



## Michigan Influenza Surveillance Summary 2013-2014 Influenza Season

Michigan Department of Community Health  
September, 2014



### **SEASONAL INFLUENZA**

For the purposes of this report, data for the 2013-2014 season will be described from September 29, 2013 through May 17, 2014 unless otherwise indicated. This time frame is used as it mirrors the standard influenza season surveillance period of Morbidity and Mortality Weekly Report (MMWR) weeks 40-20 used by the Centers for Disease Control and Prevention (CDC).

The 2013-2014 influenza season had a moderately severe level of activity compared to most non-pandemic influenza seasons in Michigan. The first positive influenza specimens detected at the Michigan Department of Community Health (MDCH) Bureau of Laboratories were announced on October 23, 2013 and included influenza A/H3 and influenza A/H1N1pdm09 specimens. The 2013-2014 season saw a mix of circulating influenza A/H3N2, influenza A/H1N1 pdm09 (pH1N1) and B viruses, with influenza A pH1N1 viruses predominating for the first season since the 2009-2010 pandemic.

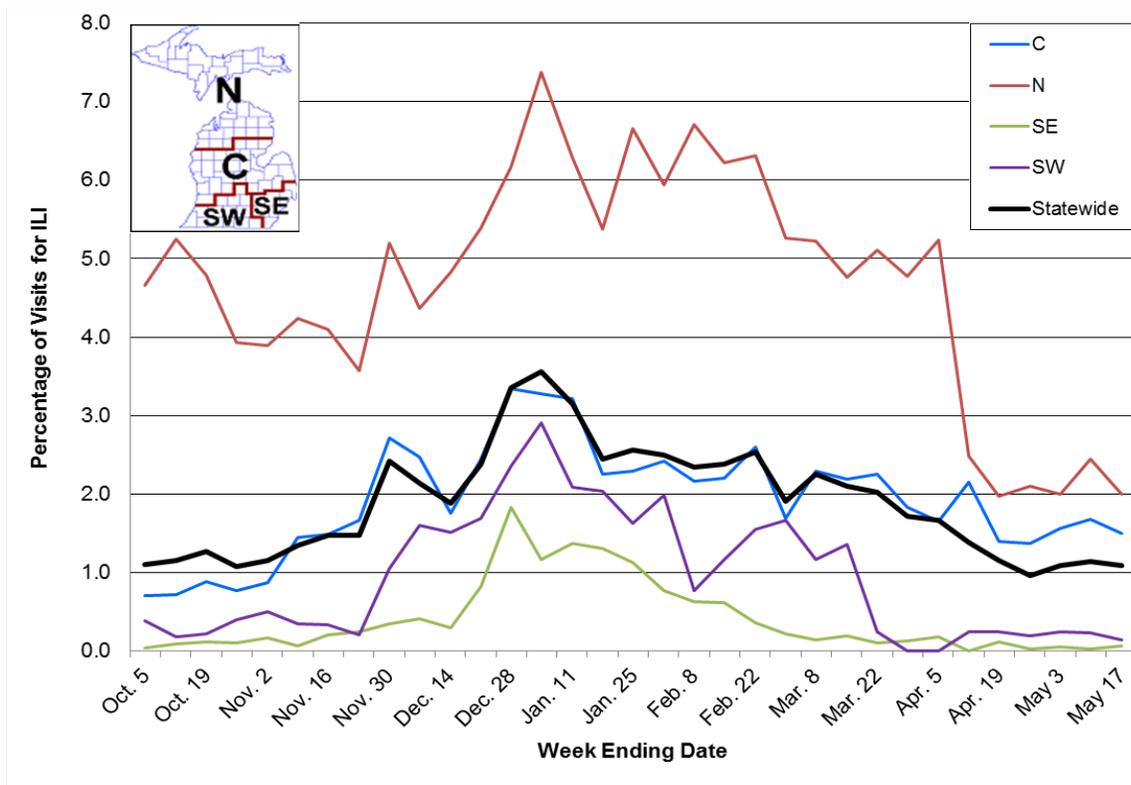
MDCH influenza surveillance systems indicated that influenza activity peaked during the weeks ending December 28, 2013 through January 11, 2014 (MMWR Weeks 52-2). Michigan reported "widespread" statewide influenza activity, the highest level of reporting to the CDC, for four straight weeks from the week ending January 11, 2014 through the week ending February 1, 2014 (MMWR Weeks 2-5). Peak activity in Michigan occurred during a time frame similar to the majority of the nation and other Midwestern states. Influenza circulation in Michigan quickly increased during December to the peak and then declined fairly quickly over the next few weeks. Activity gradually decreased through mid-April and then circulated at lower levels through May. This activity made for an early, long, and moderately severe 2013-2014 Michigan influenza season.

### **Sentinel Provider Data**

Healthcare providers participating in the Michigan component of the CDC U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet) report weekly the percentage of healthcare visits due to influenza-like illness (ILI). Eighty sentinel sites are enrolled for Michigan; an average of 48 sites reported data on over 14,540 weekly patient visits. By surveillance region, the average number of ILINet providers that submitted reports each week was: Central (20), North (10), Southeast (12), and Southwest (7). The percentage of visits due to ILI peaked statewide at 3.6% during the week ending January 4, 2014 (MMWR Week 1) (Figure 1). Influenza activity in the Central and Southwest regions was similar to activity statewide with peaks in the end of December to early January. Activity in the Southeast region was lower than the rest of

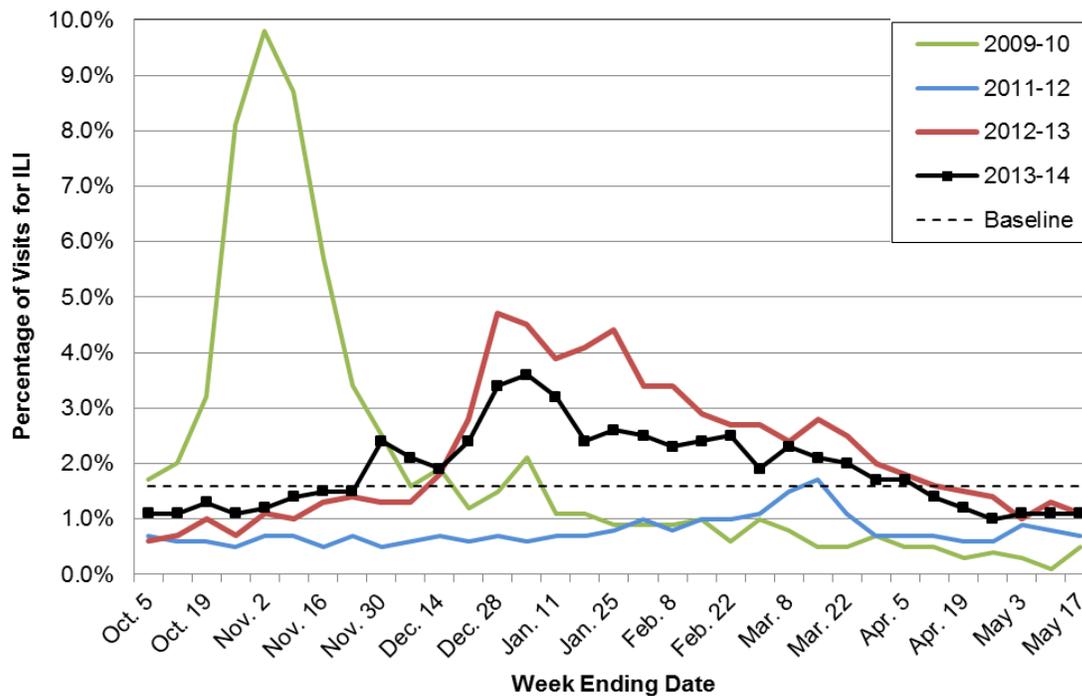
the state and peaked at 1.8% at the end of December. Activity in the North Region was much higher than the rest of the state for the majority of the season, with a peak of 7.4% visits due to ILI at the beginning of January. Surveillance regions were at or above Michigan's baseline activity level of 1.6% for various durations (Central: 21 consecutive weeks, North: the entire 33-week flu season, Southeast: 1 week, Southwest: 19 consecutive weeks). Since sentinel practices in each region vary by type, size, and number, these data should not be used to make direct comparisons of intensity among regions.

