



## INFLUENZA IN RHODE ISLAND



2017-2018 EPIDEMIOLOGY AND SURVEILLANCE REPORT

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## INTRODUCTION

This report provides a summary of seasonal influenza surveillance in Rhode Island during the 2017-2018 influenza season, which spanned from October 1, 2017 to May 19, 2018. Rhode Island Department of Health's (RIDOH) Center for Acute Infectious Disease Epidemiology maintains multiple influenza surveillance systems that together provide a comprehensive picture of influenza in the state of Rhode Island. These surveillance systems are designed to monitor influenza activity intensity levels and geographic spread of influenza-like illness (ILI); assess the severity of influenza infections as measured by hospitalizations and deaths; characterize influenza strains; monitor outbreaks in congregate living settings; and aid the Centers for Disease Control and Prevention (CDC) in detecting novel influenza viruses. Each surveillance system collects data on a different aspect of influenza activity in Rhode Island. Data from each system will be presented in this report. For the purposes of influenza surveillance, Morbidity and Mortality Weekly Report Weeks (MMWR Weeks) will be used to represent time. Each MMWR Week spans from Sunday to Saturday and is numbered, with MMWR Week 1 beginning with the first week of January. Although influenza surveillance occurs year-round, each year the influenza season spans from MMWR Week 40-20, typically October through May. Using MMWR weeks when presenting influenza data facilitates comparison across seasons. Even though the exact dates of the weeks change slightly each year, MMWR weeks are generally consistent over time.

## SUMMARY OF SEASON

In Rhode Island, and in the United States as a whole, the 2017-2018 influenza season was a high severity season, with high levels of influenza and influenza-like illness (ILI) visible in each surveillance system<sup>1</sup>. The epidemic curves from all Rhode Island surveillance sources revealed a season with an early increase in activity and an unusually high peak. Levels were highest between MMWR Weeks 5-7 (January 28-February 17, 2018), with individual systems reaching peak levels at different points within those weeks. During many influenza seasons, all surveillance systems peak in the same week, so this range of peaks was slightly atypical, but was present both in Rhode Island and nationally.

Influenza-like illness (ILI) in Rhode Island, reported by community healthcare providers in the US Outpatient Influenza-like Illness Surveillance Network, or ILINet,<sup>2</sup> reached the highest level since the 2009 H1N1 pandemic. In MMWR Week 6 (February 4-10, 2018) 7.8% of all visits to ILINet providers were due to ILI. This peak was 5.6 times greater in magnitude than the regional ILI baseline (1.4% ILI), and 1.8 times greater than the peak of the 2016-2017 influenza season (4.3% ILI).

Influenza A viruses predominated in the 2017-2018 season. Of the influenza A specimens that were subtyped, influenza A (H3N2) was the most prevalent. Influenza A (H3N2) was predominant across all influenza surveillance systems, both in Rhode Island and nationally<sup>3</sup>. Influenza A (H3N2) is known to be associated with severe illness, mortality, and increased hospitalization, particularly among older adults and those with compromised immune systems. Atypical in the 2017-2018 influenza season was the co-circulation of influenza A (H1N1) 2009. Generally, more than one influenza A strain does not circulate widely during the same influenza season. Additionally, during the 2017-2018 influenza season, influenza B viruses began to circulate unusually early, increasing the magnitude of the season's peak rather than causing a secondary peak later in the season. The co-circulation of all three virus types throughout the season was likely a contributing factor to the severity of the 2017-2018 influenza season.

In Rhode Island, 6,577 specimens tested positive for influenza at hospitals, 2,500 more positive tests than in the 2016-2017 influenza season. Of the individuals who tested positive for influenza at hospitals in the 2017-2018 season, 1,390 were admitted to the hospital (21.1%). Adults age 65 or older accounted for 65.8% of influenza hospitalizations. RIDOH responded to and monitored 141 respiratory outbreaks in congregate living settings such as long-term care facilities, assisted living facilities, and hospitals. There were 60 influenza-associated deaths reported to RIDOH during the 2017-2018 influenza season, 90% of which occurred in adults age 65 or older. Of the 60 individuals who died, 66.7% had received influenza vaccination this influenza season. These high rates of hospitalizations and mortality in older adults are consistent with the circulating influenza A (H3N2) virus.

The 2017-2018 seasonal influenza vaccine was reasonably well-matched to the influenza viruses circulating throughout the season<sup>4</sup>. The preliminary estimated vaccine effectiveness was 36%, which is lower than the 2016-2017 seasonal influenza vaccine effectiveness of 40%<sup>5</sup>. When vaccine effectiveness was estimated against each circulating strain of influenza, it was found to be 25% effective against influenza A (H3N2), the predominant strain of influenza during the 2017-2018 influenza season. Vaccine effectiveness was higher against influenza A (H1N1) 2009 virus (67%) and influenza B viruses (42%). Influenza vaccine is typically less effective against H3N2 viruses, possibly because these viruses undergo genetic changes as they are grown in eggs during vaccine production. Even when vaccine effectiveness is not ideal, influenza vaccination still averts millions of illnesses each year, and substantially reduces the risk of hospitalization and death.

Rhode Island's robust, multi-source influenza surveillance system provided a well-rounded picture of a high severity influenza season. The subsequent sections of this report contain detailed information on each portion of that surveillance system and the findings for the 2017-2018 influenza season.

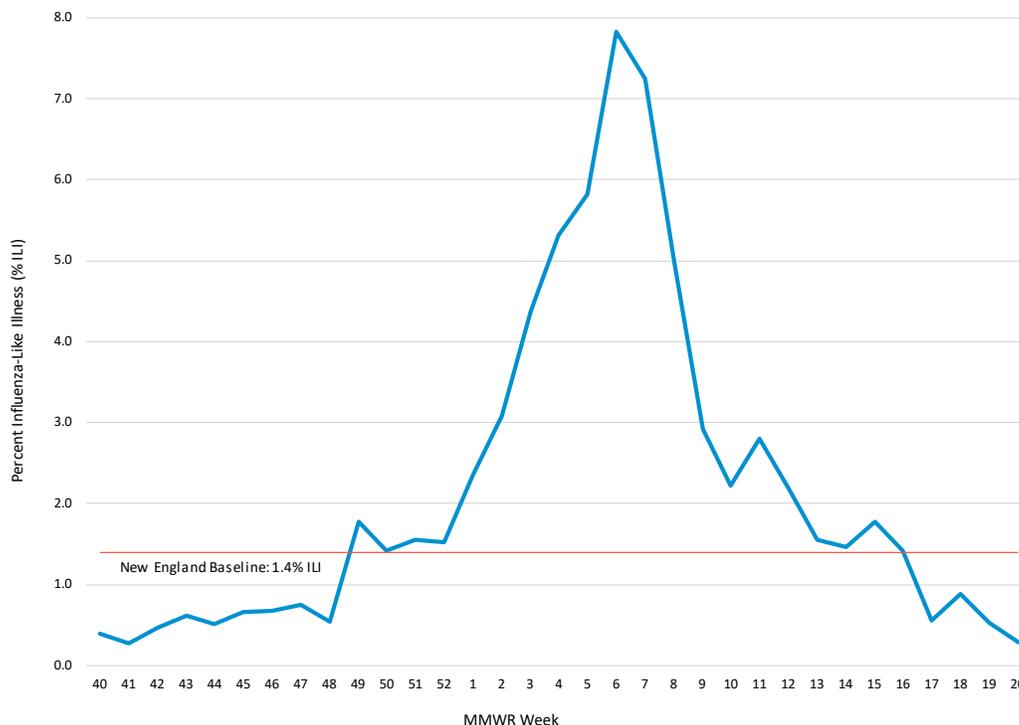
## INFLUENZA-LIKE ILLNESS NETWORK (ILINET): SENTINEL PRACTICES IN THE COMMUNITY

RIDOH participates in a national surveillance program known as the US Outpatient Influenza-like Illness Surveillance Network, or ILINet<sup>6</sup>. This program is a collaborative effort among the Centers for Disease Control and Prevention (CDC), state health departments, and sentinel outpatient healthcare providers recruited by each state. In Rhode Island, 23 community-based healthcare practices geographically dispersed throughout Rhode Island serve as ILINet sentinel providers. In the 2017-2018 influenza season, Rhode Island's ILINet sentinel providers consisted of eight CVS MinuteClinic locations, five family practices, four student health centers, three pediatric practices, two internal medicine practices, and one urgent care center (Appendix B). The MinuteClinic locations were a new addition in the 2017-2018 season and will continue in the upcoming influenza season.

Each week of the year, ILINet providers report data to RIDOH and CDC on the total number of patients seen in the practice for any reason and the number of those patients presenting with influenza-like illness, or ILI. Influenza-like illness is defined as a fever ( $\geq 100^{\circ}$  F or  $37.8^{\circ}$ C) and cough and/or sore throat in the absence of a known cause other than influenza. Influenza-like illness is assessed solely on symptoms and is independent of laboratory testing for influenza or other infectious diseases. These data are aggregated by age group (0-4 years, 5-24 years, 25-49 years, 50-64 years, and  $\geq 65$  years).

