

## **Influenza**

Agent: Influenza virus; Types A, B and (rarely) C cause human disease.

Mode of Transmission: Person-to-person primarily through inhalation of droplets released through coughing or sneezing.

Signs/Symptoms: Fever, headache, muscle pain, fatigue, sore throat and cough; influenza can also lead to pneumonia, especially in those with underlying medical conditions (e.g., lung or heart disease).

Prevention: Annual vaccination is the primary prevention strategy; antiviral medications are sometimes used with high-risk populations (e.g., nursing home residents) to prevent illness. Transmission may be reduced by frequent hand washing or using alcohol-based hand-sanitizers; avoidance of touching the eyes, nose, and mouth with contaminated hands; and covering the nose and mouth with a tissue or the bend of the elbow when coughing or sneezing.

Other Important Information: The influenza virus changes slightly from year to year (antigenic drift), making it necessary to prepare a new vaccine each year. Periodically, the virus will change to form a completely new subtype (antigenic shift) which can lead to pandemics.

## **Influenza Surveillance**

The 2008-2009 influenza season began in October 2008 and lasted through April of 2009, and included the beginning of the 2009 H1N1 pandemic. The start of the season reflected typical influenza-like illness (ILI) with a peak in activity in late February. However, in late April, a novel H1N1 strain emerged and extended ILI activity beyond the timeframe considered as the traditional flu season. During the influenza pandemic, influenza illness continued through the summer of 2009, peaked at the end of October and dropped off sharply in December 2009. Activity continued to decline until May 2010 when it reached background levels usually observed during the late summer months. This report covers the 2008-2009 influenza season, as well as influenza activity associated with the pandemic through the end of calendar year 2009, but does not include the remainder of the pandemic period which extended through May 2010.

Flu surveillance efforts do not count every individual with disease but instead monitor indicators of activity level using multiple sources of data. Surveillance information is shared across health districts and with CDC to track influenza-related illness, determine the types of influenza viruses circulating, detect changes in influenza viruses, and measure the impact of influenza on morbidity and mortality.

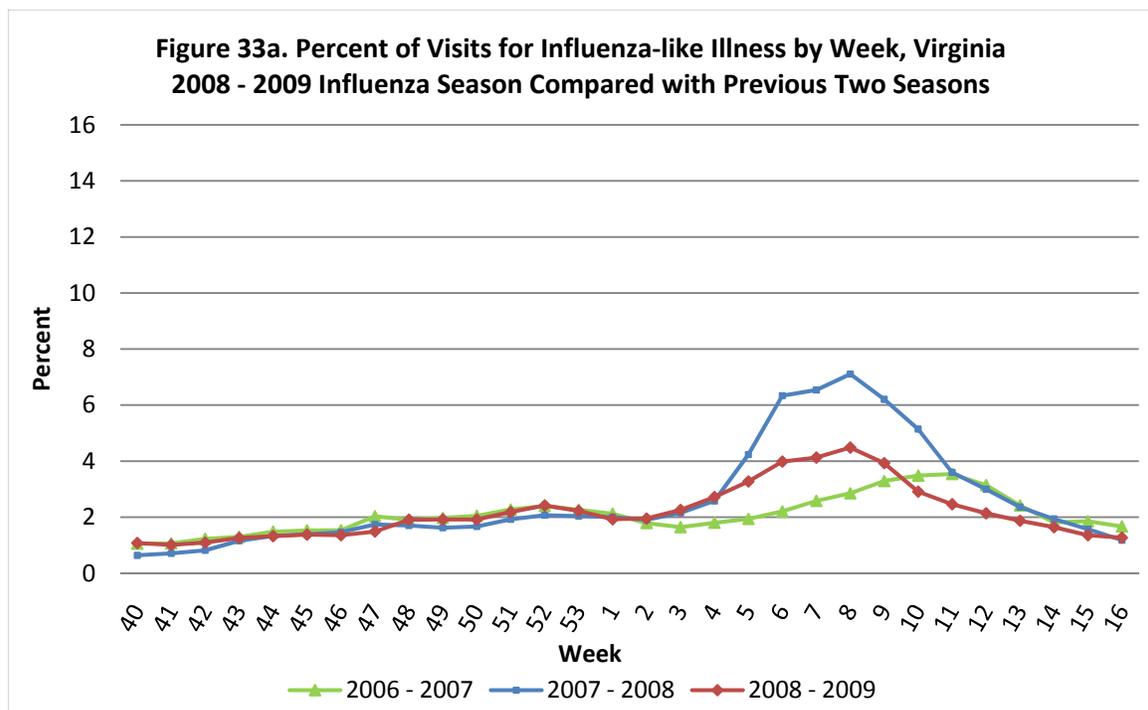
For the 2008-2009 influenza season, data sources included reporting from hospital emergency departments and urgent care centers, laboratory reports, evaluations of outbreak investigations, pediatric deaths associated with influenza and school absenteeism data. During the pandemic period, existing surveillance activities were enhanced to provide better state-wide coverage and richer data. In addition, new initiatives were implemented to expand the type of information available to monitor the impact of the epidemic. The initiatives included monitoring of school closures, the identification of pneumonia and influenza deaths from death certificates, evaluation of