**Figure 1. Percentage of Influenza-like Illness Visits Reported by Michigan Sentinel Providers, by Influenza Surveillance Region, September 29, 2013-May 17, 2014**



The 2013-2014 season was a moderate season with an earlier peak in activity than most seasons, similar to the 2012-2013 season (Figure 2). The percentage of visits due to ILI peaked at 3.6% this season, compared to 4.7% during the 2012-2013 season, and 1.7% in 2011-2012. During the pandemic 2009-2010 influenza season, ILI activity peaked in late October at an activity level of 9.8%, above historic norms. The 2013-2014 season, like 2012-2013, did not have a sharp decrease in activity following the peak. Instead, ILI activity alternately increased and decreased, remaining at or above baseline for 19 consecutive weeks through early April.

**Figure 2. Percentage of Visits for Influenza-like Illness Reported by Michigan ILINet Sentinel Providers, 2009-2010 and 2011-2014**



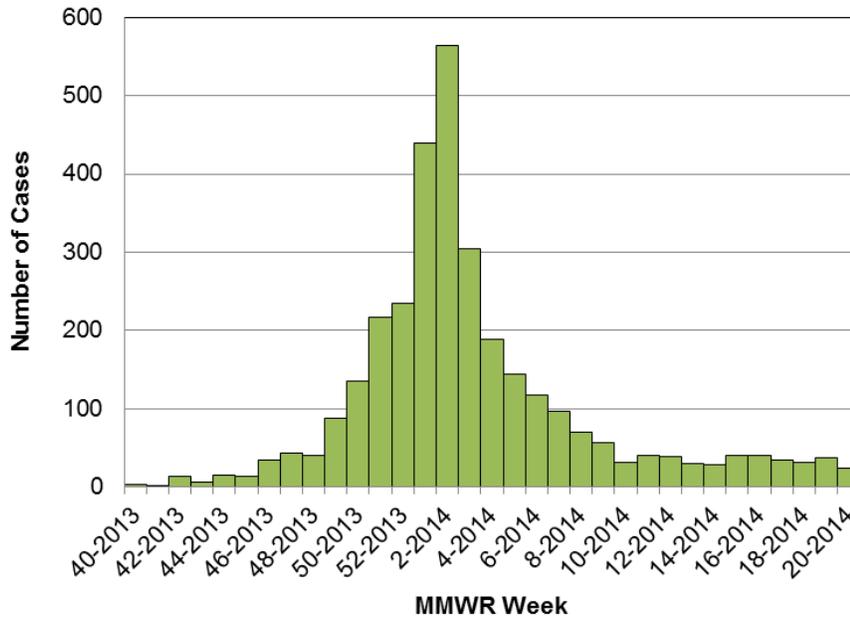
### Individual Influenza Reports

Cases included in the data below are of probable, confirmed, suspect or unknown status, with a completed, completed – follow up, active, review or new investigation status. Data may not represent the statewide impact of influenza as local health departments are not required to individually report influenza; in addition, the greater number of reports from large local health departments may unintentionally bias statewide results. When interpreting these data, one should consider the possibility of age-related reporting or testing bias between different influenza seasons (e.g., variant H3N2 guidance that encouraged testing of children <18 years during the 2011-2012 season).

From September 29, 2013 to May 17, 2014, 3221 individual cases were reported into the Michigan Disease Surveillance System (MDSS). Only 3,206 of these cases were used for the following analysis; 15 cases were excluded due to incomplete serologic testing or being incorrectly reported as influenza when another etiologic agent was identified. By comparison, 5,731 cases were reported during the 2012-2013 season.

Individual MDSS case referrals peaked at 564 cases during the week ending January 11, 2014 (MMWR Week 2) (Figure 3). High numbers of cases were also seen during late December through early February. In comparison, during the 2012-2013 influenza season, 511 cases were seen during the peak in the week ending February 9, 2013 (MMWR Week 6). Therefore, the timing of the peak of individually reported influenza cases was earlier for the 2013-2014 season when compared to the 2012-2013 season.

**Figure 3. Individually Reported Influenza Cases in the Michigan Disease Surveillance System, with Referral Dates from September 29, 2013-May 17, 2014**



The median age of individual cases was 43.0 years, with a mean of 40.3 years; these data indicated a slightly older population than the previous season (median: 37.0 years, mean: 38.9 years). Age was unknown for 4 cases. The 18-49 year old age group had the most cases (36.9%) (Table 1). All age groups had the most cases reported during January (Table 1). When comparing to 2012-2013, the percentage of cases increased in adults 18-64 years of age during 2013-2014, while decreasing in children and adults ≥65 years (Table 2). Of 3,189 cases with available gender status, 52.9% were female.

**Table 1. Individually Reported Influenza Cases in the Michigan Disease Surveillance System by Month and Age Group, Referred During September 29, 2013-May 17, 2014**

Month	Number of Cases and Percentage of Monthly Total, by Age Group											
	0-4 years		5-17 years		18-49 years		50-64 years		≥65 years		Total	
<b>October</b>	8	22.9%	4	11.4%	11	31.4%	3	8.6%	9	25.7%	35	1.1%
<b>November</b>	22	16.2%	28	20.6%	59	43.4%	16	11.8%	11	8.1%	136	4.2%
<b>December</b>	100	11.7%	84	9.8%	396	46.3%	179	20.9%	97	11.3%	856	26.7%
<b>January</b>	179	12.3%	119	8.2%	502	34.5%	397	27.3%	259	17.8%	1456	45.5%
<b>February</b>	34	10.0%	39	11.5%	113	33.2%	92	27.1%	62	18.2%	340	10.6%
<b>March</b>	16	10.5%	20	13.1%	43	28.1%	45	29.4%	29	19.0%	153	4.8%
<b>April</b>	22	14.3%	23	14.9%	35	22.7%	28	18.2%	46	29.9%	154	4.8%
<b>May</b>	7	9.7%	10	13.9%	23	31.9%	16	22.2%	16	22.2%	72	2.2%
<b>Total</b>	<b>388</b>	<b>12.1%</b>	<b>327</b>	<b>10.2%</b>	<b>1182</b>	<b>36.9%</b>	<b>776</b>	<b>24.2%</b>	<b>529</b>	<b>16.5%</b>	<b>3202</b>	<b>100.0%</b>

**Table 2. Percentage of Individual Influenza Cases, by Age Group, 2012-2014**

Season	0-4 years	5-17 years	18-49 years	50-64 years	≥65 years
2013-2014	12.1%	10.2%	36.9%	24.2%	16.5%
2012-2013	13.8%	23.7%	22.6%	14.3%	25.6%

