MMWR
Morbidity and Mortality Weekly Report
www.cdc.gov/mmwr

Early Release
Vol. 57 / February 15, 2008

Update: Influenza Activity — United States, September 30, 2007–February 9, 2008

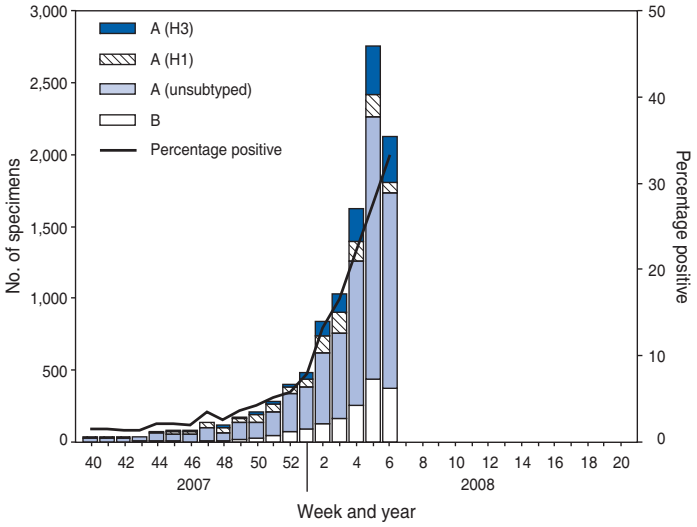
This report summarizes U.S. influenza activity* since the beginning of the 2007–08 influenza season (September 30, 2007) and updates the previous summary (*1*). From September through early December, influenza activity remained low in the United States. Activity increased from early December through the end of the year and has continued to increase in January and February.

Viral Surveillance

During September 30, 2007–February 9, 2008,† World Health Organization (WHO) and National Respiratory and Enteric Virus Surveillance System (NREVSS) collaborating laboratories in the United States reported testing 94,502 specimens for influenza viruses, and 10,568 (11%) tested positive (Figure 1). Of these positive specimens, 8,889 (84%) were influenza A viruses, and 1,679 (16%) were influenza B viruses. A total of 2,299 (26%) of the influenza A viruses have been subtyped: 1,033 (45%) were influenza A (H1N1) viruses, and 1,266 (55%) were influenza A (H3N2) viruses. Although influenza A (H1N1) viruses predominated through mid-January, an increasing proportion of subtyped influenza A viruses are influenza A (H3N2) viruses. Influenza A (H3N2) viruses were reported more frequently than influenza A (H1N1) viruses during January 20–February 9. During the week ending February 9, H3N2 became the predominant virus for the season overall.

This season, more influenza A viruses than influenza B viruses have been identified in all regions. Among influenza A viruses, influenza A (H1N1) has predominated in the New England, Mid-Atlantic, West North Central, Mountain, and Pacific regions, and influenza A (H3N2) has predominated in the East North Central, South Atlantic, East South Central, and West South Central regions. This season, laboratory-confirmed influenza has been reported by the District of Columbia and 47 states from all nine surveillance regions.§

FIGURE 1. Number* and percentage of respiratory specimens testing positive for influenza reported by World Health Organization and National Respiratory and Enteric Virus Surveillance System collaborating laboratories, by type, week, and year — United States, September 30, 2007–February 9, 2008



* N = 10,568 (of 94,502 tested).

* The CDC influenza surveillance system collects five categories of information from 10 data sources. *Viral surveillance*: U.S. World Health Organization collaborating laboratories, the National Respiratory and Enteric Virus Surveillance System, and novel influenza A virus case reporting. *Outpatient illness surveillance*: U.S. Influenza Sentinel Provider Surveillance Network and the U.S. Department of Veterans Affairs/U.S. Department of Defense BioSense Outpatient Surveillance System. *Mortality*: 122 Cities Mortality Reporting System and influenza-associated pediatric mortality reports. *Hospitalizations*: Emerging Infections Program and New Vaccine Surveillance Network. Summary of geographic spread of influenza: state and territorial epidemiologist reports.

† As of February 9, 2008. Data are preliminary and might change as more reports are received.

§ New England (Connecticut, Maine, Massachusetts, New Hampshire, Vermont, and Rhode Island); Mid-Atlantic (New Jersey, New York City, upstate New York, and Pennsylvania); East North Central (Illinois, Indiana, Michigan, Ohio, and Wisconsin); West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota); South Atlantic (Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia); East South Central (Alabama, Kentucky, Mississippi, and Tennessee); West South Central (Arkansas, Louisiana, Oklahoma, and Texas); Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming); Pacific (Alaska, California, Hawaii, Oregon, and Washington).

