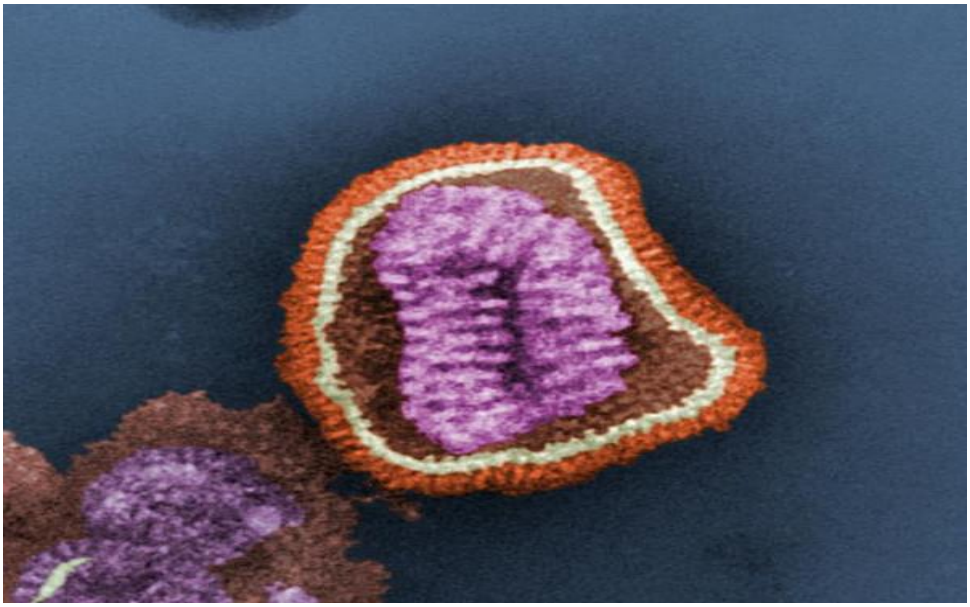
INFLUENZA IN MARYLAND 2012-2013 SEASON REPORT



October 2012 to May 2013

The 2012-13 influenza season was the most active since the 2009 H1N1 influenza pandemic. By some measures, it was more active and more severe than the pandemic. All three major influenza strains were circulating. Influenza type A (H3N2) was the predominant strain, followed by influenza type B, and then type A (H1N1). Over 3,000 influenza-associated hospitalizations and over 5,600 laboratory-confirmed cases were reported in Maryland. The season saw two peaks of activity, one in December and another in March 2013, corresponding to peak influenza type A (H3N2) activity then influenza type B activity. Nationally, circulating influenza A viruses were an excellent match to this season's vaccine (99.5% of isolates tested), but influenza B isolates were less well matched (66.3% of isolates tested).]

Influenza in Maryland 2012-2013 Season Report

OCTOBER 2012 TO MAY 2013

DIFFERENT TYPES OF INFLUENZA SURVEILLANCE

Surveillance is the systematic collection and analysis of data, and the distribution of the information derived from that data to support public health action and decision making. In Maryland, several different systems are used to collect influenza data, and they are discussed below. Epidemiologists at the Maryland Department of Health and Mental Hygiene (DHMH) analyze the data, and weekly influenza surveillance reports are published from October to May. This is the final report for the 2012-2013 influenza season, and it contains a description of the different types of surveillance used, followed by a summary of the entire season's observations. It concludes with suggested readings for more information on influenza, influenza epidemiology, and influenza surveillance.

Syndromic Surveillance

Syndromic surveillance is surveillance that looks for cases based on clinical syndromes – combinations of signs and symptoms – rather than laboratory diagnoses. We currently use four systems for syndromic surveillance of influenza. Two of these systems rely on people with symptoms of influenza seeking medical care, while the other two use web technology to track cases of influenza-like illness (ILI) who may not necessarily come into contact with healthcare. ILI is a surrogate indicator for influenza during the flu season and in the absence of laboratory testing. The additional tracking of ILI rather than only influenza cases confirmed by laboratory tests gives us access to much more information about the impact of influenza in the community.

ILINet

The U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet) is a network of healthcare providers ("sentinel providers") who report, on a weekly basis, the total number of patients visiting their practices for **influenza-like illness** (ILI). For this system, ILI is defined as a fever (greater than or equal to 100 degrees Fahrenheit) and a cough, or a fever and a sore throat, so long as the sore throat is not known to be the result of another illness, like strep throat. The Centers for Disease Control and Prevention (CDC) manage ILINet in collaboration with the influenza surveillance coordinators in states and territories. In Maryland, a total of 20 sentinel providers participated in ILINet during the 2012-13 influenza season. For proper coverage of the population under surveillance, a ratio of one sentinel provider per 250,000 residents is recommended. For Maryland, 24 sentinel providers would meet this recommendation.

ILINet ILI = Fever + Cough,
Or
Fever + Sore Throat

ESSENCE ILI Surveillance

The Office of Preparedness and Response (OPR) at DHMH uses the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) to keep track of visits to emergency departments for ILI. For this system, the definition of ILI is similar to the one used in ILINet. A person with a chief complaint of fever and a cough or fever and a sore throat, or complaining of "influenza" is classified as an ILI case in ESSENCE. Each week, OPR epidemiologists analyze the data reported from 45 emergency departments and share their findings with the

ESSENCE ILI = Fever + Cough,
Or
Fever + Sore Throat
Or
Chief Complaint of "Influenza"

influenza surveillance coordinator in the Office of Infectious Disease Epidemiology and Outbreak Response (OIDEOR). These two systems rely on contacts with healthcare in order to to count cases. That is, people who are not sick enough or do not have access to healthcare are not counted as ILI cases.

Non-Healthcare System Internet-Based Influenza Surveillance

Two systems are used to count cases of ILI in persons who may not come into contact with the healthcare system. First is the Maryland Resident Influenza Tracking System (MRITS), an email-based surveillance system where participants who register with the system are asked once a week if they experienced any symptoms of ILI. If they respond in the affirmative, they are then asked if they sought care for their symptoms, if they traveled in the week before their onset of symptoms, and if they missed any regular daily activities because of their symptoms. Upon registering and at the beginning of the influenza season, participants are asked about their influenza vaccination status and whether or not they work in a healthcare setting. This information can also be updated as necessary.

MRITS was the first flu surveillance system of its kind in the US. It was modeled after a similar system in Australia.

The other system used to track individuals who may not seek medical care is Google Flu Trends. Google analyzes queries made to their web search engine to determine if the user making the query is experiencing ILI. This is done through a computerized algorithm that determines if the search (e.g. "Flu Symptoms"), the time of the search (e.g. February vs. June) and the location of the search (e.g. an area known to have elevated influenza activity) indicate that the user has ILI. The system is hosted by Google, and the data are freely available for download at http://google.org/flutrends.

Data from ILINet from previous influenza seasons was used to calibrate the computer algorithm used in Google Flu Trends.

Laboratory Surveillance

There are many different types of laboratory tests available to detect influenza. The most simple and widely available tests are called "rapid influenza screening tests." These tests are done in hospitals, physician offices or urgent care centers. They are fast, easy to perform, and the results are interpreted as "positive" or "negative." In most cases, the rapid test can differentiate between type A and type B influenza. Rapid tests cannot distinguish between different subtypes of influenza (e.g. H3N2 vs. H1N1). This season, 39 clinical laboratories in 18 counties and Baltimore City agreed to report the total number of rapid tests performed each week along with the results.