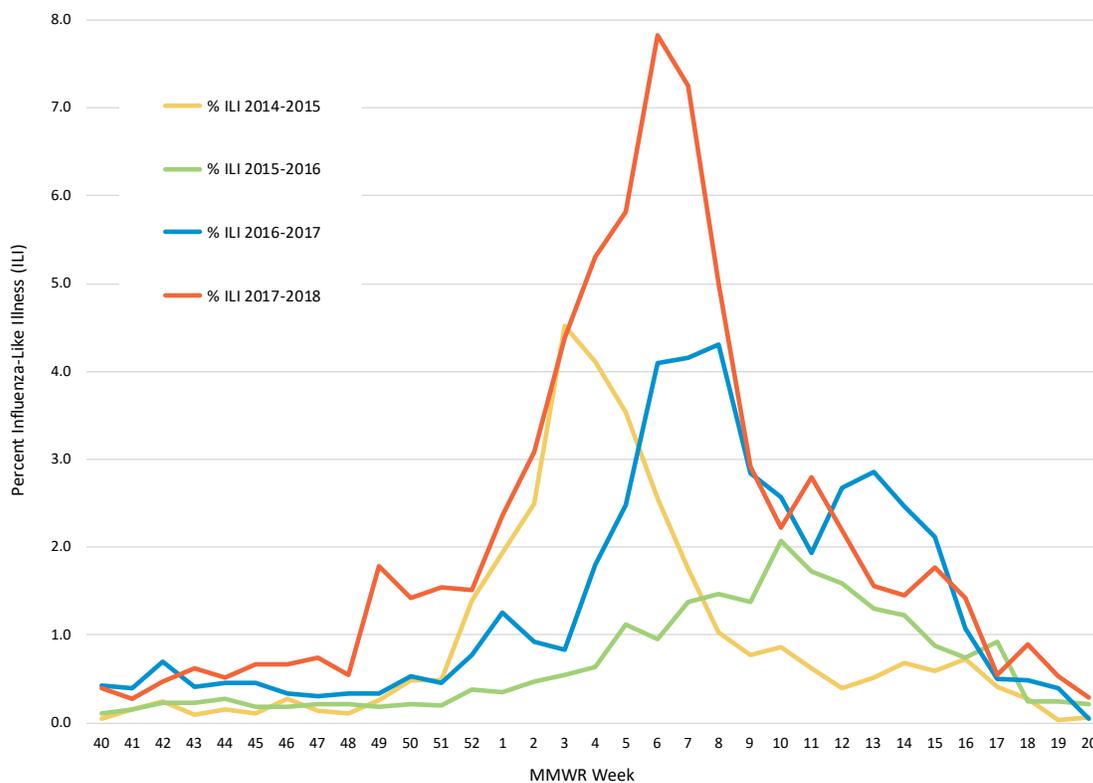
RIDOH analyzes ILINet data weekly to determine the geographic spread of ILI throughout the state and the level of ILI in each county. Sentinel surveillance through ILINet is an essential component of influenza surveillance in Rhode Island.

FIGURE 1. INFLUENZA-LIKE ILLNESS (ILI) AS A PERCENTAGE OF ALL PATIENT VISITS TO ILINET SENTINEL PROVIDERS, 2017-2018 INFLUENZA SEASON, RHODE ISLAND



In the 2017-2018 influenza season, which occurred between October 1, 2017, and May 19, 2018, levels of influenza-like illness jumped above the regional baseline (1.4% ILI) early in the season, in MMWR Week 49 (December 3-9, 2017) (Figure 1). ILI hovered slightly above the baseline for the month of December, then escalated quickly throughout January and early February. The 2017-2018 influenza peaked in MMWR Week 6 (February 4-10, 2018), with 7.8% of visits to the sentinel providers due to influenza-like illness. Following this peak, ILI dropped steeply over the next few weeks, but remained high throughout February and March. Influenza-like illness remained above baseline for a total of 20 weeks, between MMWR Week 49 and 16 (December 3, 2017-April 21, 2018). The level and duration of ILI were mirrored throughout the country and are an excellent representation of the length and intensity of the 2017-2018 influenza season.

**FIGURE 2. PERCENTAGE OF VISITS FOR INFLUENZA-LIKE ILLNESS (ILI) REPORTED BY ILINET: 2014-2018 INFLUENZA SEASONS, RHODE ISLAND**



The 2017-2018 influenza season had much higher levels of ILI than any of the previous three seasons (Figure 2). In fact, in Rhode Island, the 2017-2018 season saw the highest level of ILI since the 2009 H1N1 influenza pandemic. At the peak of the season, 2017-2018 ILINet providers reported 7.8% of all visits due to ILI, compared with the peak ILI of 4.3% in the 2016-2017 influenza season. For comparison, both the 2016-2017 and 2014-2015 influenza seasons were considered to have had high levels of ILI, making the peak of 2017-2018 influenza season appear even more dramatic.

**FIGURE 3. INFLUENZA-LIKE ILLNESS (ILI) AS A PERCENTAGE OF ALL PATIENT VISITS TO ILINET SENTINEL PROVIDERS, 2017-2018 INFLUENZA SEASON, RHODE ISLAND, NEW ENGLAND, AND THE UNITED STATES**

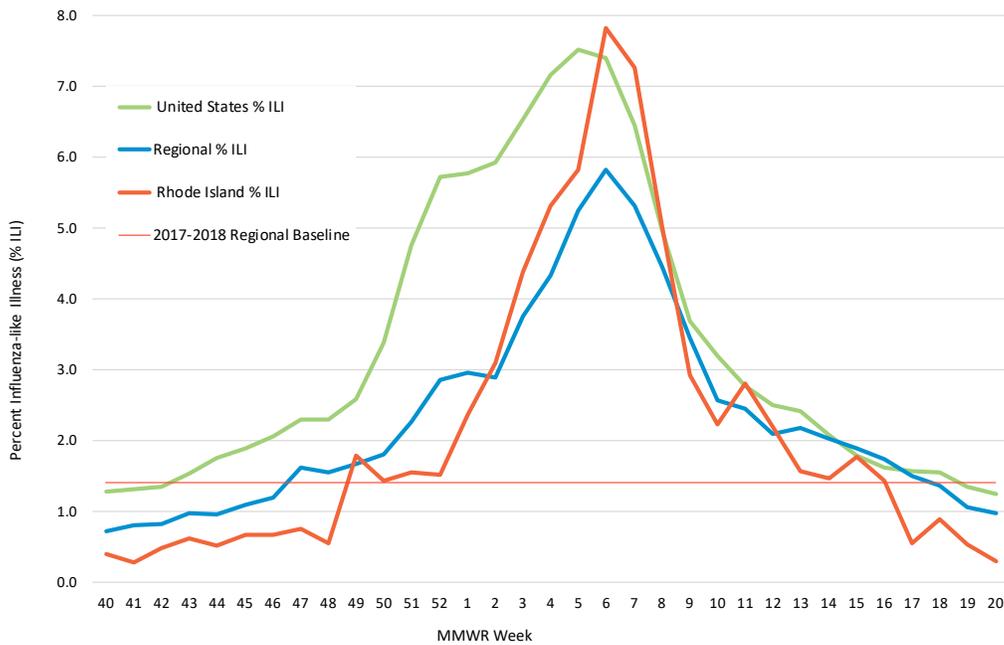
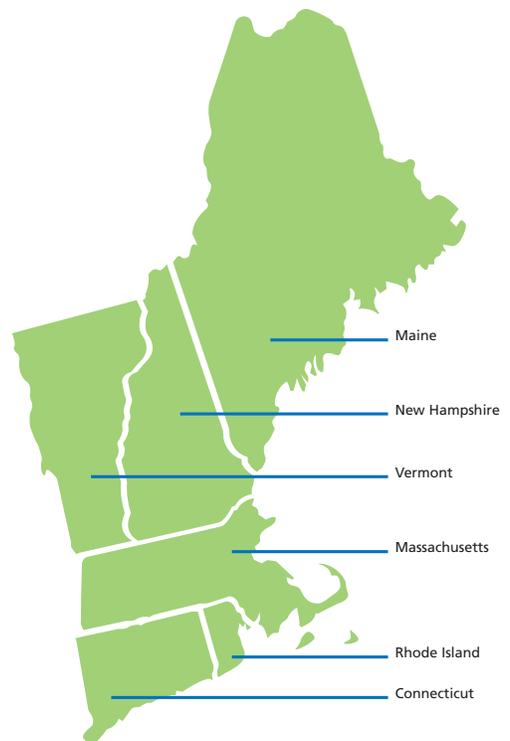
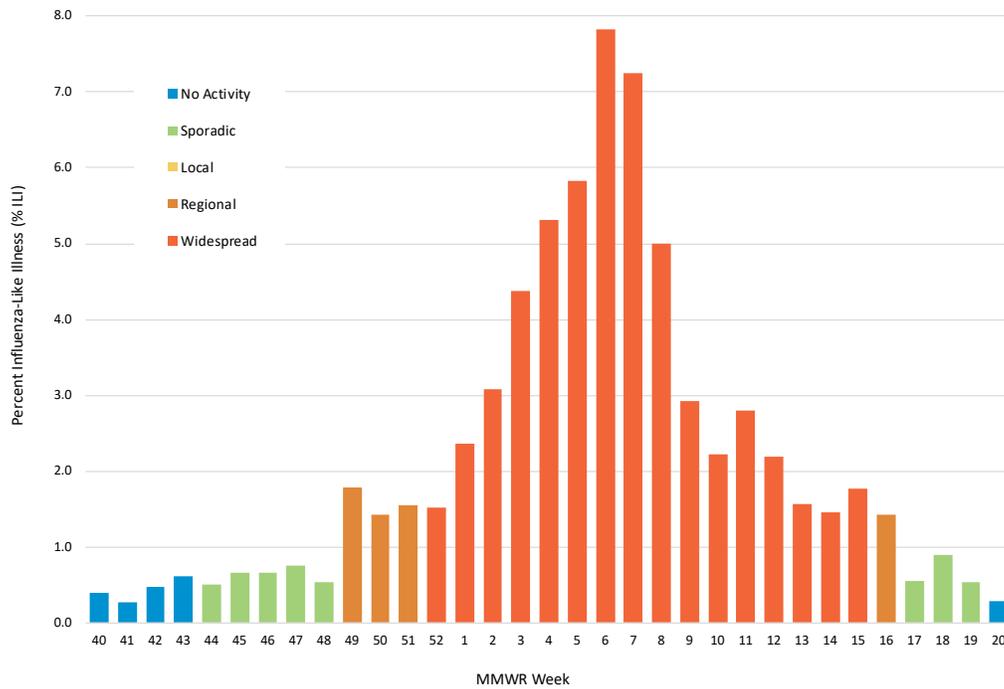


