

Section 5

Summary of 2009 H1N1 Influenza A Surveillance

Background

Influenza causes annual seasonal epidemics in Florida and around the world. In Florida, influenza typically occurs in the fall through early spring and peaks sometime in the first three months of the year. Periodically, a genetically novel strain of influenza circulates worldwide, causing an influenza pandemic. These periodic pandemics vary in severity but are defined by a number of criteria: there must be a new influenza A subtype in humans with minimal or no immunity in the population; it must cause clinical illness; and it must show evidence of sustained person-to-person transmission.

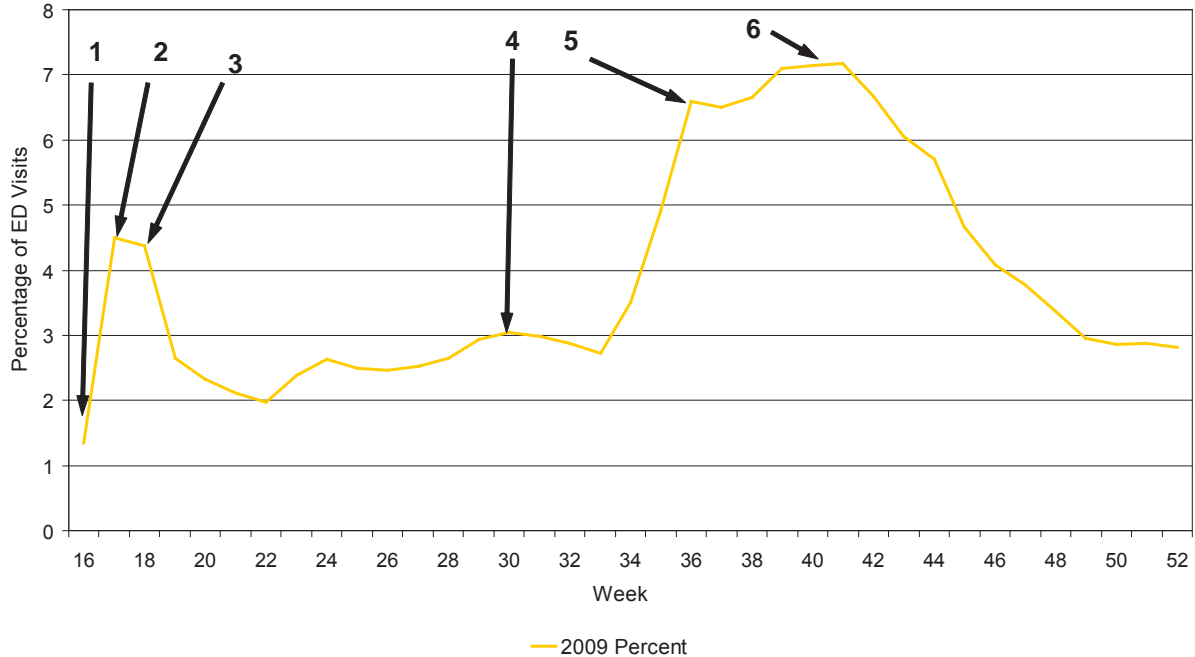
The 2009 calendar year began in the middle of a traditional influenza season, in which influenza activity peaked in late February. Multiple strains of seasonal influenza were present during the first months of 2009, including seasonal influenza A H1 and H3, but unusually the dominant strain was influenza B. This contrasted with the rest of the U.S., where the majority of influenza identified was seasonal influenza A H3. Multiple surveillance systems in Florida, as well as nationally, showed that the severity of the 2008-2009 influenza season was mild and comparable to that in previous non-pandemic influenza seasons.

In April 2009, a novel strain of influenza A H1N1 was identified in California, and Florida began issuing guidance for diagnosing and investigating potential infections with this novel virus within the state. (A summary of the California index cases can be found in the April 24, 2009 MMWR: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5815a5.htm>). The new novel influenza A H1N1 virus had emerged in early 2009 in Mexico. Although it was an H1N1 influenza virus, it was different than the recent circulating seasonal H1N1 virus. The novel 2009 influenza A H1N1 virus was the result of a triple re-assortment with some genes from birds, pigs, and humans. The highest attack rate was in children and young adults. Adults born before 1957 had some pre-existing immunity to the new strain and were, therefore, relatively spared.

Figure 1 that follows depicts the overall 2009 Influenza A H1N1 Florida activity timeline of key events. Key events include: the CDC state conference call notifying states of the identification of the California index cases; the identification of the first suspected cases in Florida; the laboratory confirmation date of the first Florida case; and dates when key case reporting and surveillance guidance were issued. These events are referenced throughout the following influenza surveillance discussions.

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Figure 1. 2009 Influenza A H1N1 Florida Activity Timeline, Influenza-like Illness Visits (by Chief Complaint) to Emergency Departments (ED) as a Percentage of All ED Visits, Florida ESSENCE Participating Hospitals (N=138), Week 1, 2009 through Week 52, 2009



1. April 23-25, 2009
 - 4/23: CDC call with states – Situation Briefing
 - 4/24: First CHD Epidemiology Conference call – H1N1 Situation Briefing
 - Guidance issued: a) hospitals and clinicians b) sentinel physicians
 - 4/25: First suspect cases begin to be investigated by CHDs
2. April 26-May 2, 2009
 - 4/28: Outbreak module 1521 opened
 - 4/29: CHD notified of first H1N1 case
 - 5/1: Florida shifts to a community mitigation strategy
 - CDC Laboratory confirms first 2 Florida cases
3. May 7, 2009
 - Bureau of Laboratories begins RT-PCR testing for H1N1
4. August 3, 2009
 - H1N1 reporting guidelines change
5. September 4 -10, 2009
 - Influenza activity rises dramatically in multiple surveillance systems
6. October 5, 2009
 - First deliveries of H1N1 vaccine arrive in Florida

Influenza Surveillance in Florida

To collect information on seasonal influenza transmission, morbidity, and mortality in Florida, the Florida Department of Health (FDOH) maintains a number of influenza surveillance systems listed here and described in more detail in following sections. All of these systems were used during some phase of the pandemic and their strengths and weaknesses are discussed later, as well.