This season, four influenza subtypes were identified in Maryland by laboratory surveillance:

- **Type A (H1N1)**
- **Type A (H3N2)**
- **Type B, Yamagata Lineage**
- **Type B, Victoria Lineage***

***Not included in seasonal vaccine**

The Maryland DHMH State Laboratories Administration performs complex laboratory tests on respiratory specimens to detect and identify influenza virus. These tests are polymerase chain reaction (PCR) and viral culture. PCR tests do not require a viable (living) virus in the specimen since they detect the viral genetic material (RNA). On the other hand, viral culture requires viable virus in the specimen in order to grow in culture. Both of these tests are similar in their ability to properly detect influenza virus. Both PCR and culture provide the ability to determine the subtype of the influenza virus in the specimen (e.g. H1N1 vs. H3N2).

Influenza-Associated Hospitalizations

The Emerging Infections Program (EIP) at DHMH conducts active surveillance of laboratory-confirmed influenza-associated hospitalizations in Maryland. EIP staff members go to hospitals and review medical charts of people who were hospitalized and had a positive influenza test of any kind. These chart reviews are extensive, and they help to accurately describe severe cases of influenza (those requiring hospitalization) in order to identify co-morbidities and other factors that may exacerbate the symptoms of influenza. All 46 acute care hospitals participate in weekly reporting of the numbers of influenza-associated hospitalizations.

Influenza-Associated Pediatric Mortality

Maryland participates in national tracking of deaths of persons under 18 who had a positive influenza test during their course of illness leading to death, and for whom no other disease or condition can be established.

During the 2012-2013 influenza season, five such cases were reported to DHMH. Due to confidentiality considerations, details of these cases are not discussed in this report. Please refer to the additional readings section at the end of this report for more information on influenza-associated pediatric deaths in the United States.

Outbreaks of Influenza in Institutional Settings

In Maryland, health regulations mandate that all disease outbreaks should be reported to public health authorities. For influenza surveillance, data collected during the investigation of all respiratory disease outbreaks are analyzed. These data help guide the response to the outbreak to control the spread of infection as well as to prevent future outbreaks. The investigation of outbreaks is done in collaboration with local health departments and staff at the facilities where the outbreaks occur.

Influenza Geographic Spread and Intensity

Every week, the influenza surveillance coordinator consults with the state epidemiologist to determine the extent of influenza's geographic spread. This geographic spread is based on a number of variables, including the number of laboratory-confirmed cases, the proportion of visits for ILI to sentinel providers, and the locations of these cases. There are five levels of geographic spread, from "no activity" to "widespread." These levels do not indicate the severity of the flu season, only where influenza may be active. The different 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.

Maryland consists of five surveillance regions:

- **Baltimore Metro:** Baltimore City along with Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties.
- **Eastern Shore:** Caroline, Cecil, Dorchester, Kent, Queen Anne's, Somerset, Talbot, Wicomico, and Worcester Counties.
- **National Capital:** Frederick, Montgomery, and Prince George's Counties
- **Southern Maryland:** Calvert, Charles, and St. Mary's Counties
- **Western Maryland:** Allegany, Garrett, and Washington Counties

Current and historical geographic spread data may be accessed at http://www.cdc.gov/flu/weekly/WeeklyFluActivityMap.htm.

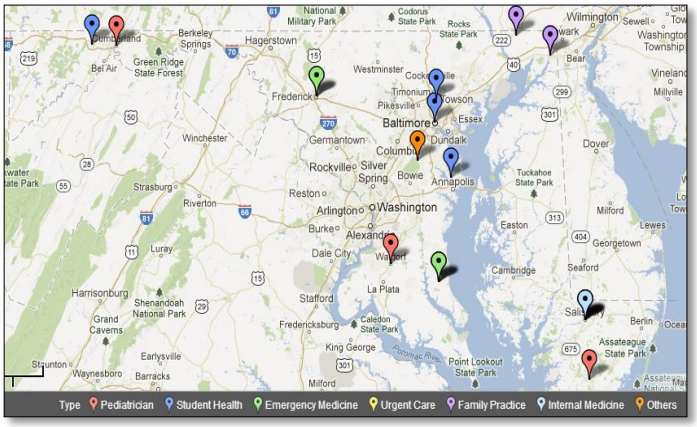
Beginning with the 2008-2009 influenza season, CDC has been reporting the level of intensity of influenza-like illness in the United States. This "ILI Activity Level" has 10 levels from "minimal" to "high." This level is determined by comparing the number of ILI cases reported through ILINet with the season's "baseline" level. This baseline level is the proportion of visits to sentinel providers when there is no laboratory confirmed influenza, and it is subject to change from one season to the next. Current and historical intensity data can be accessed at http://gis.cdc.gov/grasp/fluview/main.html.

INFLUENZA SURVEILLANCE DATA RESULTS

In the following sections, the data collected during the 2012-2013 influenza season with the systems described above will be displayed. Whenever possible, an analysis of those data will be included. It should be noted that the data are subject to change even after the final drafting of this report as more data are reported from the participants in the different systems.

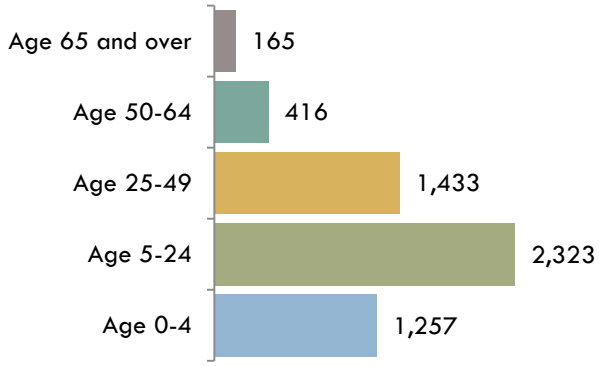
ILINet

During the season, a total of 20 sentinel providers participated in influenza surveillance. Of those, 14 (70%) reported their findings 16 or more weeks during the influenza season – more than half of the time. Five of the sentinel providers practice medicine in student health settings, followed by four in family practice, three in internal medicine, and three in pediatrics. Two providers practice in emergency medicine settings, two others in urgent care, and one in an OB/GYN practice. There are sentinel providers in Allegany, Anne Arundel, Baltimore, Calvert, Cecil, Charles, Frederick, Wicomico, and Worcester counties.

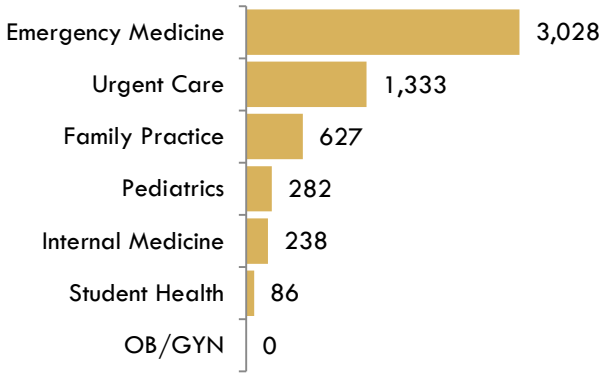


LOCATION AND TYPES OF PRACTICE OF SENTINEL PROVIDERS IN MARYLAND

Of the 263,016 total visits to all sentinel providers during the season, 5,594 (2.1%) were for ILI. Most of the ILI visits were in the 5-24 age group, followed by the 25-49 age group and the 0-4 age group. The 50-64 and over 65 age groups together made up only 10% of all ILI visits to sentinel providers.

