



**Bureau of Infectious Disease Control
Infectious Disease Surveillance Section (IDSS)**

**2016-17 Influenza Season
Summary Report for New Hampshire
October 2, 2016 – May 20, 2017**

In New Hampshire (NH), influenza is not a reportable disease, but surveillance systems are in place to help determine the extent of influenza morbidity and mortality in the State. During each influenza season (beginning of October through mid-May), a weekly influenza surveillance report is posted on the NH Department of Health and Human Services' website at the following link: <http://www.dhhs.nh.gov/dphs/cdcs/influenza/activity.htm>. In addition, a weekly assessment of influenza activity in NH is submitted to the Centers for Disease Control and Prevention (CDC) for inclusion in the weekly U.S. influenza surveillance report.

This report summarizes outpatient illness surveillance data reported by NH participants in the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet) and by the Automated Hospital Emergency Department Data (AHEDD) system, virologic surveillance data from the NH Public Health Laboratories, and pneumonia and influenza mortality data from the NH Division of Vital Records Administration.

New Hampshire Surveillance

Outpatient Illness Surveillance

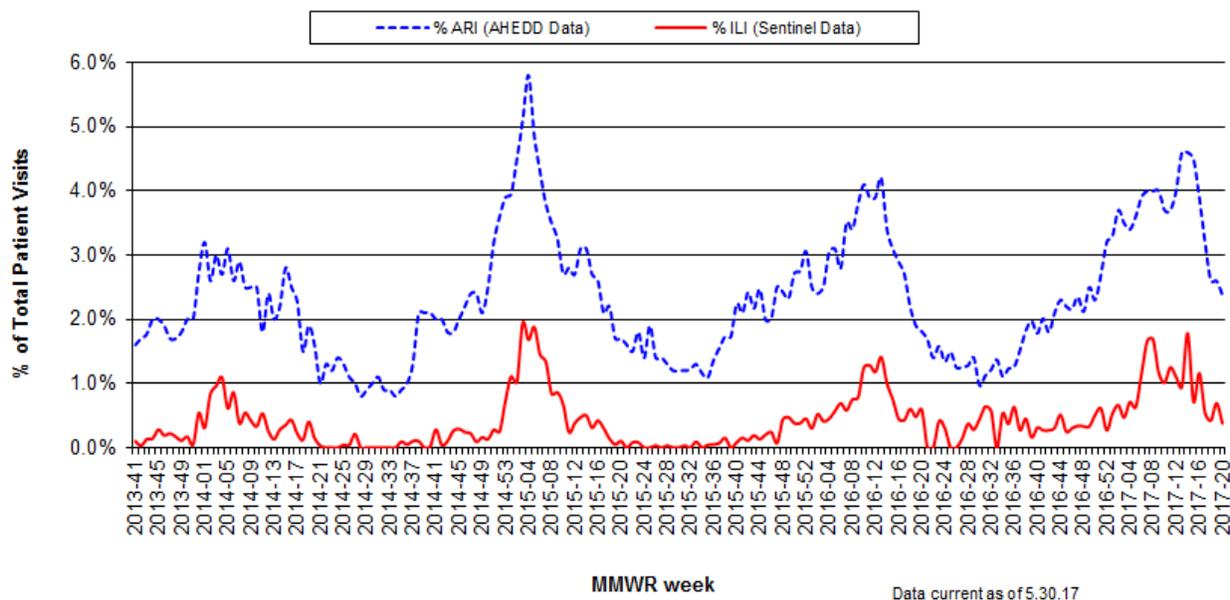
The two components of outpatient illness surveillance in New Hampshire are as follows:

1. **U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet):** Beginning in 1997, NH has participated in this collaborative effort between the Centers for Disease Control and Prevention, state and local health departments, and health care providers. For the 2016-17 influenza season, 22 NH health care providers participated. ILINet sentinel providers reported the proportion of patients who presented with influenza-like illness (ILI) on a weekly basis. ILI is defined as 1) a fever and 2) cough and/or sore throat, in the absence of a known cause. Participating providers were also asked to collect respiratory specimens from select patients and submit them to the PHL for viral subtyping.
2. **The Automated Hospital Emergency Department Data (AHEDD) system:** This system is a collaborative effort between NH acute care hospitals and the NH DHHS. The goal is for all 26 acute care hospitals in the State to participate in this system. For the 2016-17 influenza season, the number of hospitals electronically transmitted real-time data each week from emergency department encounters throughout the day to NH DHHS ranged between 22-26 hospitals per week. Chief complaint text within the system was queried for complaints of acute respiratory illness (ARI) in patients seen in emergency departments. While ARI includes encounters that fit the definition of ILI above, it also includes encounters for complaints such as acute bronchitis or otitis media. Because these two systems collect information using different methods and represent different patient populations, it is expected that the proportions of ILI and ARI seen in these systems will differ. However, the overall trend of activity is expected to be similar.