- Notifiable disease case reports
 - Influenza due to novel or pandemic strains
 - Pediatric influenza-associated mortality
- Bureau of Laboratories (BOL) viral strain surveillance
- Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) Emergency Department (ED) syndromic surveillance for
 - Influenza-like illness (ILI) chief complaints
 - ILI admissions from EDs
- Florida Pneumonia and Influenza Mortality Surveillance System (FPIMSS)
- County influenza activity code reporting
- Influenza and ILI outbreak reporting (through EpiCom)
- Florida Influenza-Like Illness Surveillance Network (ILINet) sentinel surveillance

2009 Influenza A H1N1 Case Report Data

Two specific conditions related to influenza are reportable. In preparation for an influenza pandemic, Florida made influenza due to novel or pandemic strains a reportable condition in 2006. Influenza deaths from seasonal or pandemic strains in people under 18 years old are also reportable. Individual infections due to seasonal influenza viruses are not currently reportable in Florida.

In the initial weeks of the pandemic, DOH sought case reports of all laboratory-confirmed cases of 2009 influenza A H1N1. On April 25, 2009, county health departments (CHD) began investigating the first cases of suspected infection in Florida, and by May 1, the CDC had confirmed the first two 2009 influenza A H1N1 cases in Florida. As 2009 influenza A H1N1 became more widespread, the reported cases of infection were recognized to be a substantial underestimation of the true number of infections across the state. On August 3, the guidelines for individual influenza case reporting were modified to include only people with life-threatening 2009 influenza A H1N1 illness, people who died, and pregnant women who were hospitalized with 2009 influenza A H1N1. All case reports, including those from special surveillance populations, were entered into Merlin, the state's internet-based system for notifiable disease reporting. An outbreak module was opened in the Merlin Outbreak Module four days after the first case was identified. Use of the Merlin Outbreak Module enhanced case reports by allowing a flexible set of survey questions to be attached to the electronic 2009 H1N1 case report, making it possible to collect and manage data electronically on demographics, underlying conditions, vaccination status, and other characteristics.

There were 5,291 cases of 2009 influenza A H1N1 infection reported during 2009. Figure 2 displays a timeline of these reports. The peak of 2009 influenza A H1N1 reporting was in week 29 (ending July 25), after which reporting declined due to the previously mentioned change

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in case reporting guidelines to include only special surveillance populations. Because of the change in case definition, laboratory-confirmed case data represented in Figure 2 that follows does not accurately represent the true level of morbidity caused in Florida by 2009 influenza A H1N1. The actual peak of 2009 influenza A H1N1 activity occurred in the early fall between weeks 35 and 43 (Figure 6).

Figure 2. Laboratory-Confirmed H1N1 Cases by week of Report, Week 1, 2009 to Week 52, 2009