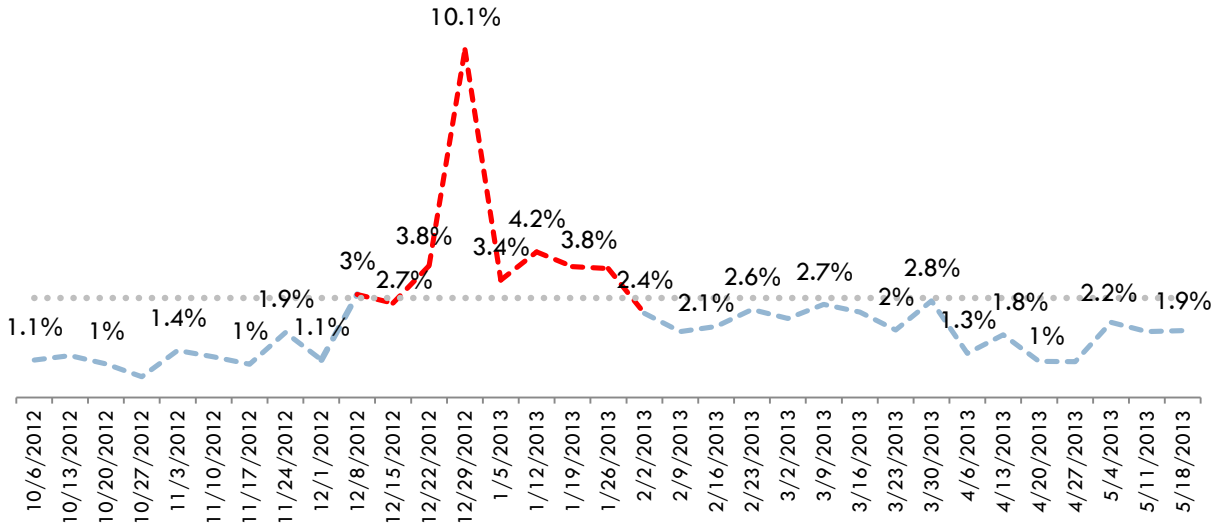


NUMBER OF ILI VISITS TO SENTINEL PROVIDERS BY AGE GROUP



NUMBER OF ILI VISITS TO SENTINEL PROVIDERS BY PRACTICE TYPE

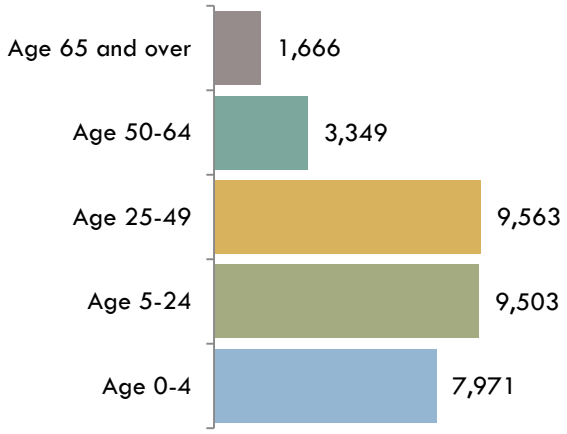
Broken down by week, we can see (below) that the proportion of visits for ILI to sentinel providers began to rise in December 2012, peaked in January 2013, and then progressed on a downward trend from mid-January to May. The highest proportion of visits for ILI reported was 10.1% during the week ending December 29, 2012. The baseline proportion of visits for ILI is 2.9% for Maryland – the horizontal dotted line on the graph. The first week that rates of ILI visits to sentinel providers were greater than the baseline rates of ILI visits was the week ending December 8. The level dropped slightly below baseline the following week, but rates were then above that proportion for six continuous weeks between late December and late January.



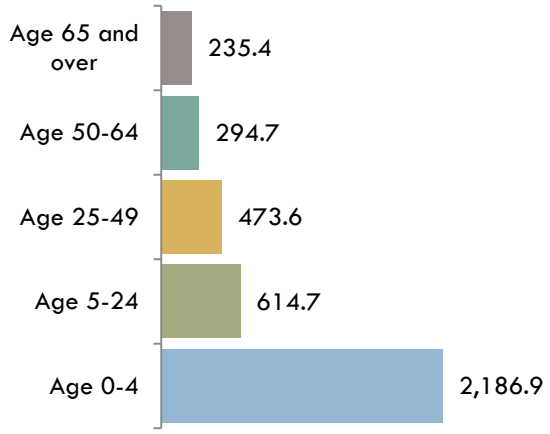
PROPORTION OF VISITS TO SENTINEL PROVIDERS FOR ILI BY WEEK (RED LINE INDICATES WEEKS ABOVE BASELINE)

ESSENCE ILI Surveillance

There were a total of 1,543,630 visits to emergency departments reported this season through ESSENCE. Of those, 32,052 (2.1%) were visits with a chief complaint of ILI. Most of the ILI visits were by people in the 25-49 age group, followed closely by the 5-24 age group and the 0-4 age group. However, adjusted for population, the 0 to 4 age group had the highest rate of visits per 100,000 residents. Whenever an abnormal or unexpected increase in ILI chief complaints at a hospital was detected, epidemiologists from OPR, OIDEOR, and the local health departments investigated the situation and acted if necessary.

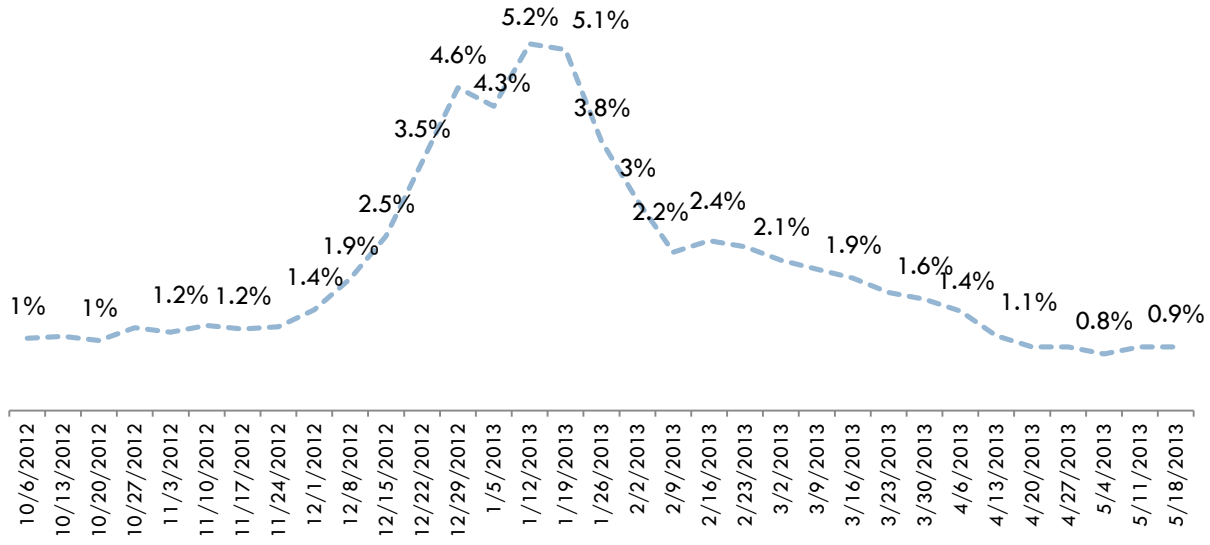


VISITS TO EMERGENCY DEPARTMENTS FOR ILI BY AGE GROUP



VISITS TO EMERGENCY DEPARTMENTS FOR ILI BY AGE GROUP PER 100,000 POPULATION (BASED ON 2010 CENSUS DATA)

