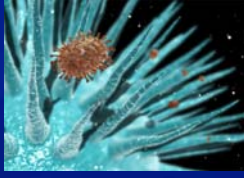


## 2012-2013 Influenza Season



**Scott Epperson**

Surveillance and Outbreak Response Team  
Epidemiology and Prevention Branch  
Influenza Division

National Center for Immunization & Respiratory Diseases  
Influenza Division



## Influenza

### □ Influenza virus

- Type A
  - Subtypes determined by surface proteins HA (1-17) and NA (1-9)
- Type B
  - Divided into 2 distinct lineages (Victoria and Yamagata)
- Type C
  - Does not typically cause substantial human disease, not routinely tested for
- Yearly co-circulation of seasonal viruses: A (H3N2), A (H1N1), and B

### □ Seasonal epidemics in the U.S.

- >200,000 hospitalizations\*
- Avg. 3,000 to 49,000 deaths†

\*Thompson et al. Influenza-Associated Hospitalizations in the United States. *JAMA* 2004; 292(11):1333-1340.  
†CDC. Estimates of Deaths Associated with Seasonal Influenza – United States, 1976 – 2007. *MMWR* 59(33):1057-1062.

## Influenza Virus

- Eight RNA segments code for 11 proteins
- Virus needs one of each of the 8 gene segments to be viable
- HA (hemagglutinin) and NA (neuraminidase) genes code for surface proteins; A subtype nomenclature
- Other genes are responsible mostly for virus structure and replication



## Influenza Illness

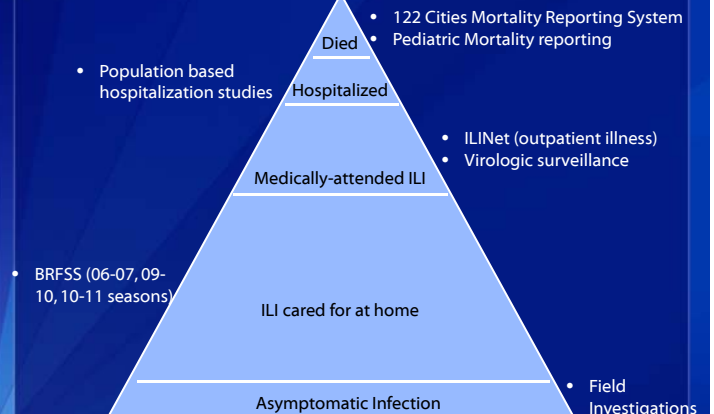
- Illness ranges from asymptomatic to severe (including death)
- Viruses circulate and cause illness year round, seasonal epidemics in winter months in temperate northern and southern hemispheres

## Routine Influenza Surveillance

National Center for Immunization & Respiratory Diseases  
Influenza Division



## National Influenza Surveillance



## Objectives of Influenza Surveillance

- Determine which influenza viruses are circulating; where are they circulating; when are they circulating
- Determine intensity and impact of influenza activity
- Detect unusual events
  - Infection by unusual viruses
  - Unusual syndromes caused by influenza viruses
  - Unusually large/severe outbreaks
  - Other strange things...

## Influenza Surveillance

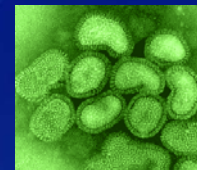
- Responsibility for national influenza surveillance rests with CDC
- State, local, and territorial public health departments are our primary partners
  - Influenza surveillance coordinator
- Goal is to build a system that is useful on the local level that feeds into national level surveillance
- CDC participates in global influenza surveillance efforts coordinated by WHO

## The Five Categories of Influenza Surveillance

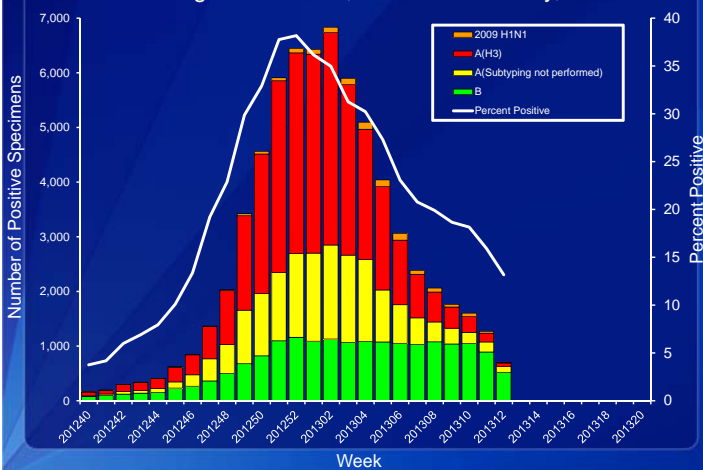
- Virologic Surveillance
  - WHO (World Health Organization) and NREVSS (National Respiratory and Enteric Virus Surveillance System) Collaborating Laboratories
  - Novel influenza A virus reporting
- Outpatient Illness Surveillance
- Mortality Surveillance
- Hospitalization Surveillance
- Summary of the Geographic Spread of Influenza