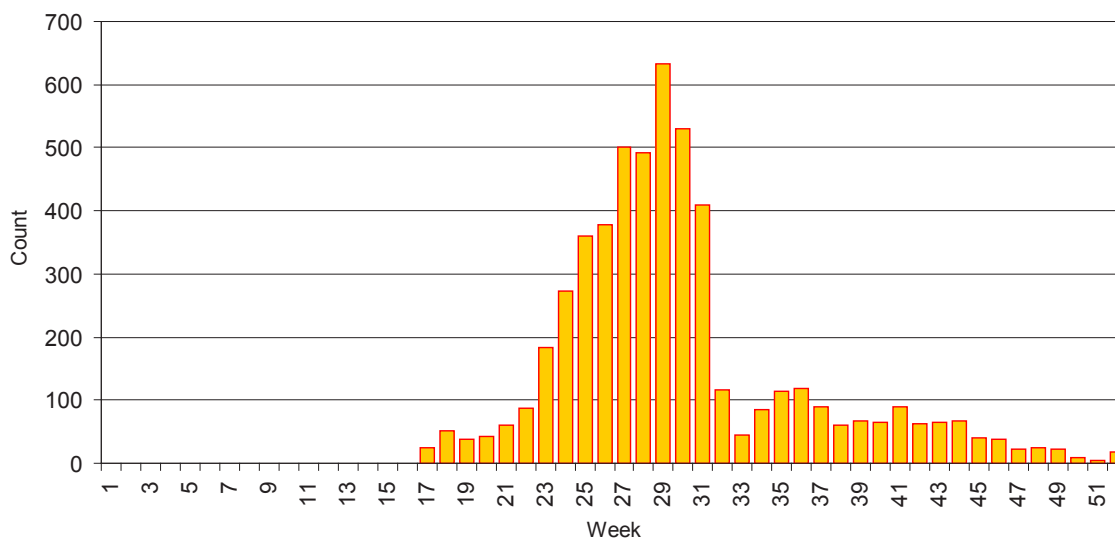
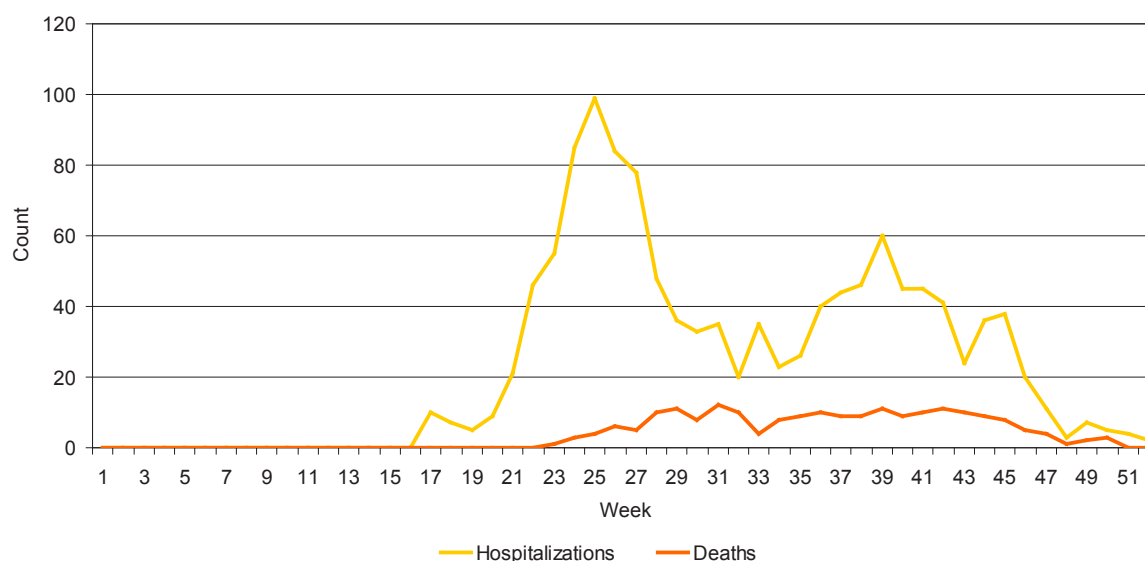


Figure 3 indicates that a first peak in confirmed 2009 influenza A H1N1 hospitalizations occurred before the change in case reporting guidelines, followed by a second peak in fall 2009. As publicity surrounding the developing pandemic escalated in April and May 2009, there was a sharp increase in hospital ED visits and hospitalizations. These were most likely “worried ill,” meaning that they were seeking care for mild respiratory symptoms that they were concerned might be 2009 influenza A H1N1 and for which, in a non-pandemic situation, they would not normally have sought care. Additionally, as anecdotal reports of severe illness in pregnant women increased, physicians became more likely to admit symptomatic pregnant women to the hospital even with relatively mild influenza. Therefore, the early peak is unlikely to represent the peak of influenza severity or distribution among the population. H1N1 death reporting did not have a similar early peak. Death reporting remained relatively consistent throughout the pandemic and was not subject to some of the biases that affected hospitalization and case reporting.

Figure 3. Total Deaths and Hospitalizations Per Week in Novel H1N1 Cases, Week 1, 2009 to Week 52, 2009



In 2009, there were 187 laboratory confirmed deaths of people with 2009 influenza A H1N1 and 1,204 laboratory confirmed hospitalizations reported. These counts are likely substantial underestimations of the total deaths and hospitalizations due to the novel virus for several reasons. At the height of the pandemic, the guidelines for testing and treatment were to treat all ILI as 2009 influenza A H1N1 because 100% of the detected circulating influenza strain was the new virus. As a result, many patients were treated empirically by their physicians without also being tested for influenza. Additionally, many who were tested by their physicians were tested using influenza A rapid tests that were not specific for 2009 H1N1 and that gave false negative results. Lab-confirmed influenza cases are only a small proportion of actual infections, because infected people may have had mild illness, not have sought care for their influenza illness, or not have been tested specifically for influenza.

As Figures 3 and 4 indicate, rates of 2009 influenza A H1N1 death and hospitalization were distributed unequally among different age groups. A death was recorded as a 2009 influenza A H1N1 death if the person was ill with laboratory-confirmed 2009 influenza A H1N1 at the time of death, regardless of the contribution to the cause of death from infection due the influenza virus. Hospitalizations were defined similarly. Rates of 2009 H1N1 death were highest in the 50- to 64-year-old age group, while rates of hospitalization were highest among the 0- to 4-year-old age group. Both death and hospitalization rates were relatively low for those 65 and older; a contrast from normal seasonal influenza in which the elderly are traditionally the most affected.

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Figure 4. Cumulative Laboratory-Confirmed Death Rate in Novel H1N1 Cases and Cumulative Deaths in Novel H1N1 Cases by Age Group through Week 52