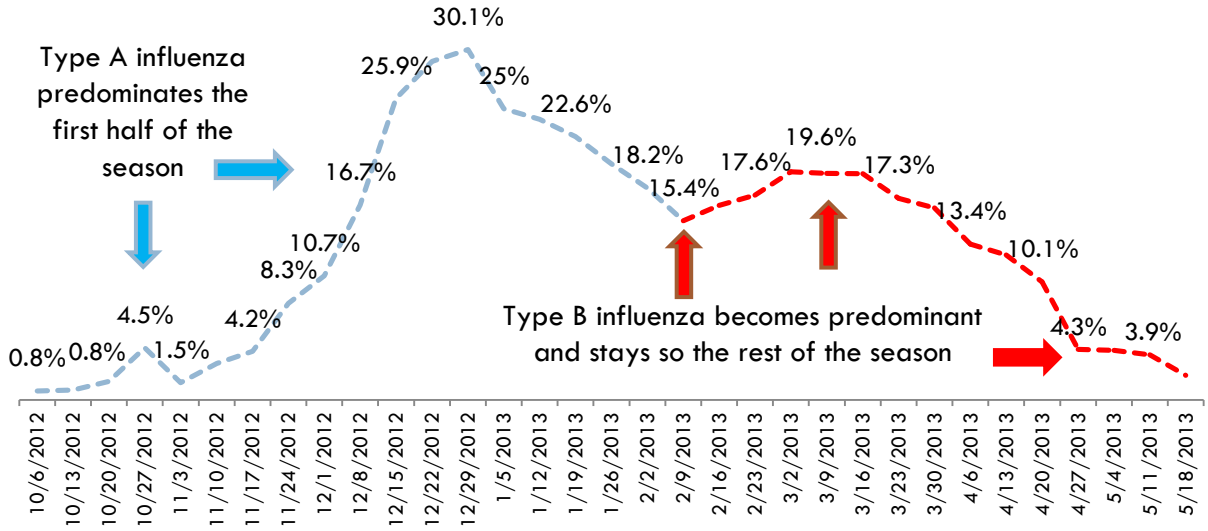
Looking at the data by week (below), the proportion of visits to emergency departments for ILI was steady at around 1% from October to December 2012. Mid-December, the proportion increased each week, peaking at 5.2% during the week ending January 12, 2013. This elevated proportion remained around 5% for one more week before beginning a steady decline back toward 1% through February and March.



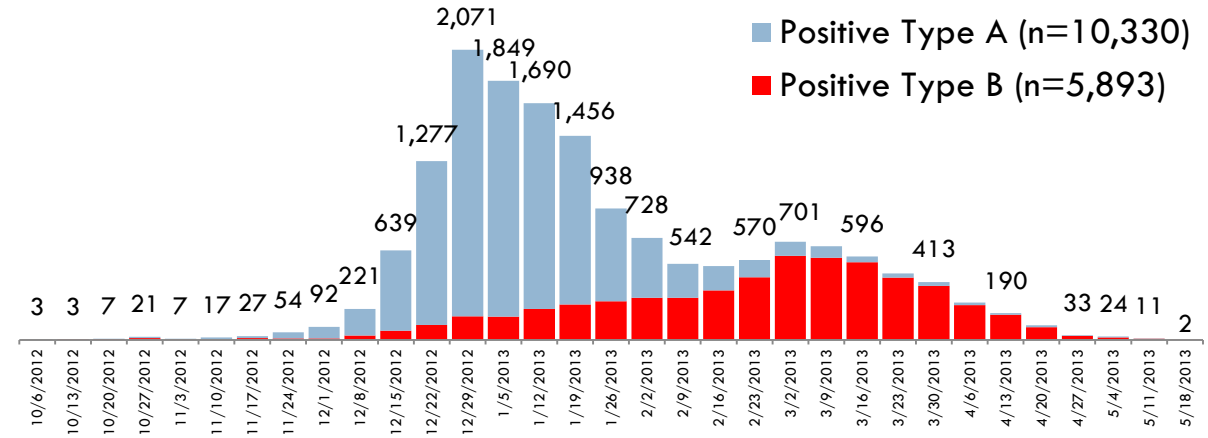
PROPORTION OF VISITS TO EMERGENCY DEPARTMENTS WITH CHIEF COMPLAINT OF ILI BY WEEK

Rapid Laboratory Testing

This season, 39 clinical laboratories agreed to report the total number of rapid influenza tests they performed along with the number of positive tests and the proportion of positives that were type A or type B. Of those 39 laboratories, 24 (62%) reported more than 16 weeks during the season, and the rest reported at least one week. The graph below shows that the proportion of positive tests began to increase rapidly in early November 2012, peaking at 30.1% during the week ending December 22. From that week to the week ending February 9, 2013, the proportion of rapid positive tests declined. Then, the proportion increased again, peaking at 19.6% in the week ending March 9. Since that week, the proportion steadily declined. In addition to the "rebound" seen in February, type B influenza positive tests outnumbered type A after the week ending February 9.



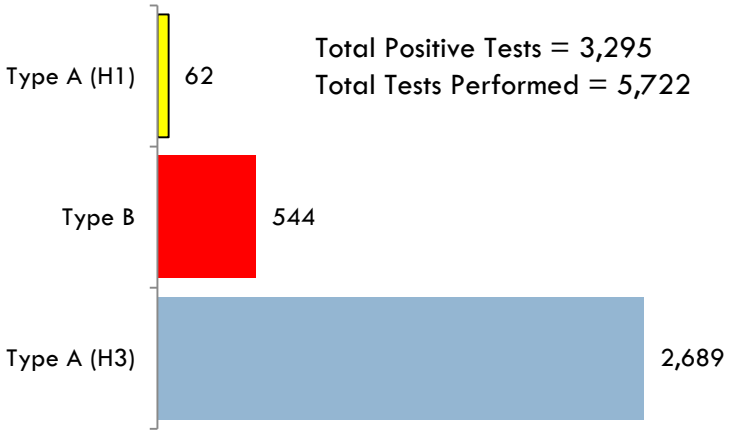
PROPORTION OF RAPID POSITIVE INFLUENZA TESTS BY WEEK (RED LINE INDICATES WEEKS WITH TYPE B INFLUENZA PREDOMINANCE)