the proportion of ILI visits to emergency departments that resulted in admissions, and monitoring of the number of antiviral prescriptions filled. In addition, a number of events were tracked, including reported H1N1 deaths, reported H1N1 hospitalizations, reported H1N1 infections in pregnant women, and treatment with the antiviral peramivir under an emergency use authorization. Surveillance was conducted for Guillan-Barré Syndrome and intensive medical record reviews were carried out on a small sample of H1N1-associated hospitalizations and deaths and severe illness due to H1N1 infection in pregnant women to contribute to national studies.

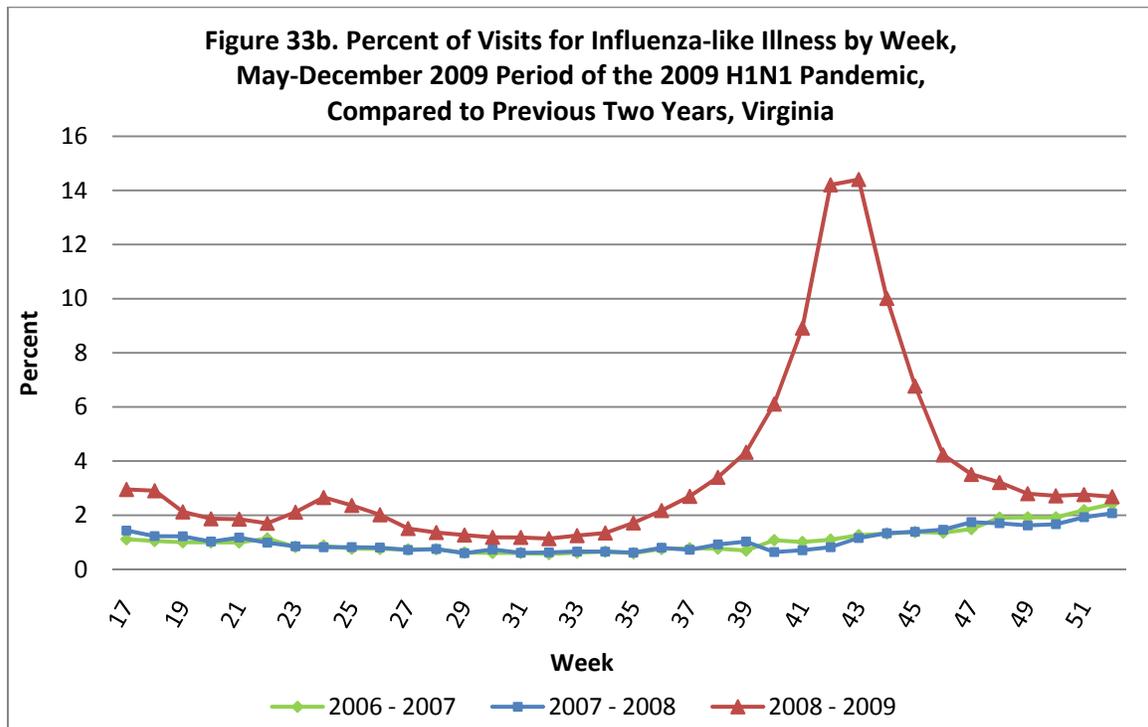
## Influenza-Like Illness Surveillance

VDH receives information regarding patient visits to emergency departments and urgent care facilities for influenza-like illness symptoms. ILI symptoms include a complaint of fever and cough or fever and sore throat. Other illnesses may show similar symptoms, but the strategy has proven to be a reliable indicator of influenza activity during flu season. During the 2008-2009 influenza season, 79 emergency or urgent care facilities provided data to VDH for surveillance monitoring and the number of participating facilities was expanded to 91 during the pandemic period.