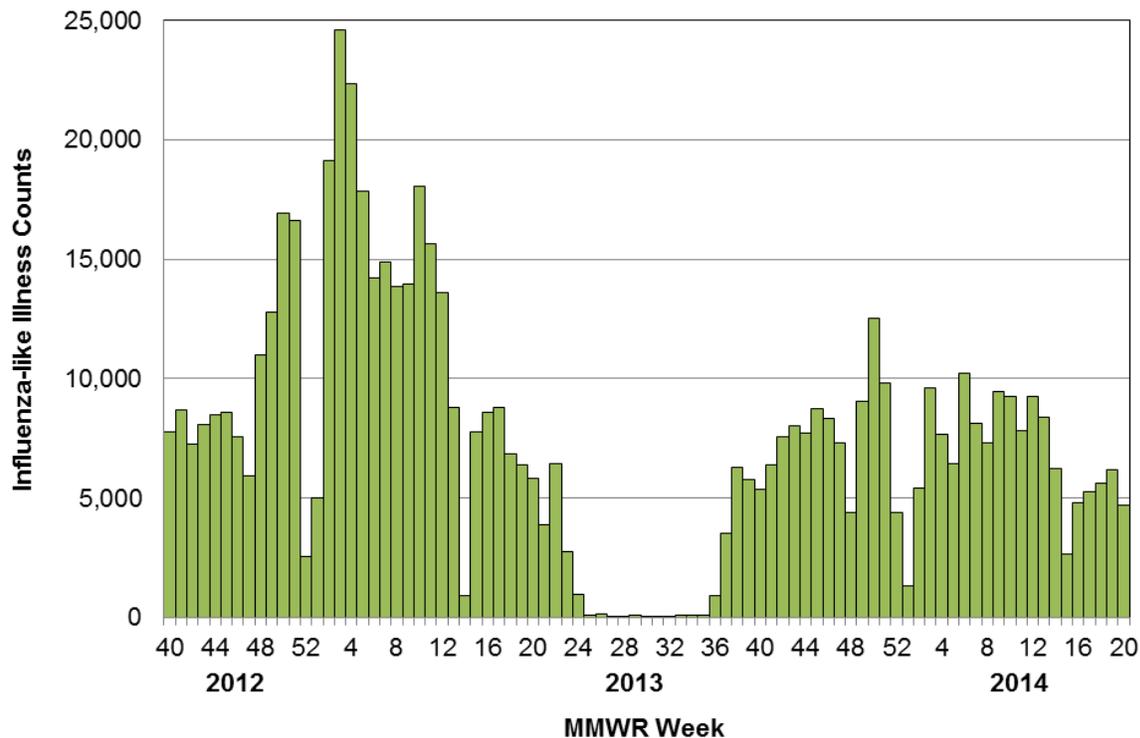
Information on the type of influenza identified via laboratory testing was available for 1,772 (55.3%) cases. Influenza A was reported for 1,637 cases (92.4% of cases with typing results) and influenza B for 135 (7.6%) cases. Subtyping results were reported for 423 (25.8%) of the influenza A cases; influenza A/pH1N1 was identified for 409 (96.7%) cases and influenza A/H3 in 14 (3.3%) cases.

### Aggregate Influenza-like Illness

Aggregate influenza-like illness reports from local health departments are entered into MDSS as “Flu-like Disease” cases on a weekly basis. The data below includes cases of probable, confirmed, suspect or unknown status. While the majority of aggregate reports come from school-based absenteeism due to influenza-like illness, these reports sometimes capture absenteeism due to other causes. Even with possible confounding data, aggregate reporting trends with confirmed cases of influenza in most years.

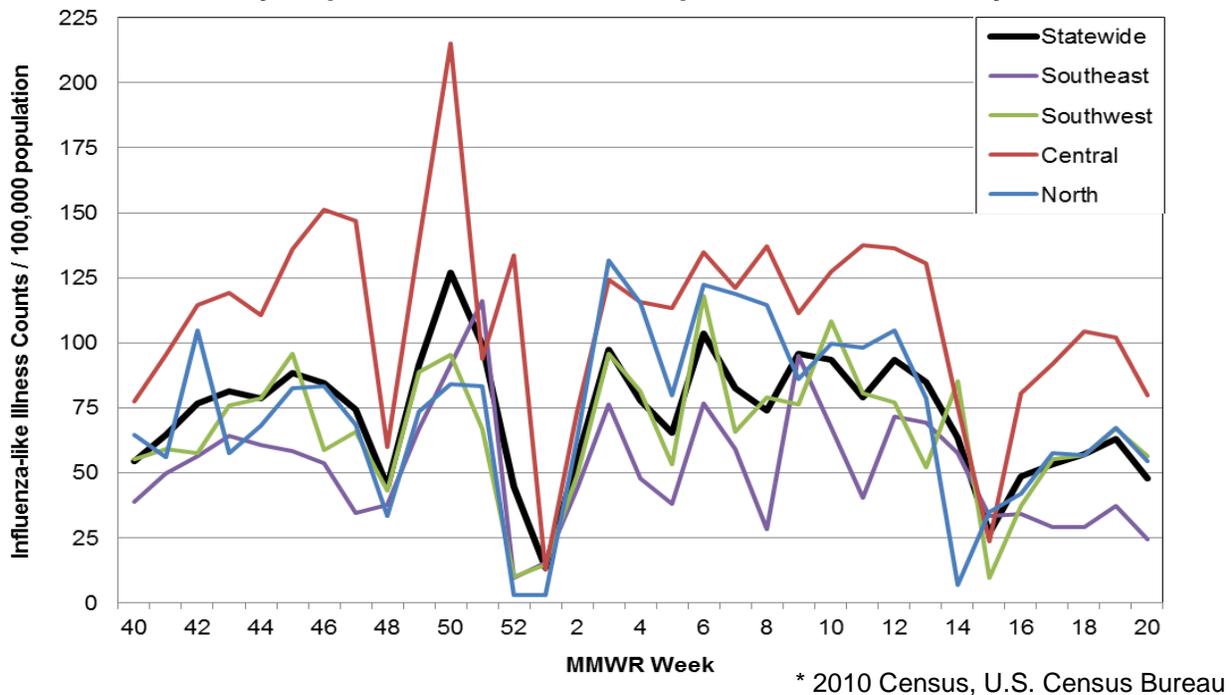
During the 2013-2014 season, peak aggregate activity occurred during the week ending December 14, 2013 (MMWR Week 50) at 12,549 reports. The noticeable decreases during MMWR Weeks 1, 14, 23-35 and 52 correspond to school breaks. In comparison, during the 2012-2013 season, peak aggregate activity occurred in mid-January with 24,469 reports (Figure 4).

**Figure 4. Aggregate Influenza-like Illness Counts, September 30, 2012-May 17, 2014**



Rates of influenza-like illness per 100,000 population were calculated from aggregate ILI reports and U.S. Census Bureau population estimates (Figure 5). The Central Region had the highest peak rate at 215 cases/100,000; peak rates for other regions included 131 cases/100,000 for the North, 118 cases/100,000 for the Southwest, 116 cases/100,000 for the Southeast, and 127 cases/100,000 statewide. The Central and statewide rates peaked during MMWR Week 50 (week ending December 14, 2013), while the Southeast peaked during Week 51 (week ending December 21, 2013), the North during Week 3 (week ending January 18, 2014) and the Southwest during Week 6 (week ending February 8, 2014). Regions had an approximate 25-50% decrease in the rate of ILI during 2013-2014 compared to 2012-2013. Regional and inter-seasonal variations in ILI rates may indicate disparities in the consistency of aggregate reporting or true differences in influenza transmission.

**Figure 5. Rates of Aggregate Influenza-like Illness per 100,000 Population, Based on County Population Estimates\*, September 29, 2013-May 17, 2014**