Figure 3 compares the ILI in Rhode Island to the ILI in the nation and in Region 1. Region 1 is comprised of the New England states: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. During the 2017-2018 influenza season, activity in Rhode Island followed the same trends as the rest of the region and the country, albeit a few weeks later. This lag between the country and the state occurs every influenza season. In most years, Rhode Island maintains lower levels of ILI than the region and the country throughout the influenza season. However, during the 2017-2018 season, ILI in Rhode Island surpassed regional ILI activity between MMWR Weeks 2 and 8 (January 7-February 24, 2018), and surpassed national ILI between MMWR Weeks 6 and 8 (February 4-24, 2018). In fact, the peak ILI in Rhode Island of 7.8% in MMWR Week 6 was higher than the national peak of 7.5% in MMWR Week 5. Overall, the country, region, and state saw an influenza season with high, sustained levels of ILI. The country and the region also experienced higher levels of ILI than in any recent season, surpassing all seasons since the 2009 H1N1 pandemic. In 2017-2018, the country spent 19 weeks above baseline levels of ILI, three weeks longer than the average influenza season.



**FIGURE 4: PERCENTAGE OF VISITS FOR INFLUENZA-LIKE ILLNESS (% ILI) AND GEOGRAPHIC SPREAD OF ILI ACTIVITY: RHODE ISLAND, 2017-2018 INFLUENZA SEASON**



Geographic spread is a metric that all states report weekly to CDC<sup>7</sup>. It describes the range of activity of ILI within a state but does not measure the severity of the state’s influenza activity. The levels of geographic spread, in order from least to greatest activity, are No Activity, Sporadic, Local, Regional, and Widespread. Each week, RIDOH determines the geographic spread of ILI within Rhode Island using CDC’s algorithm (Appendix C). Figure 4 shows ILI and the geographic spread of ILI in Rhode Island by week. As levels of ILI increased in Rhode Island during the 2017-2018 season, ILI became more geographically dispersed. Rhode Island experienced widespread influenza activity for 16 weeks in the 2017-2018 influenza season, from MMWR Week 52 through MMWR Week 15 (December 24, 2017-April 14, 2018). When influenza is widespread in Rhode Island, any unvaccinated healthcare worker must wear a surgical mask during direct patient contact. Most years, different parts of the country experience widespread influenza at different points in the season. However, during the 2017-2018 season, the entire continental US reported widespread influenza for the first three weeks of 2018 (December 31, 2017-January 20, 2018), a rare occurrence. The following four weeks (MMWR Weeks 4-7), all continental states except for Oregon reported widespread influenza (January 21-February 17, 2018). The simultaneous high levels of influenza throughout the country significantly contributed to the season’s high severity.

**FIGURE 5. NUMBER OF VISITS FOR INFLUENZA-LIKE ILLNESS (ILI) REPORTED BY ILINET SENTINEL PROVIDERS IN RHODE ISLAND BY AGE GROUP, 2017-2018 SEASON**

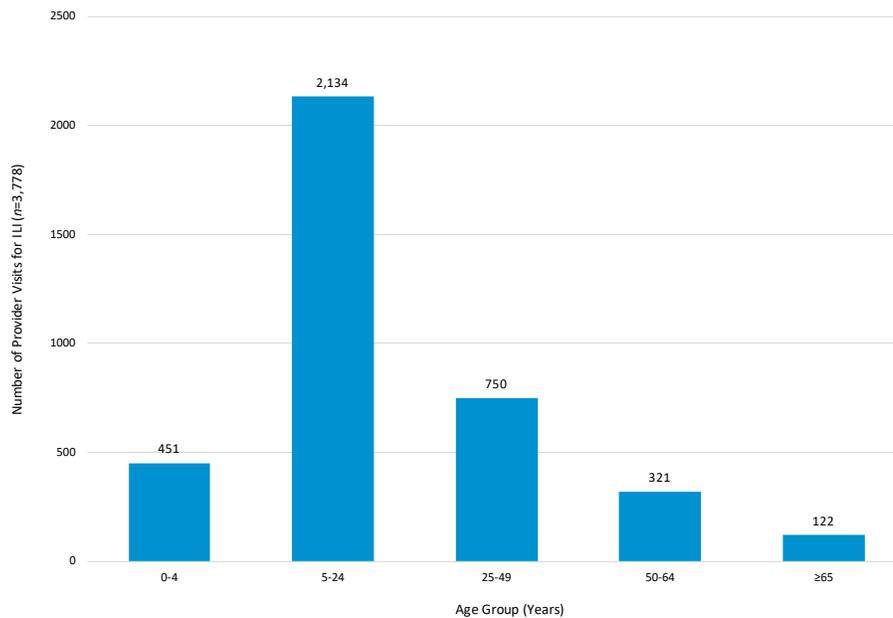


Figure 5 shows the age group distribution of individuals with ILI who visited ILINet providers during the 2017-2018 influenza season. There were 3,778 visits for ILI to ILINet sentinel providers in Rhode Island. This represents an increase of more than 1,700 visits from the 2016-2017 influenza season. ILINet providers reported the highest number of ILI visits among children and young adults 5-24 years, with 2,134 visits throughout the 2017-2018 influenza season (56% of all ILI visits). Adults age 65 or older had the lowest reported number of ILI visits with 122 visits during the season, just 3% of all ILI visits.

The age breakdown of sentinel-reported ILI can be misleading. From this graph, it might appear that Rhode Island had low levels of ILI in older adults; however, this is not the case. ILINet data measure visits to healthcare providers in the community, but do not measure emergency department visits or inpatient hospitalizations. Nationally, adults age 65 or older have the highest rates of influenza-related hospitalization among all age groups and often have severe outcomes from influenza<sup>8</sup>. High rates of hospitalization among older adults occur in Rhode Island as well (Figure 13). While Figure 5 accurately portrays high levels of ILI among individuals ages 5-24, it does not present the full picture of age and influenza or ILI in Rhode Island.

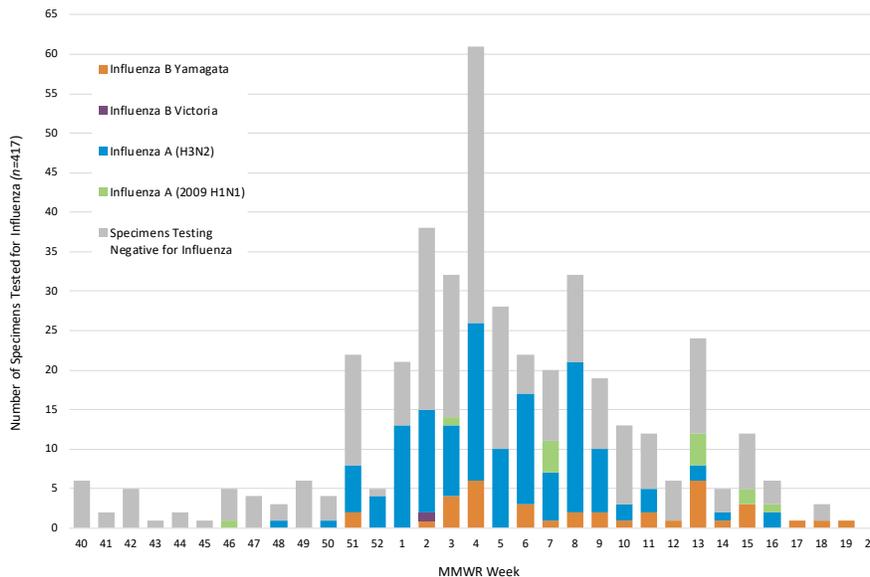
### **SUMMARY OF ILINET DATA, 2017-2018**

The 2017-2018 influenza season showed extremely high levels of ILI, peaking in MMWR Week 6 (February 4-10, 2018). The peak of ILI was the highest reported in Rhode Island since the 2009 H1N1 pandemic, peaking at 7.8% of all visits to sentinel providers. Unlike many other influenza seasons, there was not a clear secondary peak in the season, likely because influenza B circulated throughout the season, rather than after the circulation of influenza A. Rhode Island and the country as a whole experienced a long influenza season, with 16 weeks of widespread influenza activity and 19 weeks above the regional baseline. While ILINet data do not show severity of influenza (hospitalizations and deaths), or laboratory testing for influenza, they do show that there was extensive transmission of influenza-like illness throughout the state for nearly the entire influenza season.