## Virologic Surveillance in the U.S.

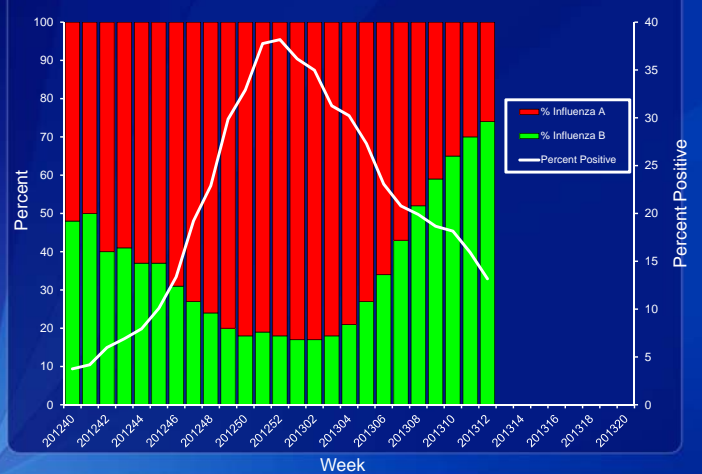
- ~150 participating laboratories
  - Weekly reports
    - # specimens tested
    - # positive for influenza by type, subtype, age
  - Specimens collected during routine patient care



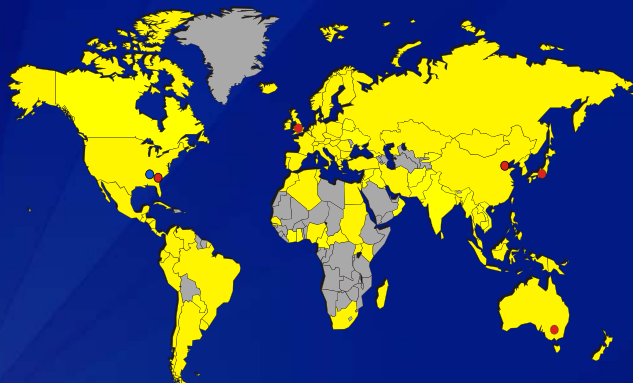
Influenza Positive Tests Reported to CDC by U.S. WHO/NREVSS Collaborating Laboratories, National Summary, 2012-13



Percent Influenza A and B, 2012-2013



## National Influenza Centres and WHO Collaborating Centres for Influenza



- WHO Collaborating Centers - Atlanta, Beijing, London, Melbourne, and Tokyo
- Countries containing at least 1 WHO influenza laboratory
- WHO Collaborating Center for Influenza in Animals - Memphis, TN

## Viral Strain Surveillance

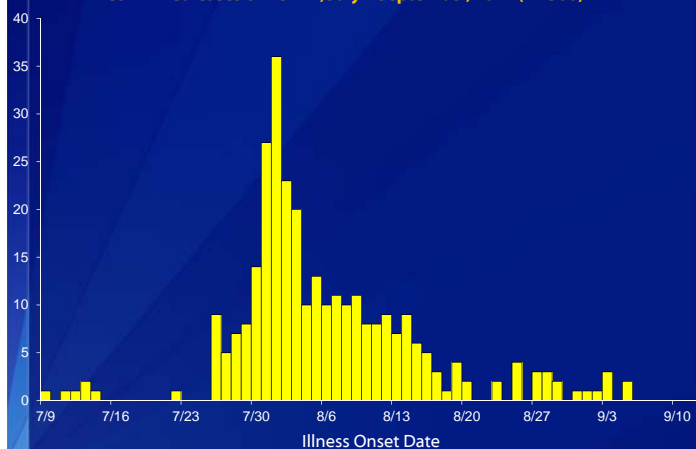
- WHO labs submit subset of positives to CDC strain surveillance lab
- Detailed antigenic characterization
  - Similarity to vaccine strains
- Antiviral resistance testing
- Genetic sequencing of a subset of isolates

## Influenza A (H3N2)v

- In August 2011 first case of triple-reassortant influenza A (H3N2) with M gene from influenza A (H1N1)pdm09 detected
- 13 confirmed cases detected from 6 states (IN, IA, ME, PA, UT, and WV)
  - Several cases were associated with larger outbreaks of respiratory illness in children
  - Child care settings became a particular focus
- Large outbreak in summer 2012 associated with exposure to swine at state and local fairs



Confirmed Cases of H3N2v, July - September, 2012 (N=306)