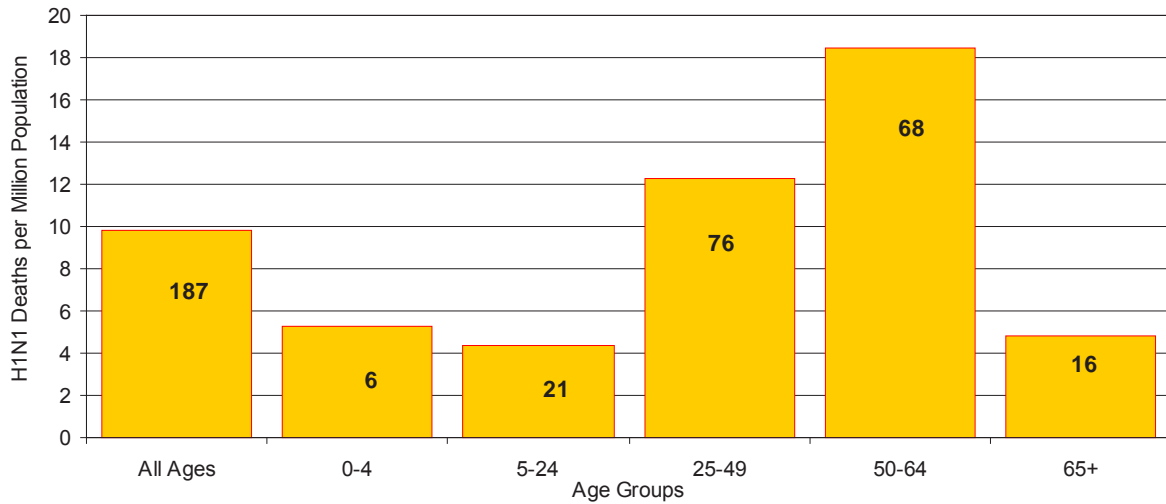
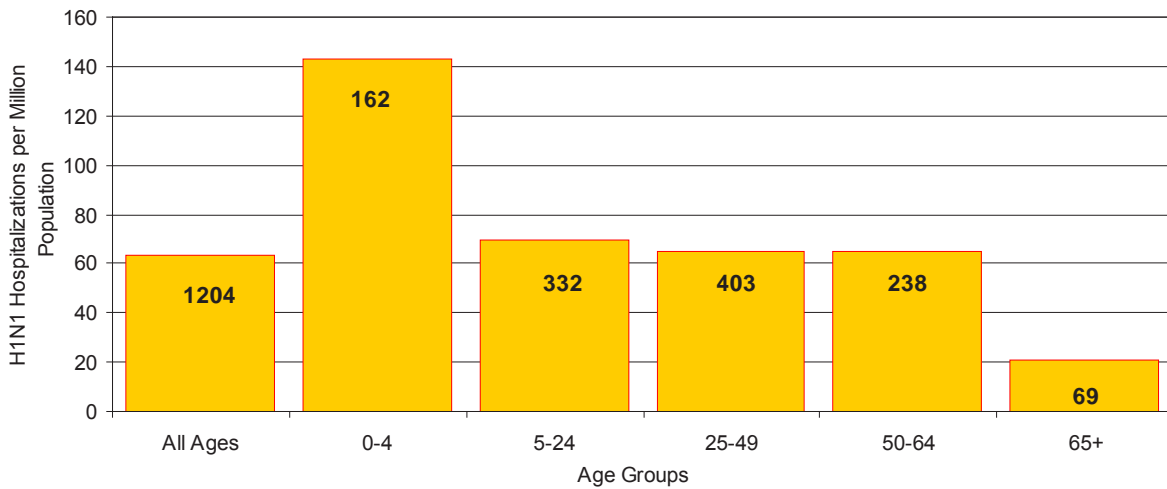


Figure 5. Cumulative Laboratory-Confirmed Novel H1N1 Hospitalization Rate and Cumulative Hospitalizations in Reported Novel H1N1 Cases by Age Group through Week 52, 2009



In addition to reporting infection with novel or pandemic strains of influenza, pediatric mortality due to all strains of influenza is reportable in Florida. In 2009, there were 13 deaths in children under age 18 from laboratory-confirmed influenza. The case definition for pediatric influenza mortality is different from the case definition that was adopted for 2009 influenza A H1N1. Pediatric influenza mortality cases are only reported after influenza is determined to be a main or directly contributing cause of death, as opposed to 2009 influenza A H1N1 deaths.

The extended information collected through the Merlin Outbreak Module made it possible to analyze novel H1N1 cases on a regular basis using a number of different variables. Among the analyses performed were studies on occupational risk of H1N1 infection, associations between age, race, ethnicity, and 2009 H1N1 infection, and the risk of severe H1N1 infection in pregnant women. Results from some of these analyses are published in the Florida Department of Health Bureau of Epidemiology's monthly newsletter, *Epi Update*, including:

- Race, Ethnicity, and Severe H1N1 Illness in Florida, 2009 http://www.doh.state.fl.us/disease_ctrl/epi/Epi_Updates/2010/January2010EpiUpdate.pdf
- Are Florida Healthcare Workers at Increased Risk of 2009 Influenza A H1N1 Infection? http://www.doh.state.fl.us/disease_ctrl/epi/November2009EpiUpdate.pdf