## RHODE ISLAND STATE HEALTH LABORATORIES (RISHL) DATA

The Rhode Island State Health Laboratories accepts nasopharyngeal swab specimens from specific sources to monitor circulating strains, subtypes, and lineages of influenza. Each ILINet sentinel provider is required to submit nine specimens to the RISHL (three early in the season, three mid-season, and three late in the season). Respiratory outbreaks in congregate living facilities are confirmed via specimen submission to the RISHL. In addition, hospitals occasionally send specimens for confirmatory influenza testing, particularly for influenza A samples that are unable to be subtyped at the hospital (unsubtypable influenza A). Within RISHL, influenza testing is conducted by the Molecular Diagnostics and Food Microbiology Laboratory. The laboratory uses molecular diagnostic testing for influenza, which allows for the subtyping of an influenza A specimen, or lineage testing of an influenza B specimen. This assay provides information on the influenza viruses circulating in Rhode Island and contributes to the CDC's national influenza data. RISHL also submits samples to CDC for further genetic characterization to monitor antiviral susceptibility of circulating influenza viruses, identify novel influenza viruses, and contribute to vaccine strain selection.

FIGURE 6. SPECIMENS TESTED FOR INFLUENZA AT THE RHODE ISLAND STATE HEALTH LABORATORIES, 2017-2018 INFLUENZA SEASON



In the 2017-2018 influenza season, the Rhode Island State Health Laboratories tested 417 specimens for influenza (Figure 6). Of these specimens, 186 tested positive. Of positive specimens, 79% were influenza A viruses, and 21% were influenza B viruses. All influenza A-positive specimens were subtyped, and all influenza B-positive specimens were lineage tested. In Rhode Island, the predominant lineage of influenza B viruses was influenza B Yamagata, making up 20.4% of all positive influenza tests, and 97.4% of influenza B specimens. Nationally, influenza B Yamagata comprised 88.8% of lineage-tested influenza B specimens<sup>9</sup>. Of the 147 influenza A specimens, 91.2% were influenza A (H3N2), and 8.8% were influenza A (H1N1) 2009. Although these results clearly indicate an H3N2-predominant season, they also represent a higher-than-typical co-circulation of H1N1 during such a season. These results are consistent with the national co-circulation of influenza A (H3N2) and influenza A (H1N1) 2009 during the 2017-2018 season. Nationally, 84.9% of subtyped influenza A viruses were influenza A (H3N2), and 15.1% were influenza A (H1N1) 2009. This co-circulation likely contributed to the overall high influenza activity and severity during the 2017-2018 influenza season.

## HOSPITAL DATA

Each week, Rhode Island's 11 acute-care hospitals report patient-level data on all positive influenza laboratory tests to RIDOH. These data include influenza tests conducted in both emergency departments and inpatient units. Hospitals also report the total number of influenza tests conducted that week, which allows RIDOH to calculate the percent positivity of influenza tests. The following graphs compare hospital data from the 2017-2018 influenza season with hospital data from the 2016-2017 influenza season.

FIGURE 7. POSITIVE INFLUENZA TESTS BY STRAIN AND MMWR WEEK, RHODE ISLAND HOSPITALS, 2017-2018 INFLUENZA SEASON

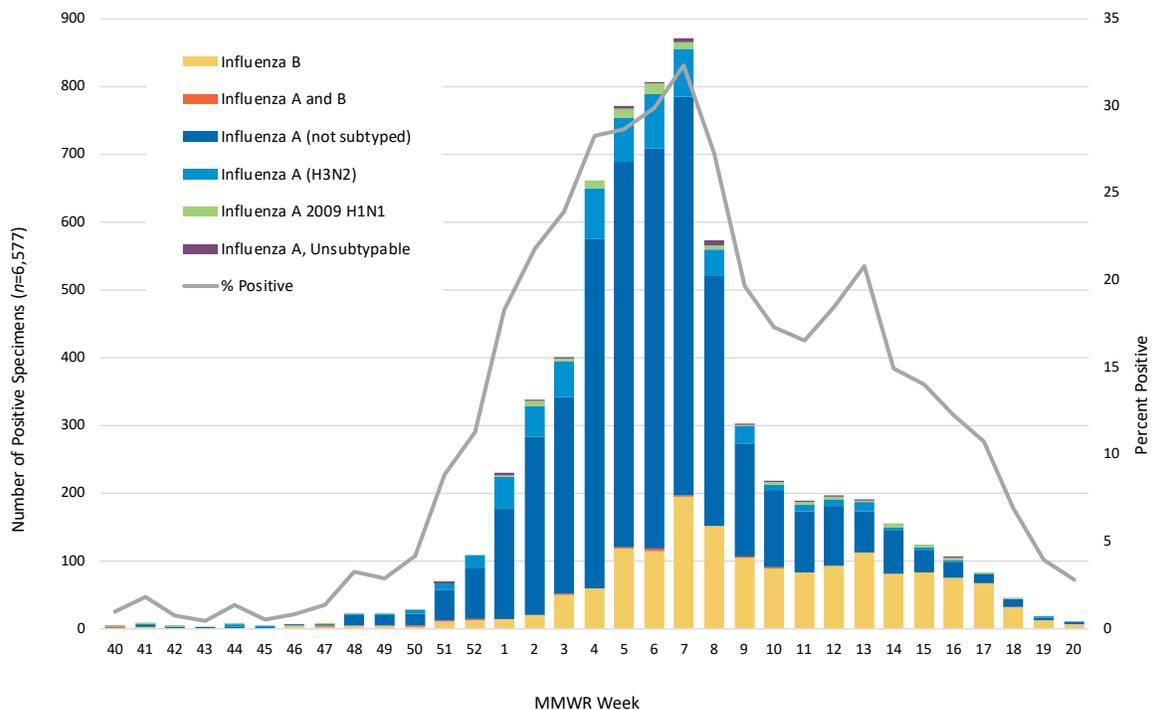


Figure 7 shows all positive influenza tests in Rhode Island hospitals during the 2017-2018 influenza season, displayed by influenza virus type and MMWR week. In the 2017-2018 influenza season, 6,577 specimens tested positive for influenza in Rhode Island hospitals. The number of positive tests peaked in MMWR Week 7 (February 11-17, 2018), with 870 out of 2,694 specimens (32.3%) testing positive for influenza. This peak occurred one week after the peak of percent ILI as reported by sentinel ILINet providers. There were 1,500 more positive influenza tests than during the 2016-2017 season. During the peak three weeks of the 2016-2017 season, between 438 and 453 positive influenza tests were reported each week. In contrast, during the peak five weeks of the 2017-2018 season, between 573 and 870 positive influenza tests were reported weekly, with an average of 736 tests per peak week. Clearly, the 2017-2018 season had significantly more positive influenza tests at hospitals than the 2016-2017 season.

More than 75% of positive influenza specimens at hospitals were characterized as influenza A viruses, while 24.5% were characterized as influenza B viruses (Table 1, see page 13). Influenza B viruses co-circulated with influenza A viruses throughout the season, rather than displaying their typical appearance later in the season. Of the 701 influenza A virus specimens that were subtyped at hospitals, 84.7% were identified as influenza A (H3N2), while 15.4% were identified as influenza A (H1N1) 2009. These results are consistent with data from the RISHL, demonstrating the co-circulation of influenza A (H1N1) 2009 along with the predominant strain of influenza A (H3N2), an unusual occurrence that doubtlessly contributed to a more severe influenza season.

**FIGURE 8. POSITIVE INFLUENZA TESTS BY MMWR WEEK, RHODE ISLAND HOSPITALS, COMPARISON OF 2017-2018 AND 2016-2017 INFLUENZA SEASONS**