As shown in Figure 33a, the 2008-2009 season showed a small increase in ILI activity during the last weeks of December (week 52 in 2008). ILI activity then decreased slightly before the seasonal peak during the week ending February 28 (week 8 in 2009), when 4.4% of visits were due to ILI. Significantly, ILI activity peaked during the same week during the 2007-2008 season, but approximately three weeks later during the 2006-2007 season.



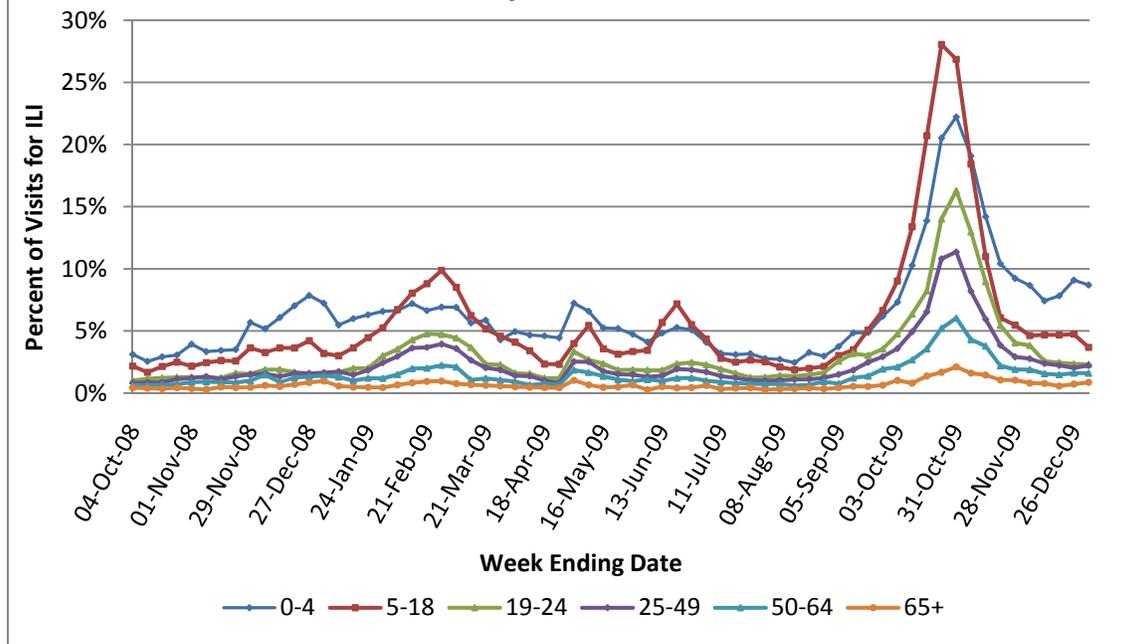
During typical seasons, ILI activity continues to decline and reaches baseline levels during the summer months. However, the identification of the 2009 H1N1 strain in late April altered the pattern in 2009 (Figure 33b). A small increase in visits for ILI was observed in May (weeks 17 and 18) when the 2009 H1N1 strain was identified. Because there were few 2009 H1N1 infections in Virginia at this point, this is likely to represent people with flu-like symptoms seeking medical evaluation. A second increase occurred in June (week 24), and laboratory testing indicated that, by this time, the 2009 H1N1 virus was circulating in Virginia. Although ILI visits and positive specimens declined at the end of the summer (weeks 30-33), activity began to increase in the fall as children returned to school. It peaked during October (weeks 41-43), and then dropped off sharply in December.



### ILI Activity by Age

Analyzing ILI activity by age provides additional insight. While influenza vaccination efforts have often targeted the elderly due to concerns over complications of infection, the youngest age groups show the highest proportions of health care visits for ILI. An early peak among the 0-4 year age group historically marks the beginning of influenza activity during a season. It often occurs during mid- to late-December and can be seen on the graph below in late December 2008 (Figure 34a). A similar peak in late April through early May 2009 occurred when the 2009 H1N1 strain was identified, although there were still few infections in Virginia. In all age groups, the proportion of visits for ILI was much higher at the peak of the epidemic than in an ordinary season or during the rest of the year.