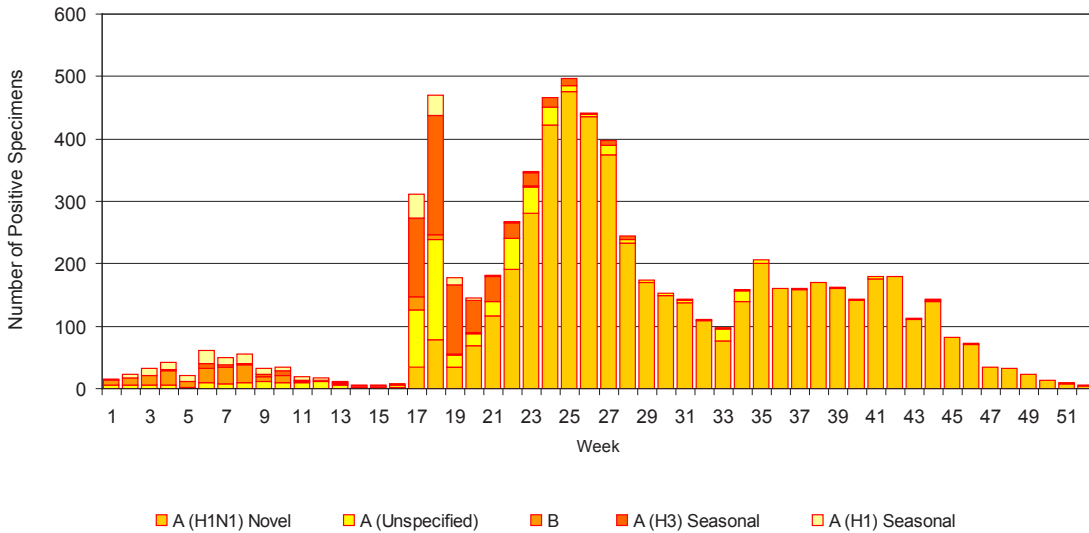
After the case reporting guidelines were changed to no longer require reporting of every case, surveillance systems other than notifiable disease reporting became even more important. In the absence of individual case reports for all Floridians with 2009 H1N1, each system contributed to a larger overall view of influenza activity.

Bureau of Laboratories (BOL) Viral Strain Surveillance

Figure 5 shows BOL influenza surveillance data for 2009. In the early months of 2009, the majority of influenza-positive isolates tested by the BOL were influenza B, although a substantial proportion tested positive for other strains such as seasonal influenza A H1. When the BOL was first able to test for the novel virus in week 17, the number of influenza laboratory submissions increased dramatically. During the early part of the pandemic, BOL was the only location in the state where testing to confirm 2009 influenza A H1N1 could be conducted, as no private laboratory had the appropriate reagents and testing capability. In April and May, the majority of the positive influenza results from the BOL were for other influenza types. Similar to the Merlin case data from Figures 1 and 2, there is a large peak around week 28, followed by a decrease when reporting guidelines were changed, then a sustained number of positive specimens over the late summer and early fall. This later peak (~weeks 35-43) coincides with the true peak in 2009 influenza A H1N1 activity. During the fall and winter of 2009, the new H1N1 virus predominated among influenza-positive laboratory submissions, with very few specimens testing positive for any other influenza viruses. Specimen submission and the total number of positive specimens declined after week 26 even though other influenza surveillance mechanisms showed that the virus was in wide circulation. The decreased number of submissions and positives most likely reflects the testing and treatment guidance that was issued during that period; namely that the vast majority of cases with influenza-like illness were infected with 2009 influenza A H1N1 and should be treated as such before, or in the absence of, positive test results. BOL specimen submission was limited to testing associated with a death, a patient with severe life threatening illness, outbreaks in defined settings, or if resistance to antivirals was suspected. In addition, laboratory testing to confirm 2009 influenza A H1N1 strain became available in the private sector. BOL laboratory surveillance data were extremely helpful in developing influenza treatment and testing guidance during the course of the pandemic.

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Figure 6. Number of Influenza-Positive Specimens Tested by the Florida Bureau of Laboratories (BOL) by Subtype by Lab Event Date* Week 1-52, 2009

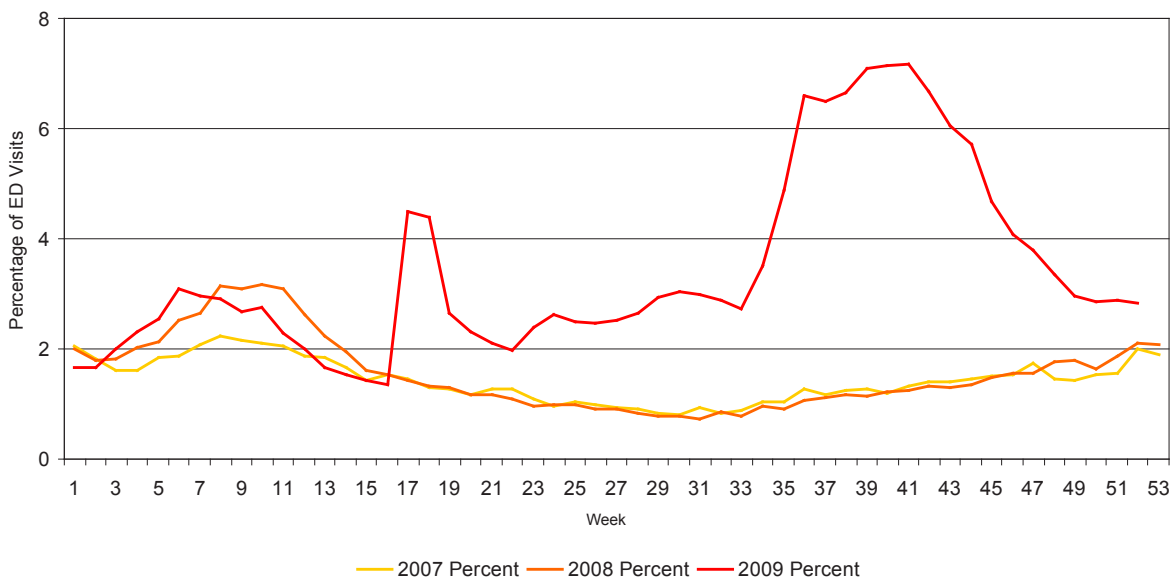


* Lab Event Date: The earliest of the following dates associated with the laboratory test result: date specimen collected, date specimen received by the laboratory, date reported, or date inserted.

Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE) Emergency Department (ED) Syndromic Surveillance:

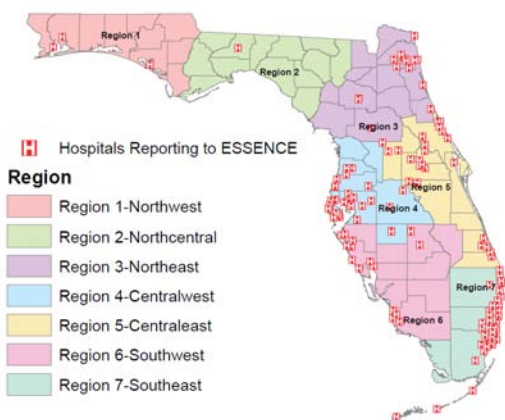
ESSENCE is Florida's ED syndromic surveillance system that compiles data from 138 hospital EDs, spread across every region of the state. The ESSENCE system provided near-real time information on ED chief complaints for ILI throughout the course of the epidemic, in addition to historical admissions data for ILI. Figure 7 provides the percentage of ED visits due to ILI for the years 2007 to 2009. The ESSENCE data show an initial surge in 2009 week 17, before the new H1N1 virus was in wide circulation, which was probably composed of people who were ill with something other than 2009 influenza A H1N1 and presented for care at the ED because they were concerned about possible infection with the pandemic virus. The data also show the large increase in ILI visits during the fall of 2009 compared with previous years. Because the ED data were not affected by the case definition changes, the peak of influenza activity seen in ESSENCE around week 42 probably reflects the true course of the epidemic better than case report counts. They were also more timely and complete than the reportable disease data, which helped the Bureau of Epidemiology stay up-to-date with influenza activity in Florida.

Figure 7. Influenza-like Illness Visits (by Chief Complaint) to Emergency Departments (ED) as a Percentage of All ED Visits, Florida ESSENCE Participating Hospitals (N= 138), Week 1, 2007 through Week 52, 2009

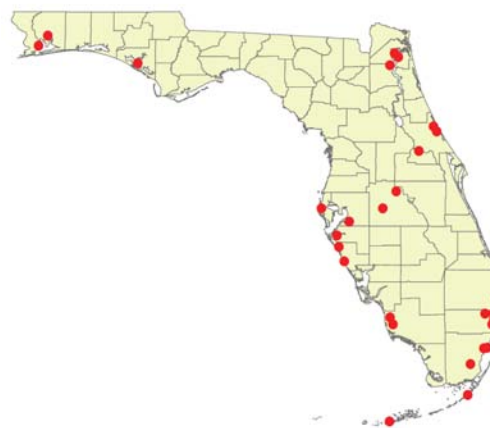


A subset of hospitals participating in ESSENCE were able to provide daily data about patients' ED discharge disposition. This provided information about the number of patients who presented to the ED for care that met the ILI case definition and were admitted to the facility. Information from these 30 facilities was used to assess the severity of the ILI ED visits.

Hospitals Reporting Emergency Department (ED) Data to Florida ESSENCE, April 20, 2010 (N=137)



Hospitals Reporting Emergency Department (ED) Admissions Data to Florida ESSENCE, April 20, 2010 (N=30)

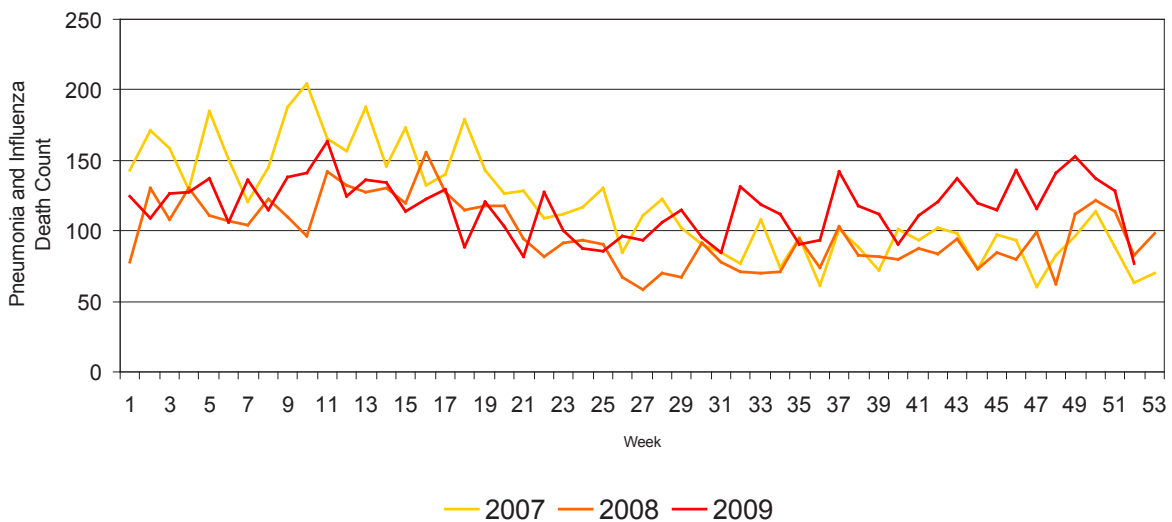


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Florida Pneumonia and Influenza Mortality Surveillance System (FPIMSS):