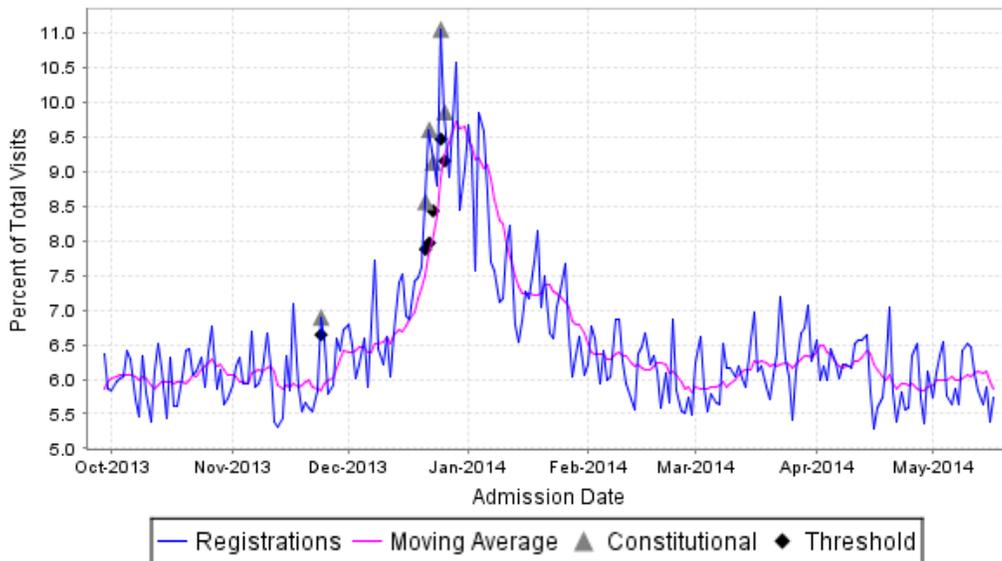
### Syndromic Surveillance

For the 2013-2014 season, emergency department visits due to constitutional complaints (fever, chills, body ache, flu symptoms, fatigue, anorexia, malaise, etc.) rapidly increased in mid-December, peaked at 11.0% of total visits in late December, and then decreased through February back to baseline levels (Figure 6). Visits due to respiratory complaints (nose, throat or lung problems, cold symptoms, bronchitis, asthma, COPD, sore throat, etc.) increased rapidly during September from 8.0% to 12.8% (not shown) and fluctuated between 10.0% and 13.8% during October through December (Figure 7). Respiratory complaints rapidly increased starting in mid-December, peaked in late December at 16.6% of all visits, and then quickly decreased to around 11% by mid-January. The rapid rise of respiratory visits in September, during which time influenza circulation in Michigan was low, was most likely due to an increase

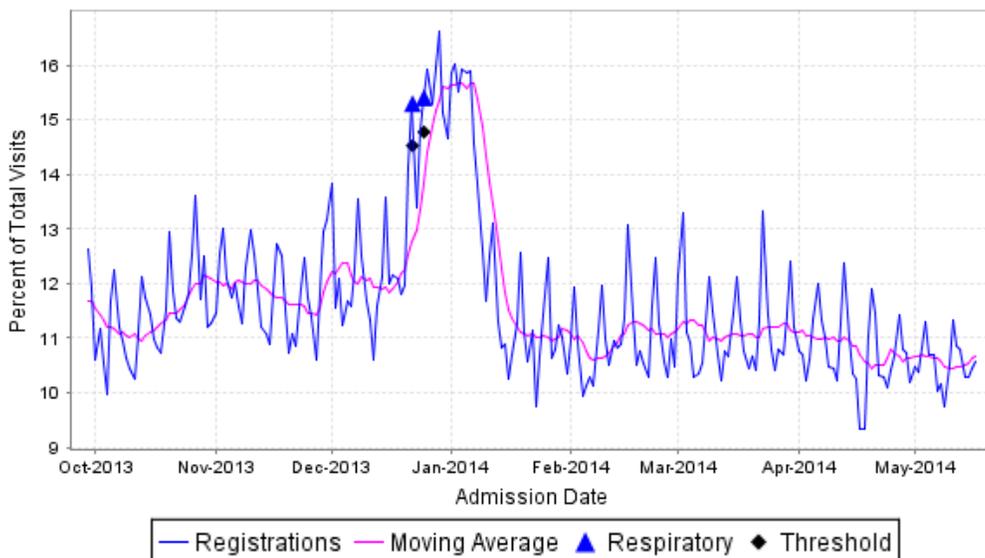
in other respiratory pathogens or illnesses (e.g. asthma, allergies). The peaks in both constitutional and respiratory complaints during late December correspond to other influenza activity indicators.

During the 2012-2013 season, constitutional visits peaked twice at 11.3% in late December and at 11.7% in mid-January; respiratory complaints peaked at 18.7% in late December. Therefore, during 2013-2014 the timing of peak visits due to constitutional and respiratory complaints was similar but at slightly lower levels than during 2012-2013. Data from this surveillance system are based on individuals who present at emergency departments and may not be representative of the entire Michigan population. This system only captures chief complaints, not clinical or laboratory diagnoses. The individual facilities reporting into the system change throughout the years; therefore, past influenza seasons are best compared in the form of trends, as opposed to absolute values.

**Figure 6. Emergency Department Visits due to Constitutional Complaints, September 29, 2013-May 17, 2014**



**Figure 7. Emergency Department Visits due to Respiratory Complaints, September 29, 2013-May 17, 2014**

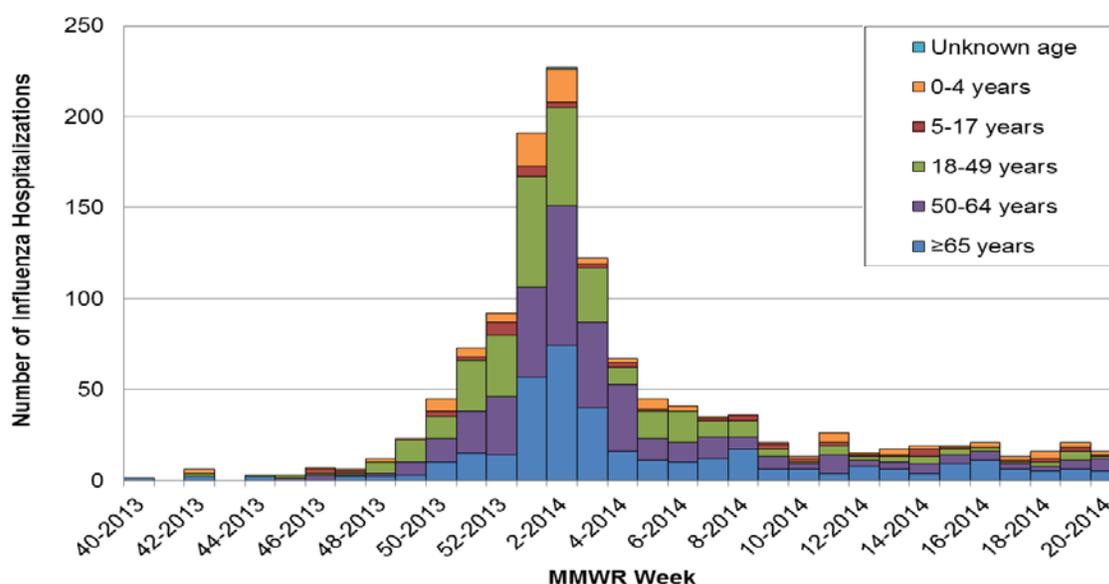


## Individually Reported Influenza Hospitalizations

Influenza hospitalizations are voluntarily entered into the MDSS by local health departments or healthcare providers. Cases included in these data are confirmed or probable cases, with an investigation status of completed, completed – follow up, active, review or new. Since cases are entered voluntarily, data may not be representative and may be dependent on available resources at the local level. Data reported here are most likely underestimations of the total number of influenza hospitalizations.

From September 29, 2013 to May 17, 2014, 1252 influenza-associated hospitalizations were reported. The highest number of referrals occurred during the week ending on January 11, 2014 (MMWR Week 2) at 227 hospitalizations (Figure 8). In contrast, required reporting during the pandemic 2009-2010 season (September 2009 through May 2010) resulted in 2,154 reported cases, and voluntary reporting during the 2010-2011, 2011-2012 and 2012-2013 influenza seasons resulted in 867, 414 and 1,828 cases, respectively. The peak week for case referrals during the 2012-2013 season was during MMWR Week 2 (mid-January).

**Figure 8. Influenza Hospitalizations Reported into the Michigan Disease Surveillance System, By Entry Date, September 29, 2013-May 17, 2014**



Among the five age groups, the highest percentage of hospitalizations occurred in the 50-64 year age group (31.5%). When compared to U.S. Census Bureau data, the ≥65 year olds had the largest percentage point difference, +15.3, and the 18-49 year olds had the lowest percentage point difference, -15.3, than what would be expected if influenza hospitalizations were proportionate to the age distribution of Michigan's population (Table 3). During recent influenza seasons, the 18-49 year (2009-2010 and 2010-2011) and ≥65 year (2011-2012, 2012-2013) age groups had the highest percentage of hospitalizations, while the ≥65 year age group had the largest percentage point difference over what was expected during each influenza season from 2009-2013.