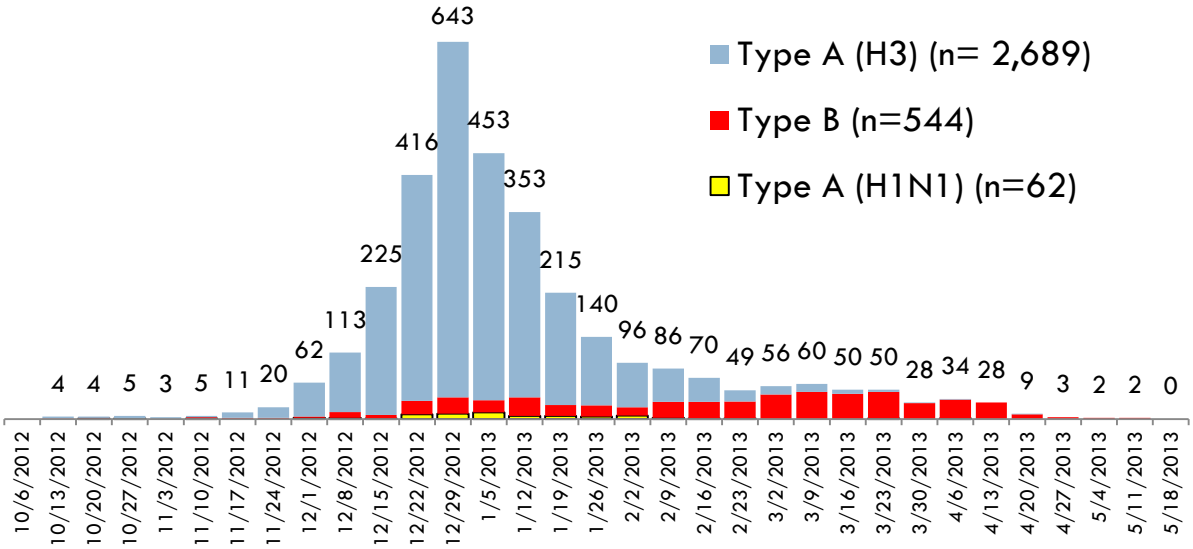
NUMBER OF RAPID POSITIVE INFLUENZA TESTS BY TYPE (A/B) AND WEEK

Influenza Testing at the State Laboratories Administration

The DHMH State Laboratories Administration performed a total of 5,722 PCR tests for influenza. Of those, 3,295 (58%) were positive. These specimens came from throughout the state and were submitted by ILINet sentinel providers, sentinel clinical laboratories, hospital laboratories, private practitioners, and by local health departments as part of outbreak investigations. The first PCR-positive specimens were collected during the week ending October 13, 2012. From then on, the number of positive tests steadily increased, peaking during the week ending December 29, when 781 specimens were tested and 643 (82%) of those were positive. Similar to the rapid testing results, the number of type B influenza positive specimens exceeded the number of type A positive specimens beginning in February 2013. Type B influenza remained the predominant strain for the rest of the season. Type A (H1N1), the 2009 pandemic strain, was virtually undetected throughout the season, with only 62 (2%) of specimens testing positive for that strain. (PCR testing is considered more accurate than rapid testing.)



NUMBER OF PCR-POSITIVE TESTS BY INFLUENZA TYPE AND SUBTYPE REPORTED BY THE DHMH LABORATORIES ADMINISTRATION

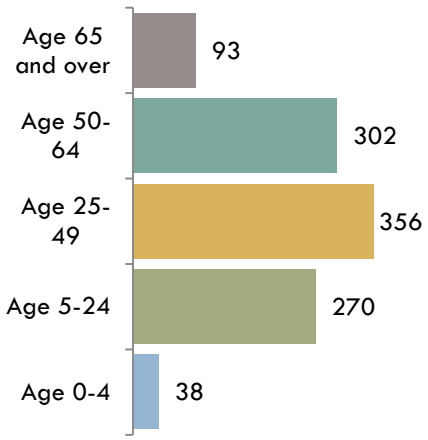


NUMBER OF PCR-POSITIVE TESTS BY INFLUENZA TYPE AND SUBTYPE AND WEEK REPORTED BY THE DHMH LABORATORIES ADMINISTRATION

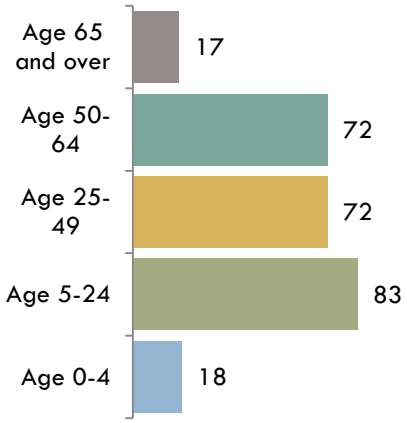
Maryland Resident Influenza Tracking Survey (MRITS)

The number of participants in MRITS increased through the flu season from 1,828 at the beginning of the season to 2,009 at the end. Of all participants enrolled, 1,059 responded at least once during the season, with 613 (58%) responding more than half of the weeks. The median age of MRITS participants who responded to the weekly surveys was 42.7 years. About 47% of the children ages 0 to 4 for whom their parents responded were reported to have ILI at one point during the season. However, none of these children with ILI were reported to have been taken to see a healthcare provider for their symptoms.

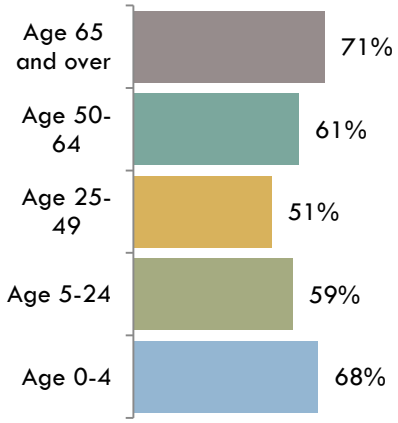
On the other hand, 17 (18%) of participants over the age of 65 reported ILI at one point during the season, with 16 (94%) of them reporting seeking care from a healthcare provider for their symptoms. Seasonal influenza vaccination rates of participants ranged from 51% in the 25 to 49 age group to 71% in the 65 and over age group.