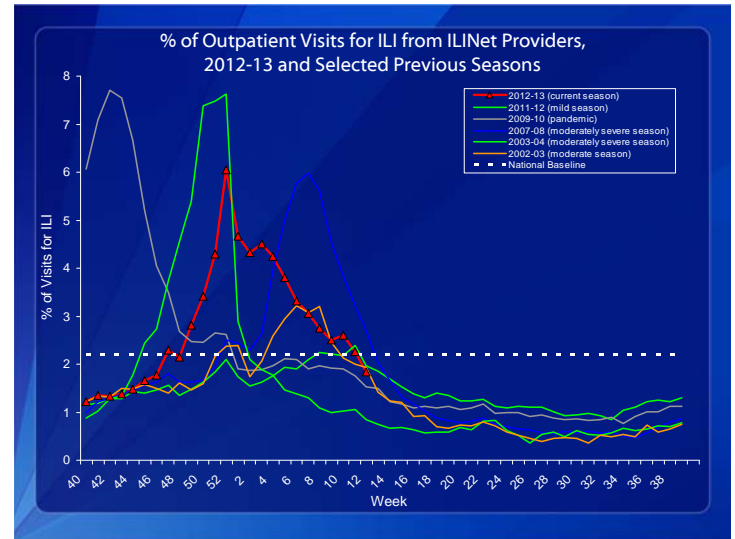
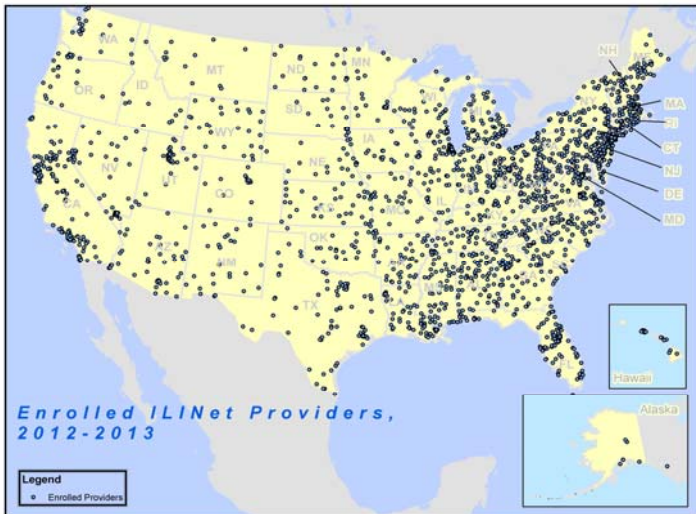


## The Five Categories of Influenza Surveillance

- Viral Surveillance
- Outpatient Illness Surveillance
  - U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet)
- Mortality Surveillance
- Hospitalization Surveillance
- Summary of the Geographic Spread of Influenza

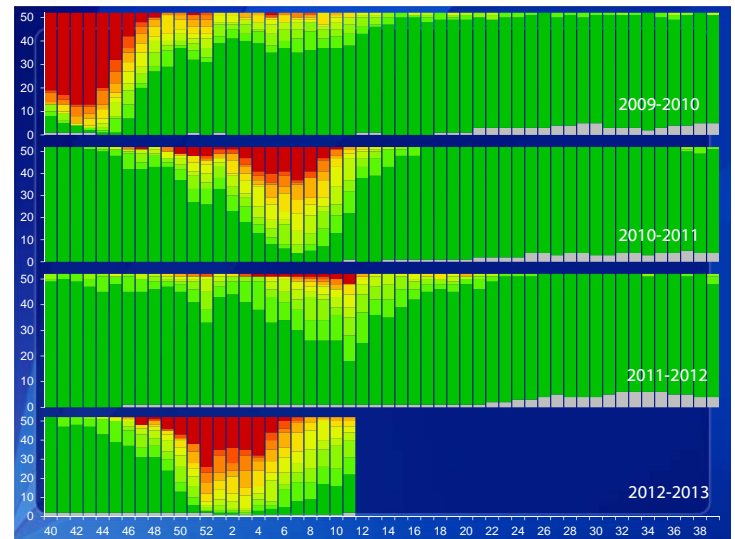
## ILINet

- ~2,900 physicians/facilities enrolled for the 2012-13 season
- Weekly reports
  - Total # of patient visits
  - # visits for influenza-like illness (ILI) by age group
    - ILI = fever  $\geq 100^{\circ}\text{F}$  ( $37.8^{\circ}\text{C}$ ) and cough or sore throat, in absence of a known cause other than influenza
- Submit respiratory specimens to state lab for testing



### ILINet Activity Indicator Map

- Individual provider baselines
- Helps to control for which sites are reporting
- Consistent analysis method that allows between jurisdiction comparisons