**Figure 34a. Percent of Emergency Department and Urgent Care Visits for Influenza-like Illness, by Age Group, 2008-2009 Influenza Season and May-December of 2009 H1N1 Pandemic**



## Influenza Outbreaks

VDH received ten confirmed reports of influenza outbreaks during the 2008-2009 season from various facilities, the first of which occurred on December 9, 2008 (week 50). This represented significantly fewer outbreaks than occurred during the 2007-2008 season, during which the state confirmed 31 influenza outbreaks. Five of the 2008-2009 outbreaks occurred in schools (K-12), three occurred in nursing homes, one occurred in an adult and pediatric skilled nursing facility, and one was in a correctional facility. By region, two of the outbreaks were reported from the central region, three from the eastern region, two from the northern region, one from northwestern region, and one from the southwestern region. Laboratory analysis identified influenza B in two of the outbreaks and a combination of influenza A and B in two outbreaks. Influenza typing was not available for the remaining six outbreaks. The number of cases associated with the outbreaks ranged from 2 – 140 individuals, with an average of 40 cases per outbreak.

In comparison, 116 confirmed influenza outbreaks occurred during the pandemic period from May to December 2009. The first Virginia outbreak related to the pandemic occurred on a university campus. VDH conducted a thorough epidemiologic investigation including an online survey. Twelve students were confirmed to have the 2009 H1N1 virus. Overall, 15 outbreaks were reported from the central region, 22 from the eastern region, 26 from the northern region, 32 from northwest region, and 21 from the southwest region. The outbreaks occurred in various settings including 73 schools (K-12), 10 daycare settings, nine camp/campgrounds, six assisted living facilities, five colleges/universities, five medical facilities (non long-term care), four nursing homes, three correctional facilities, and one military base.

## **Sentinel Provider Specimen Collection**

Throughout each influenza season, sentinel physicians and medical facilities located throughout the Commonwealth submit specimens from patients with ILI to the Virginia Division of Consolidated Laboratory Services (DCLS) for analysis. DCLS performs viral culture and reverse transcription polymerase chain reaction (RT-PCR) testing on the specimens. The testing aids in detecting the seasonal emergence of influenza and characterizing the strains of influenza circulating throughout the state.

During the 2008-2009 influenza season, 47 facilities participated in sentinel surveillance and represented 34 of the 35 health districts in Virginia. These providers were asked to submit two specimens early in the influenza season, two mid-season, and two specimens during the latter portion of the season. During the traditional influenza season, approximately 50 percent of sentinel providers regularly submitted specimens. To address pandemic influenza, additional providers were added in each district, and an in-patient facility was added for each region. From August through December 2009, there were 303 participating sentinel facilities who were encouraged to submit specimens each month.