Antigenic Characterization

Since September 30, 2007, CDC has antigenically characterized 250 influenza viruses submitted by U.S. laboratories: 117 influenza A (H1N1), 65 influenza A (H3N2), and 68 influenza B viruses. One hundred seven (91%) of the 117 influenza A (H1N1) viruses were characterized as A/Solomon Islands/3/2006-like, the influenza A (H1N1) component of the 2007–08 influenza vaccine for the Northern Hemisphere and the 2008 influenza A (H1N1) component of the vaccine for the Southern Hemisphere; 10 (9%) of the 117 influenza A (H1N1) viruses were observed to have somewhat reduced titers with antisera produced against A/Solomon Islands/3/2006. Nine (14%) of the 65 influenza A (H3N2) viruses were characterized as A/Wisconsin/67/2005-like, the influenza A (H3N2) component of the 2007–08 influenza vaccine for the Northern Hemisphere. Fifty-three (81%) of the 65 influenza A (H3N2) viruses were characterized as A/Brisbane/10/2007-like, a recent antigenic variant that has evolved from A/Wisconsin/67/2005-like. A/Brisbane/10/2007-like virus is the recommended influenza A (H3N2) component for the 2008 Southern Hemisphere vaccine. Three (5%) of the 65 influenza A (H3N2) viruses were observed to have somewhat reduced titers with antisera produced against A/Wisconsin/67/2005 and A/Brisbane/10/2007.

Influenza B viruses currently circulating can be divided into two antigenically distinct lineages represented by B/Victoria/02/87 and B/Yamagata/16/88. Four (6%) of the 68 influenza B viruses characterized belong to the B/Victoria lineage of viruses. One virus with B/Victoria lineage, B/Malaysia/2506/2004, is the influenza B component of the 2007–08 influenza vaccine. Sixty-four (94%) of the 68 influenza B viruses belong to the B/Yamagata lineage of viruses.

Outpatient Illness Surveillance

For the week ending February 9, the percentage of outpatient visits for influenza-like illness (ILI)[¶] reported by approximately 1,400 U.S. sentinel providers in 50 states, Chicago, the District of Columbia, and New York City was 5.7%. This marks the seventh consecutive week that the percentage of outpatient visits for ILI exceeded the national baseline of 2.2%.** ILI was reported above region-specific baselines in all nine influenza surveillance regions. Also for the week ending February 9, the percentage of outpatient visits for acute respiratory illness (ARI)[††] reported by approximately 800 U.S. Department of Defense (DoD) and Department of Veterans' Affairs (VA) BioSense[§§] outpatient treatment facilities was 3.5%,[¶¶] which was above the national baseline of 3.2% (Figure 2).

State-Specific Activity Levels

Until the week ending January 5, widespread*** influenza activity had not been reported in any state. During the week ending January 5, widespread influenza activity was reported in Colorado. The number of states reporting widespread activity has increased each week. For the week ending February 9, widespread activity was reported by 44 states, and regional activity was reported by five states (Figure 3).

Pneumonia and Influenza-Related Mortality

Pneumonia and influenza (P&I) was listed as an underlying or contributing cause of death for 7.6% of all deaths reported through the 122 Cities Mortality Reporting System for the week ending February 9. This percentage was above the epidemic threshold of 7.2% for the week[†††] and marked the fifth consecutive week that P&I deaths were above the epidemic threshold since influenza activity began rising in the United States (Figure 4).

[¶] Defined as a temperature of ≥100.0°F (≥37.8°C), oral or equivalent, and cough and/or sore throat, in the absence of a known cause other than influenza

[**] The national and regional baselines are the mean percentage of visits for ILI during noninfluenza weeks for the previous three seasons plus two standard deviations. A noninfluenza week is a week during which <10% of specimens tested positive for influenza. National and regional percentages of patient visits for ILI are weighted on the basis of state population. Use of the national baseline for regional data is not appropriate.

[††] Based on *International Classification of Diseases, Ninth Revision* codes for ARI: 460–66 and 480–88.

