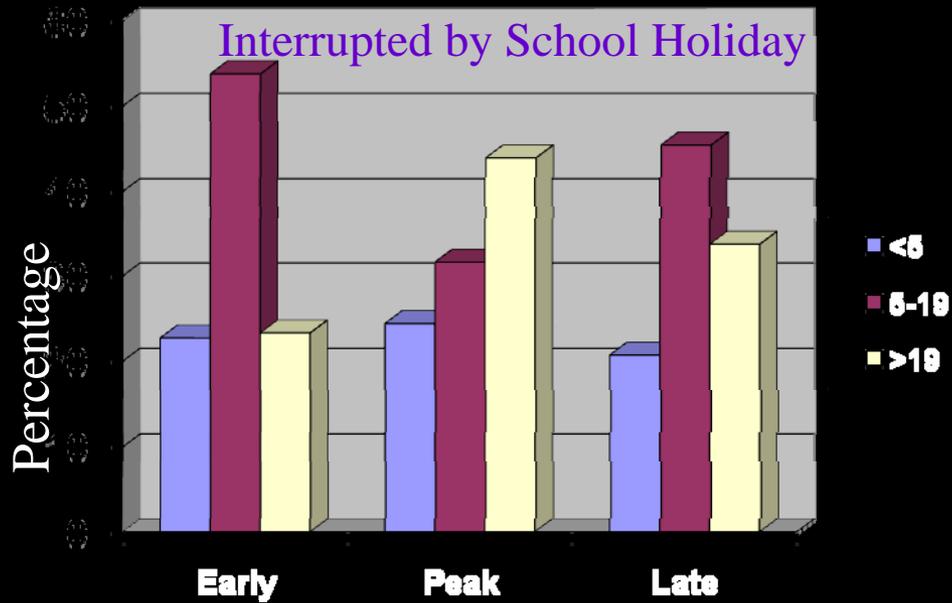


Shift in Age Distribution of Persons with Culture-Positive Illness Presenting to Sentinel Clinics during Influenza Epidemics, Houston, 1974-1981

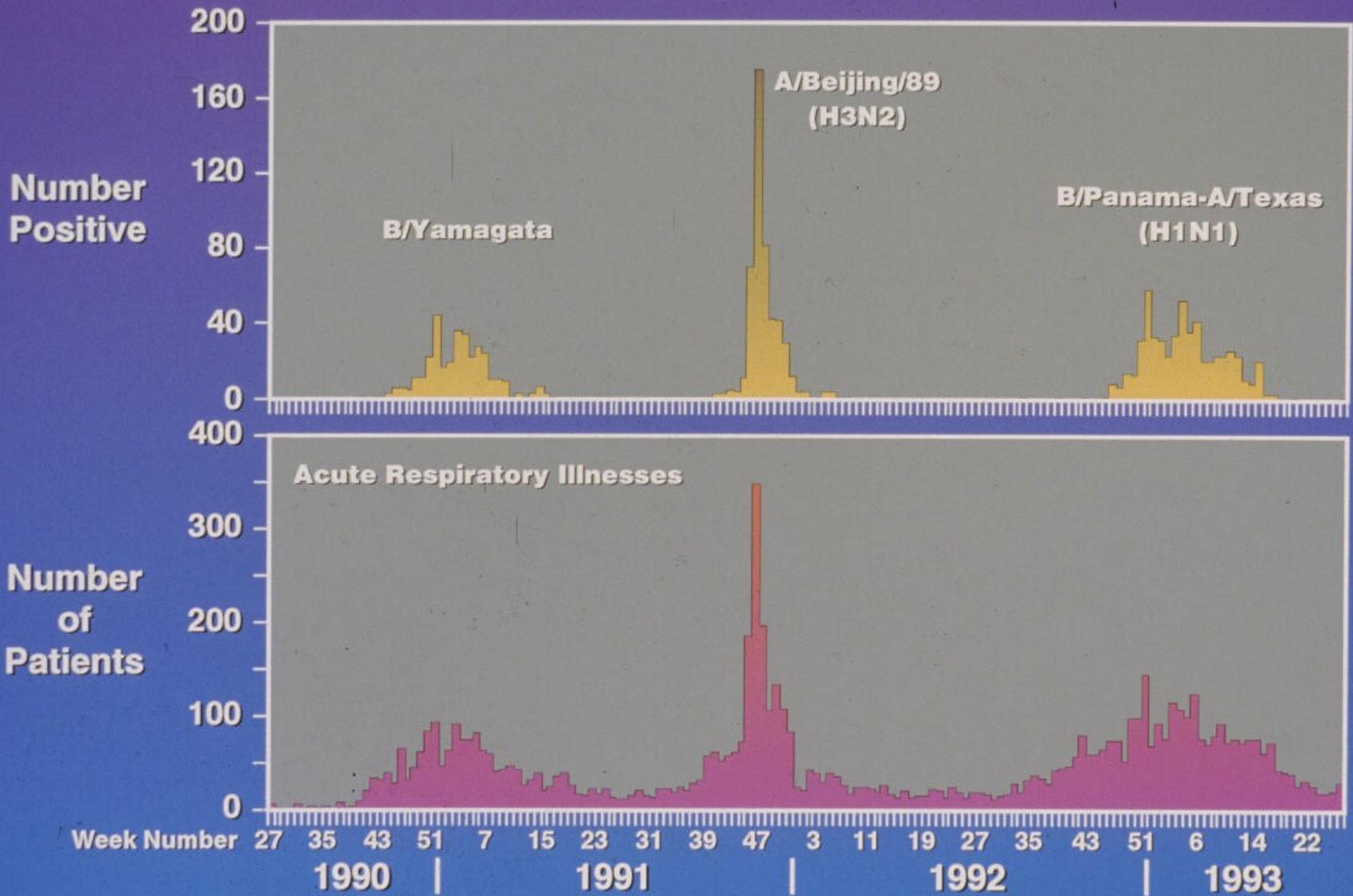
Age (yr)	Epidemic stage		
	Early (%)	Peak (%)	Late (%)
< 5	236(18.4)	489(24.3)	248(24.5)
5-19	687(53.6)	741(36.8)	356(35.2)
> 20	359(28.0)	785(39.0)	407(40.3)
Total	1,282	2,015	1,011