For the 2016-17 season, reported ILI activity in NH reached its highest levels during MMWR weeks 7-8 (weeks ending February 18 and February 25 2017, respectively) and 13-15 (weeks ending April 1, 8, and 15 of 2017, respectively), when the peak percentages of patient visits to NH ILINet providers with patients presenting with ILI were 1.7% and 1.8%, respectively. The highest percentage of patient visits due to ARI reported through the AHEDD system was during weeks 13-15 (weeks ending April 1, 8, and 15 of 2017) when 4.6% of patient encounters in hospital emergency departments were due to ARI. Another smaller sustained peak in percentage of visits due to ARI at 4.0% was observed during weeks 7-9 (weeks ending February 18, 25, and March 4 of 2017).

Using percent ARI and ILI together as indicators for when flu activity was highest, activity for the 2016-17 season peaked during week 14, when ARI and ILI were at 4.6% and 1.8%, respectively, which is similar to the timing for peak activity in the previous 2015-16 season when highest activity was observed during week 13, but much later than what is typically seen during most other previous seasons. This influenza activity peaked at the latest point in the season since formal influenza surveillance first began in NH. The 2016-2017 season was slightly more intense compared to the previous 2015-16 season, as indicated by comparing the peaks for ARI and ILI. For example during the 2015-16 season ARI and ILI peaked at 4.2% and 1.4%, respectively. See Figure 1 below for ILI and ARI reported during the 2016-17 season and the previous three influenza seasons.

Figure 1: Acute Respiratory Illness (ARI) & Influenza-like Illness (ILI) as a Percentage of Total Patient Visits Reported through the Automated Hospital Emergency Department Data (AHEDD) System and by NH ILINet Providers, 09/29/13-5/20/17



Reported Influenza-like Illness (ILI) by Age Group & Practice Type

During the 2016-17 influenza season, persons in the 5-24 year age group accounted for the greatest percentage (55.4%) of patients presenting with ILI reported by NH ILINet providers, followed by the 0-4 year age group (18.3%), then by the 25-49 year age group (15.4%). The next highest percentage ILI by age category was in the 50-64 year age group (7.7%) followed by the 65-plus year age group (3.2%). The percentages of ILI cases by age categories were observed to follow a different order of ranking

compared to the previous 2015-16 season, with the percentage of ILI patients in the 0-4 year age category swapping rank with the 25-49 year age category (i.e., the 0-4 year age category comprised a higher percentage than the 25-49 year age group in the 2016-17 season). Reported ILI by age groups for the 2016-17 influenza season is shown in Figure 2 and Table 1 below.

Each year there are typically some changes in NH healthcare providers who participate in the U.S. ILINet program. For the 2016-17 influenza season there were 21 providers enrolled in the ILINet program, which is a slight decrease compared to the previous season which had 24. At least 18 (86%) of the 21 providers reported on a regular basis throughout the season. The majority were family practice offices where patients of all ages are seen.

Figure 2: Influenza-like Illness (ILI) by Age Group and Practice Type as Reported by NH ILINet Providers, 2016-17 Influenza Season (10/02/16–5/20/17)