**Table 3. Number and Percentage of Influenza Hospitalizations, by Age Group, Compared with the Michigan Population**

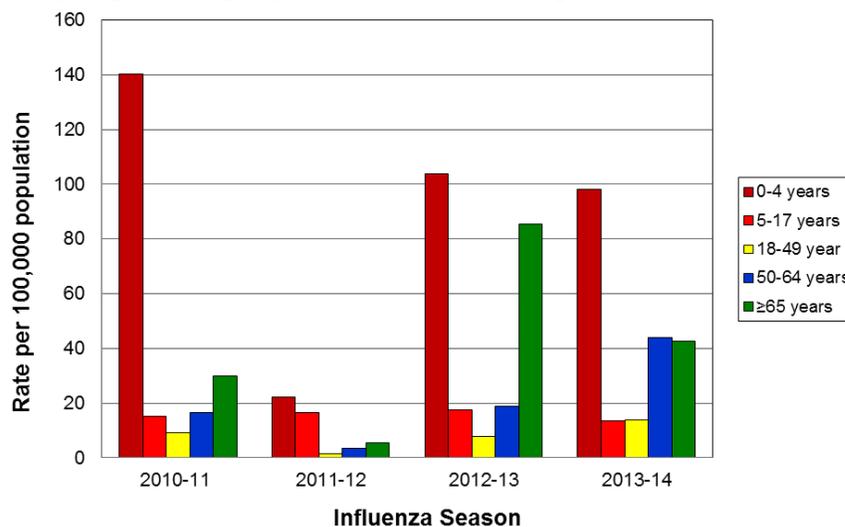
Age category	No. of hospitalizations	% of total hospitalizations	% of MI population*
0-4 years	103	8.2%	6.0%
5-17 years	54	4.3%	17.7%
18-49 years	336	26.8%	42.1%
50-64 years	394	31.5%	20.4%
≥65 years	364	29.1%	13.8%

\*2010 Census, U.S. Census Bureau

### Influenza Hospitalization Surveillance Project

Influenza hospitalizations are also monitored through the CDC Influenza Hospitalization Surveillance Project (IHSP), which provides population-based rates of influenza hospitalizations in Clinton, Eaton, Ingham and Genesee counties through active surveillance. The reporting period for the 2013-2014 season was from October 1, 2013 through April 30, 2014. Two hundred fifty-three cases (74 pediatric and 179 adult) were reported. The first case was admitted on October 15, 2013 and the last on April 30, 2014; the timing of admissions was similar to the 2012-2013 season. The majority (67.9%) of cases were admitted during December and January. Incidence rates per 100,000 persons were calculated (Figure 9); the 0-4 year old age category had the highest rate at 98 hospitalizations per 100,000. Among pediatric cases, 64.9% had an underlying medical condition, the most common being asthma at 27.0% of all pediatric cases. Among adult cases, 94.4% had an underlying medical condition; cardiovascular conditions were the most common type at 47.5% of adult cases. Antiviral treatment was started in 225 (88.9%) cases. Eighty-five (33.6%) cases were admitted to an intensive care unit and 44 (17.4%) required mechanical ventilation. There were nine deaths, all of which were among adults. Twenty-six pediatric and 68 adult cases (37.2% of all cases) had reports of at least one influenza vaccination during the 2013-2014 season at least two weeks prior to their illness. Compared to 2012-2013, there were a similar number of adult and pediatric hospitalizations during 2013-2014. The median age of pediatric cases was 4 years and for adult cases was 56 years. There were 231 (91.3%) influenza A cases and 11 (4.3%) influenza B cases; of the 72 influenza A cases with subtyping results, 94.4% were pH1N1 and 6.9% were A/H3.

**Figure 9. IHSP Influenza Hospitalization Incidence Rates per 100,000 Population, By Age Category, 2009-2010 through 2012-2013**

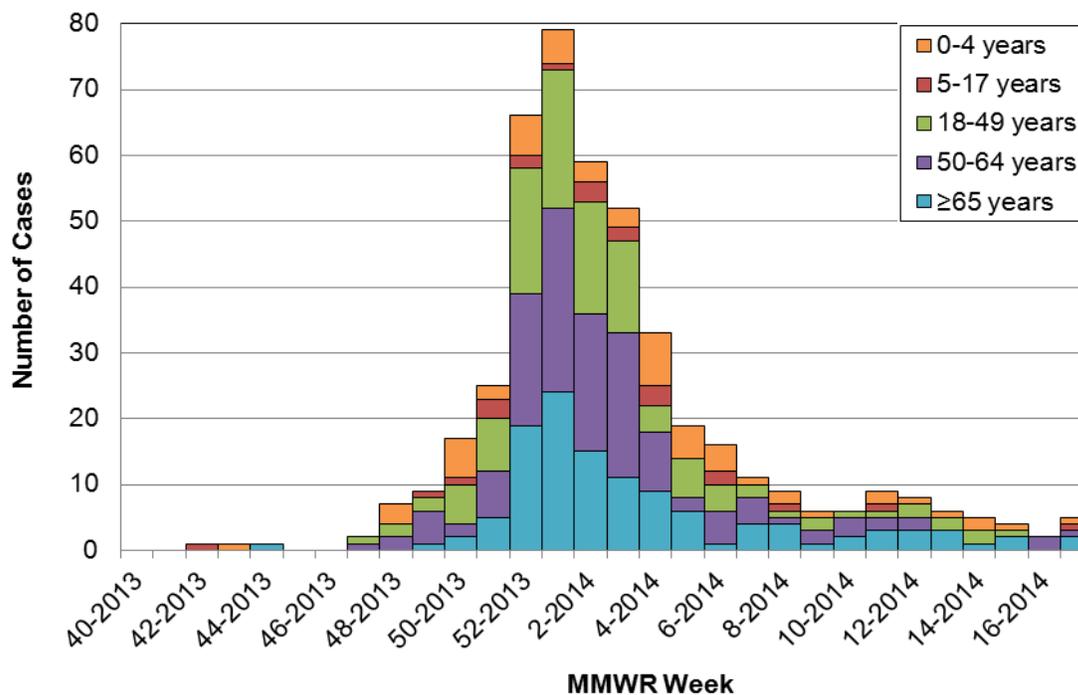


## Influenza Hospital Sentinel Network

During the 2009-2010 pandemic influenza season, MDCH mandated that healthcare providers report all influenza-associated hospitalizations. This surveillance effort yielded vital information on the burden and age distribution of influenza hospitalizations, but could not be continued statewide due to the demands it placed on healthcare providers. To continue these efforts and to supplement the IHSP, MDCH established a network of sentinel hospitals that report influenza-associated hospitalizations. Participants report weekly the number of influenza-associated hospitalizations in each of five age categories and the total number of admissions during that time frame.

Twelve hospitals representing all four influenza surveillance regions reported 458 hospitalizations during September 29, 2013-April 26, 2014. The number of hospitalizations was similar to that reported during the previous influenza season. The number of hospitalizations ranged between 0 and 151 with a mean of 28.7 hospitalizations per hospital. During 2012-2013, there was a mean of 17.9 hospitalizations per hospital. The 50-64 year age group had the highest number of hospitalizations among the five age groups at 141 (30.8%), followed closely by the ≥65 year age group (26.0%) and the 18-49 year age group (25.8%). Although hospitalizations were sporadically distributed throughout the season, 78.4% of reported hospitalizations occurred during the months of December and January. The number of reported hospitalizations peaked during the week ending January 4, 2014 (MMWR Week 1) (Figure 10). For the hospitals reporting admission data, influenza-associated hospitalizations ranged between 0.0% and 12.0% (mean 4.5%) of total admissions during the facility's peak week of influenza hospitalizations.

