



## Overview of Influenza Surveillance in the United States

The Epidemiology and Prevention Branch in the Influenza Division at CDC collects, compiles and analyzes information on influenza activity year round in the United States and produces FluView, a weekly influenza surveillance report. The U.S. influenza surveillance system is a collaborative effort between CDC and its many partners in state, local, and territorial health departments, public health and clinical laboratories, vital statistics offices, healthcare providers, clinics, and emergency departments. Information in five categories is collected from eight different data sources that allow CDC to:

- Find out when and where influenza activity is occurring
- Track influenza-related illness
- Determine what influenza viruses are circulating
- Detect changes in influenza viruses
- Measure the impact influenza is having on hospitalizations and deaths in the United States

### Five Categories of Influenza Surveillance

**1. Virological Surveillance** — Approximately 85 U.S. **World Health Organization (WHO) Collaborating Laboratories** and 60 **National Respiratory and Enteric Virus Surveillance System (NREVSS)** laboratories located throughout the United States participate in virologic surveillance for influenza. All state public health laboratories participate as U.S. WHO collaborating laboratories along with some city and county public health laboratories and some large tertiary care or academic medical centers. Most NREVSS laboratories participating in influenza surveillance are hospital laboratories. The U.S. WHO and NREVSS collaborating laboratories report the number of respiratory specimens tested and the number positive for influenza types A and B each week to CDC. Most of the U.S. WHO collaborating laboratories also report the influenza A subtype (H1 or H3) of the viruses they test and the age or age group of the persons from whom the specimens were collected, and a subset of laboratories report basic epidemiologic information from the patient. The majority of NREVSS laboratories do not report the influenza A subtype. Reports from both sources are combined and the weekly total number of positive influenza tests, by virus type/subtype, and the percent of specimens testing positive for influenza are presented in the weekly influenza update, FluView. A subset of the influenza viruses collected by U.S. WHO collaborating laboratories are sent to CDC for further characterization, including gene sequencing, antiviral resistance testing and antigenic characterization. This information is presented in the antiviral resistance and antigenic characterization sections of the FluView report.

**Surveillance for Novel Influenza A Viruses** – In 2007, human infection with a novel influenza A virus became a nationally notifiable condition. Novel influenza A virus infections include all human infections with influenza A viruses that are different from currently circulating human seasonal influenza H1 and H3 viruses. These viruses include those that are subtyped as nonhuman in origin and those that are unsubtypeable with standard laboratory methods and reagents. Rapid reporting of human infections with novel influenza A viruses will facilitate prompt detection and characterization of influenza A viruses and accelerate the implementation of effective public health responses.

**2. Outpatient Illness Surveillance** — Information on patient visits to health care providers for influenza-like illness is collected through the **U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet)**. ILINet consists of more than 2,700 outpatient healthcare providers in all 50 states, the District of Columbia and the U.S. Virgin Islands reporting more than 30 million patient visits each year. Each week, approximately 1,800

outpatient healthcare providers around the country report data to CDC on the total number of patients seen and the number of those patients with influenza-like illness (ILI) by age group (0-4 years, 5-24 years, 25-49 years, 50-64 years, and ≥ 65 years). For this system, ILI is defined as fever (temperature of 100°F [37.8°C] or greater) and a cough and/or a sore throat without a KNOWN cause other than influenza. Sites with electronic health records use an equivalent definition as determined by public health authorities.

- The percentage of patient visits to healthcare providers for ILI reported each week is weighted on the basis of state population. This percentage is compared each week with the national baseline of 2.2%. The baseline is developed by calculating the mean percentage of patient visits for ILI during non-influenza weeks for the previous three seasons and adding two standard deviations. A non-influenza week is defined as periods of two or more consecutive weeks in which each week accounted for less than 2% of the season's total number of specimens that tested positive for influenza. Due to wide variability in regional level data, it is not appropriate to apply the national baseline to regional data; therefore, region specific baselines are calculated using the same methodology.

Regional baselines for the 2012-13 influenza season are:

**Region 1** — 1.0%

Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont

**Region 2** — 2.0%

New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands

**Region 3** — 2.2%

Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia

**Region 4** — 2.3%

Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee

**Region 5** — 1.5%

Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin

**Region 6** — 3.4%

Arkansas, Louisiana, New Mexico, Oklahoma, and Texas

**Region 7** — 2.1%

Iowa, Kansas, Missouri, and Nebraska

**Region 8** — 1.9%

Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming

**Region 9** — 3.5%

Arizona, California, Hawaii, and Nevada

**Region 10** — 1.4%

Alaska, Idaho, Oregon, and Washington

- **ILI Activity Indicator Map:** — Data collected in ILINet are used to produce a measure of ILI activity for all 50 states, the District of Columbia, and New York City. Activity levels are based on the percent of outpatient visits in a jurisdiction due to ILI compared with the average percent of ILI visits that occur during weeks with little or no influenza virus circulation (non-influenza weeks). Because the number of sites reporting each week is variable, baselines are adjusted each week based on which sites within each jurisdiction provide data. To perform this adjustment, provider level baseline ratios are calculated

for those that have a sufficient reporting history. Providers that do not have the required reporting history are assigned the baseline ratio for their practice type. The jurisdiction level baseline is then calculated using a weighted sum of the baseline ratios for each contributing provider.

The activity levels compare the mean reported percent of visits due to ILI for the current week to the mean reported percent of visits due to ILI for non-influenza weeks. The 10 activity levels correspond to the number of standard deviations below, at or above the mean for the current week compared to the mean of the non-influenza weeks. There are 10 activity levels classified as minimal (levels 1-3), low (levels 4-5), moderate (levels 6-7), and high (levels 8-10). An activity level of 1 corresponds to values that are below the mean, level 2 corresponds to an ILI percentage less than 1 standard deviation above the mean, level 3 corresponds to ILI more than 1, but less than 2 standard deviations above the mean, and so on, with an activity level of 10 corresponding to ILI 8 or more standard deviations above the mean.