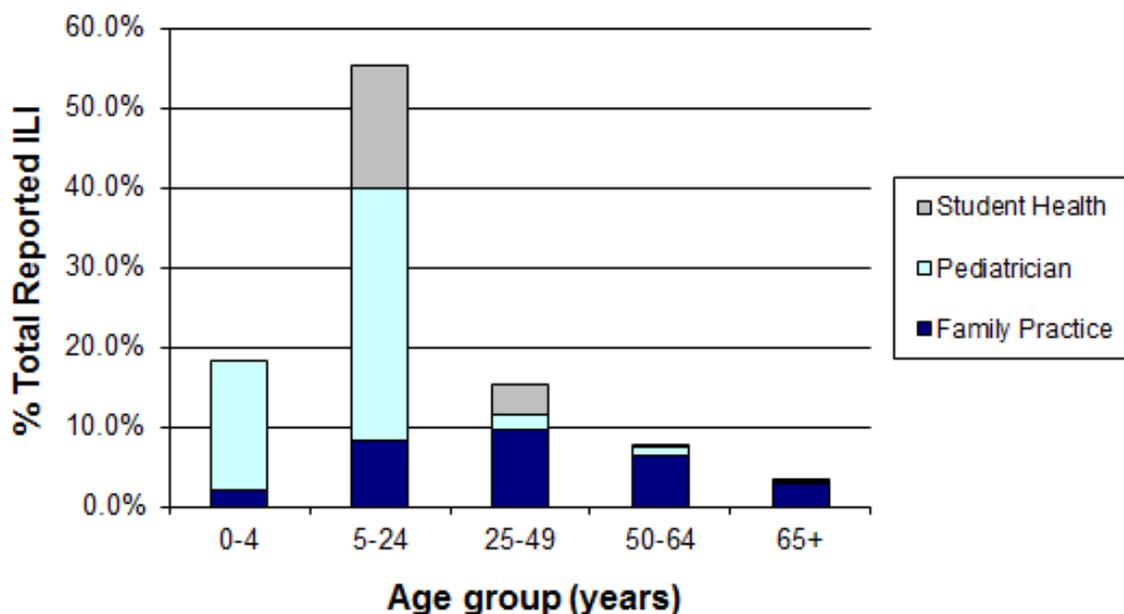


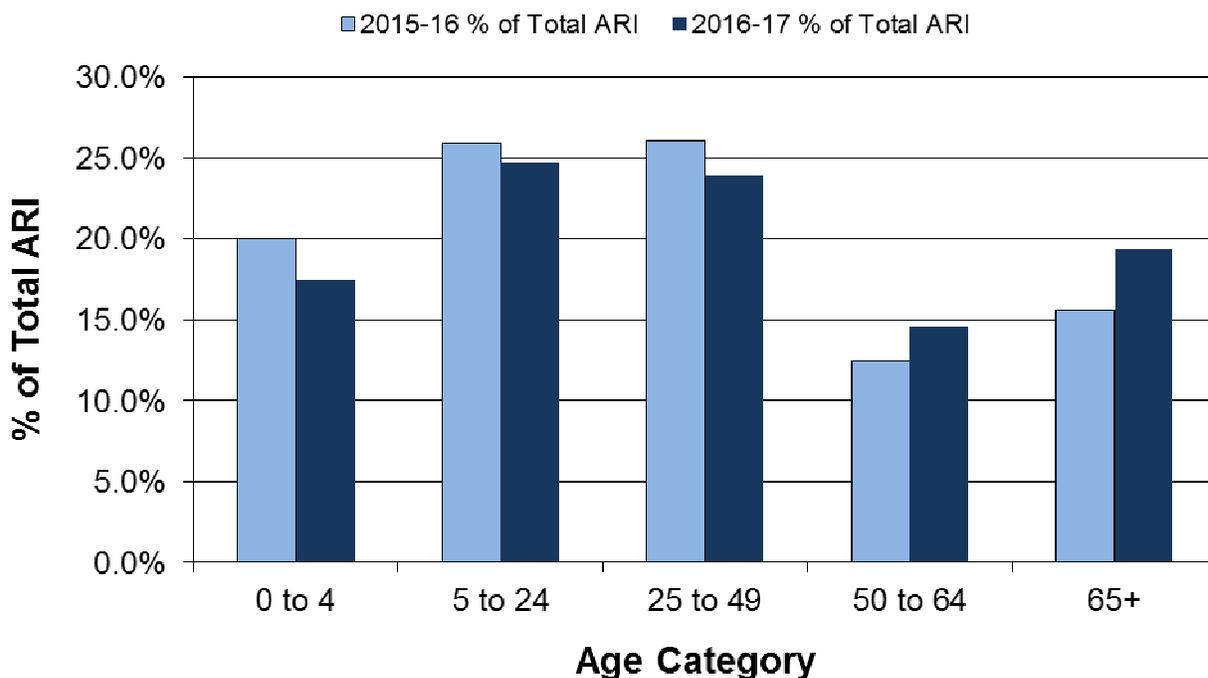
Table 1: Patient Visits for Influenza-like Illness (ILI) by Age Group and Practice Type, NH ILINet Providers, 2016-17 Influenza Season (10/02/16–5/20/17)