AGE DISTRIBUTION OF MRITS RESPONDERS

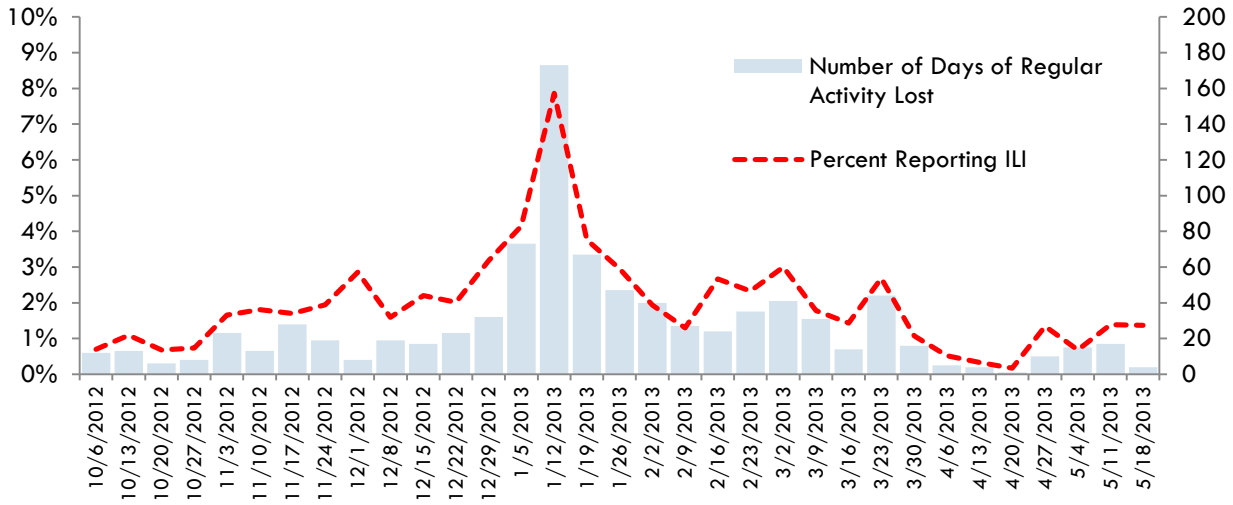


AGE DISTRIBUTION OF MRITS RESPONDERS REPORTING ILI



VACCINATION RATE BY AGE GROUP OF MRITS RESPONDERS

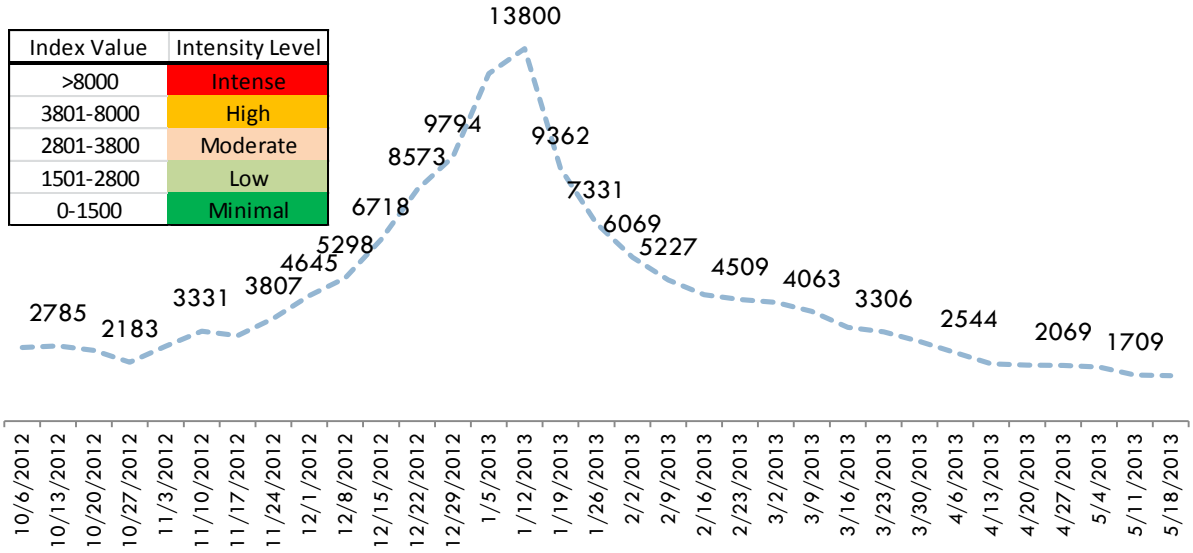
During the season, an average of 30% of participants reported their symptoms during the weekly surveys. The proportion of MRITS participants reporting ILI remained low through December 2012. Beginning in late December, a steady increase was observed until a peak occurred for the week ending January 12, 2013. That week, 7.9% of respondents reported ILI and a cumulative 173 days of regular daily activities missed. Of the 380 participants that reported ILI at one time or another during the influenza season, 140 (37%) did not seek medical care of any kind for their symptoms.



PROPORTION OF MRITS PARTICIPANTS REPORTING ILI AND CUMMULATIVE NUMBER OF DAYS OF DAILY ACTIVITY LOST PER WEEK

Google Flu Trends

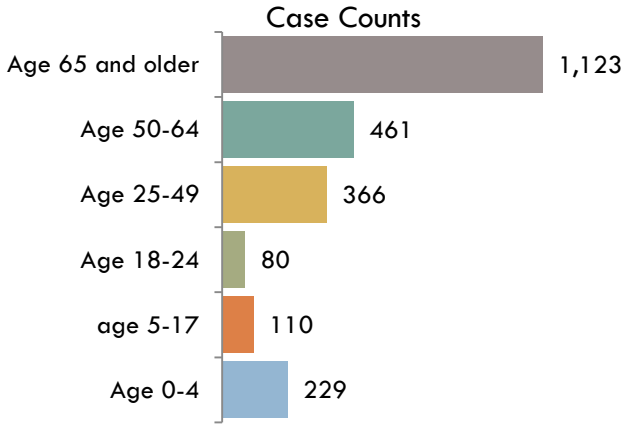
The Google Flu Trends activity index remained steady through November 2012 when an increase in ILI and influenza-related web searches began to be detected. This increase would continue through December and peak during the week ending January 12, 2013. From then on, the activity decreased steadily, returning to "low" activity by April. To access an interactive tool for visualizing Google Flu data, please visit http://google.org/flutrends. (There are other tools on that site to visualize other syndromes being tracked via Google, including some experimental visualizations.)



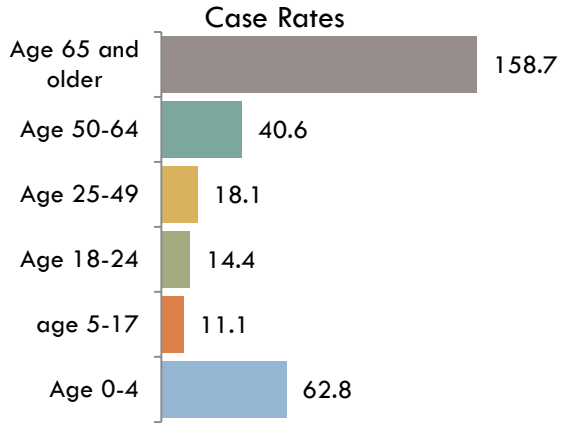
GOOGLE FLU ILI ACTIVITY INDEX BY WEEK

Influenza-Associated Hospitalizations

A total of 2,369 influenza-associated hospitalizations were reported to the Emerging Infections Program at DHMH during the season. Almost half of those hospitalizations (1,123, 47%) were people over the age of 65. That age group was followed by persons in the 50 to 64 age group (461, 19%). The 18 to 24 age group made up the least number of hospitalizations (80, 3%). Even when adjusted for population size, the 65 and older age group had the highest rate of hospitalizations (158.7/100,000 population).