### ILINet Activity Indicator Map

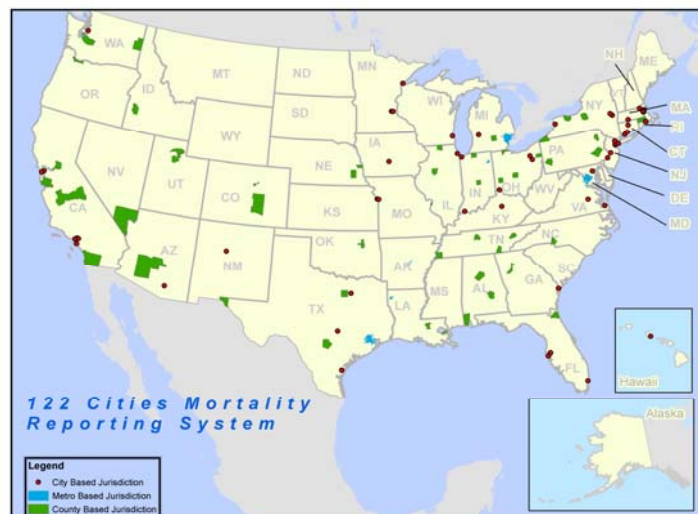
<http://gis.cdc.gov/grasp/fluview/main.html>

### The Five Categories of Influenza Surveillance

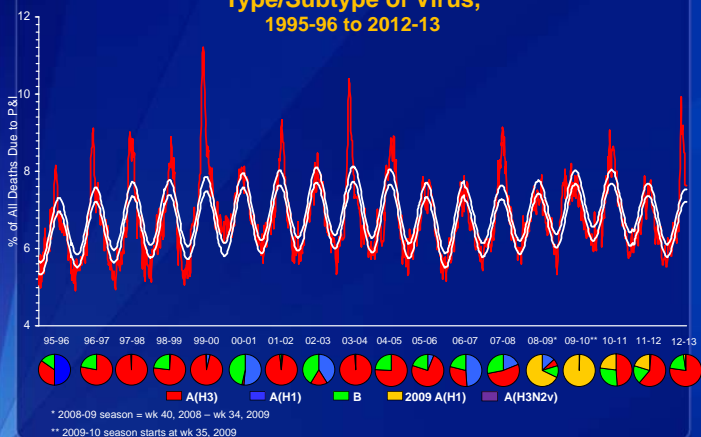
- Viral Surveillance
- Outpatient Illness Surveillance
- Mortality Surveillance
  - 122 Cities Mortality Reporting System
  - Influenza-Associated Pediatric Deaths
- Hospitalization Surveillance
- Summary of the Geographic Spread of Influenza

## 122 Cities Mortality Reporting System

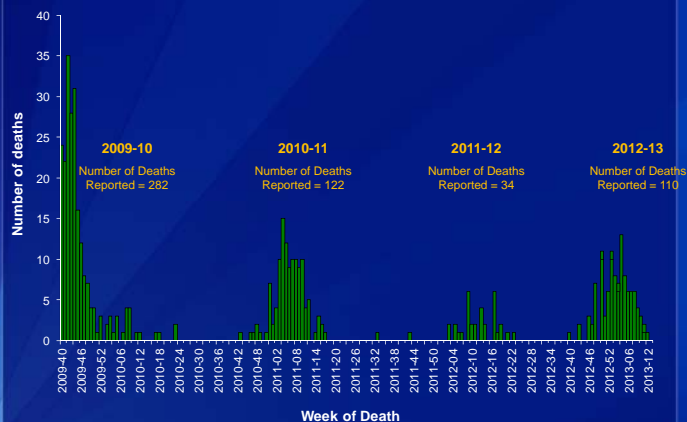
- Purpose: monitor P&I related mortality in a timely manner
- Weekly reports from vital statistics offices in 122 U.S. cities
  - Total # of death certificates processed
  - # with pneumonia or influenza listed (some exclusions)
- Approximately 25% of U.S. deaths
- Timely