The FPIMSS uses death certificate data from the 24 largest Florida counties to track influenza mortality by counting deaths in which either pneumonia or influenza (P&I) are mentioned on the death certificate, regardless of underlying cause. Although the aggregate data collected in FPIMSS are not as detailed as those collected as part of reportable disease surveillance, the historical data collected in previous years provided a basis of comparison for the influenza mortality seen in 2009. According to FPIMSS data displayed in Figure 8, total P&I mortality in 2009, although concentrated in different age groups than previous seasons, was similar to that in previous influenza seasons in both total numbers and proportions. These results agreed with, and helped to validate, information from our other surveillance systems. FPIMSS is a broadly defined, timely indicator of P&I mortality, and it indicated that the change in case reporting requirements for 2009 influenza A H1N1 did not hide any substantial increases in influenza mortality.

Figure 8. Pneumonia and Influenza Deaths for 24 Florida Counties, 2007 (Weeks 1-52), 2008 (Weeks 1-53), and 2009 (Weeks 1-52)

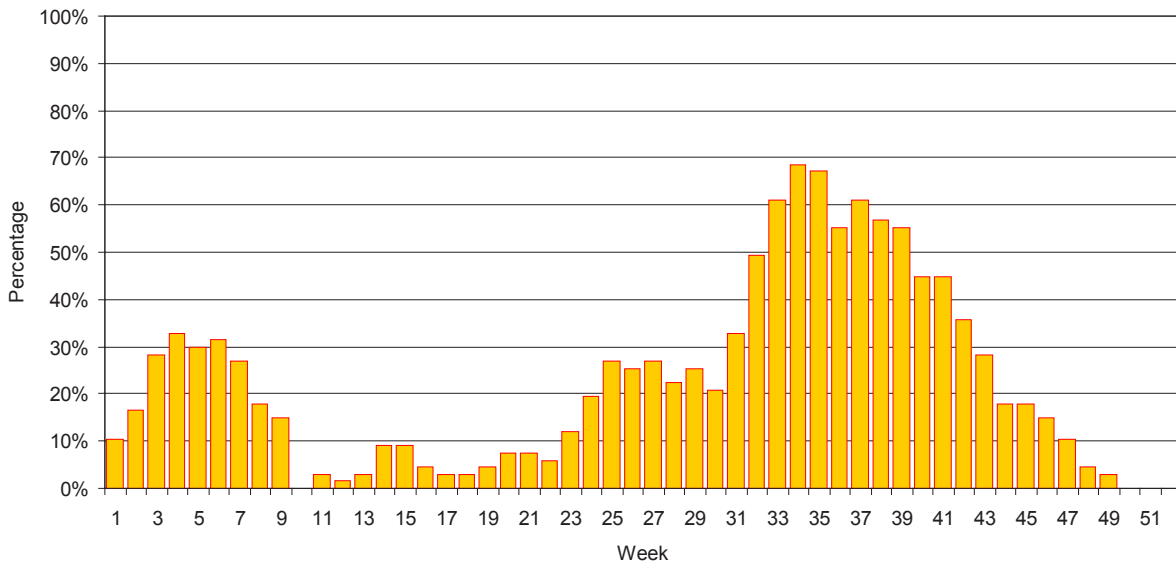


County Influenza Activity Code Reporting

Each week all county FDOH epidemiologists are asked to report on the level of influenza activity in their respective counties. There are two county influenza activity reporting mechanisms; the overall county influenza activity code, which collects a single report of influenza activity from each county, and an additional set of indicators that were started in response to the 2009 influenza A H1N1 pandemic. These new indicators display information about influenza activity at different sites (schools, businesses, jails) in their counties, and an assessment of whether influenza activity is increasing, decreasing, or at a plateau.

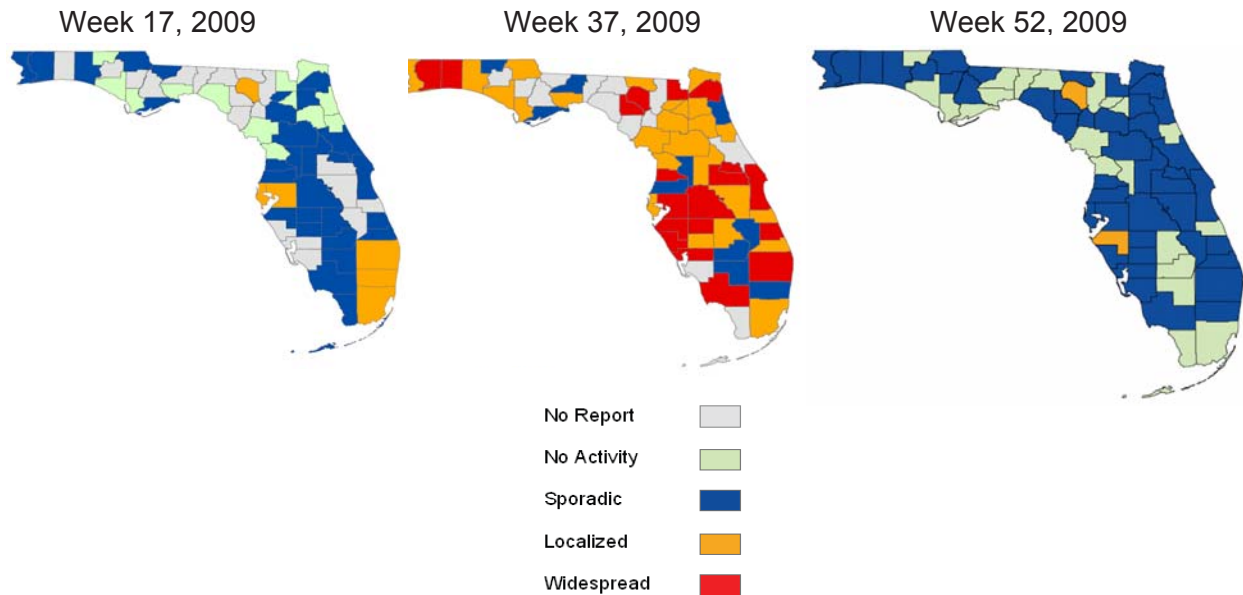
Overall county weekly influenza activity was reported as one of four codes: no activity, sporadic, localized, or widespread. Figure 9 shows the percentage of counties that reported either localized and widespread activity each week. The number of counties reporting localized or widespread activities shows a similar pattern of influenza activity to that seen in the other surveillance systems that were not affected by the change in individual case reporting requirements. These systems provided valuable data about the progression of influenza activity in each county, and the site-specific data helped pinpoint areas of special concern.