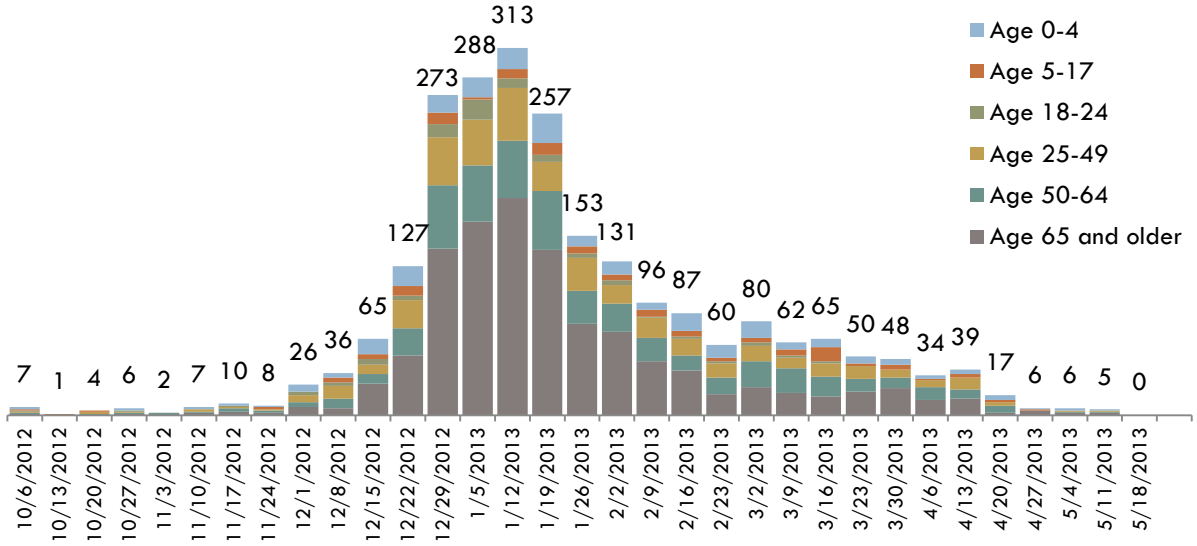


INFLUENZA-ASSOCIATED HOSPITALIZATIONS BY AGE GROUP



INFLUENZA-ASSOCIATED HOSPITALIZATIONS BY AGE GROUP PER 100,000 POPULATION (BASED ON 2010 CENSUS DATA)

The number of reported hospitalizations began to rise steadily during the week ending December 1, 2012. There was a spike in the number of reported hospitalizations from the week ending December 22 to the week ending December 29, when the count went from 127 to 273. The number of hospitalizations then continued to increase, peaking at 313 hospitalizations during the week ending January 12, 2013. Since that week, the number of hospitalizations reported each week declined steadily across all age groups.



NUMBER OF INFLUENZA-ASSOCIATED HOSPITALIZATIONS BY AGE GROUP AND WEEK

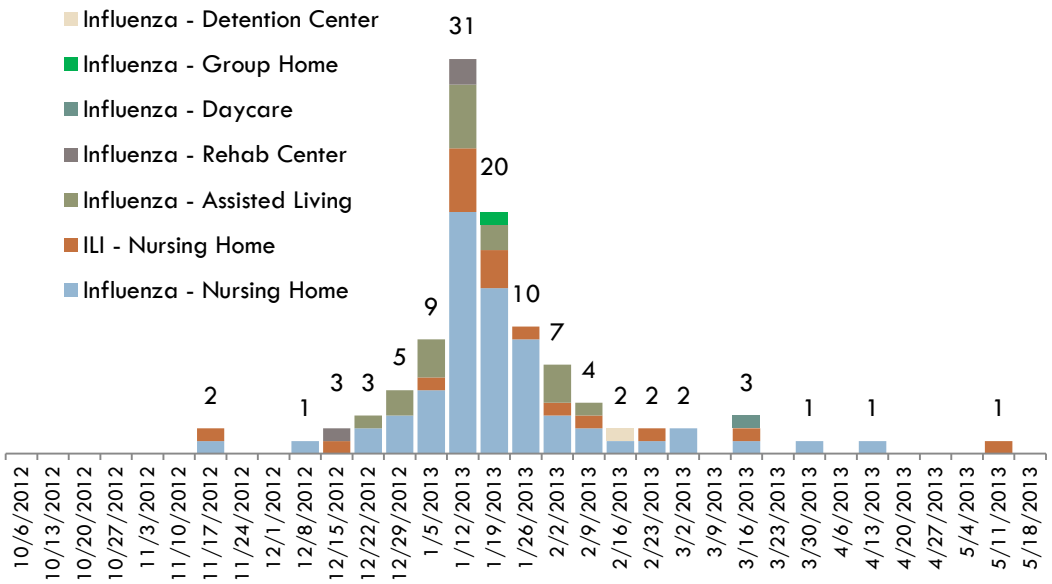
Outbreaks of Influenza in Institutional Settings

During this season, most of the 107 reported outbreaks of influenza and ILI occurred in nursing homes (82, 77%) and assisted living facilities (17, 16%), followed by rehabilitation centers (3, 3%), elementary schools (2, 2%), and one outbreak each in a daycare, a group home, and a detention center.

Type of Setting	Influenza Outbreaks	ILI Outbreaks	Total Outbreaks
Nursing Homes	65	17	82
Assisted Living Facilities	17	--	17
Rehab Centers	3	--	3
Elementary Schools	--	2	2
Daycares	1	--	1
Detention Centers	1	--	1
Group Homes	1	--	1
Total Outbreaks	88	19	107

REPORTED OUTBREAKS OF INFLUENZA AND ILI BY TYPE OF SETTING AND TYPE OF OUTBREAK

There was a steady upswing in the number of outbreaks reported starting the week ending December 8, 2012, peaking on the week ending January 12, 2013, when 31 outbreaks of influenza and ILI were reported. Since then, the number of outbreaks reported decreased each week, with only a slight increase during the week ending March 16.



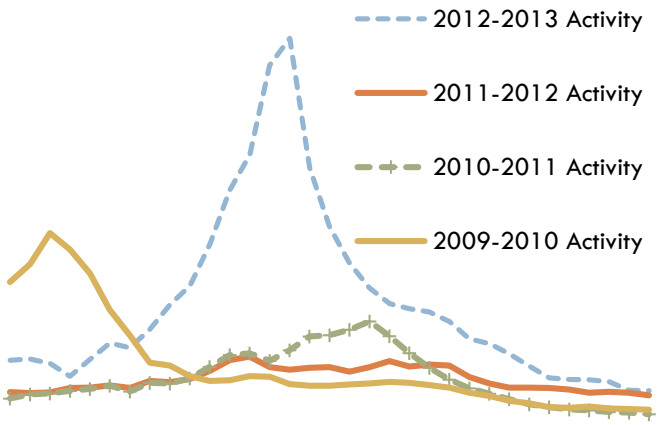
Geographic Spread and Intensity

The geographic spread of influenza remained "sporadic" for eight weeks from the week ending October 13, 2012, to the week ending December 1. The following week, the geographic spread increased to "local," and then it increased again to "widespread" on the week ending December 15. Maryland would remain at "widespread" for nine weeks until the week ending February 9, 2013. From that week on, the geographic spread of influenza decreased to "regional" for three weeks until the middle of March, and then down to "sporadic" on the week ending March 23 to the end of the surveillance season. To see the United States map of geographic spread of influenza throughout the season, please visit http://www.cdc.gov/flu/weekly/WeeklyFluActivityMap.htm.