## Pneumonia and Influenza Mortality and Type/Subtype of Virus, 1995-96 to 2012-13



## Influenza-Associated Pediatric Deaths by Week of Death

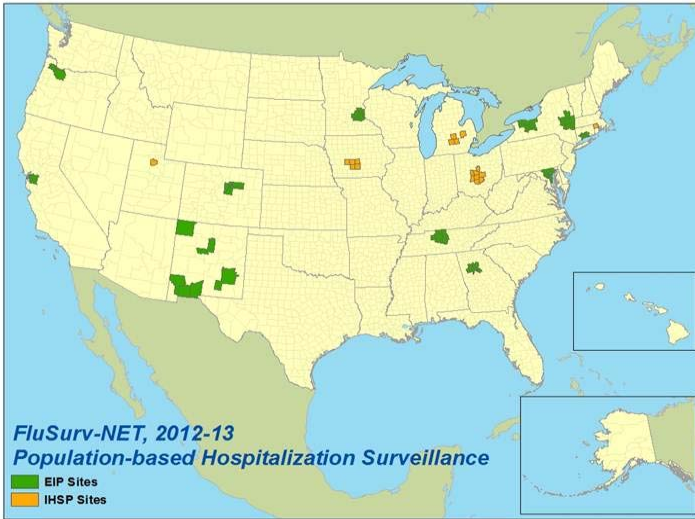


## The Five Categories of Influenza Surveillance

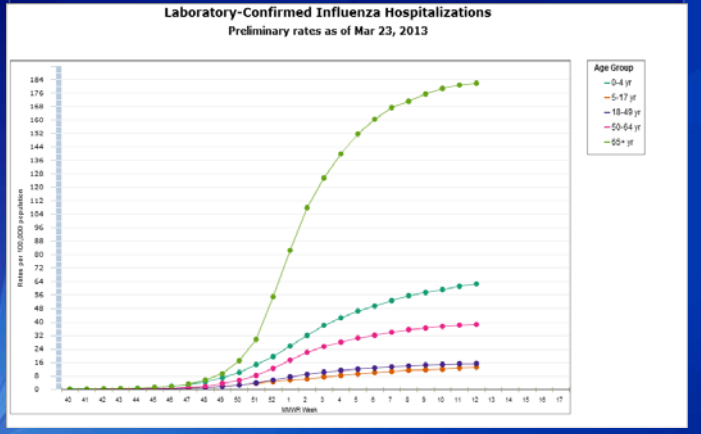
- Viral Surveillance
- Outpatient Illness Surveillance
- Mortality Surveillance
- Hospitalization Surveillance
  - Emerging Infections Program (EIP)
  - Influenza Hospitalization Surveillance Project (IHSP)
- Summary of the Geographic Spread of Influenza

## Hospitalization Surveillance

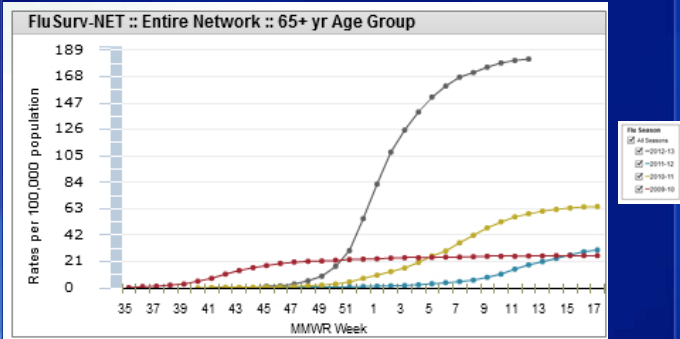
- Emerging Infections program (EIP) in 10 states
  - Population-based surveillance for laboratory-confirmed influenza-associated hospitalizations
  - Cases identified from testing performed as part of routine patient care
  - CRF completed by program staff
- Influenza Hospitalization Surveillance Project (4 states)
  - Sites added during pandemic to increase geographic coverage
  - Same case finding and data collection methods as EIP



### Rates of Laboratory-Confirmed Influenza Hospitalization by FluSurvNet



### FluSurvNet Hosp. rates, 65+ years



### The Five Categories of Influenza Surveillance

- Viral Surveillance
- Outpatient Illness Surveillance
- Mortality Surveillance
- Hospitalization Surveillance
- Summary of the Geographic Spread of Influenza

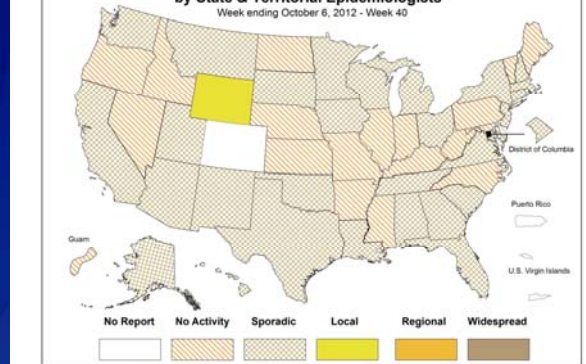
### Geographic Spread of Influenza

- Weekly reports from State and Territorial epidemiologists
- Assessment of overall influenza activity at state level
  - None, sporadic, local, regional, or widespread
  - Incorporates multiple sources of surveillance data