Epidemic Period



Epidemic Period





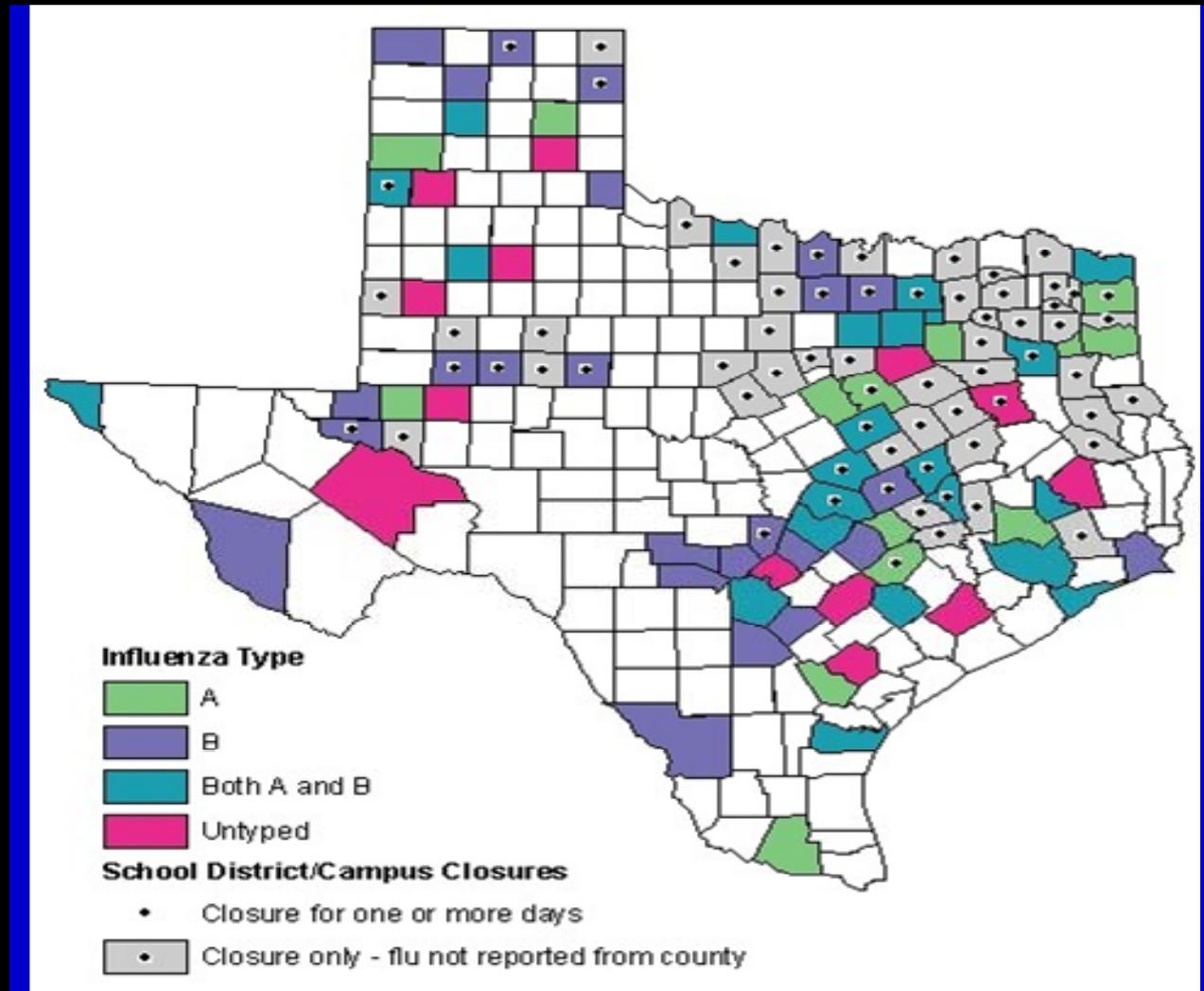
Influenza Epidemic Disease –Texas, 2003-2004

Year	Month Epidemic Started	Virus
2000-2001	November 2000	A (H1N1)
2001-2002	January 2002	A (H3N2)
2002-2003	November 2002	B (Victoria Lineage)
2003-2004	October 2003	A (H3N2)