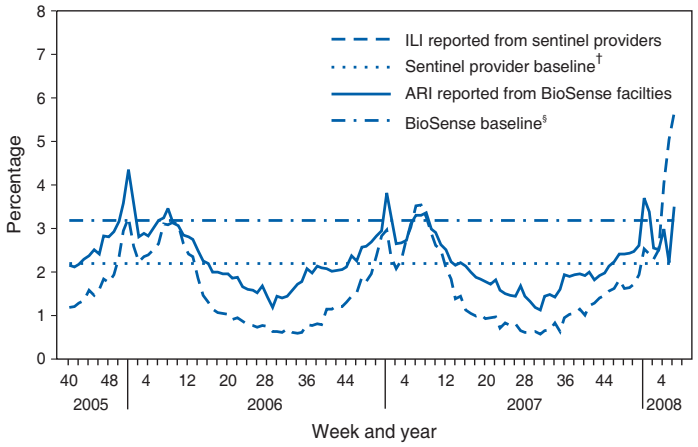
[§§] BioSense is a national surveillance system that receives, analyzes, and evaluates health data from multiple sources, including 1) approximately 1,150 VA/DoD hospitals and ambulatory-care clinics; 2) multihospital systems, local hospitals, and state and regional syndromic surveillance systems in 37 states; and 3) Laboratory Corporation of America (LabCorp) test orders.

[¶¶] The national, regional, and age-specific baselines are the mean percentage of visits for ARI during noninfluenza weeks for the previous three seasons plus two standard deviations. A noninfluenza week is a week during which <10% of specimens tested positive for influenza. Use of the national baseline for regional data is not appropriate.

[***] Levels of activity are 1) *no activity*; 2) *sporadic*: isolated laboratory-confirmed influenza cases or laboratory-confirmed outbreak in one institution, with no increase in ILI activity; 3) *local*: increased ILI or at least two institutional outbreaks (ILI or laboratory-confirmed influenza) in one region with recent laboratory evidence of influenza in that region; virus activity no greater than sporadic in other regions; 4) *regional*: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least two but fewer than half of the regions in the state with recent laboratory evidence of influenza in those regions; and 5) *widespread*: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least half the regions in the state with recent laboratory evidence of influenza in the state.

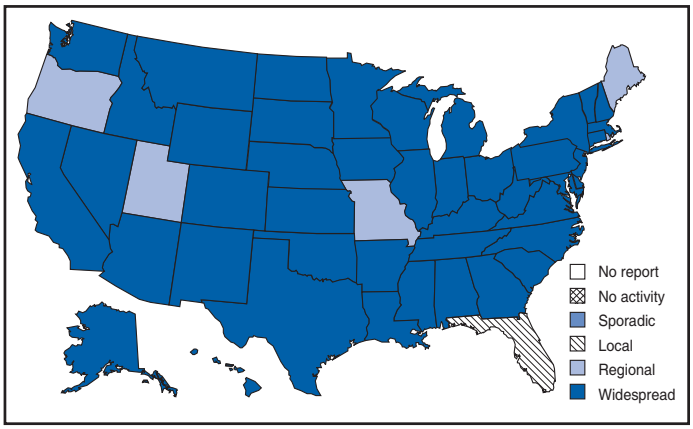
[†††] The expected seasonal baseline proportion of P&I deaths reported by the 122 Cities Mortality Reporting System is projected using a robust regression procedure in which a periodic regression model is applied to the observed percentage of deaths from P&I that occurred during the preceding 5 years. The epidemic threshold is 1.645 standard deviations above the seasonal baseline.

FIGURE 2. Percentage of outpatient visits for influenza-like illness (ILI) and acute respiratory illness (ARI) reported by the Sentinel Provider Surveillance Network and the U.S. Department of Veterans Affairs/U.S. Department of Defense BioSense Outpatient Surveillance System, by week and year — United States, 2005–06, 2006–07, and 2007–08 influenza seasons*



* As of February 9, 2008.
† The national and regional baselines are the mean percentage of visits for ILI during noninfluenza weeks for the previous three seasons plus two standard deviations. A noninfluenza week is a week during which <10% of specimens tested positive for influenza. National and regional percentages of patient visits for ILI are weighted on the basis of state population. Use of the national baseline for regional data is not appropriate.
§ The national and regional baselines are the mean percentage of visits for ARI during noninfluenza weeks for the previous three seasons plus two standard deviations. A noninfluenza week is a week during which <10% of specimens tested positive for influenza. Use of the national baseline for regional data is not appropriate.

FIGURE 3. Estimated influenza activity levels reported by state epidemiologists, by state and level of activity* — United States, week ending February 9, 2008



* Levels of activity are 1) *no activity*; 2) *sporadic*: isolated laboratory-confirmed influenza cases or a laboratory-confirmed outbreak in one institution, with no increase in activity; 3) *local*: increased influenza-like illness (ILI), or at least two institutional outbreaks (ILI or laboratory-confirmed influenza) in one region with recent laboratory evidence of influenza in that region; virus activity no greater than sporadic in other regions; 4) *regional*: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least two but less than half of the regions in the state with recent laboratory evidence of influenza in those regions; and 5) *widespread*: increased ILI activity or institutional outbreaks (ILI or laboratory-confirmed influenza) in at least half the regions in the state with recent laboratory evidence of influenza in the state.