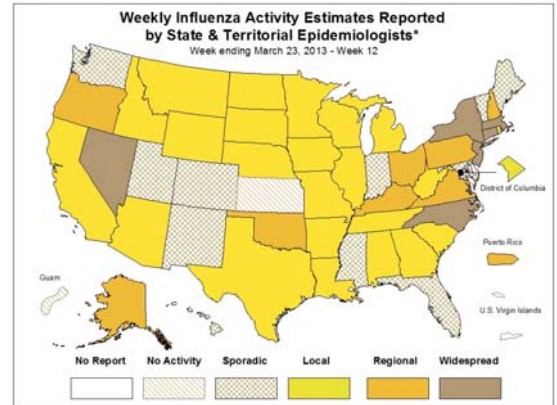
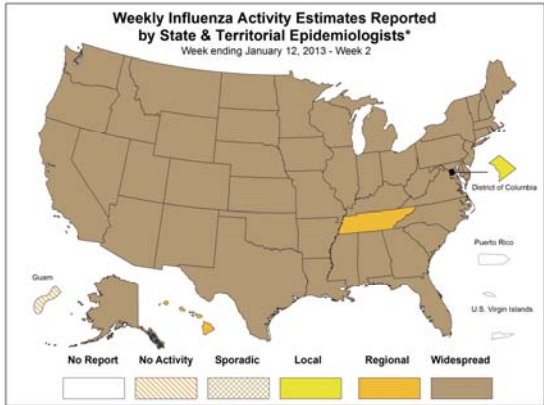
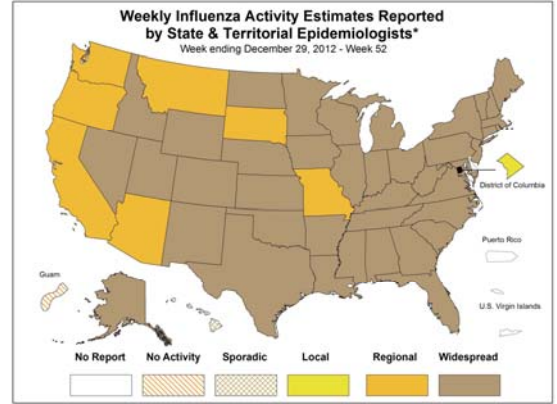
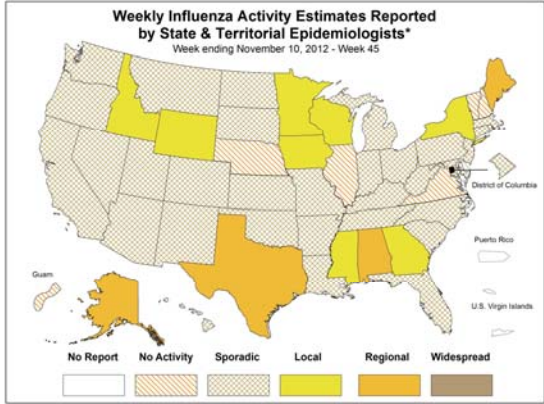
Activity Level	ILI activity* Outbreaks	Laboratory data
No activity	Low No increase	And No lab-confirmed cases
Sporadic	Not increased	And Isolated lab-confirmed cases
Local	Increased ILI in 1 region** ILI activity in other regions is not increased	And Recent (within the past 3 weeks) lab-confirmed influenza in region with increased ILI
Regional (doesn't apply to states with 18 regions)	2 or more institutional outbreaks (ILI or lab confirmed) in 1 region; ILI activity in other regions is not increased	And Recent (within the past 3 weeks) lab-confirmed influenza in region with the outbreaks; virus activity is no greater than sporadic in other regions
Widespread	Increased ILI in 12 or more than half of the regions	And Recent (within the past 3 weeks) lab-confirmed influenza in the state

\*ILI activity can be assessed using a variety of data sources including ILNet providers, school/workplace absenteeism, and other syndromic surveillance systems that monitor influenza-like illness.  
 \*\*Lab-confirmed case = case confirmed by rapid diagnostic test, antigen detection, culture, or PCR.  
 †Institution includes nursing home, hospital, prison, school, etc.  
 ‡Region = population under surveillance in a defined geographical subdivision of a state.

### Weekly Influenza Activity Estimates Reported by State & Territorial Epidemiologists\*



\* This map indicates geographic spread & does not measure the severity of influenza activity



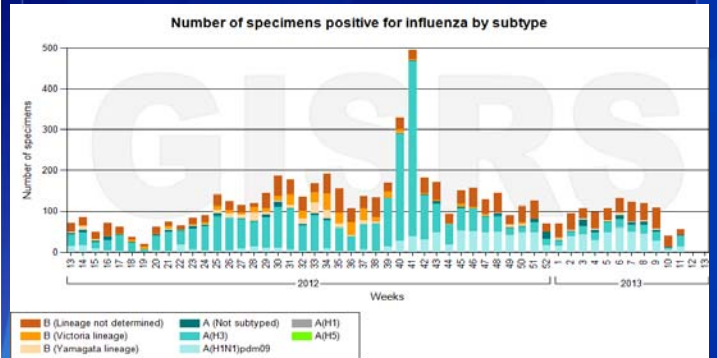
## International Influenza Surveillance

National Center for Immunization & Respiratory Diseases  
Influenza Division



## WHO AFRO Region

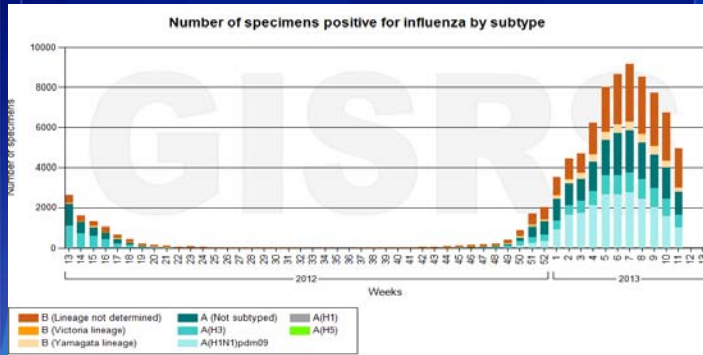
2012-2013: number of influenza-positive cases by epidemiologic week and subtype  
• February and March: Mix of Influenza A(H3N2), Influenza B, and 2009 H1N1.