Texas Influenza Activity

School district/
campus closures
due to flu-like
illness

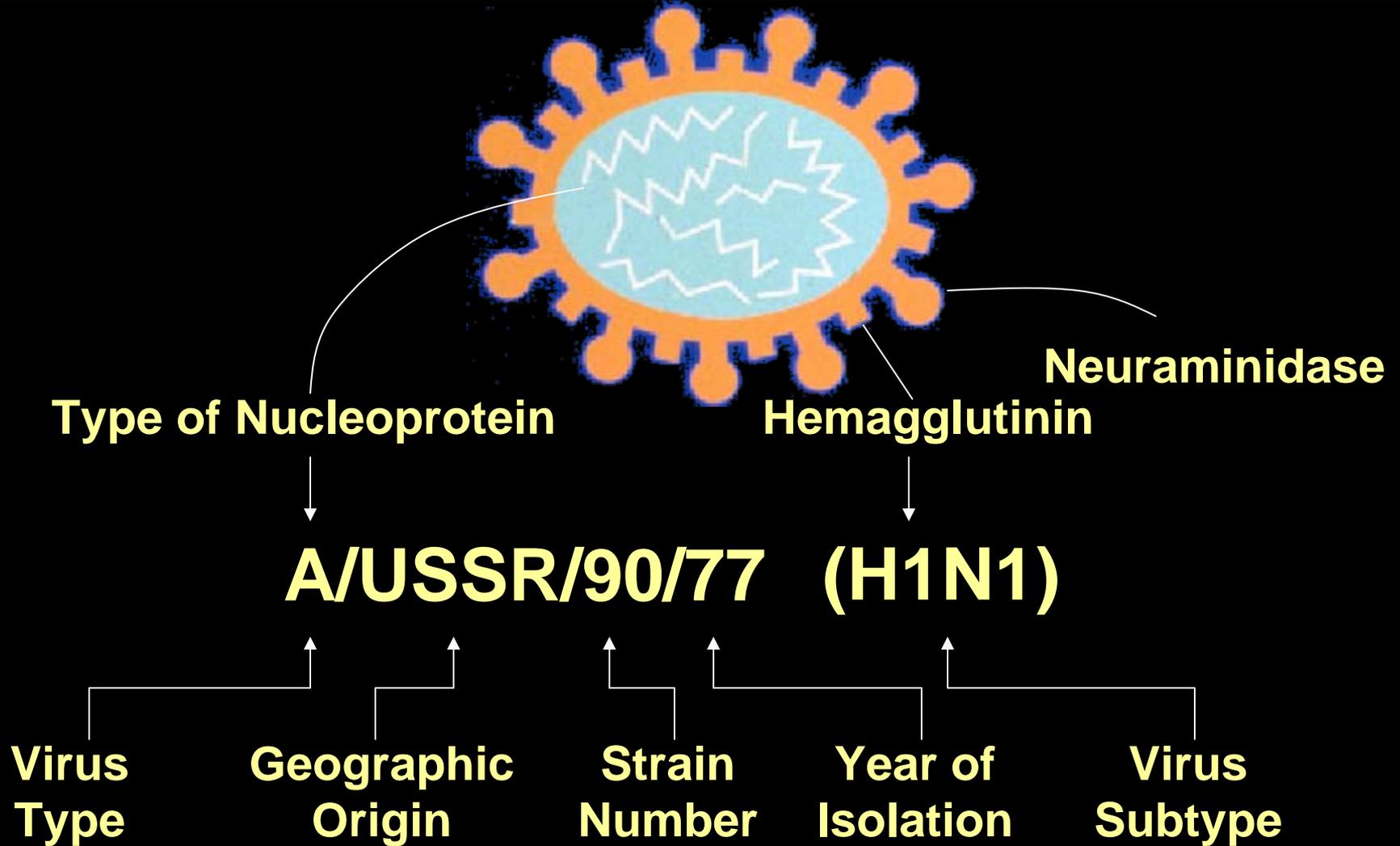
9/29/02 to 4/5/03



Hemagglutinin Subtypes of Influenza A Virus

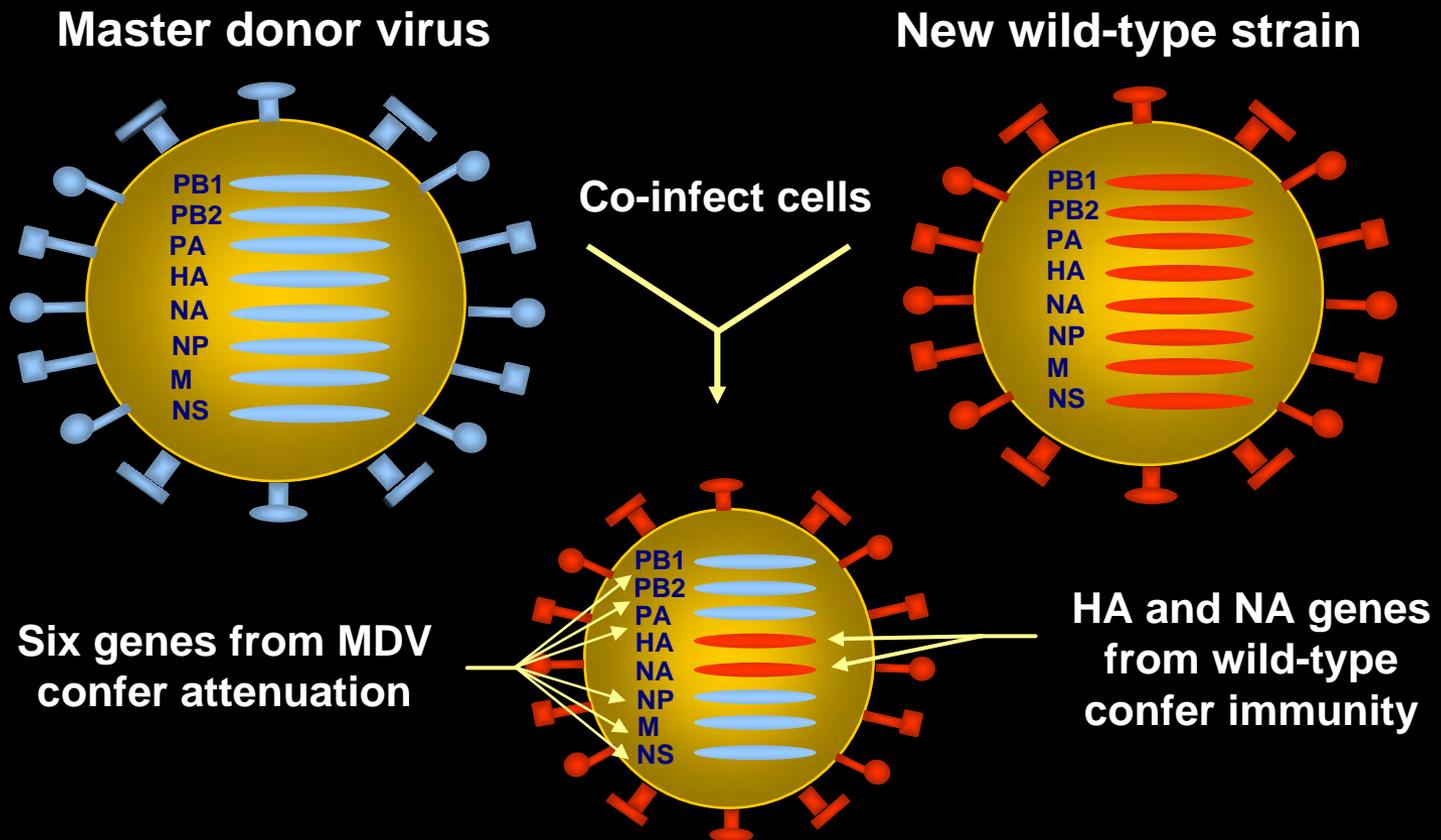
Subtype	Human	Swine	Horse	Bird
H1				
H2				
H3				
H4				
H5				
H6				
H7				
H8				
H9				
H10				
H11				
H12				
H13				
H14				
H15				