Influenza-Associated Pediatric Hospitalizations

Pediatric hospitalizations associated with laboratory-confirmed influenza infections are monitored by two population-based surveillance networks, the Emerging Infections Program (EIP) and the New Vaccine Surveillance Network (NVSN). During November 4, 2007–January 26, 2008, the preliminary laboratory-confirmed influenza-associated hospitalization rate reported by NVSN for children aged 0–4 years was 0.73 per 10,000. During September 30, 2007–February 2, 2008, EIP sites reported a preliminary laboratory-confirmed influenza-associated hospitalization rate of 0.36 per 10,000 for children aged 0–17 years. For children aged 0–4 years, the rate was 1.0 per 10,000, and for children aged 5–17 years, the rate was 0.1 per 10,000.[§§§]

Influenza-Related Pediatric Mortality

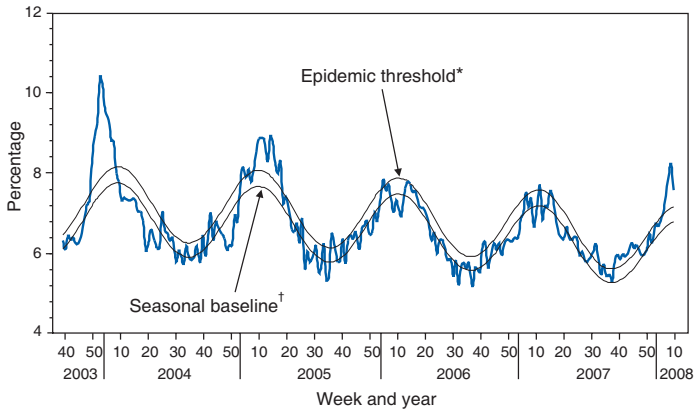
As of February 9, a total of 10 pediatric deaths among children with laboratory-confirmed influenza had been reported to CDC through the National Notifiable Diseases Surveillance System for the 2007–08 influenza season. Ages of children who died ranged from 4 months to 14 years, with a median of 5.5 years. During the preceding three influenza seasons, the numbers of influenza-related pediatric deaths reported to CDC have ranged from 46 to 74.

Resistance to Antiviral Medications

During this influenza season, a small increase in the number of influenza viruses resistant to the neuraminidase inhibitor, oseltamivir, has been observed. Among the 350 influenza A and B viruses tested during the 2007–08 influenza season,

§§§ NVSN conducts surveillance in Monroe County, New York; Hamilton County, Ohio; and Davidson County, Tennessee. NVSN provides population-based estimates of laboratory-confirmed influenza hospitalization rates in children aged <5 years admitted to NVSN hospitals with fever or respiratory symptoms. Children are prospectively enrolled, and respiratory samples are collected and tested by viral culture and reverse transcription–polymerase chain reaction (RT-PCR). EIP conducts surveillance in 60 counties associated with 12 metropolitan areas: San Francisco, California; Denver, Colorado; New Haven, Connecticut; Atlanta, Georgia; Baltimore, Maryland; Minneapolis/St. Paul, Minnesota; Albuquerque, New Mexico; Las Cruces, New Mexico; Albany, New York; Rochester, New York; Portland, Oregon; and Nashville, Tennessee. EIP conducts surveillance for laboratory-confirmed, influenza-related hospitalizations in persons aged <18 years. Hospital laboratory and admission databases and infection-control logs are reviewed to identify children with a positive influenza test (i.e., viral culture, direct fluorescent antibody assays, RT-PCR, or a commercial rapid antigen test) from testing conducted as a part of their routine care.

FIGURE 4. Percentage of all deaths attributed to pneumonia and influenza (P&I) reported by the 122 Cities Mortality Reporting System, by week and year — United States, 2003–2008



* The epidemic threshold is 1.645 standard deviations above the seasonal baseline.
† The seasonal baseline is projected using a robust regression procedure that applies a periodic regression model to the observed percentage of deaths from P&I during the preceding 5 years.

