2012-2013 Influenza Season

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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

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

- Population based hospitalization studies
- ILINet (outpatient illness)
- Virologic surveillance
- BRFSS (06-07, 09-10, 10-11 seasons)
- Field Investigations

National Influenza Surveillance

- 122 Cities Mortality Reporting System
- Pediatric Mortality reporting
- Asymptomatic Infection
- Medically-attended ILI
- ILI cared for at home
- Hospitalized
- Died

†CDC. Estimates of Deaths Associated with Seasonal Influenza – United States, 1976 – 2007. MMWR 59(33);1057-1062.
Objectives of Influenza Surveillance

- Determine which influenza viruses are circulating; where 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
Countries containing at least 1 WHO influenza laboratory - Atlanta, Beijing, London, Melbourne, and Tokyo

WHO Collaborating Centres for Influenza

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 ≥ 100 °F (37.8 °C) and cough or sore throat, in absence of a known cause other than influenza
- Submit respiratory specimens to state lab for testing
Enrolled ILINet Providers, 2012-2013

% of Outpatient Visits for ILI from ILINet Providers, 2012-13 and Selected Previous Seasons

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

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

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

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Deaths Reported</th>
</tr>
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<tbody>
<tr>
<td>2009-10</td>
<td>282</td>
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<tr>
<td>2010-11</td>
<td>122</td>
</tr>
<tr>
<td>2011-12</td>
<td>34</td>
</tr>
<tr>
<td>2012-13</td>
<td>110</td>
</tr>
</tbody>
</table>

**Influenza-Associated Pediatric Deaths by Week of Death**

**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

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**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
Rates of Laboratory-Confirmed Influenza Hospitalization by FluSurvNet

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

Weekly Influenza Activity Estimates Reported by State & Territorial Epidemiologists

- None, sporadic, local, regional, or widespread
- Incorporates multiple sources of surveillance data

* This map indicates geographic spread but does not measure the severity of influenza activity.
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.

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.

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.

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.

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

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).
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

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Useful Links
• WHO FluNet: 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

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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.