Influenza Virus Nomenclature



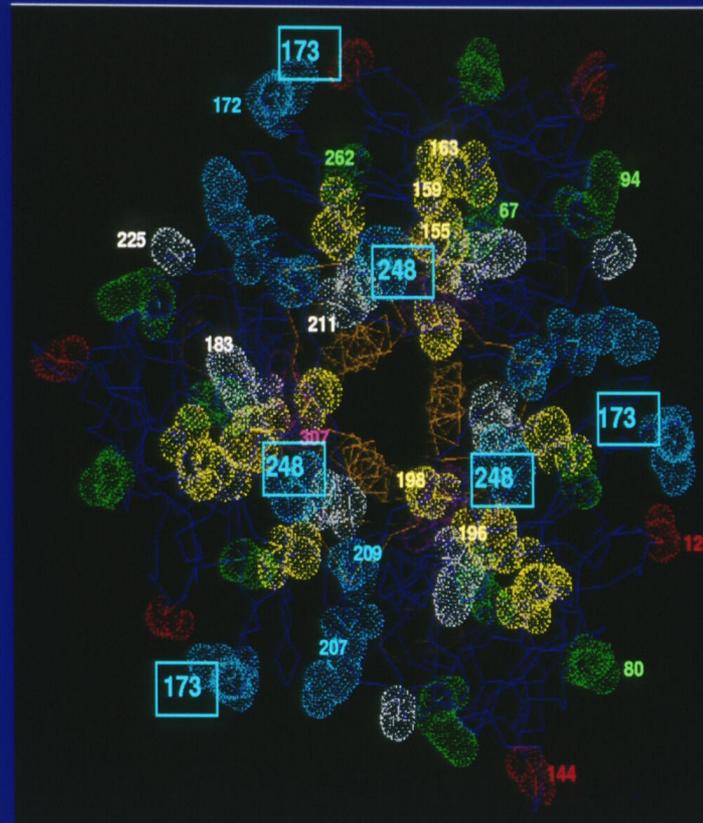
FluMist[®]: Preparation of Vaccine Strains

Reassortants for each of three vaccine strains are derived by coinfection



Antigenic Variants of Influenza A (H3N2) and Changing Hemagglutinin Amino Acid Positions

<u>Year</u>	<u>Variant</u>
1968-72	A/Hong Kong/68
1972-73	A/England/72
1974-75	A/Port Chalmers/73
1975-76	A/Victoria/75
1977-78	A/Texas/77
1980-83	A/Bangkok/79
1984-85	A/Philippines/73
1985-86	A/Stockholm/85
1987-88	A/Sichuan/87
1989-90	A/Shanghai/87
1991-92	A/Beijing/89
1993-94	A/Beijing/92
1994-95	A/Shangdong/93
1995-96	A/Johannesburg/94
1996-97	A/Wuhan/95
1997-00	A/Sydney/97
2001-02	A/Panama/99
2003-2004	A/Fujian/02
2004-05	A/California/04
2005-06	A/Wisconsin/05



Position of amino acid differences in pair 4 on the hemagglutinin trimer looking down the three-fold axis. Amino acids 2 and 6 are at the carboxy terminus and cannot be seen in this orientation.

ORIGIN OF 20TH CENTURY PANDEMIC STRAINS

Gene segment	Year		
	1968	1957	1918
PB1	<i>Avian</i>	<i>Avian</i>	<i>Avian</i>
PB2	Human	Human	<i>Avian</i>
PA	Human	Human	<i>Avian</i>
HA	<i>Avian</i>	<i>Avian</i>	<i>Avian</i>
NA	Human	<i>Avian</i>	<i>Avian</i>
NP	Human	Human	<i>Avian</i>
M	Human	Human	<i>Avian</i>
NS	Human	Human	<i>Avian</i>

*1968 and 1957 viruses were reassortants of human and avian strains.