### **3. Mortality Surveillance** — Rapid tracking of influenza-associated deaths is done through two systems:

- **122 Cities Mortality Reporting System** — Each week, the vital statistics offices of 122 cities across the United States report the total number of death certificates processed and the number of those for which pneumonia or influenza was listed as the underlying or contributing cause of death by age group (Under 28 days, 28 days – 1 year, 1-14 years, 15-24 years, 25-44 years, 45-64 years, 65-74 years, 75-84 years, and  $\geq 85$  years). The percentage of deaths due to pneumonia and influenza (P&I) are compared with a seasonal baseline and epidemic threshold value calculated for each week. The seasonal baseline of P&I deaths is calculated using a periodic regression model that incorporates a robust regression procedure applied to data from the previous five years. An increase of 1.645 standard deviations above the seasonal baseline of P&I deaths is considered the “epidemic threshold,” i.e., the point at which the observed proportion of deaths attributed to pneumonia or influenza was significantly higher than would be expected at that time of the year in the absence of substantial influenza-related mortality.
- **Influenza-Associated Pediatric Mortality Surveillance System** — Influenza-associated deaths in children (persons less than 18 years) was added as a nationally notifiable condition in 2004. Any laboratory-confirmed influenza-associated death in a child is reported through this system. Demographic and clinical information are collected on each case and are transmitted to CDC.

### **4. Hospitalization Surveillance** — Laboratory confirmed influenza-associated hospitalizations in children and adults are monitored through the Influenza Hospitalization Surveillance Network (FluSurv-NET).

- **Influenza Hospitalization Surveillance Network (FluSurv-NET)** — FluSurv-NET conducts surveillance for population-based, laboratory-confirmed influenza related hospitalizations in children (persons less than 18 years) and adults. The network covers over 80 counties in the 10 Emerging Infections Program (EIP) states (CA, CO, CT, GA, MD, MN, NM, NY, OR, and TN) and five additional states (IA, MI, OH, RI and UT). Cases are identified by reviewing hospital laboratory and admission databases and infection control logs for children and adults with a documented positive influenza test (viral culture, direct/indirect fluorescent antibody assay (DFA/IFA), reverse transcription-polymerase chain reaction (RT-PCR), or a rapid influenza diagnostic test (RIDT)) conducted as a part of routine patient care. FluSurv-NET estimated hospitalization rates are reported each week during the influenza season.

### **5. Summary of the Geographic Spread of Influenza** — State health departments report the estimated level of geographic spread of influenza activity in their states each week through the **State and Territorial**

**Epidemiologists Reports.** States report geographic spread of influenza activity as no activity, sporadic, local, regional, or widespread. These levels are defined as follows:

- **No Activity:** No laboratory-confirmed cases of influenza and no reported increase in the number of cases of ILI.
- **Sporadic:** Small numbers of laboratory-confirmed influenza cases or a single laboratory-confirmed influenza outbreak has been reported, but there is no increase in cases of ILI.
- **Local:** Outbreaks of influenza or increases in ILI cases and recent laboratory-confirmed influenza in a single region of the state.
- **Regional:** Outbreaks of influenza or increases in ILI and recent laboratory confirmed influenza in at least two but less than half the regions of the state with recent laboratory evidence of influenza in those regions.
- **Widespread:** Outbreaks of influenza or increases in ILI cases and recent laboratory-confirmed influenza in at least half the regions of the state with recent laboratory evidence of influenza in the state.

Together, the five categories of influenza surveillance are designed to provide a national picture of influenza activity. Human infections with novel influenza A viruses, pneumonia and influenza mortality from the 122 Cities Mortality System, and influenza-associated pediatric deaths are reported on a national level only. FluSurv-NET data provides population-based, laboratory-confirmed estimates of influenza-related hospitalizations but are reported from limited geographic areas. Outpatient influenza-like illness and laboratory data are reported on a national level and by Department of Health and Human Services region. The state and territorial epidemiologists' reports of the geographic spread of influenza activity and the ILI activity indicator display state-level information.

It is important to maintain a comprehensive system for influenza surveillance for several reasons:

- Influenza viruses are constantly changing which requires ongoing collection and characterization of the strains.
- Influenza strains can rapidly undergo changes leading to pandemics of influenza; surveillance of viruses will detect these changes.
- Vaccines must be administered annually and are updated regularly based on surveillance findings.
- Treatment for influenza is guided by laboratory surveillance for antiviral resistance.
- National responses to emerging pandemic strains are triggered by surveillance data.
- Varying segments of the population are affected by influenza and may require targeted interventions. These groups are determined through influenza surveillance.

It is important to remember the following about influenza surveillance in the United States:

- All influenza activity reporting by public health partners and health-care providers is voluntary.
- The reported information answers the questions of where, when, and what influenza viruses are circulating. It can be used to determine if influenza activity is increasing or decreasing, but cannot be used to ascertain how many people have become ill with influenza during the influenza season.
- The system consists of eight complementary surveillance components in five categories. These components include reports from more than 145 laboratories, 2,700 outpatient health care providers, vital statistics offices in 122 cities, research and health-care personnel at the FluSurv-NET sites, and influenza surveillance coordinators and state epidemiologists from all state, local and territorial health departments.

- Influenza surveillance data collection is based on a reporting week that starts on Sunday and ends on Saturday of each week. Each surveillance participant is requested to summarize weekly data and submit it to CDC by Tuesday afternoon of the following week. Those data are then downloaded, compiled, and analyzed at CDC. The FluView surveillance report is distributed and posted on this Web site each Friday.