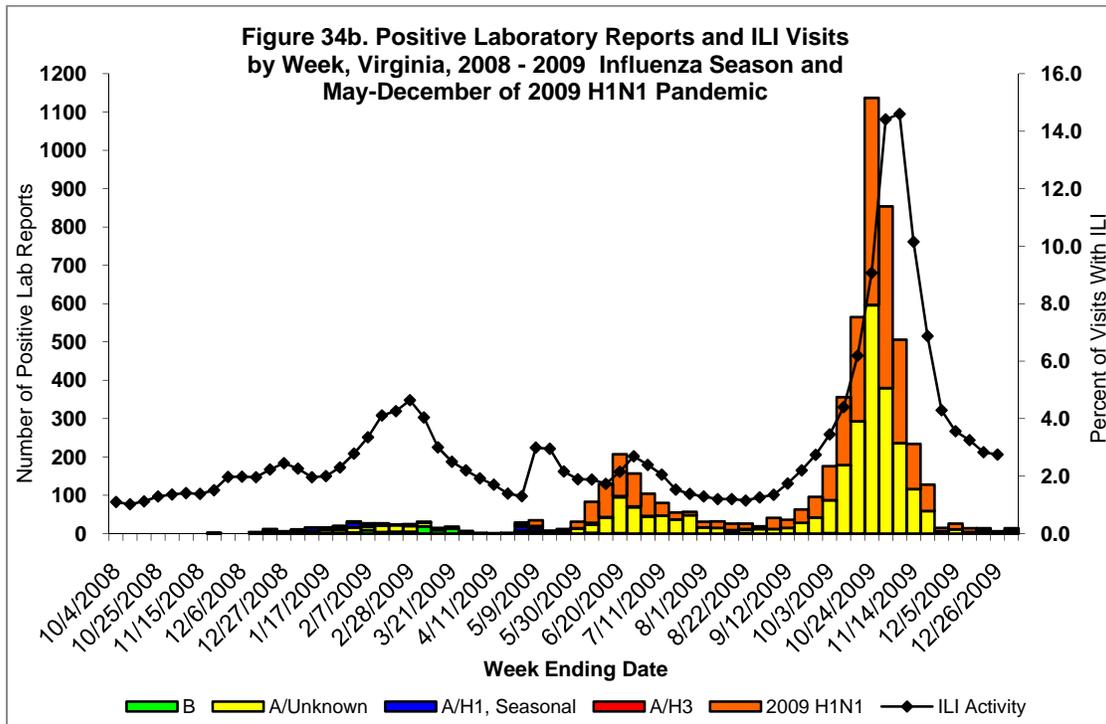
## **Laboratory Testing**

Laboratory surveillance for influenza includes findings from specimens submitted by the sentinel providers, specimens from outbreaks, influenza findings reported by private laboratories and findings from Virginia facilities participating in the National Respiratory and Enteric Virus Surveillance System (NREVSS). Only results from three testing procedures, DFA (direct fluorescent antibody), PCR (polymerase chain reaction), and viral culture, are used for laboratory surveillance. Rapid antigen tests are not included.

During the 2008-2009 season, VDH received results from 364 specimens with influenza virus detected by one of these three methods. Among the reports, 46% (166) were from DCLS, while 40% (146) were reported through NREVSS and 14% (52) were submitted by private laboratories.

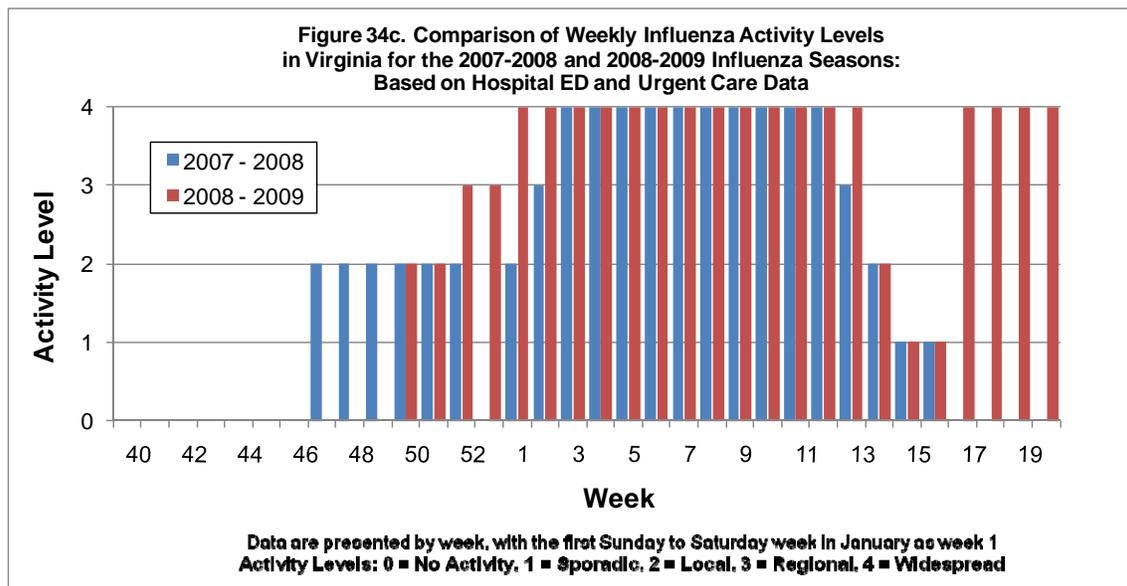
Among influenza findings received during the normal 2008-2009 influenza season, 70% (236) were type A and 30% (99) were type B. Subtyping of influenza A viruses indicated that 36% were H1, 7% were H3, and 56% were not subtyped.