**Figure 10. Influenza-associated Hospitalizations reported by the MDCH Influenza Hospital Sentinel Network, September 29, 2013-April 26, 2014**



## **Pediatric Influenza-Associated Mortalities**

Three pediatric influenza-associated mortalities were reported to MDCH for the 2013-2014 influenza season, which was a decrease from the seven reported during 2012-2013. Two cases were confirmed to be infected with influenza A/H1N1pdm, while one case was associated with an influenza A infection that was not subtyped. All three cases were 0-4 years of age. One case had a bacterial co-infection. One case was fully vaccinated during the 2013-2014 season, while the other two cases were too young for influenza vaccination.

## **Congregate Setting Influenza-like Illness Outbreaks**

Twenty-three congregate setting outbreaks were reported to MDCH during the 2013-2014 influenza season (as of August 7, 2014); this was a significant decrease compared to the 115 respiratory outbreaks reported during the 2012-2013 season. The outbreaks were from the SE(2), SW(11), C(7) and N(3) Influenza Surveillance Regions. Sixteen outbreaks were reported from long-term care facilities, three from assisted living facilities, two from correctional facilities, one from a special education school and one from an adult foster home. Facility outbreaks were reported from December through July, with nine (39%) occurring during January. In general, influenza A and influenza B 2009 A/H1N1pdm results were more common during the winter months, and influenza B and other respiratory viruses were more common during spring and summer months. Laboratory testing results for these outbreaks are listed below:

<u>Lab Test Result (number of facilities)</u>	<u>Regions</u>
• Influenza 2009 A/H1N1pdm (4)	(1SE, 2SW, 1C)
• Influenza A/H3 (1)	(1SW)
• Influenza A, not subtyped (4)	(3SW, 1C)
• Influenza B (3)	(1SW, 1C, 1N)
• Influenza positive (1)	(1SW)
• RSV (1)	(1SW)
• Human metapneumovirus (2)	(1SE, 1N)
• Parainfluenza (1)	(1SW)
• Negative/no testing (6)	(1SW, 4C, 1N)

## **MDCH Laboratory Isolates**

Sentinel physicians, sentinel laboratories and other clinical health partners provide virologic data by submitting clinical specimens and/or viral isolates for respiratory virus culture and RT-PCR testing at the MDCH Bureau of Laboratories (MDCH BOL). During September 29, 2013 through May 17, 2014, 580 specimens were tested for influenza. MDCH BOL identified 399 positive influenza specimens, of which 365 (91.5%) were influenza A, 33 (8.3%) were influenza B, and 1 (0.3%) was positive for influenza A and B (an LAIV vaccine recovery). The number of positive specimens peaked during the week ending January 11, 2014 (MMWR Week 2), based on the dates results were reported (Figure 11). MDCH BOL had a moderate influenza testing volume.

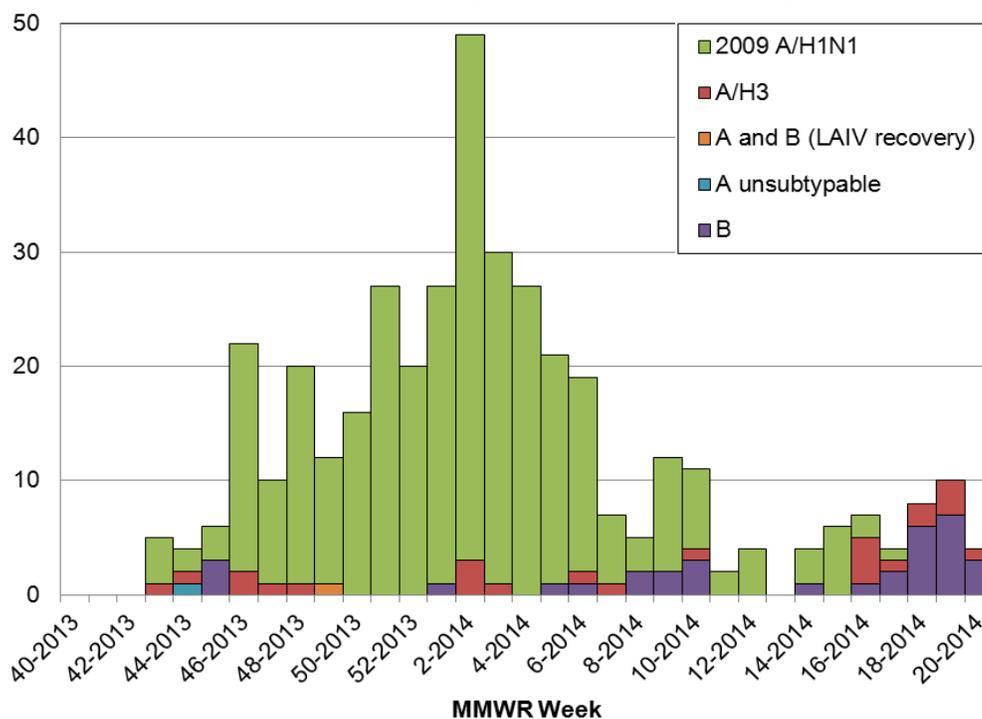
Of the 364 influenza A specimens that could be subtyped, 340 (93.4%) were influenza A pH1N1 specimens and 24 (6.6%) were A/H3N2 specimens (Figure 11). The proportion

of positive influenza A/H3 and influenza B specimens increased later in the season. Of the influenza B viruses submitted to MDCH BOL by August 11, 2014 that have undergone further characterization, 29 (99.7%) were identified as B/Massachusetts/02/2012-like viruses, which was included in both the 2013-2014 Northern Hemisphere influenza trivalent and quadrivalent vaccines. The remaining influenza B specimen (1, 0.3%) was a B/Brisbane/60/2008-like virus, which was included in the 2013-2014 quadrivalent vaccine but not in the trivalent vaccine.

In comparison, during the 2012-2013 season, a similar high proportion of influenza A viruses was seen with a similar peak in early January. However, during 2012-2013 the majority of influenza viruses were influenza A/H3N2 viruses.

MDCH BOL has the capacity to perform antiviral resistance testing on influenza A/H3N2 and A pH1N1 specimens for public health surveillance and for diagnostic testing of severe influenza cases in which antiviral resistance is suspected. Of the 124 influenza A pH1N1 and 15 influenza A/H3N2 specimens submitted to MDCH BOL by August 11, 2014 that have undergone antiviral resistance testing, 100% have been identified as having no antiviral resistance (i.e., wild type).

**Figure 11. MDCH Bureau of Laboratories Influenza Positive Specimens, Based on Date Result Reported, September 29, 2013-May 17, 2014**