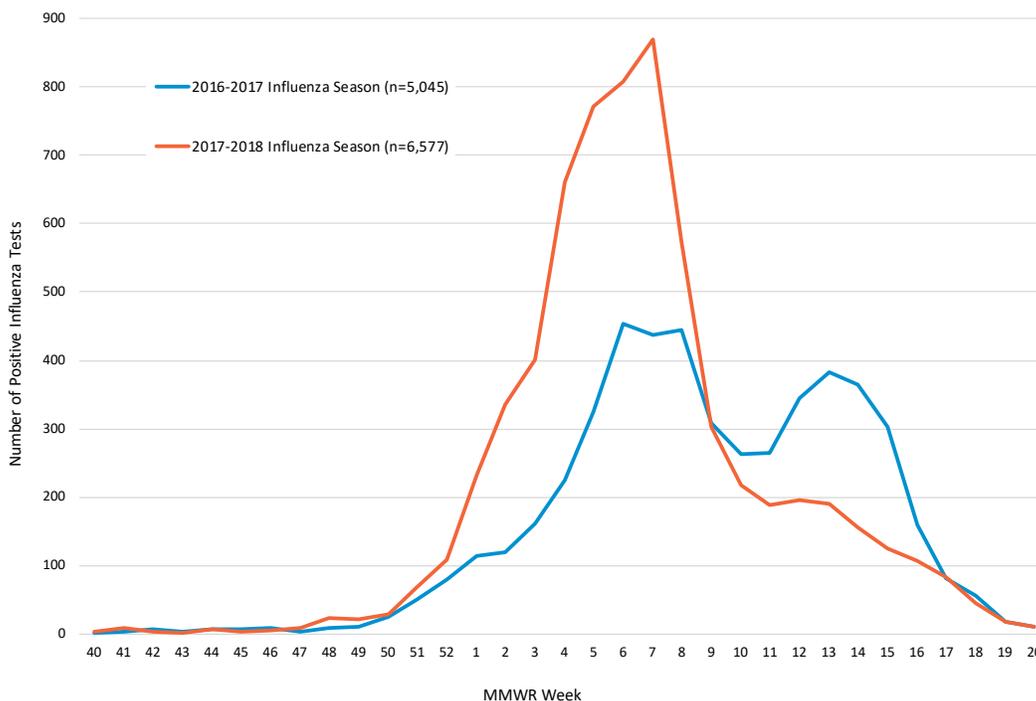


Figure 8 compares the overall curves of hospitals’ positive influenza specimens in the 2017-2018 and 2016-2017 seasons, providing a visualization of the shapes of the influenza seasons. There were significantly more positive tests at hospitals during the 2017-2018 influenza season compared with the prior season. The 2017-2018 influenza season had a higher and longer peak of influenza than the 2016-2017 season. The peak week of 2017-2018 occurred in MMWR Week 7 (February 11-17, 2018). In contrast to the one peak week in 2017-2018, 2016-2017 had three weeks of nearly identical peak influenza activity, occurring in MMWR Weeks 6-8 (February 5-25, 2017). However, the 2017-2018 influenza season had five weeks where activity surpassed the peak of the 2016-2017 influenza season.

The 2017-2018 influenza season had one large, long peak and did not experience a true secondary peak of influenza B, although increasing influenza B viruses likely caused the visible plateau in the decline of positive tests between MMWR Weeks 11-13 (March 11-31, 2018). In contrast, the 2016-2017 influenza season had a distinct secondary peak between MMWR Weeks 12-14 (March 19-April 8, 2017), caused by influenza B viruses.

**FIGURE 9. POSITIVE INFLUENZA TESTS BY MMWR WEEK AND STRAIN, RHODE ISLAND HOSPITALS, COMPARISON OF 2017-2018 AND 2016-2017 INFLUENZA SEASONS**

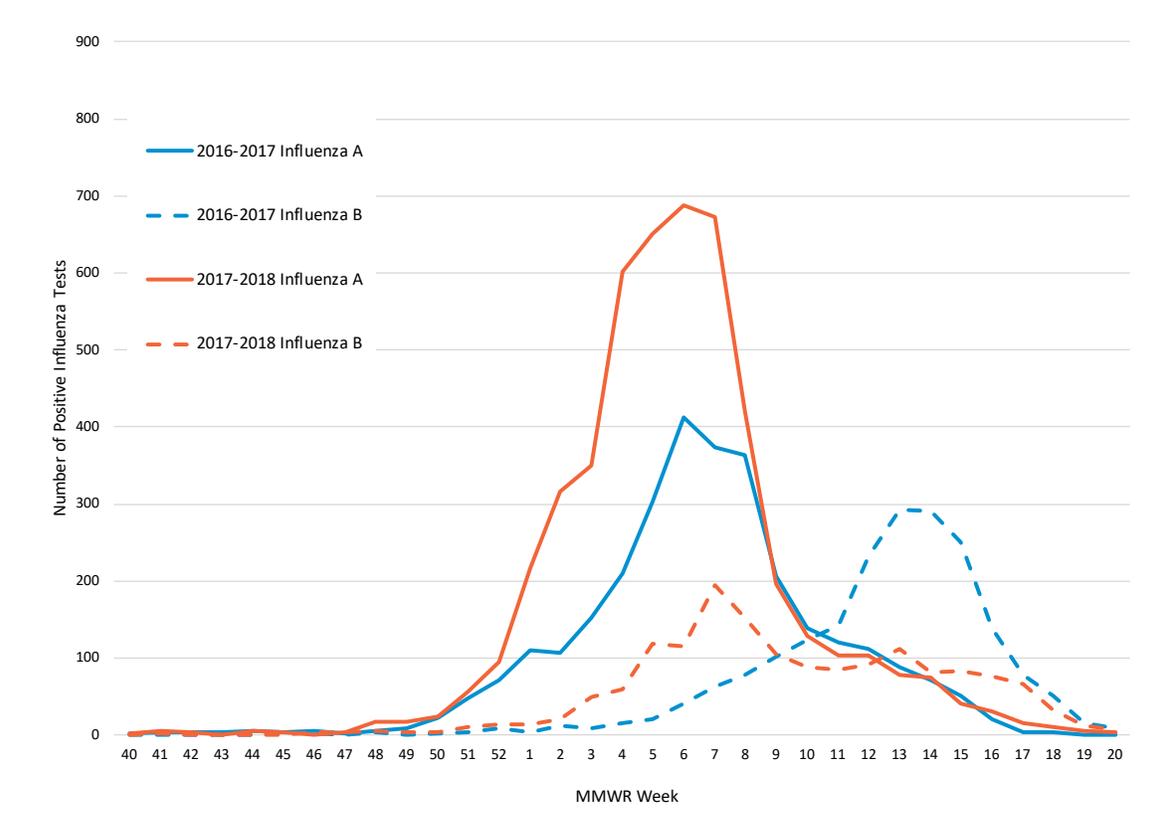


Figure 9 further demonstrates the biphasic nature of the 2016-2017 influenza season in contrast to the 2017-2018 season. In this graph, positive influenza A and B specimens are separated to highlight the peaks of each strain during the two seasons. In the 2017-2018 season, influenza A viruses had a large and long peak, but influenza B viruses co-circulated throughout much of the season, rising unusually early in the season. One can see the influenza B virus activity rising only a few weeks after influenza A virus activity increases, peaking the same week as the combined influenza A and B positive tests [MMWR Week 7 (February 11-17, 2018)]. In fact, influenza A viruses themselves peaked at MMWR Week 6 (February 4-10, 2018), rather than MMWR Week 7 (February 11-17, 2018), the peak of all influenza positives. This difference suggests that influenza B viruses were partially responsible for driving the peak of the 2017-2018 influenza season. In most seasons, influenza A viruses drive the peak of the season, with influenza B viruses only really coming into heavy circulation once influenza A viruses decline.

**TABLE 1. POSITIVE INFLUENZA TESTS BY STRAIN, RHODE ISLAND HOSPITALS, COMPARISON OF 2017-2018 AND 2016-2017 INFLUENZA SEASONS**

Strain	2016-2017 (N=5,045)		2017-2018 (N=6,577)	
	N	%	N	%
Influenza A (not subtyped)	2,963	58.7%	4,207	64.0%
Influenza B	1,993	39.5%	1,613	24.5%
Influenza A (H3N2)	72	1.4%	594	9.0%
Influenza A 2009 (H1N1)	0	0.0%	108	1.6%
Influenza A and B	14	0.3%	19	0.3%
Inconclusive	2	0.0%	2	0.0%
Influenza A, unsubtypeable	1	0.0%	34	0.5%

In both the 2017-2018 and 2016-2017 influenza seasons, Influenza A (not subtyped) viruses comprised the largest percentage of positive tests, at 58.7% of positive tests in 2016-2017 and 64.0% of positive tests in 2017-2018. However, in the 2016-2017 influenza season, a greater percentage of specimens tested positive for influenza B viruses than in the 2017-2018 season (39.5% in 2016-2017, compared to 24.5% in 2017-2018). These numbers reflect the significant influenza B secondary peak in the 2016-2017 season. Overall, in 2016-2017, 60.1% of viruses at hospitals were influenza A viruses, compared with 75.2% in the 2017-2018 influenza season.

Nearly 10 times the number of influenza A viruses were subtyped at hospitals during the 2017-2018 season than during the prior season (701 versus 72 specimens subtyped). Of the influenza A specimens that were subtyped, the majority were Influenza A (H3N2) in both influenza seasons. However, during the 2017-2018 season, 108 hospital influenza specimens, or 1.6% of all positive specimens, were identified as influenza A (H1N1) 2009, while no specimens were identified as such during the 2016-2017 season. One way in which the 2017-2018 season differed from prior seasons was the co-circulation of a non-predominant influenza A subtype throughout the season. The 2017-2018 season saw an increase in positive influenza tests at hospitals by more than 1,500 positive specimens, another indicator of the magnitude of the season.