The 1918 virus was an avian strain that mutated to allow human-to-human transmission.

THE VIRUS

- Several viruses have been sequenced
- Unusual constellation of genes derived from 2 swine viruses has resulted in a virus capable of human-to-human spread

EURASIAN
SWINE VIRUS

X

NORTH AMERICAN
SWINE VIRUS
(present >10 yrs)



HUMAN H1N1 VIRUS

NA
M

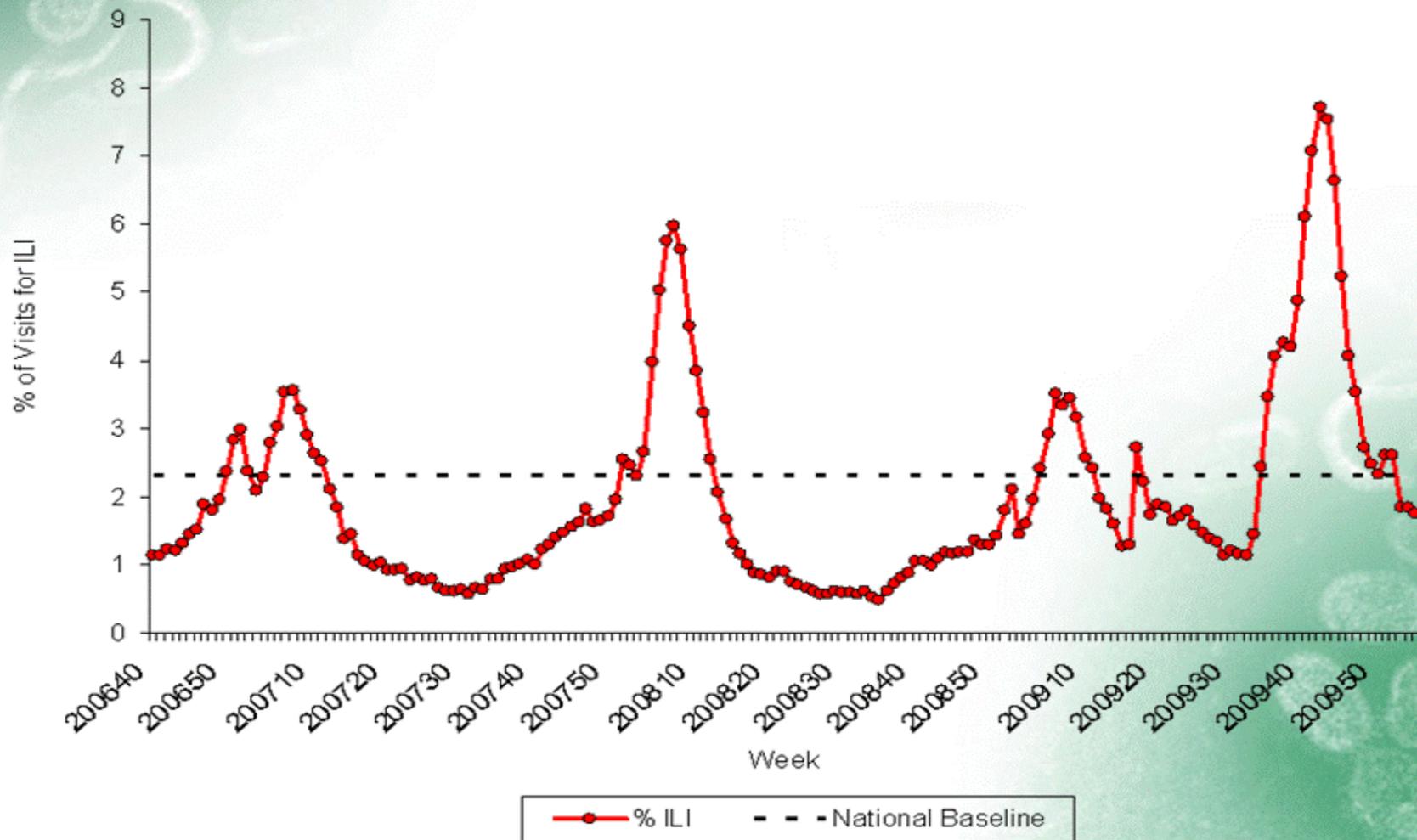
PB1 (HUMAN)
PA, PB2 (AVIAN)
HA, NP, NS (SWINE)