The increased participation of sentinel providers during the pandemic period allowed VDH to test over 2,300 specimens from May through December 2009. Of these, 61% (1,420) showed evidence of influenza. Of the 722 specimens that were subtyped, 57% (410) were identified as 2009 H1N1, 41% (294) were identified as seasonal A (H1), 1% (10) were identified as A (H3), and 1% (7) were identified as influenza B (Figure 34b).



## Activity Level

The state follows national guidelines to describe the geographic distribution of influenza activity. The weekly activity level is based on ILI data, laboratory findings, and outbreak occurrences, and is classified in the following categories: no activity, sporadic, local, regional, or widespread. The levels are not indicators of the severity of influenza illness but instead serve as a gauge for the geographic spread of influenza activity around the state. Six weeks of ILI data, collected from July through September, are used to establish baseline thresholds for the five health planning regions; ILI activity is considered elevated when a region exceeds its threshold.



During the 2008-2009 season, localized influenza activity occurred from late November through mid-December, correlating to weeks 51 and 52 (Figure 34c). After a brief period of regional activity in December, the state quickly elevated to widespread activity in January (week 1). The activity level remained elevated through March 2009 and decreased to sporadic activity by the traditional end of flu season in April (week 16). However, the emergence of the 2009 H1N1 strain increased the influenza activity level in Virginia in late April (week 17). Activity levels hovered at widespread and regional from May to July, with a slight decrease in July, to localized levels, before increasing to regional in August. The state experienced widespread levels in October. Widespread activity remained through the month of December. Activity continued to decline until May 2010 when it reached background levels.

## **Pediatric Mortality**

Physicians and directors of medical care facilities are required to report influenza-associated pediatric deaths to VDH to allow monitoring of this severe outcome of influenza illness. Two influenza-associated pediatric deaths were reported to VDH during the normal 2008–2009 flu season, one in February in a preschool-aged child (0-4 years) and the second in March in a teen (13-17 years). CDC received reports of 65 influenza-associated pediatric deaths for the 2008-2009 season (through the week ending April 11, 2009). During the pandemic period, Virginia received reports of six influenza-associated deaths among school-aged children, ages 5 to 18 years, which occurred from September to November, 2009. All six were associated with influenza A strains and three were subtyped as 2009 H1N1 influenza A. Nationwide, CDC received reports of 329 pediatric deaths from April 15, 2009 through January 23, 2010.

## **School Absenteeism**

School absenteeism data are a recent addition to influenza surveillance in Virginia. Information on absenteeism was submitted by school divisions on a daily basis and made available to the health districts to identify emerging problems and monitor potential influenza activity in their communities. Centrally, it was evaluated by region and school level (elementary, middle and high school) for unusual patterns. During the normal influenza season, six school divisions in the eastern and central regions of the state provided data. However, during the pandemic period efforts expanded to include information from 123 school divisions. While school absenteeism provides a general, but not influenza-specific, measure of illness, it was very useful for monitoring illness activity and identifying schools with emerging outbreaks during the pandemic period.

## **School Closure**

During the pandemic period, the Virginia Department of Education encouraged school districts considering school closures to consult with their local health department. School closure is generally not recommended for reducing the spread of influenza and is usually recommended only when student and faculty absenteeism reach levels that interfere with the educational process. It was important that health officials were consulted before closure decisions were made so that they could reinforce messages about disease control practices within the schools and address health concerns in the community. VDH learned

of one school closure that involved Amelia County public schools. The schools remained closed for one week.

### **Admissions from Emergency Department Visits for ILI or Pneumonia**

To monitor the severity of illness during the pandemic period, the information used to assess ILI visits was further analyzed to evaluate the proportion of emergency department visits for ILI or pneumonia that resulted in a hospital admission. While this strategy did not provide as precise a measure as direct reporting of all pneumonia and influenza hospital admissions, when combined with evidence from other Virginia information sources and hospital admission data from other states, all indicated that while there were more individuals being admitted than expected during a normal season, and while some individuals were severely affected, 2009 H1N1 influenza was not causing unusually severe illness. This strategy provided a useful monitoring tool that did not impose an additional reporting burden on hospital staff. If the evidence had indicated changes in disease severity, more intensive surveillance efforts could have been implemented.