## INFLUENZA TEST TYPES IN HOSPITALS

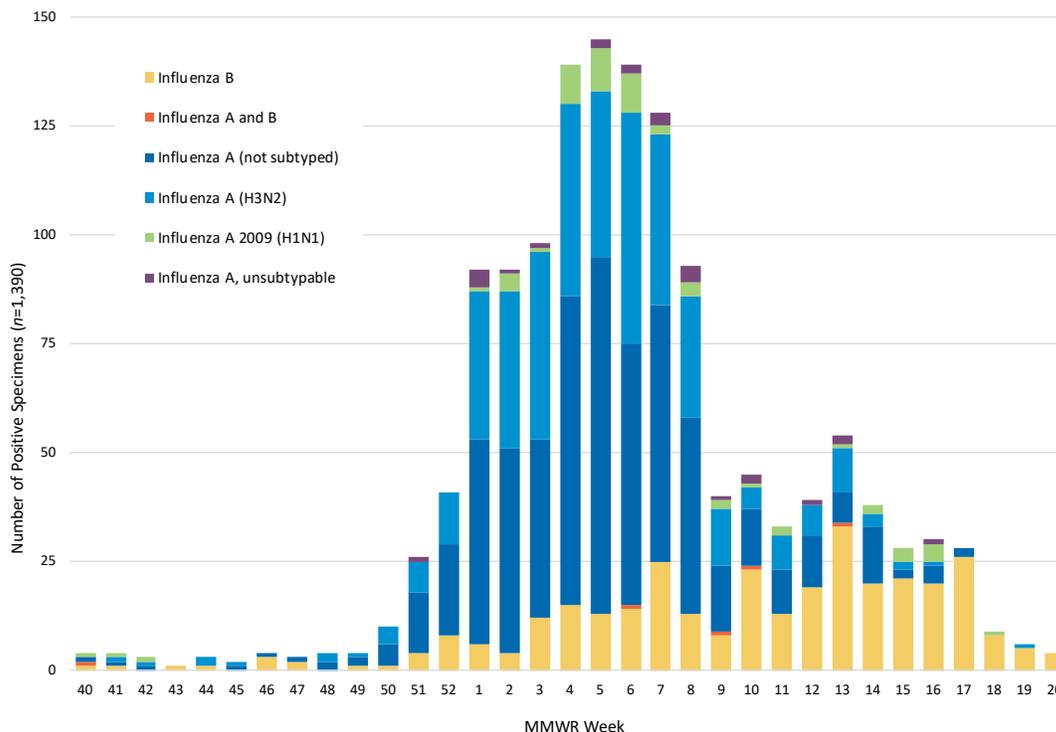
Hospitals use two types of tests for influenza: molecular assays and rapid diagnostic tests. In the 2017-2018 influenza season, 30% of positive specimens were assessed by rapid influenza diagnostic tests, and 70% were tested by molecular assay. This breakdown is a distinct reversal from the 2016-2017 influenza season, where 61.5% of positive specimens were assessed by rapid influenza diagnostic tests, and 38.5% were tested by molecular assay. This switch represents the increase in availability of molecular influenza tests that produce rapid, accurate results. Some molecular tests can determine influenza A subtype (such as influenza A H1N1 or influenza B lineage (such as influenza B Yamagata), while others can only classify a virus as influenza A or influenza B. All rapid influenza diagnostic tests can only distinguish between influenza A and influenza B viruses. Although specific viral information is useful for public health, it does not affect clinical decision making or the course of treatment.

During the beginning and end of influenza season, rapid diagnostic tests are not as specific as molecular tests and can result in false positives. During the peak of the influenza season, rapid tests are not as sensitive and can result in false negatives. However, due to their speed of providing results and ease of use, they remain an important component of the armamentarium of influenza tests.

## INFLUENZA-RELATED HOSPITALIZATIONS

Data on influenza-related hospitalizations are a subset of the data on all positive influenza tests at hospitals described above. This subset consists of individuals who tested positive for influenza and were hospitalized as inpatients.

FIGURE 10. INFLUENZA HOSPITALIZATIONS BY STRAIN AND MMWR WEEK, RHODE ISLAND HOSPITALS, 2017-2018



In the 2017-2018 influenza season, 1,390 individuals who tested positive for influenza were hospitalized. The shape of the curve of hospitalizations is similar to the curve of all positive influenza tests (Figure 7), although the peak in inpatient hospitalizations occurred in MMWR Week 5 (January 28-February 3, 2018), two weeks before the peak in all positive influenza tests at hospitals, which occurred in MMWR Week 7 (February 11-17, 2018). During the peak week of inpatient hospitalizations, 145 individuals were hospitalized with influenza. There were four weeks during the season where more than 120 individuals were hospitalized each week with influenza, MMWR Weeks 4-7 (January 21-February 17, 2018). These four weeks were during the peak of all positive hospital influenza tests, which is not surprising, as the hospitalization data are a subset of positive hospital test data.

Of the 1,390 hospitalizations due to influenza throughout the season, 76.2% were due to influenza A viruses, and 23.4% were attributable to influenza B viruses, similar to the breakdown of all positive hospital influenza tests. Influenza B viruses caused hospitalizations throughout the season and did not cause a clear secondary peak. However, the percent of hospitalizations due to influenza B viruses increased steadily throughout the second half of the season, causing more than half of hospitalizations each week between MMWR Weeks 13 and 20 (March 25-May 19, 2018).

**FIGURE 11. INFLUENZA HOSPITALIZATIONS BY MMWR WEEK, COMPARISON OF 2017-2018 AND 2016-2017 INFLUENZA SEASONS**

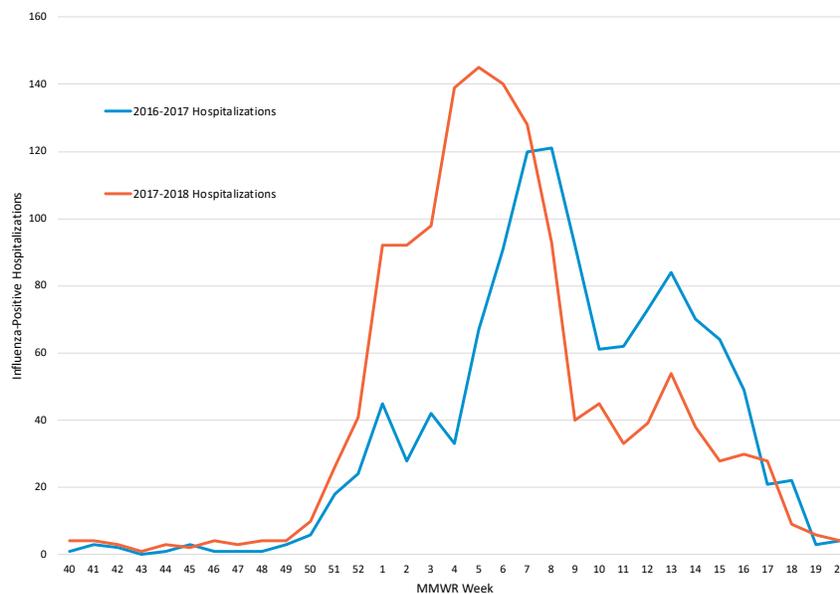


Figure 11 compares the overall curves of influenza hospitalizations throughout the 2017-2018 and 2016-2017 seasons, providing a visualization of the shapes of each season. There were more influenza hospitalizations during the 2017-2018 influenza season: 1,390 in 2017-2018 compared to 1,216 in the 2016-2017 season. The 2017-2018 influenza season also had a higher and longer peak than the 2016-2017 influenza season, with four weeks where more than 120 people were hospitalized each week. The 2017-2018 season peaked at MMWR Week 5 (January 28-February 3, 2018), with 145 individuals hospitalized. Hospitalizations peaked later in the 2016-2017 season, with around 120 individuals hospitalized during each of the two peak weeks of the season, MMWR Weeks 7-8 (February 12-25, 2017). Although there were more hospitalizations during the 2017-2018 influenza season, the difference in hospitalizations between the seasons was not as great as the difference in positive hospital influenza tests.

**FIGURE 12. INFLUENZA HOSPITALIZATIONS BY MMWR WEEK AND STRAIN, COMPARISON OF 2017-2018 AND 2016-2017 INFLUENZA SEASONS**