Figure 9. Percentage of Counties Reporting Localized or Widespread Activity into County Flu Activity Code, Weeks 1-52, 2009



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Map 1. County Flu Activity Codes by County, 2009



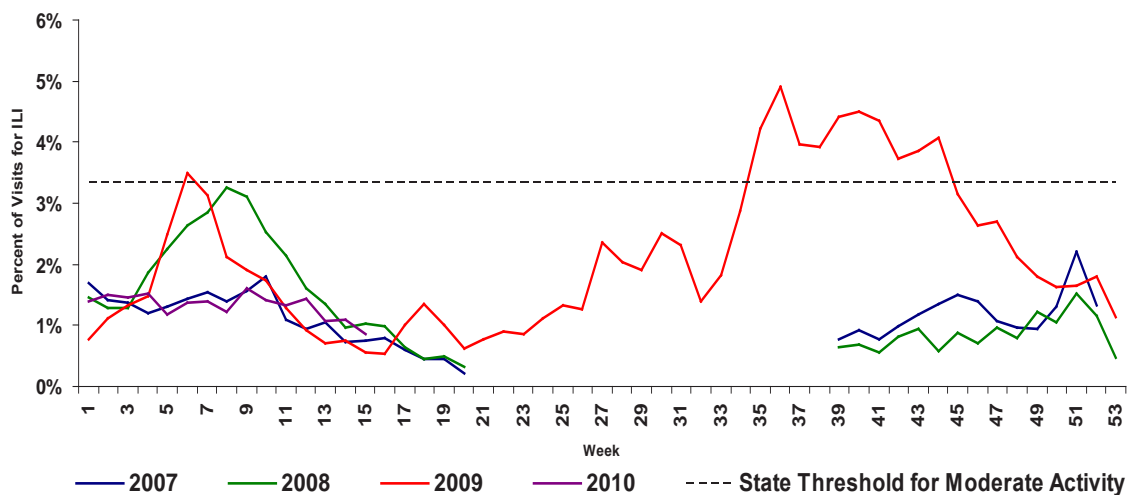
Influenza and ILI Outbreak Reporting (through EpiCom)

Outbreak reporting into EpiCom (Florida's electronic, secure, threaded, moderated notification system) helped identify the specific settings where influenza clusters and outbreaks were occurring. Outbreak setting information collected through EpiCom shows that a majority of outbreaks occurred in settings where children were present. In 2009, there were 426 confirmed or suspected outbreaks of 2009 influenza A H1N1 or ILI, most of which occurred in schools (60.3% of outbreaks), summer camps (11.7%), day care centers (6.3%), and correctional facilities (5.4%). This information helped characterize the burden from 2009 influenza A H1N1 and inform interventions and guidance during the pandemic. More detailed outbreak reports can be found in "Section 6: Summary of Notable Outbreaks and Case Investigations, 2009" under the "Influenza" heading.

Florida Influenza-Like Illness Surveillance Network (ILINet) Sentinel Surveillance

The Influenza-Like Illness Surveillance Network (ILINet), which collects specimens and ILI reports (Figure 10) from sentinel physicians across the state, was useful in reinforcing the information collected by other surveillance systems. Specimens submitted by physicians participating in the ILINet program were consistently identified as 2009 influenza A H1N1, which reinforced the idea that this novel virus was causing the vast majority of ILI and that laboratory confirmation of each case of illness was not always necessary.

Figure 10. Percentage of Visits for Influenza-Like Illness Reported by ILINet Sentinel Providers Statewide, 2007 (Weeks 1-20, 40-52), 2008 (Weeks 1-20, 40-53), 2009 (Weeks 1-52), and 2010 (Weeks 1-15) as Reported by 5:00 p.m. April 20, 2010



Summary:

Each of the surveillance systems used during the 2009 H1N1 pandemic (including notifiable disease reporting) had its own strengths and weaknesses. Combined, these systems provided timely, accurate information on the pandemic, which helped inform clinicians, policymakers, and the general public.

Information from the previously mentioned surveillance systems was monitored on a daily and weekly basis and used in a variety of reports, including the weekly influenza surveillance report, “Florida Flu Review”, available online at: http://www.doh.state.fl.us/disease_ctrl/epi/swineflu/Reports/reports.htm.