FLUVIEW



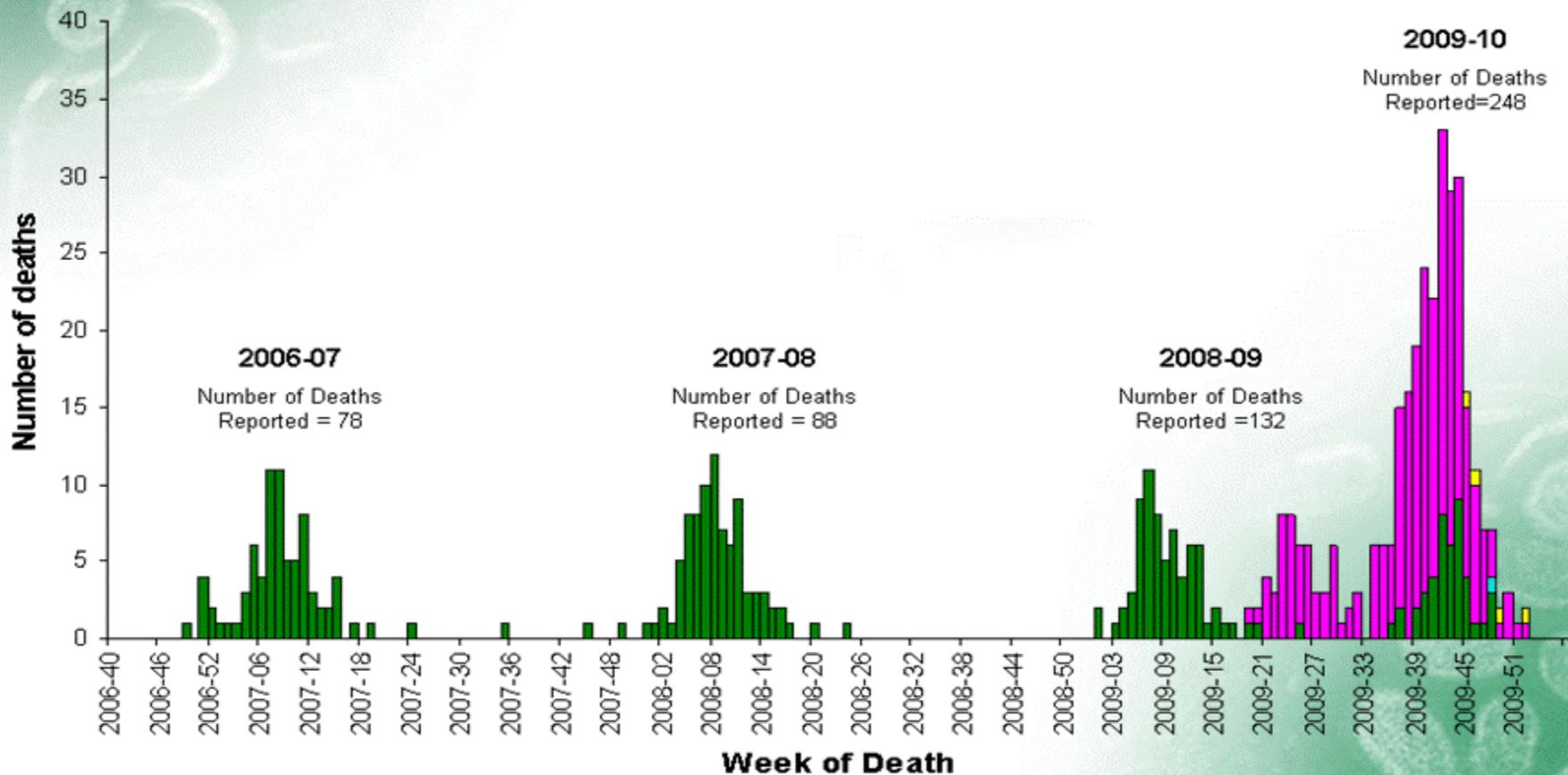
A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Percentage of Visits for Influenza-like Illness (ILI) Reported by the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet), Weekly National Summary, October 1, 2006 – January 23, 2010