Practice type	Age Group (years)					Total ILI	Total Patient Visits
	0-4	5-24	25-49	50-64	65+		
Family Practice	18	69	80	53	23	243	83,163
Pediatrics	136	267	17	10	3	433	18,685
Student Health	0	129	32	2	1	164	17,915
Total	154	465	129	65	27	840	119,763
% of total ILI	18.3%	55.4%	15.4%	7.7%	3.2%		

Reported Acute Respiratory Illness (ARI) by Age Group

During the 2016-17 influenza season, persons in the 5-24 and 25-49 year age groups accounted for the largest percent of all ARI encounters in hospital emergency departments at 24.7% and 24.7%, respectively (see Figure 3 below). Age groups with the next highest percentage of ARI encounters include 65-plus (19.3%), 0-4 (17.5%), and 50-64 (14.6%). As seen in Figure 3, the percentage distributions by age category were slightly higher in the three youngest age categories, and lower in the two oldest age categories.

Figure 3: Acute Respiratory Illness (ARI) by Age Group as Reported by NH Automated Hospital Emergency Department Data (AHEDD) System, 2016-17 Influenza Season (10/02/16-5/20/17) (N = 10,474 ARI encounters) and 2015-16 Influenza Season (10/04/15-5/21/16) (N = 10,776 ARI encounters)

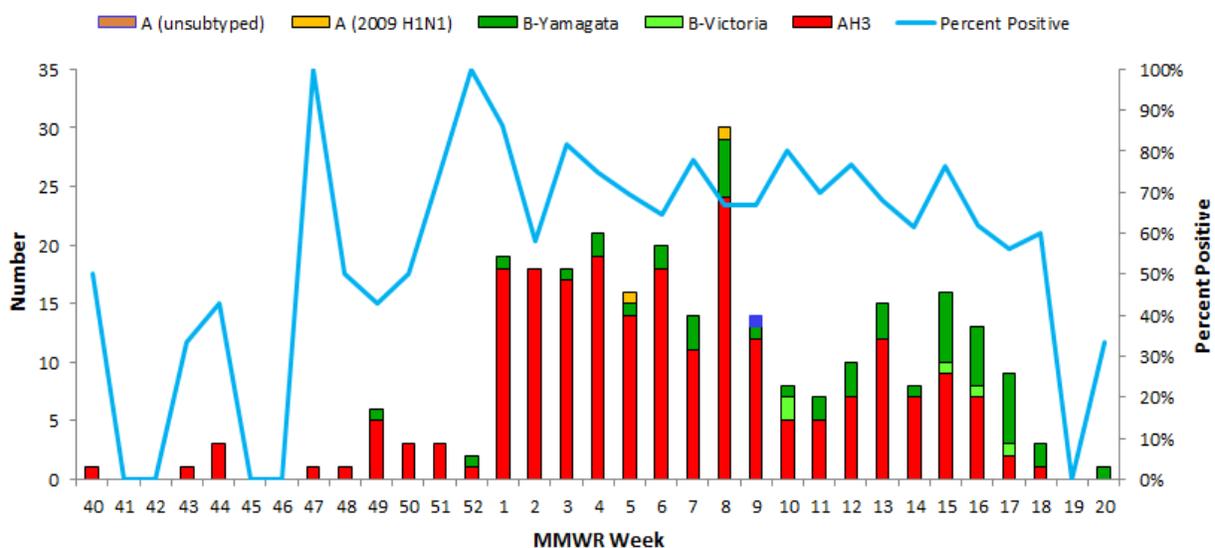


Laboratory Surveillance

The NH Public Health Laboratories (PHL) receives respiratory specimens for influenza testing from ILINet providers, other health care providers and hospitals throughout the State, and from respiratory outbreak settings such as in long-term care facilities. Testing is important to identify circulating influenza viral subtypes, and to confirm specimens that test positive by rapid test. Typically, a large majority of specimens submitted to the PHL have previously tested positive by rapid test in health care provider offices or hospital laboratories. Therefore, it is expected that a high percentage of specimens received by the PHL for influenza testing will be positive. This was observed in the previous 2013-14, 2014-15, and 2015-16 seasons when 54%, 57%, and 71% of total submitted specimens, respectively, tested positive. During the 2016-17 season 66% (n=282) of 427 specimens submitted tested positive for influenza.