As far as intensity goes, Maryland was at "minimal" intensity for the first ten weeks of the season. For eight weeks beginning on the week ending December 15, 2012, intensity went up and down from "low" to "moderate" to "high." Then, beginning on the week ending February 9, 2013, it went back down to "minimal" for 13 of the remaining 15 weeks, rising only slightly in March. To see an interactive map of the United States showing ILI intensity, please visit http://gis.cdc.gov/grasp/fluview/main.html.

DISCUSSION

Compared to recent influenza seasons, including the 2009 pandemic, the 2012-2013 influenza season was very active, and the highest levels of activity were sustained for several weeks. The period of elevated activity lasted from early December to late January. The peak number of rapid and PCR influenza tests were reported during the week ending December 29, 2012. Meanwhile, the peak numbers of influenza-associated hospitalizations and visits to emergency departments with ILI were reported during the week ending January 19, 2013. The peak number of outbreaks was reported during the week ending January 12.

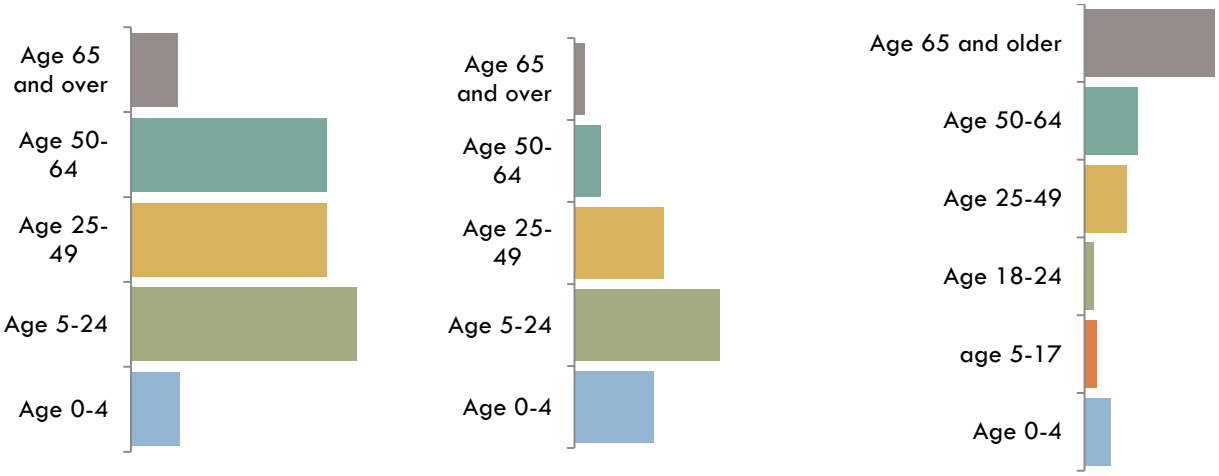


INFLUENZA ACTIVITY FOR THE LAST FOUR SEASONS

With respect to the circulating strains of influenza, both type A (H3N2) and type B influenza appeared in October 2012. Type A influenza would remain the predominant strain until late February 2013, when type B influenza became predominant. Looking at rapid influenza testing, we can see that there was a bi-modal (two peaks) distribution of positive rapid testing, with the first peak attributable to type A and the second peak to type B influenza, which is a common pattern seen in previous influenza seasons. Type A (H1N1), which is the strain seen during the 2009 pandemic, only constituted about 2% of laboratory-confirmed cases. Regarding novel influenza viruses, although a cluster of novel influenza A variant H3N2 viruses was seen associated with livestock prior to the 2012-2013 influenza season, Maryland surveillance detected neither this strain of influenza nor novel H7N9 influenza A reported in China.

The reason for the bimodal distribution of positive rapid testing remains to be fully explained. However, according to national influenza surveillance data, about one third of the laboratory confirmed cases were due to influenza type B, Victoria lineage. This strain of type B influenza was not included in the seasonal vaccine. It is then reasonable to hypothesize that the second "wave" of type B cases were due mostly to Victoria lineage cases along with Yamagata (the type B strain included in the vaccine). Subtyping of the Maryland strains would be needed to fully confirm this.

With regard to severity, we observed in our surveillance that most of the visits to sentinel providers and emergency departments for ILI were by people in the younger age groups. However, looking at the data for hospitalizations, about half of the people hospitalized with influenza were in the over 65 age group. Likewise, most of the outbreaks reported during this season were in nursing homes and assisted living facilities, compared to most of the outbreaks reported during the 2009 pandemic occurring in schools and colleges. From our MRITS data, we saw that the younger age groups made up most of the reports of ILI. However, it was people in the older age groups, especially the 65 and older group, who sought care from a healthcare provider for their symptoms. In essence, most of the cases of ILI and influenza were young, but severity seemed to increase with age.



FROM LEFT TO RIGHT: REPORTS OF ILI THROUGH MRITS (WHO WAS SICK?), VISITS TO SENTINEL PROVIDERS (WHO SOUGHT CARE?), AND INFLUENZA HOSPITALIZATIONS (WHO WAS SICK ENOUGH TO BE HOSPITALIZED?)

Throughout the summer in the northern hemisphere, which is wintertime in the southern hemisphere, we have continued to monitor data through these surveillance systems and others. Surveillance for influenza and other respiratory conditions is year-round, not just in Maryland but around the world. We work with our colleagues at all levels to monitor everything from single cases of disease to clusters and outbreaks, whether they are happening in Maryland or elsewhere.

ADDITIONAL READINGS

- "CDC Reports About 90 Percent of Children Who Died From Flu This Season Not Vaccinated" Centers for Disease Control and Prevention, available at: http://www.cdc.gov/flu/spotlights/children-flu-deaths.htm
- Blanton, et al. (2012). Neurologic Conditions Among Pediatric Deaths Associated With the 2009 Pandemic Influenza. *Pediatrics,* 130(3), pp. 390-396. http://pediatrics.aappublications.org/content/130/3/390.long
- Lombardo, et. al. (2004). ESSENCE II and the Framework for Evaluating Syndromic Surveillance Systems. *Morbidity and Mortality Weekly Report*, 53, pp. 159-165. http://www.cdc.gov/Mmwr/preview/mmwrhtml/su5301a30.htm
- "The Compelling Need for Game-Changing Influenza Vaccines: An Analysis of the Influenza Vaccine Enterprise and Recommendations for the Future" Center for Infectious Disease Research and Policy, available at http://www.cidrap.umn.edu/cidrap/center/mission/articles/ccivi-landing.html
- "Influenza Seasonal Flu Activity and Surveillance" Centers for Disease Control and Prevention, available at: http://www.cdc.gov/flu/weekly/fluactivitysurv.htm
- "H7N9 Situation and CDC Response" Centers for Disease Control and Prevention, available at: http://www.cdc.gov/flu/spotlights/h7n9-cdc-response.htm
- "Novel Coronavirus" Centers for Disease Control and Prevention, available at: http://www.cdc.gov/coronavirus/ncv/