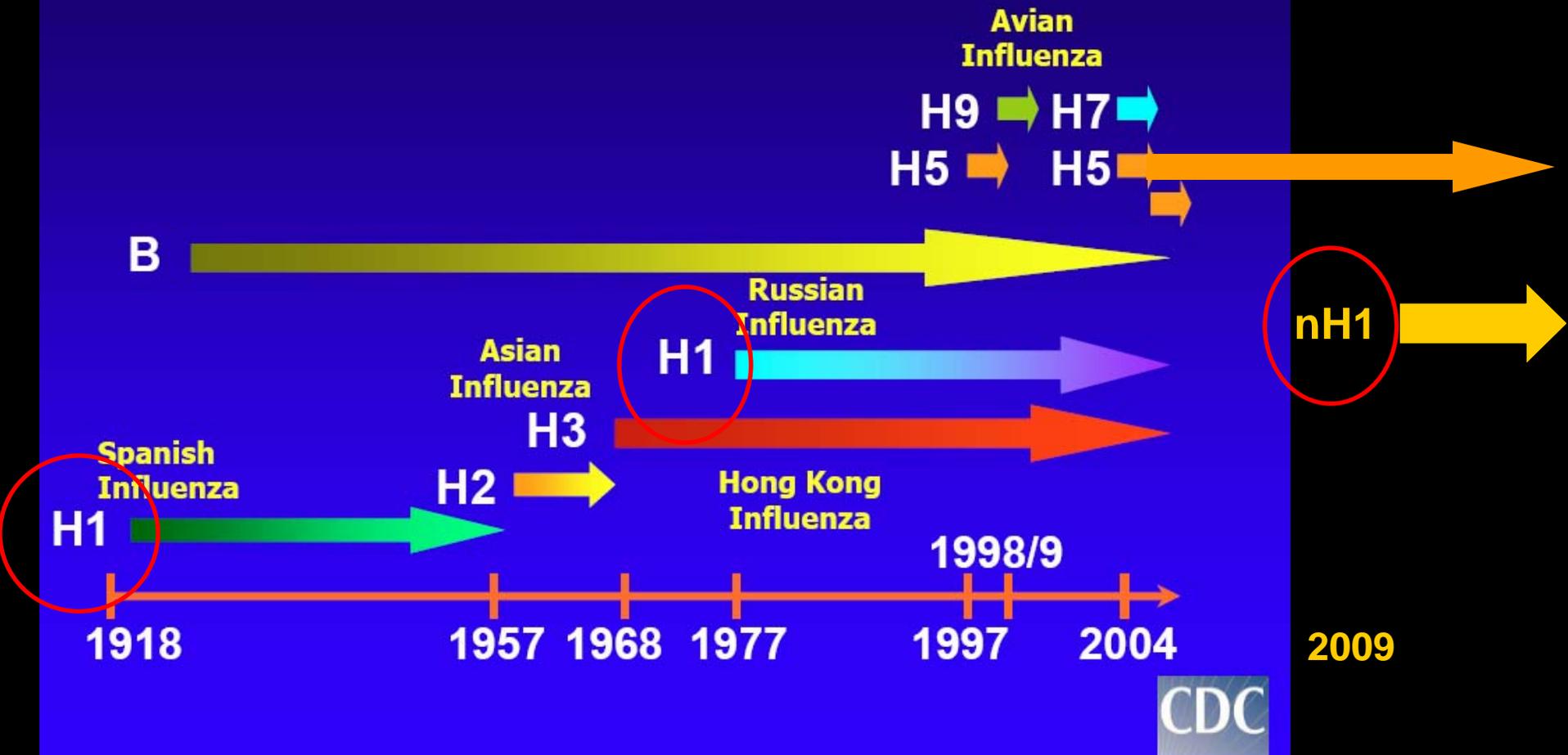


A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Number of Influenza-Associated Pediatric Deaths by Week of Death: 2006-07 season to present



Timeline of Emergence of Influenza Viruses in Humans

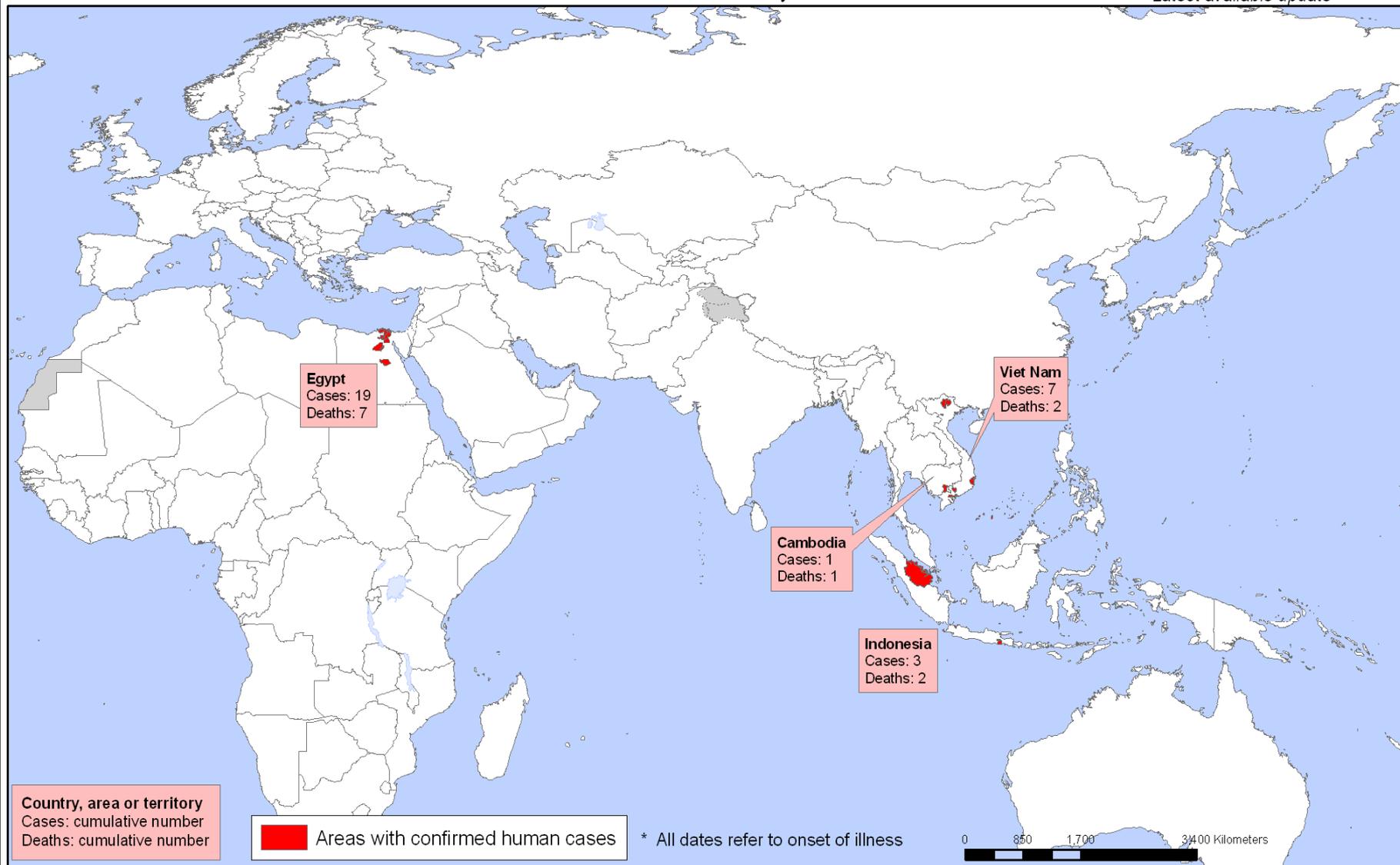


Annual Impact of Seasonal Influenza in the US: Measuring Disease Burden and Costs