The number of positive specimens and subtypes reported for each MMWR week of the 2016-17 season is shown in Figure 4. The first positive specimen was detected at the start of the flu season during MMWR week 40 in early October, when one specimen tested positive for influenza A (H3). Figure 4 depicts a peak for the number of positive specimens (n=30) during week 8 (ending February 25, 2017), which is in line with what is typically seen during other regular flu seasons when the highest number of positives tend to occur in the month of February (e.g., typically during weeks 6 through 9). The peak week for positive specimens (week 8) coincides with same week when ILI activity first peaked (during weeks 7-8) and during the first (smaller) peak of ARI (weeks 7-9). Although we might normally expect to see such peaks occur during the highest peak week of ILI/ARI, given that the magnitude the first and second peaks in ILI/ARI were fairly similar these laboratory results still correlate fairly well with the height of observed respiratory illness.

Figure 4: Influenza Virus Isolates, by Viral Subtype, NH Public Health Laboratories, 2016-17 Influenza Season (10/02/16-5/20/17) (N = 296)



The different viral subtypes that circulated in NH during the 2016-17 influenza season are presented in table 2. Positive isolates consisted of 79.8% influenza A (H3), 0.7% influenza A (H1N1)pdm09, 0.4% influenza A (unsubtyped), and 19.2% influenza B (including Yamagata lineage, Victoria lineage, and influenza B virus for which lineage was not performed). In comparison during NH’s 2015-16 season positive isolates consisted of 6.7% influenza A (H3), 56.5% influenza A (H1N1)pdm09, and 36.8% influenza B. Compared to the previous 2015-16 season a much higher percentage of specimens tested positive for influenza A (H3), and lower percentages were positive for influenza A (H1N1)pdm09 and influenza B. The NH PHL developed capabilities to test for influenza B lineage, and each of the two lineages were reported out in weekly reports throughout the season. The first influenza B detection this season occurred during week 49, and these viruses were detected consistently between weeks 3 through 20 with only one week (week 19) when there was no influenza B detected. Of the 54 total influenza B viruses detected, five (9.3%) were B-Victoria, 48 (88.9%) were B-Yamagata, and one (1.9%) was influenza B for which lineage was not performed. The percentage of total positive specimens comprised of influenza B (19.2%) is well within the range of what was observed during the previous five influenza seasons (4%-30%).

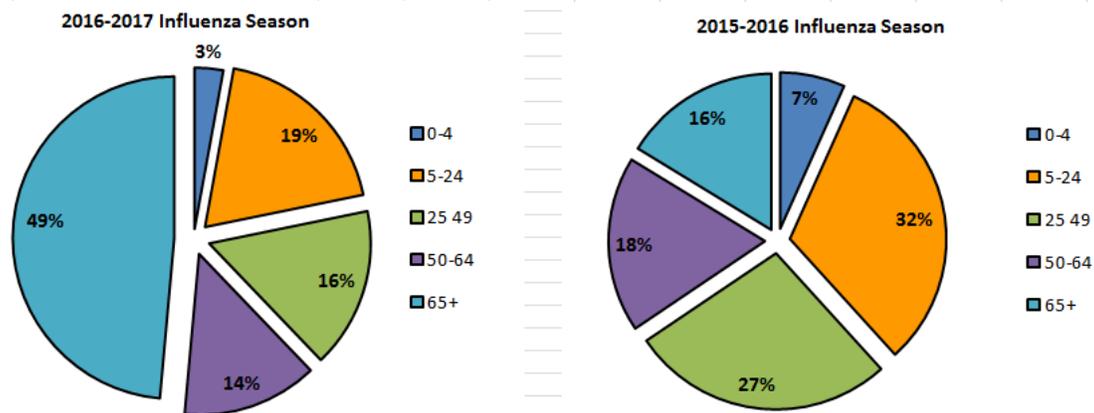
Table 2: Results of Specimens Received by NH Public Health Laboratories, 2016-17 Influenza Season (10/02/16-5/20/17)

Results	# Specimens	% of total positive
Influenza A (H3)	225	79.8%
2009 influenza A (H1N1)	2	0.7%
Influenza B Victoria	5	1.8%
Influenza B Yamagata	48	17.0%
Influenza B (lineage not performed)	1	0.4%
Influenza A (unsubtyped)	1	0.4%
Negative for influenza	145	
Total	427	

Influenza test results reported by CDC for the New England region as a whole indicated the following percentages of each subtype (denominator equals specimens with known subtypes): 74.5% influenza A (H3), 1.1% influenza A (H1N1)pdm09, and 24.4% influenza B. Compared to regional New England data NH had a slightly higher percentage of total positive for influenza A (H3) (79.8% vs 74.5%), a similar percentage of influenza A (H1N1)pdm09 (0.7% vs 1.1%), and a lower percentage of total positives for influenza B (19.2% vs 24.4%). Subtypeable flu results breakdown for the New England Region were similar but slightly different when compared to the national test results, with a similar percentage for influenza A (H3) (74.5% vs. 75.4%), a slightly lower percentage for influenza A (H1N1)pdm09 (1.1% vs 2.2%), and a slightly higher percentage for influenza B (24.4% vs. 22.4%).