Source: WHO FluNet

## WHO EURO Region

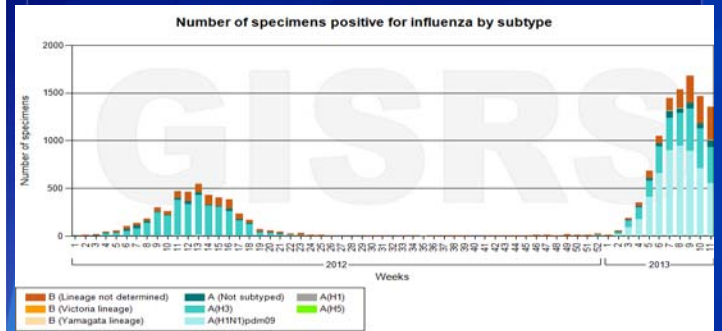
2012-2013: number of influenza-positive cases by epidemiologic week and subtype  
 • February to mid-March: Mix of Influenza B, Influenza A(H3N2), and 2009 H1N1.



Source: WHO FluNet

## Russian Federation

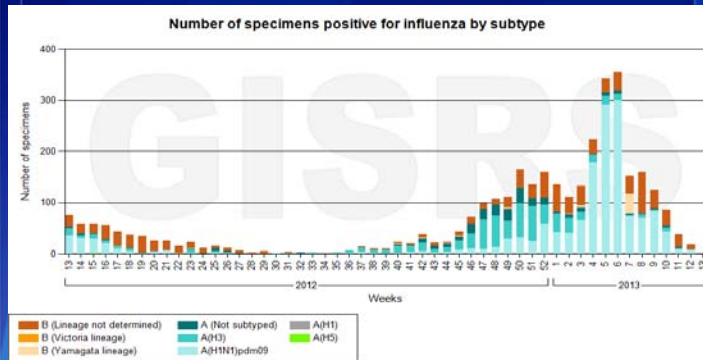
2012-2013: number of influenza-positive cases by epidemiologic week and subtype  
 • February to mid-March: sharply increasing activity, now decreasing; 2009 H1N1 predominant, some Influenza A(H3N2) and Influenza B also.



Source: WHO FluNet

## WHO EMRO Region

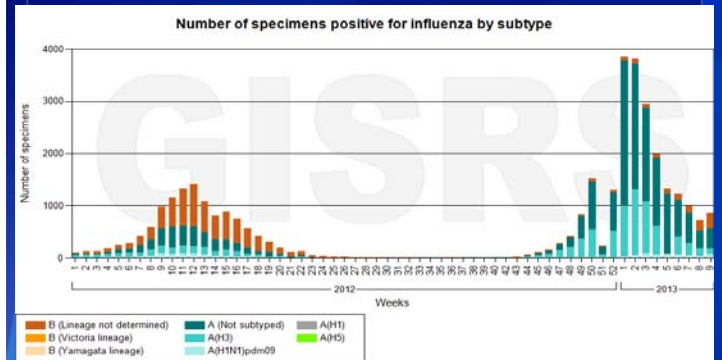
2012-2013: number of influenza-positive cases by epidemiologic week and subtype  
 • February to mid-March: 2009 H1N1 predominant, increasing Influenza B.



Source: WHO FluNet

## Canada

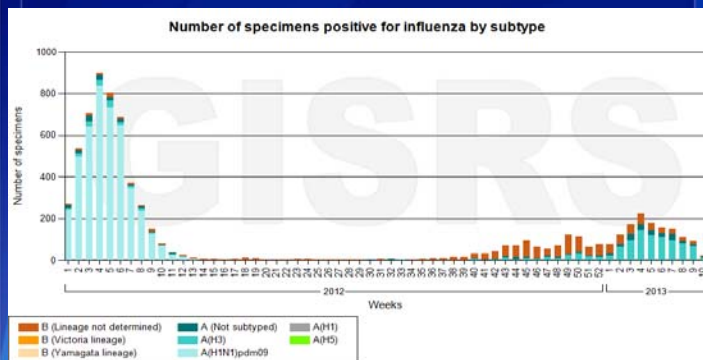
2012-2013: number of influenza-positive cases by epidemiologic week and subtype  
 • February: decreasing activity; mix of mostly Influenza A(H3N2) and Influenza B