- Annual Disease Burden based on 2003 US population
 - 610,660 life-years lost
 - 3.1 million hospitalized days
 - 31.4 million outpatient visits
- Annual Costs
 - Direct medical costs: \$ 10.4 billion
 - Direct cost and projected lost earning: \$ 16.3 billion
 - Total economic burden (using projected life values):
\$ 87.1 billion

Areas with confirmed human cases of H5N1 avian influenza since 1 January 2010 *

Status as of 06 May 2010
Latest available update



Country, area or territory
Cases: cumulative number
Deaths: cumulative number

■ Areas with confirmed human cases

* All dates refer to onset of illness

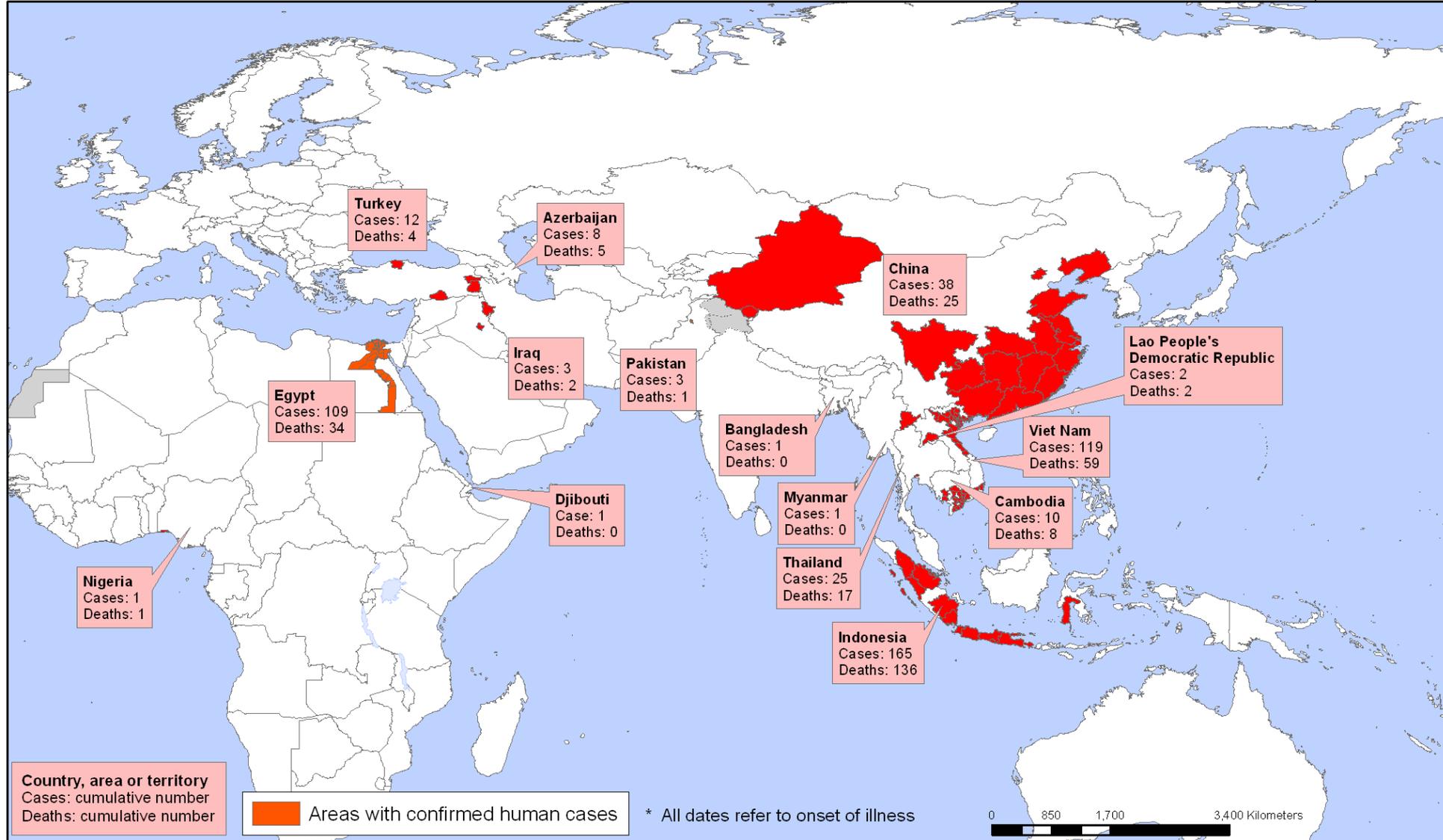
0 850 1,700 3,400 Kilometers



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Data Source: WHO
Map Production: Public Health Information and Geographic Information System (GIS)
World Health Organization

Areas with confirmed human cases of H5N1 avian influenza since 2003 *



PROBABILITY OF INFLUENZA PREVALENCE FOR 2010-2011

1. Influenza A(H1N1) 2009 (Novel or Pandemic H1N1)
2. Influenza A/Perth/2009 (H3N2)
3. Influenza B lineage not in vaccine
4. Influenza A(H1N1) – “seasonal”
5. Influenza B, vaccine lineage
6. Influenza A/avian(H5N1) – mutated to spread readily in humans

CONCLUSIONS

- ❖ Virus detection will be the earliest epidemic indicator
- ❖ Culture-based surveillance
 - Need viruses for characterization
 - Antigenic
 - Antiviral Sensitivity
- ❖ Start early with dedicated clinics (no later than 1 October)
- ❖ Maintain high index of suspicion (send suspicious viruses to reference laboratory)