16 (4.6%) have been found to be resistant to oseltamivir. All of the oseltamivir-resistant viruses have been influenza A viruses (16 of 270, 5.9%). Of the resistant viruses, all are of the H1N1 subtype and have been determined to share the same genetic mutation that confers oseltamivir resistance. These 16 viruses represent 8.1% of the 198 influenza A (H1N1) viruses that have been tested, an increase from four (0.7%) of 588 influenza A (H1N1) viruses tested during the 2006–07 season. No resistance to oseltamivir has been determined among the 72 influenza A (H3N2) or the 80 influenza B viruses tested, and no antiviral resistance to zanamivir has been detected in any subtype. Adamantane resistance continues to be high; 87 (32%) of 271 influenza A viruses tested were resistant to adamantanes (i.e., amantadine or rimantadine), including 99% of influenza A (H3N2) viruses and 7.6% of influenza A (H1N1) viruses tested. Adamantanes are not recommended for the prevention or treatment of influenza this season because of the high rate of resistance among circulating influenza A viruses.

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Editorial Note: During October—December 2007, the United States experienced low but increasing levels of influenza activity. During January and early February, influenza activity increased more rapidly. For the week ending February 9, a total of 49 states reported either widespread or regional activity. During the most recent three influenza seasons (2004–05, 2005–06, and 2006–07), the number of states reporting regional or widespread activity peaked at 41–48 states. During this season, influenza virus isolates have been reported in all nine surveillance regions in the United States and, during the week ending February 9, 33% of specimens tested for influenza were positive. The peak percentage of specimens testing positive for influenza during the preceding three seasons ranged from 23% to 28%. During the week ending February 9, 5.7% of outpatient visits to sentinel providers were for influenza-like illness (ILI). The peak percentage of visits for ILI in the three previous seasons ranged from 3.3% to 5.4%.

Since 1977, influenza A (H1N1), influenza A (H3N2), and influenza B viruses have circulated globally. Each year's influenza vaccine contains a virus representing each of these three distinct influenza virus groups. The three viruses selected to be included in this season's vaccine were selected in February 2007 as the viruses that appeared most likely to be circulating during this influenza season (*2*). The degree of antigenic match between current influenza vaccine strains and the influenza viruses that are circulating this season will continue to be assessed as more viruses become available for analysis. To date, 91% of influenza A (H1N1) viruses sent to CDC for antigenic characterization were similar to A/Solomon Islands/3/2006, the influenza A (H1N1) component of the 2007–08 influenza vaccine. Although the majority of influenza A (H3N2) and influenza B viruses are not optimally matched, vaccination with the trivalent influenza vaccine continues to be recommended because the vaccine can provide partial protection against related strains and reduce the risk for influenza-related complications and deaths (*3–6*). In addition, the vaccine contains three strains, and communities can experience outbreaks with more than one strain of influenza in a given year.

Vaccination with trivalent influenza vaccines remains the best method for preventing influenza and its potentially severe complications. Although influenza activity is on the rise, vaccination during the current season still can provide benefit. Because persons require approximately 2 weeks after vaccination to develop immune response to vaccination, use of neuraminidase inhibitors for prevention of influenza in the 2 weeks after vaccination might be considered, especially for persons at high risk during a documented influenza outbreak (*7*).

Antiviral medications are an important tool for treatment of influenza and also can be used for prevention. Recent studies have identified a considerable protective effect of antiviral treatment against complications associated with influenza (*8*), including death among older adults hospitalized with laboratory-confirmed influenza (*9*). This season, a low level of resis-

tance to the influenza antiviral drug oseltamivir among influenza A viruses (16 of 270 tested, 5.9%) has been detected. All 16 resistant viruses identified this season were of the influenza A (H1N1) subtype and share the same genetic mutation; this mutation is the most common mutation in this subtype that confers resistance to oseltamivir. Given the low level of resistance to oseltamivir, the finding of resistance only in influenza A (H1N1) viruses, and no resistance to zanamivir, these drugs continue to be recommended for the treatment and prophylaxis of influenza (*10*). Although recommendations for use of antiviral medications have not changed, enhanced surveillance for detection of oseltamivir-resistant viruses is ongoing and will enable continued monitoring for changing trends over time. In addition to vaccination and antivirals, other means of decreasing the spread and impact of influenza include frequent handwashing, staying home from work or school when ill, and covering the nose or mouth with a tissue when coughing or sneezing. Additional information is available at http://www.cdc.gov/flu/protect/habits.htm.

Acknowledgments

This report is based, in part, on data contributed by participating state and territorial health departments and state public health laboratories, WHO collaborating laboratories, National Respiratory and Enteric Virus Surveillance System collaborating laboratories, the U.S. Influenza Sentinel Provider Surveillance Network, the New Vaccine Surveillance Network, the Emerging Infections Program, the Influenza-Associated Pediatric Mortality Surveillance System, and the 122 Cities Mortality Reporting System.

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