### **Identification of Pneumonia and Influenza Deaths from Death Certificates**

Cause of death information is generally not available quickly because of the processes for certifying a death and correctly classifying the cause of death. During the pandemic period, the VDH Office of Vital Records expedited the process and implemented special procedures to generate information about pneumonia and influenza deaths on a weekly basis. This provided important information for assessing the severity of influenza illness. The data showed only a small increase in the number of influenza-related deaths compared to the previous year.

### **Tracking of High Profile Events**

VDH utilized additional tracking methods to address high profile events such as H1N1 deaths and hospitalizations, and severe H1N1 illness in pregnant women. This was not an attempt at thorough enumeration, but an effort to be responsive to situations that required medical consultation or received media attention. Additionally, VDH staff conducted medical record reviews and interviewed physicians and patients to collect information for CDC studies on hospitalizations and deaths and on patients receiving peramivir, an antiviral drug made available under an FDA Emergency Use Authorization.

### **Guillain-Barré Syndrome Surveillance**

A special surveillance system was established during the pandemic period using neurologists to identify Guillain-Barré Syndrome (GBS) incidence and to evaluate whether there was any relationship to influenza vaccination. GBS is an acute ascending paralysis that is associated with various infections and rarely with vaccination. In the United States, an estimated 3,000 to 6,000 people develop GBS each year, whether or not they received a vaccination. This is about 1 to 2 cases of GBS per 100,000 people. During the 1976 H1N1 “swine flu” vaccination campaign, incidence of GBS increased by one additional case of GBS per 100,000 persons vaccinated; however, studies of seasonal

influenza vaccines used in subsequent years have found small or no increased risk of GBS. The 2009 H1N1 monovalent vaccine was produced in the same manner as the 2008-2009 seasonal influenza vaccine and was expected to have a similar safety profile. Special surveillance was implemented to detect any H1N1 vaccine-associated GBS, to be able to reassure the community if evidence indicated that the vaccine did not present any risk and to initiate appropriate action if the vaccine appeared to present a risk of GBS.

Surveillance for GBS was conducted from October 2009 through May 2010. VDH received reports of 13 people newly diagnosed with GBS. Of these reports, only two had a reported history of receiving the 2009 H1N1 vaccine during the 8 weeks prior to onset of neurologic symptoms. Persons reported with GBS had a median age of 47 years.

### **Estimations of Immunity**

To estimate the proportion of the community that had developed immunity to 2009 H1N1 influenza through either vaccination or infection, VDH extrapolated CDC estimates of the number of infected individuals in the Virginia population, and combined this with estimates of the numbers of Virginians vaccinated for H1N1 from the VDH Division of Immunization. The estimates suggest that 37.3% of Virginians developed immunity to 2009 H1N1 influenza either through infection or vaccination.

### **Other Surveillance Information Used**

In coordination with CDC, VDH conducts the Behavioral Risk Factor Surveillance System (BRFSS) and Pregnancy Risk Assessment Monitoring System (PRAMS) to obtain population-based information about health factors among Virginians. During the pandemic period, each survey added questions related to influenza vaccination and illness. CDC's National Respiratory and Enteric Virus Surveillance System (NREVSS) provided information on respiratory syncytial virus activity in Virginia, which was useful in interpreting ILI trends. As part of the BRFSS, questions related to influenza were asked between September 2009 and February 2010. Responses indicate that in Virginia, 8.2% of adults (95% CI 6.2% – 10.2%) and 25.0% of children (95% CI 20.7 – 29.3%) experienced influenza-like illness within the month before the interview. For adults, peak illness occurred in December, affecting an estimated 15.0% (95% CI 7.7% – 22.2%) of the adult population over the course of the month. For children, peak illness occurred in November, when 36.1% (95% CI 24.2% – 47.9%) of children were ill with ILI at some time during the month. Among adults, the odds of experiencing ILI were significantly higher among unmarried persons compared to married persons, young to middle-aged adults (compared to those 65 years or older), persons with fair or poor health (compared to those with very good or excellent health), persons with a history of asthma, and adults with a child in the household who had influenza-like illness.