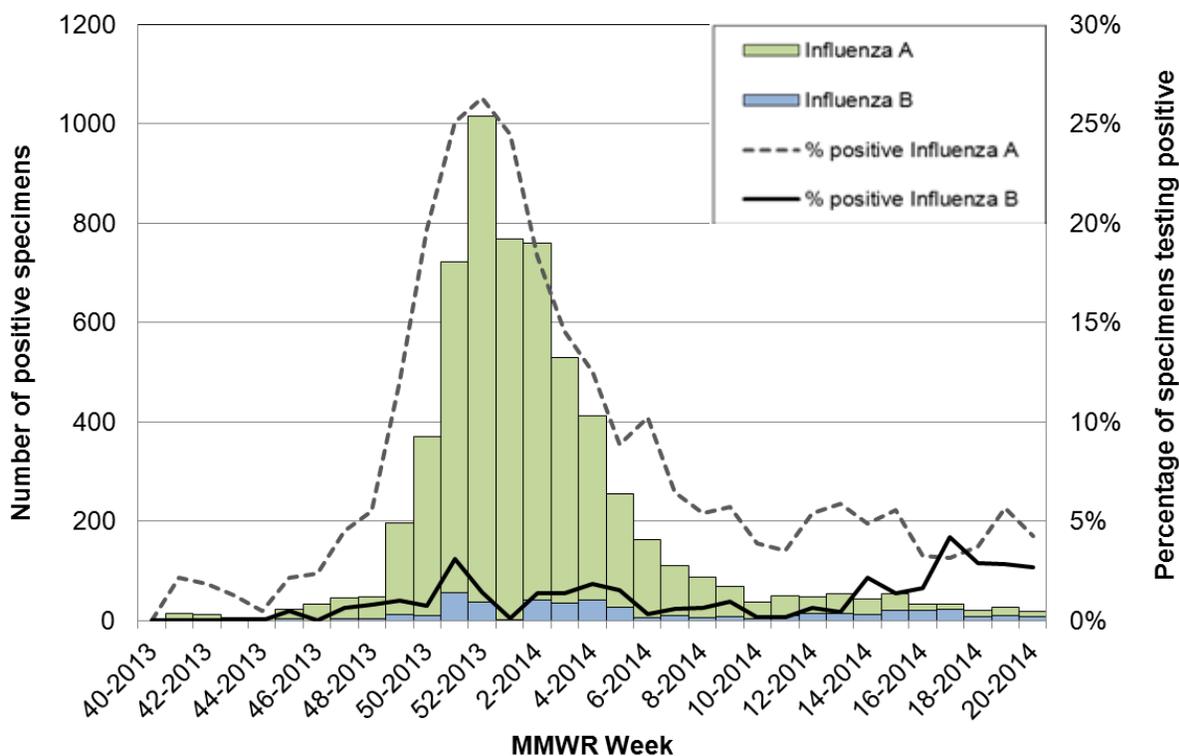
### Sentinel Laboratories

Sixteen sentinel clinical laboratories statewide voluntarily submitted weekly respiratory virologic testing results to MDCH. The month in which sentinel labs started seeing influenza A positive results varied from October to December, with the majority of labs first seeing activity in November. Increased influenza A activity was reported during late December through February, but notable levels of activity were present until May.

Several labs reported influenza A positive results into the middle of June. The majority of labs experienced their peak number of influenza A positives during the weeks ending December 28, 2013 and January 4, 2014. The highest percentage of influenza A positive results (26.3%) also occurred during the week ending December 28, 2013 (MMWR Week 52) (Figure 12). Influenza A positive specimens comprised 92.6% of influenza positive specimens reported by sentinel laboratories. Influenza A activity was similar to that reported by sentinel laboratories during the 2012-2013 season and approximately three times higher than during the 2011-2012 season.

Influenza B activity reported by the sentinel laboratories was lower than influenza A activity, comprising 7.4% of positive specimens reported. Reported influenza B activity was very sporadic throughout the influenza season, although slight increases in activity were noted during late December and early January and again during April and May. The highest statewide number of total influenza B positive results occurred during the week ending December 21, 2013 (MMWR Week 51) (Figure 12).

**Figure 12. Positive Influenza Specimens and the Percent Positive for Influenza\* from MDCH Influenza Sentinel Laboratories, by Date Reported, September 29, 2013-May 17, 2014**



\*The percent positive for influenza is calculated from data provided by 14 sentinel laboratories

Respiratory syncytial virus (RSV) was detected throughout the season, with increased activity reported during mid-December through mid-March. There was great variability in RSV activity from December to March; the highest number of positive lab specimens statewide were reported during the week ending January 11, 2014. Parainfluenza positive results occurred sporadically throughout the season; types 1, 2 and 3 were all detected. Parainfluenza 1 occurred more frequently during October and November

while parainfluenza 3 was noted more frequently during April and May. Adenoviruses were also detected sporadically throughout the season. Human metapneumovirus positive results were increased during mid-February through April and were sporadic during other times this season.

### **National Data (Centers for Disease Control and Prevention; see Resource 3)**

During the 2013–14 U.S. influenza season, influenza activity increased starting in November and peaked in late December. Influenza A/pH1N1 viruses predominated overall, but influenza B viruses and, to a lesser extent, influenza A/H3N2 viruses also were reported. This season was the first since the 2009 pH1N1 pandemic in which pH1N1 viruses predominated and was characterized by lower levels of outpatient illness and mortality than influenza A/H3N2–predominant seasons, but higher hospitalization rates among adults aged 50–64 years compared with recent years.

During September 29, 2013–May 17, 2014, 53,470 (17.3%) specimens were positive for influenza via testing at World Health Organization and National Respiratory and Enteric Virus Surveillance System collaborating laboratories in the U.S. Of the positive specimens, 46,727 (87.4%) were influenza A viruses, and 6,743 (12.6%) were influenza B viruses. Among these influenza A viruses, 31,353 (67.1%) were subtyped; 28,323 (90.3%) were pH1N1 viruses, and 3,030 (9.7%) were influenza A/H3 viruses.

CDC has antigenically characterized 2,905 influenza viruses since October 1, 2013. Of 2,036 pH1N1 viruses tested, 2,033 (99.9%) were similar to A/California/7/2009, the A/H1N1 component of the 2013–14 Northern Hemisphere vaccine. Three viruses (0.1%) of the 2,036 tested showed reduced titers. Of the 426 influenza A/H3N2 viruses tested, 406 (95.3%) were similar to A/Texas/50/2012, the A/H3N2 component of the 2013–14 Northern Hemisphere vaccine. Twenty (4.7%) of the 426 tested had reduced titers. Of the 443 influenza B viruses tested, 323 (72.9%) belonged to the B/Yamagata lineage; 322 (99.7%) were similar to B/Massachusetts/2/2012, the influenza B component of the 2013–14 Northern Hemisphere trivalent and quadrivalent vaccines. One (0.3%) virus had reduced titers against B/Massachusetts/2/2012. The remaining 120 (27.1%) B viruses were of the B/Victoria lineage and similar to B/Brisbane/60/2008, which was also included in the 2013–14 Northern Hemisphere quadrivalent vaccine.

A total of 6,294 influenza virus specimens were tested for resistance to influenza antiviral medications. All 508 influenza B viruses and 683 influenza A/H3N2 viruses tested were sensitive to oseltamivir and zanamivir. Among 5,103 pH1N1 viruses tested for oseltamivir resistance, 59 (1.2%) were resistant, and all 1,890 viruses tested for resistance to zanamivir, including 59 oseltamivir-resistant viruses, were sensitive. Resistance to the adamantanes persisted among influenza A viruses currently circulating globally (the adamantanes are not effective against influenza B viruses).

Differences in the timing of influenza activity among the 10 U.S. Department of Health and Human Services regions were observed. Activity in Region 4 in the southern U.S. peaked earliest, during the week ending December 7, 2013 (week 49), and activity in Regions 2 and 3 in the eastern U.S. peaked latest, during the week ending January 25, 2014 (week 4). Whereas pH1N1 activity peaked between late December and late

January, influenza B activity occurred later in the influenza season. Influenza A viruses predominated until late March, and influenza B viruses became most common nationally during the week ending March 29, 2014 (week 13). The intensity and timing of influenza B activity varied geographically. Region 4 never reported a single week during which B viruses predominated, whereas influenza B predominated in Region 6 from weeks 9-20 (weeks ending March 1 through May 17, 2014). During the late season increase in influenza B activity, the overall number of influenza A viruses decreased; however, the proportion of viruses subtyped as A/H3 increased. In week 13 (the week ending March 29, 2014) influenza A/H3 viruses became the predominant influenza A virus nationally. Region 2 was most heavily impacted with late season influenza B activity, whereas Region 1 reported the most late season A/H3 activity.

During the 2013–14 season, one case of human infection with an H3N2v virus occurred during week 40 (the week ending October 5, 2013) in a child from Iowa with direct exposure to swine. The child fully recovered, and no additional cases were identified.

Nationally, the weekly percentage of outpatient visits for ILI to healthcare providers participating in the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet) was at or above the national baseline level of 2.0% for 15 consecutive weeks during the 2013–14 season. The peak ILI percentage was 4.6% and occurred in the week ending December 28, 2013 (week 52). During 2012–13, when influenza A/H3N2 predominated, the peak ILI percentage was 6.1% and also occurred in late December.

State and territorial epidemiologists determine the geographic distribution of influenza in their jurisdictions using all available data sources and report a weekly influenza activity code. The geographic distribution of influenza activity was most extensive during the week ending January 18, 2014 (week 3), when 41 states reported widespread influenza activity and nine states reported regional influenza activity.