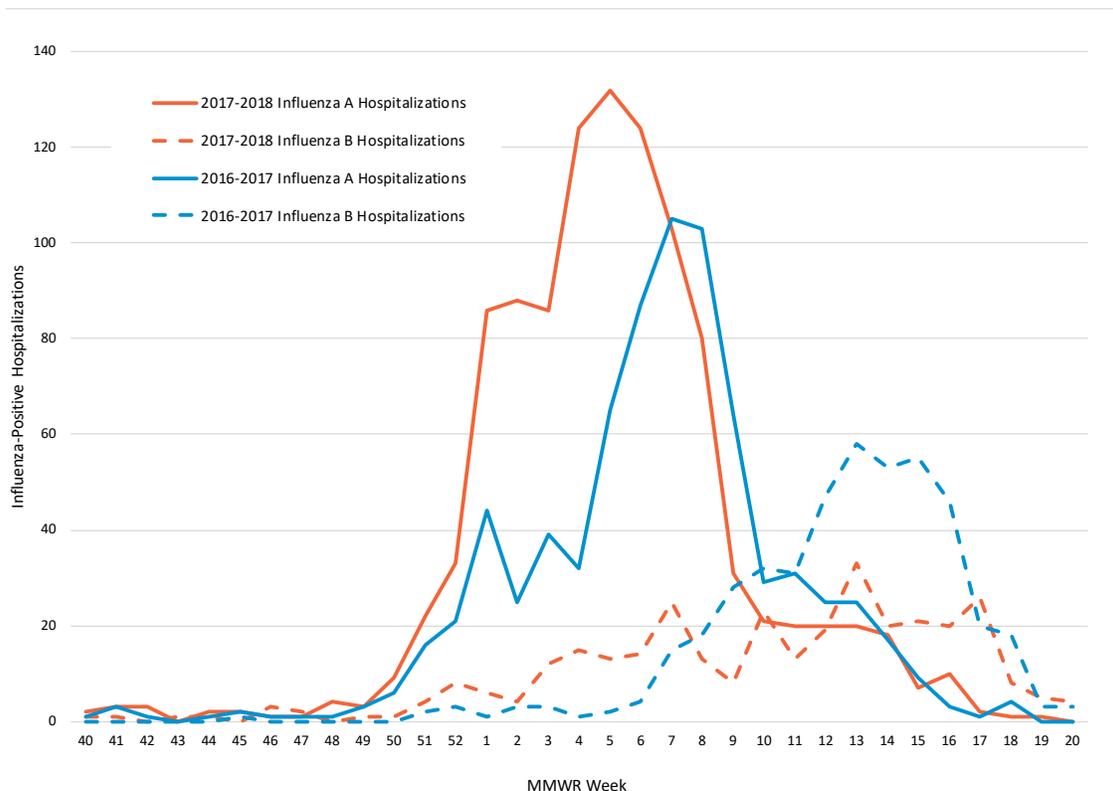


Figure 12 compares the number of influenza hospitalizations by season, separated by influenza strain. This graph demonstrates an important difference between the 2016-2017 and 2017-2018 influenza seasons. In 2016-2017, influenza B viruses caused 36.8% of all hospitalizations, a 13% greater proportion than in 2017-2018. These B viruses caused hospitalizations primarily in the second half of the 2016-2017 influenza season, increasing steadily and comprising the majority of hospitalizations between MMWR Weeks 10-20 (March 5-May 20, 2017). As B virus activity rapidly increased, influenza A virus activity decreased in the 2016-2017 season. This phenomenon allowed for a secondary peak of influenza hospitalizations due to influenza B viruses, similar to Figure 9, but with less magnitude. In contrast, in the 2017-2018 season, only 23.4% of hospitalizations were attributed to influenza B viruses. While these influenza B hospitalizations increased in the second half of the 2017-2018 season, they did not reach high enough numbers to cause a secondary peak in hospitalizations. In addition, Figure 12 demonstrates that influenza B viruses caused hospitalizations throughout the season but that the dramatic peak in hospitalizations was largely due to influenza A viruses. The increase in hospitalizations due to influenza A viruses in 2017-2018 started earlier and achieved greater magnitude than in the 2016-2017 influenza season, causing 76.2% of hospitalizations in 2017-2018, compared with 62.9% in 2016-2017.

*Data in Figures 10-12 are a subset of data from all positive flu tests at hospitals, represented in Figures 7-9 and Table 1.*

**FIGURE 13. POSITIVE INFLUENZA TESTS BY AGE GROUP AND TYPE OF HOSPITAL VISIT, RHODE ISLAND HOSPITALS, 2017-2018 INFLUENZA SEASON**

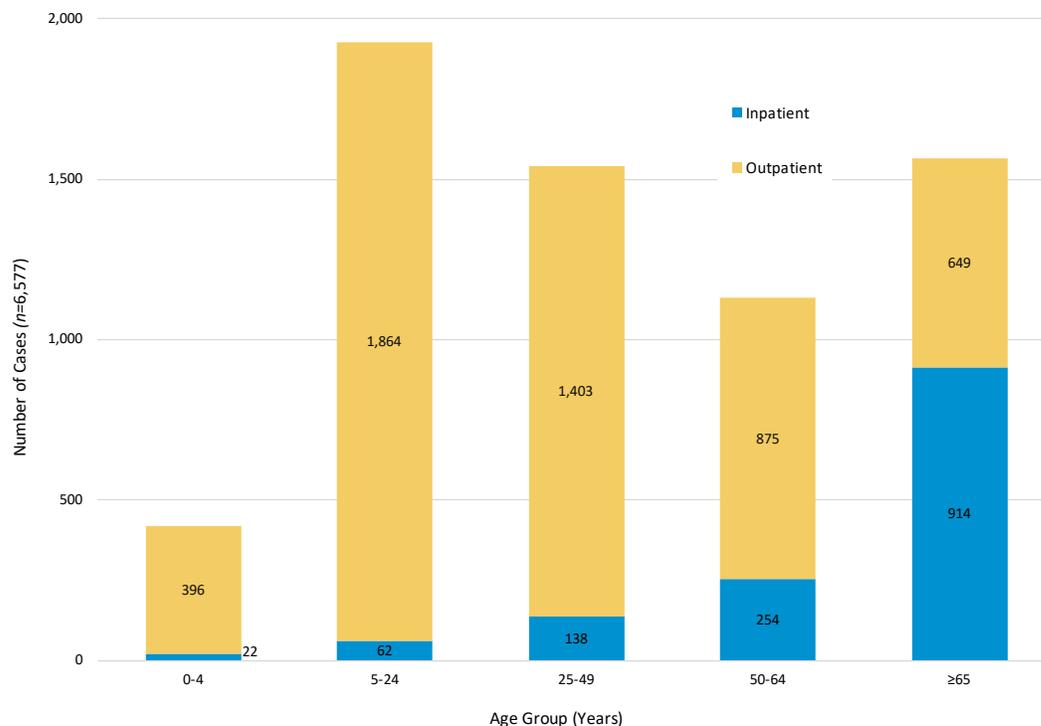
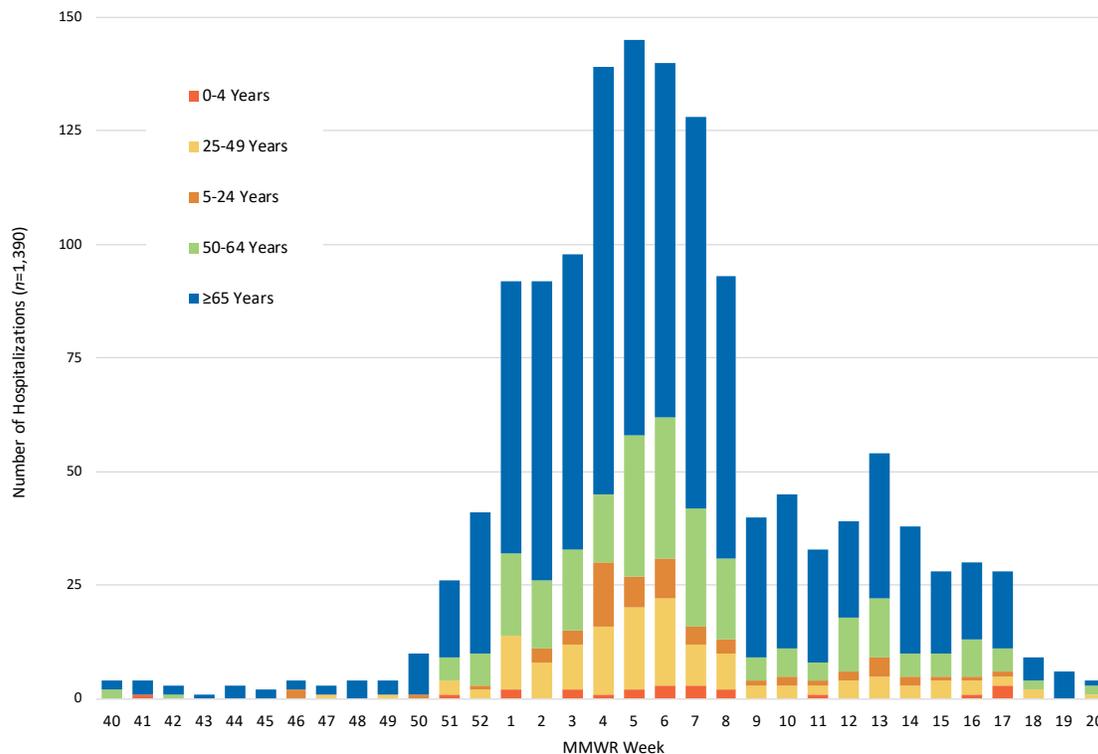


Figure 13 aggregates all positive hospital influenza tests in the 2017-2018 season by age group and type of hospital visit (inpatient or outpatient). The age group with the greatest number of positive influenza tests included individuals age 5-24. Most of the positive tests in this age category were not associated with inpatient hospitalization; in fact, only 62 individuals age 5-24, or 3% of positive tests in that age group were hospitalized. In contrast, adults age 65 or older had the second highest number of positive influenza tests, but 58.5% of patients in this age group with positive tests were hospitalized. Adults age 65 or older comprised 65.8% of all influenza hospitalizations in the 2017-2018 season. The 914 hospitalizations in adults age 65 or older represent a 3.6-fold increase over adults age 50-64, the next-highest age group, with 254 hospitalizations. The high number of influenza-associated hospitalizations in older adults is typical, particularly in an influenza season where influenza A (H3N2) viruses predominate. Influenza A (H3N2) strains are known to be associated with severe illness and increased hospitalization among older adults. While school-aged children tend to drive an influenza season in terms of positive tests and ILI (as demonstrated by Figure 5), hospitalization rates are driven by older adults, a phenomenon certainly at play in the 2017-2018 influenza season.