Figure 5 below further describes PHL influenza test results for NH according to different age groups. Compared to the 2015-16 season a much greater percentage of positive specimens were observed in the 2016-17 season for the 65-plus year age group (49% vs 16%), while the other four age groups were lower, as follows: 0-4 (3% vs 7%), 5-24 (19% vs. 32%), 25-49 (16% vs 27%) and 50-64 (14% vs 18%) year age groups.

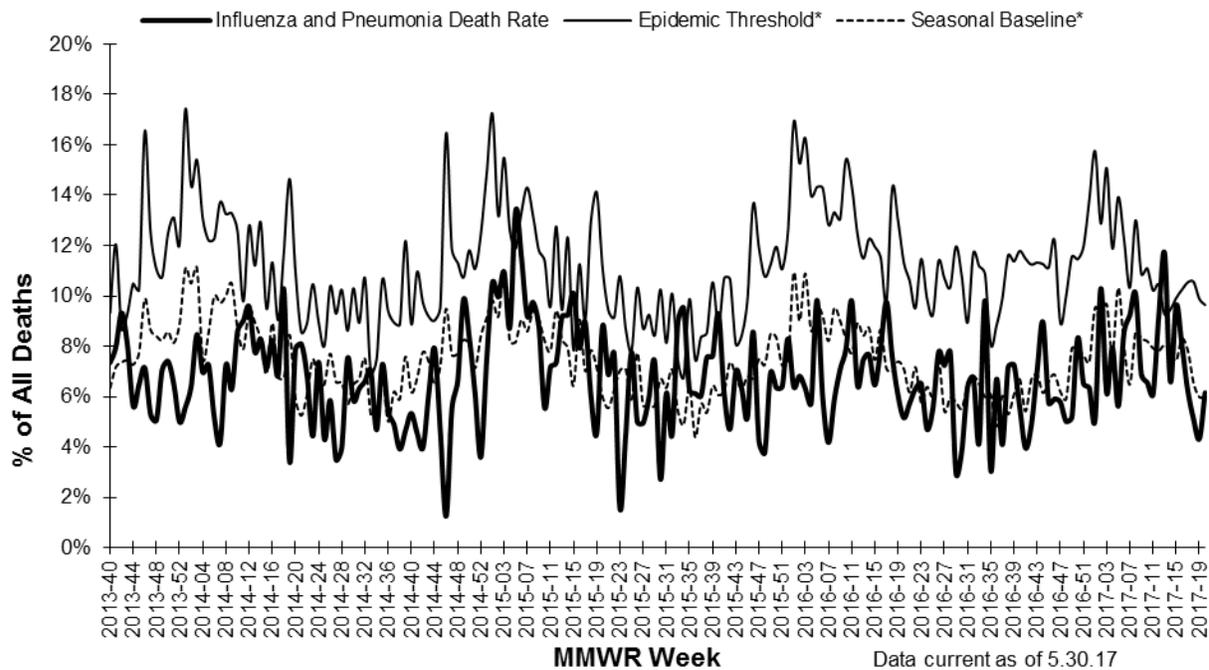
Figure 5: Age Distribution of Laboratory Confirmed Influenza, NH Public Health Laboratories, 2016-17 Influenza Season (10/02/16-5/20/17) and 2015-16 Influenza Season (10/04/15-5/21/16)



Pneumonia and Influenza (P&I) Mortality

Pneumonia and Influenza (P&I) deaths in New Hampshire are identified through review of electronically filed death certificates by looking at the causes of death listed on each death certificate. The following graph, which shows the proportion of deaths attributed to P&I, represents all deaths recorded by NH's Division of Vital Records Administration. This includes resident and non-resident deaths that occurred within the State, and may not include deaths of NH residents that occurred out-of-state, or cases being investigated by the Medical Examiner's Office.