CDC monitors hospitalizations associated with laboratory-confirmed influenza infections using the Influenza Hospitalization Surveillance Network (FluSurv-NET). Cumulative hospitalization rates (per 100,000 population) were calculated by age group based on 9,635 influenza hospitalizations during October 1, 2013–April 30, 2014. Among 9,586 cases with influenza type specified, 8,497 (88.2%) were associated with influenza A, 1,046 (10.9%) with influenza B, and 43 (0.4%) were mixed influenza A and B infections. Persons aged 18-64 years accounted for 57.4% of cases. The cumulative incidence for all ages was 35.6 per 100,000. The cumulative hospitalization rate by age group was 46.9 (for 0–4 years), 9.5 (5–17 years), 22.0 (18–49 years), 54.3 (50–64 years), and 88.1 (≥65 years). During the past four influenza seasons, age-specific hospitalization rates have ranged from 15.9 to 77.4 (0–4 years), 4.0 to 27.2 (5–17 years), 4.2 to 23.4 (18–49 years), 8.1 to 40.6 (50–64 years), and 25.7 to 183.1 (≥65 years).

As of May 30, 2014, among the FluSurv-NET adult patients for whom medical chart data were available, 89.0% had at least one underlying medical condition; the most frequent were obesity (42.9%), metabolic disorders (36.0%), and cardiovascular disease (34.6%). Among children, 57.0% had at least one underlying medical condition; the most common were asthma (25.4%) and neurologic disorders (14.1%). Among the 882 hospitalized women of childbearing age (15–44 years), 197 (22.3%) were pregnant.

During 2013–14, the percentage of deaths attributed to pneumonia and influenza (P&I) exceeded the epidemic threshold for 8 consecutive weeks, from January 11, 2014 to March 1, 2014 (weeks 2–9). The percentage of deaths due to P&I peaked at 8.7% during the week ending January 25, 2014 (week 4). From 2008–09 through 2012–13, the peak percentage of P&I deaths has ranged from 7.9% to 9.9%, and the total number of consecutive weeks at or above the epidemic threshold has ranged from 1 to 13.

During 2013–14, 96 laboratory-confirmed, influenza-associated pediatric deaths were reported from 30 states, New York City, and Chicago. The deaths included 18 children aged <6 months, 24 aged 6–23 months, 8 aged 2–4 years, 27 aged 5–11 years, and 19 aged 12–17 years. The median age was 4.6 years. Seventy-nine deaths were associated with influenza A (43 with pH1N1, 2 with A/H3, and 34 with A viruses for which subtyping was not performed), 13 deaths were associated with influenza B, 2 deaths were associated with an untyped influenza virus, and 2 deaths were related to an influenza A and B coinfection. Of 90 children with available medical history, 49 (54.4%) had at least one high-risk medical condition. Neurologic disorders (29 [32.2%]) and pulmonary disease (17 [18.9%]) were the most commonly identified conditions.

### **2014-2015 Seasonal Influenza Vaccine**

The Food and Drug Administration's Vaccines and Related Biological Products Advisory Committee has determined that the 2014–2015 influenza vaccines used in the U.S. have the same antigenic composition as those from 2013–2014. The trivalent vaccines should contain an A/California/7/2009-like (2009 H1N1) virus, an A/Texas/50/2012-like (H3N2) virus, and a B/Massachusetts/2/2012-like (B/Yamagata lineage) virus. The committee also recommended that quadrivalent vaccines contain a B/Brisbane/60/2008-like (B/Victoria lineage) virus. These recommendations were based on global influenza surveillance data related to epidemiology, antigenic and genetic characteristics, serologic responses to 2013–2014 seasonal vaccines, and the availability of candidate vaccine viruses and reagents.

### **WORLDWIDE NOVEL AND AVIAN INFLUENZA STRAINS**

The 2013-2014 influenza season saw the continuation of the highly pathogenic avian influenza A/H5N1 outbreak in humans, poultry and wild birds. Canada reported their first human case, the first in North America, in January 2014. This case had a travel history to China, where the virus is endemic. From 2003 to June 27, 2014, there have been 667 human cases, including 393 deaths, in 15 countries spanning Asia, the Middle East and Africa. All cases are considered to be sporadic, with no evidence of community-level transmission at this time.

From March 2013 through June 27, 2014, a total of 450 laboratory-confirmed cases of human infection with avian influenza A/H7N9, including 165 deaths, have been reported to WHO: 435 cases by China National Health and Family Planning Commission, 4 cases by the Taipei Centers for Disease Control, 10 cases by the Centre for Health Protection, China, Hong Kong SAR, and 1 case in a Chinese traveler, reported from Malaysia. Since June 2013 (second wave) until June 27, 2014, 317 cases were reported. The age and sex distribution of cases was fairly similar during the first and

second waves. Overall, most cases have occurred in middle-aged and older men. The median age is 58 years (first wave 62 years; second wave 57 years). Infections in men are more frequently reported than those in women. The case fatality rate among reported cases from both waves is 36%, although this might change as some patients are still hospitalized in critical condition. As in the first wave, most of the human cases reported in the second wave have been considered severe, with the exception of children, who have been presenting with milder clinical symptoms. A total of 14 family clusters have been reported during the two waves; all clusters except for one involved two family members. Although much remains unknown about this virus, such as the animal reservoir(s) in which it is circulating, the main exposures and routes of transmission to humans, and the distribution and prevalence of this virus among people and animals (including the distribution in wild birds), human infection appears to be associated with exposure to infected live poultry or contaminated environments, including markets where live poultry are sold. Current evidence suggests that these avian influenza A/H7N9 viruses do not transmit easily from poultry or environments to humans, although their transmissibility may be greater compared with avian influenza A/H5N1 viruses.

Other human infections with novel influenza viruses since October 2013 include three cases of avian influenza A/H10N8 from the Jiangxi province of China, two cases of avian influenza A/H9N2 (one in a Chinese citizen and one in a Hong Kong citizen with residency in China), and one case of low pathogenic avian influenza A/H5N6 from China.

Cases of human infection with influenza A/H3N2 variant viruses (H3N2v) associated with exposure to swine continue to be reported in the United States. During 2012 and 2013, 318 cases were reported from 12 states. As of August 29<sup>th</sup>, one human case from Ohio has been reported during 2014.

National and international surveillance is conducted for other high and low pathogenic and avian influenza virus subtypes. Since October 2013, highly pathogenic avian influenza outbreaks of subtypes other than H5N1 in poultry occurred in Australia (H7N2), China (H5N2), Chinese Taipei (H5N2), Republic of Korea (H5N8) and Vietnam (H5N6).

Since October 2013, low pathogenic avian influenza outbreaks in poultry occurred in China (H5N2, H5N6, H7N9), Chinese Taipei (H5N2, H5N3), Germany (H5N3), Hong Kong (H7N9), Mexico (H7N3), Netherlands (H5N2, H5N3), Portugal (H7), South Africa (H5N2, H7N1, H7N7), United States of America (California: H5) and Vietnam (H7). A research project also identified subclinical avian influenza A/H11N2 in Adélie penguins from Antarctica.

## **RESOURCES**

1. For information about influenza, go to the MDCH influenza homepage at <http://www.michigan.gov/influenza>
2. The most current U.S. influenza data and archived reports are available from the CDC at <http://www.cdc.gov/flu/weekly/fluactivitysurv.htm>
3. Information on national data from the 2013-2014 influenza season is described in the MMWR article “Influenza Activity --- United States, 2013--14 Season and Composition of the 2014--15 Influenza Vaccine”, available at <http://www.cdc.gov/mmwr/pdf/wk/mm6223.pdf>
4. Current worldwide human avian influenza activity from the World Health Organization (WHO): [http://www.who.int/csr/disease/avian\\_influenza/en/](http://www.who.int/csr/disease/avian_influenza/en/)
5. For more information on the designation of MMWR weeks, please visit [http://wwwn.cdc.gov/nndss/document/MMWR\\_Week\\_overview.pdf](http://wwwn.cdc.gov/nndss/document/MMWR_Week_overview.pdf)

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