Source: WHO FluNet

## Mexico

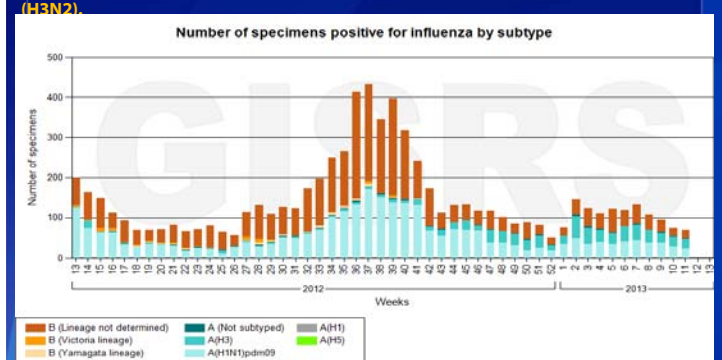
2012-2013: number of influenza-positive cases by epidemiologic week and subtype  
 • February through early March: decreasing activity; mostly influenza A (H3N2)



Source: WHO FluNet

## WHO SEARO Region

2012-2013: number of influenza-positive cases by epidemiologic week and subtype  
 • February through mid-March: Mix of 2009 H1N1, Influenza B and Influenza A (H3N2).

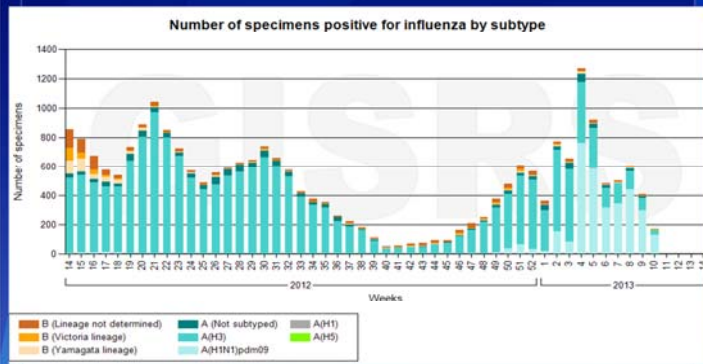


Source: WHO FluNet



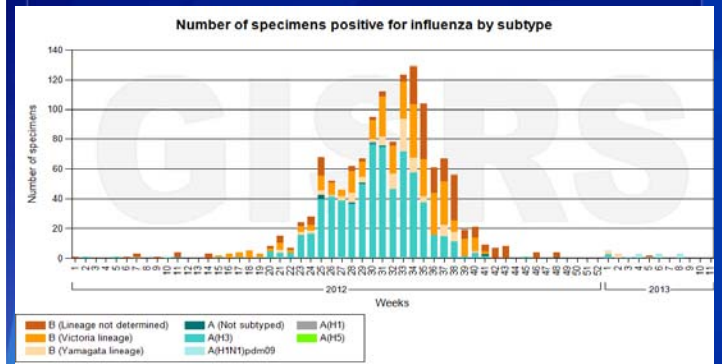
## China

- 2012-2013: number of influenza-positive cases by epidemiologic week and subtype
- 2013: mix of 2009 H1N1 and H3 in Northern and Southern China



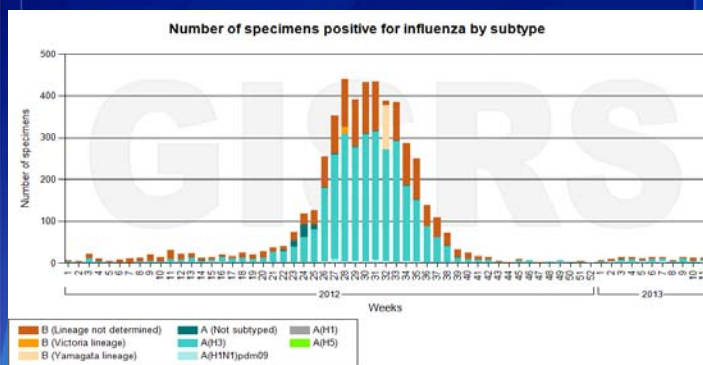
## South Africa

- 2012-2013: number of influenza-positive cases by epidemiologic week and subtype
- 2013: low activity heading into standard influenza season



## Australia

- 2012-2013: number of influenza-positive cases by epidemiologic week and subtype
- 2013: low activity heading into standard influenza season



## Acknowledgments

- State/territorial/local influenza coordinators
- Participating healthcare providers and lab
- Lynnette Brammer
- Lenee Blanton
- Krista Kniss
- Tiffany D'Mello
- Alejandro Perez
- Rosaline Dhara
- Desiree Mustaquim
- Craig Steffens

## Useful Links

- WHO FluNet: [http://www.who.int/influenza/gisrs\\_laboratory/flunet/en/](http://www.who.int/influenza/gisrs_laboratory/flunet/en/)
- CDC Flu Website: <http://www.cdc.gov/flu/>
- CDC FluView: <http://www.cdc.gov/flu/weekly/>
- FluView Interactive: <http://www.cdc.gov/flu/weekly/fluviewinteractive.htm>

## Questions?

Email: [Sepperson@cdc.gov](mailto:Sepperson@cdc.gov)

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333  
 Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348  
 E-mail: [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov) Web: <http://www.cdc.gov>

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