Figure 6: Pneumonia and Influenza Mortality, New Hampshire, MMWR Week 40 2013 to MMWR Week 20 2017 (9/29/13-5/20/17)



*Seasonal baseline is calculated using the previous 5 years of data. If the proportion of P&I deaths for a given week exceeds the baseline value for that week by a statistically significant amount (1.645 standard deviations), then P&I deaths are said to be above the epidemic threshold, and the proportion of deaths above threshold are considered attributable to influenza.

During the 2016-17 influenza season, the percent of all deaths recorded in NH that were reported as due to P&I remained below the weekly epidemic threshold, except for one week, MMWR week 13, when the threshold was exceeded (see Table 3 below).

Table 3. Percent of Total Reported Deaths in NH Attributed to Pneumonia and Influenza (P&I) Above the Epidemic Threshold by MMWR Week, 2015-16 Influenza Season (10/04/15-5/21/16)

MMWR Week	Dates	P&I Deaths (% of Total Deaths)	Weekly Epidemic Threshold
2017-13	03/26/2017 - 04/01/2017	11.7%	9.3%

Based on electronic surveillance of death certificates a total of 47 influenza-associated NH deaths (deaths where influenza is specifically listed as a cause or contributing cause of death on the death certificate) were observed during the 2016-17 influenza season, which is within the range of deaths observed during other seasons since NH first began tracking this parameter in 1997. This is comprised of 45 adults plus two pediatric influenza-related deaths. The counties of residence for persons with identified influenza-related deaths include Belknap, Carroll, Cheshire, Grafton, Hillsborough, Merrimack, Rockingham and Strafford.

Influenza Activity in New Hampshire as Assessed by the State Epidemiologist

Influenza activity levels in NH are reported each week to CDC to be included in the national weekly influenza surveillance report. Such activity levels help to describe the degree of geographic distribution of influenza activity. CDC defines influenza activity levels as follows:

- **No Activity:** Low ILI activity and no laboratory-confirmed cases of influenza.
- **Sporadic:** Low ILI activity and isolated laboratory-confirmed influenza cases or a single influenza outbreak has been reported.
- **Local:** Increased ILI activity or influenza outbreaks in a single region of the state, and recent laboratory-confirmed influenza in that region.
- **Regional:** Increased ILI activity or influenza outbreaks in ≥ 2 , but less than half of state regions, and recent laboratory-confirmed influenza in affected regions.
- **Widespread:** Increased ILI activity or influenza outbreaks in at least half of state regions, and recent laboratory-confirmed influenza in the state.

In NH, the reported influenza activity level is based on ILI and ARI reported by the Sentinel Providers and the AHEDD surveillance systems respectively, reports of laboratory confirmed influenza, and reported outbreaks in facilities.

In the 2016-17 season, geographic distribution of influenza activity was at a level of either no activity, sporadic, or local activity for weeks 40-43, with the first sign of clearly increased activity observed at week 44 (week ending November 5, 2016), when it reached regional activity. Starting at week 49 of 2016, activity remained at either regional or widespread for a span of 23 weeks, lasting through week 19 of 2017. Activity declined to local during weeks 20-24 before reaching a level of no activity during week 25.

National Surveillance

CDC reports that this was a notable influenza season due to the predominance of influenza A (H3N2). This season's severity in regards to hospitalization rates and percentage of deaths attributable to P&I compared to other seasons with a predominance of influenza A (H3N2) was within expected ranges and values. Prior seasons that experienced a predominance of influenza A (H3N2) were noted to have increased hospitalizations and deaths when compared to seasons that were not influenza A (H3N2)-predominant. During the 2016-17 season, of the subtypeable viruses, influenza A viruses predominated nationally (77.9%), with less influenza B viruses (22.1%). Influenza A (H3N2) predominated among influenza A subtyped viruses identified (97.2%) with influenza A (H1N1)pdm09 viruses making up the remainder (2.8%). This is a change from the 2015-2016 season when influenza A (H1N1)pdm09 predominated. Influenza B viruses were more commonly identified from late March through mid-May. Of the influenza B viruses for which lineage were determined, B/Yamagata lineage (76.5%)

predominated over B/Victoria lineages (28.8%). The majority of viruses characterized this season were antigenically similar to the reference viruses representing the recommended components of the 2016-17 Northern Hemisphere influenza vaccine.

Based on the percentage of specimens testing positive for influenza the national peak of influenza activity occurred during week 6 (week ending February 11, 2017). While there were some differences among U.S. Department of Health and Human Services regions observed in the timing of influenza activity (based on percentage of specimens testing positive), region 1 (comprised of the six New England states) also peaked during week 6.

Antigenic Characterization

CDC has antigenically characterized 1,824 influenza viruses collected and submitted by U.S. laboratories since October 1, 2016, including 296 influenza A (H1N1)pdm09 viruses, 772 influenza A (H3N2) viruses, and 756 influenza B viruses. Among the 296 influenza A (H1N1)pdm09 viruses characterized, 294 (99.3%) were found to be antigenically similar to A/California/7/2009, the reference virus component of the 2016-17 Northern Hemisphere influenza vaccine. 730 of 772 (94.9%) influenza A (H3N2) viruses were antigenically sequenced and characterized as A/Hong Kong/4801/2014-like, which is a virus representing the influenza A (H3N2) component of the 2016-17 Northern Hemisphere vaccine. All 429 (100%) influenza B/Yamagata viruses characterized were found to be similar to B/Phuket/3073/2013-like, the reference virus representing the influenza B/Yamagata-lineage component of the 2016-17 Northern Hemisphere trivalent and quadrivalent vaccines. 283 of 327 (86.5%) influenza B/Victoria-lineage viruses were characterized as B/Brisbane/60/2008-like, the reference virus representing the influenza B/Victoria-lineage component of the 2016-17 Northern Hemisphere quadrivalent vaccine. 44 of the B/Victoria-lineage viruses were found to reduced titers, and 39 of these belonged to a deletion subgroup.

Recommendations for the 2017-18 Influenza Season Vaccines

The Food and Drug Administration has recommended that the 2017-18 influenza trivalent vaccines used in the United States contain an A/Michigan/45/2015 (H1N1)pdm09-like virus, an A/Hong Kong/4801/2014 (H3N2)-like virus, and a B/Brisbane/60/2008-like (B/Victoria lineage) virus. For the quadrivalent vaccine, which has two influenza B viruses, the FDA recommended the viruses referenced above for the trivalent vaccines, as well as including a B/Phuket/3073/2013-like virus (B/Yamagata lineage). These recommendations for the 2017-18 season are a change for the influenza A (H1N1) component compared to the prior season's vaccine.

Influenza Mortality

During the 2016-17 season, based on data from CDC's National Center for Health Statistics Mortality Surveillance System, the proportion of deaths attributed to P&I was at or above the epidemic threshold for 12 consecutive weeks, spanning from week 52 through week 11. The percentage of deaths attributable to P&I peaked twice, once at 8.2% during week 3 (week ending January 21, 2017) and again at 8.1% during week 8 (week ending February 25, 2017).

Regarding pediatric influenza associated mortality, there were 98 laboratory-confirmed deaths reported from Chicago, New York City, and 28 states (two were reported in New Hampshire). Among the 98 deaths, 46 were associated with an influenza A (H3N2), 3 were associated with influenza A (H1N1)pdm09 virus infection, 14 were associated with an influenza A virus infection for which no

subtyping was performed, 34 were associated with influenza B virus infection, and one was associated with an influenza virus for which the type was not determined. As a reference, since influenza-associated pediatric deaths became nationally notifiable in 2004, the total number has ranged from 37 to 171 per season (excluding the 2009 pandemic when there were 358 such deaths reported between April 15, 2009-October 2, 2010).

Influenza-like Illness Outpatient Visits

Based on national data reported to CDC via ILINet, for the 2016-17 influenza season, influenza activity as measured by percentage of outpatient visits for ILI peaked nationally during week 6 (week ending February 11, 2017) at 5.1%, and was higher and earlier in the season than the previous season's peak (3.6%).

National Summary Reports

The Centers for Disease Control and Prevention influenza season summary report can be found on the CDC website at <https://www.cdc.gov/mmwr/volumes/65/wr/mm655051a5.htm>. General information about seasonal influenza, novel influenza, influenza surveillance, and influenza prevention can be found at <http://www.cdc.gov/flu/>.

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All data in this report are based upon information provided to the New Hampshire Department of Health and Human Services under specific legislative authority. The numbers reported may represent an underestimate of the true absolute number and incidence rate of cases in the state. The unauthorized disclosure of any confidential medical or scientific data is a misdemeanor under New Hampshire law. The department is not responsible for any duplication or misrepresentation of surveillance data released in accordance with this guideline.