**FIGURE 14. INFLUENZA HOSPITALIZATIONS BY AGE GROUP AND MMWR WEEK, RHODE ISLAND HOSPITALS, 2017-2018 INFLUENZA SEASON**



Within each week of the influenza season, individuals age 65 or older represented the majority of hospitalizations. Older adults are hospitalized at much higher rates than individuals of other ages. Figures 13 and 14 provide a contrast to the ILI graph in Figure 5, in which older adults had the lowest number of visits to community providers for ILI. The disparity between these graphs highlights the importance of a multi-part influenza surveillance system. It is essential to look at these two data sets in conjunction to gain a comprehensive understanding of the influenza season. While ILINet is an indicator of the volume of influenza in the state, it does not measure severity of disease. Hospitalization data do not show levels of influenza in the general community but do indicate severity. Figures 13 and 14 reflect the fact that older adults are more vulnerable to severe illness and complications from influenza infection, leading to hospitalization.

## RESPIRATORY OUTBREAKS

All influenza and respiratory illness outbreaks in congregate living settings are reportable to RIDOH. For surveillance purposes, a respiratory outbreak is defined as one case of laboratory-confirmed influenza or two cases of influenza-like illness (ILI) in a congregate living setting. Congregate living settings are primarily long-term care facilities and assisted living communities, but may also include hospital units, universities, group homes, adult day programs, prisons, and other residential programs. When a facility reports an outbreak, RIDOH provides infection control recommendations and communicates regularly with staff to obtain updated case counts. Additional guidance is provided as necessary. During an outbreak, facilities are also encouraged to submit three to five nasopharyngeal specimens to RISHL for testing and subtyping or lineage identification. RIDOH outbreak monitoring also tracks illness attack rates and the percentage of residents in a facility who received the seasonal influenza vaccine. A facility experiencing an outbreak is monitored until 10 days have passed following the illness onset of the last new case of influenza or respiratory illness. The outbreak is then officially closed and monitoring is discontinued. A single facility may have multiple respiratory outbreaks within one influenza season; each outbreak is counted separately.

FIGURE 15. RESPIRATORY OUTBREAKS IN CONGREGATE LIVING FACILITIES BY STRAIN AND MMWR WEEK, 2017-2018 INFLUENZA SEASON

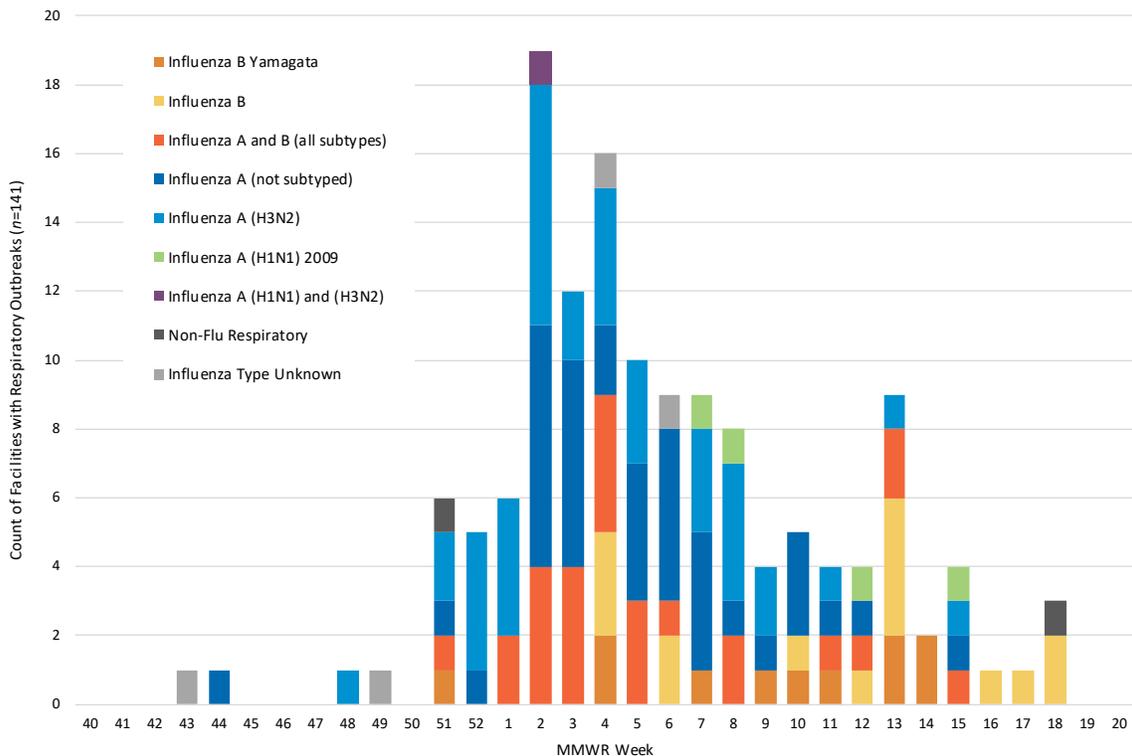


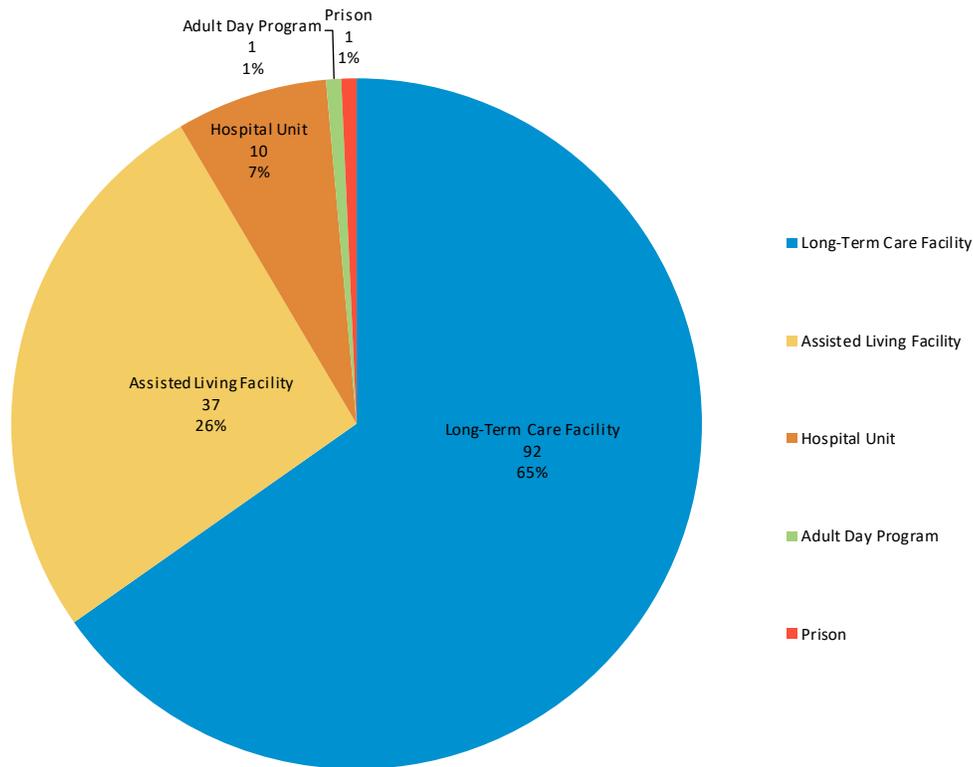
TABLE 2. RESPIRATORY OUTBREAKS IN CONGREGATE LIVING FACILITIES BY INFLUENZA STRAIN, 2017-2018 INFLUENZA SEASON

Influenza Type	Respiratory Outbreaks (N=141)	
	N	%
Influenza A (not subtyped)	39	27.7%
Influenza A (H3N2)	39	27.7%
Influenza A (H1N1) 2009	4	2.8%
Influenza A 2009 (H3N2) and (H1N1) 2009	1	0.7%
Influenza A and B (all subtypes)	26	18.4%
Influenza B	15	10.6%
Influenza B Yamagata	11	7.8%
Influenza Type Unknown	4	2.8%
Non-Influenza Respiratory	2	1.4%

During the 2017-2018 influenza season, there were 141 discrete outbreaks of respiratory illness in congregate living facilities. The most common viruses identified in these outbreaks were influenza A (not subtyped) and influenza A (H3N2), each accounting for 27.7% of outbreaks (55.4% of all outbreaks). The 2017-2018 season had 22.6% more outbreaks than the 2016-2017 season, which had 115 outbreaks. Influenza A (H3N2), predominant in the 2017-2018 season, is associated with high numbers of infections and outbreaks among older populations. This was the predominant strain during the 2016-2017 season as well. Nationally, the 2017-2018 influenza season was a more severe season than 2016-2017, despite the same viruses predominating.



FIGURE 16. RESPIRATORY OUTBREAKS BY FACILITY TYPE, 2017-2018 INFLUENZA SEASON



Many congregate living facilities experienced multiple outbreaks during the 2017-2018 season; the total 141 respiratory outbreaks occurred in 103 different facilities. Of the 141 outbreaks, 92 outbreaks (65.2%) occurred in long-term care facilities, and 37 outbreaks (26.2%) occurred in assisted living facilities. The remaining 12 outbreaks (8.5%) were divided among other congregate living settings such as hospitals, prisons, and adult day programs.

Attack rates for respiratory illness within each outbreak were calculated by dividing the number of residents with ILI or influenza at each facility by the total number of residents living in the facility. The mean attack rate was 8.5% and the median attack rate was 6.8%. Attack rates ranged from 0.4% to 50.0% ill with ILI or influenza during a given outbreak.

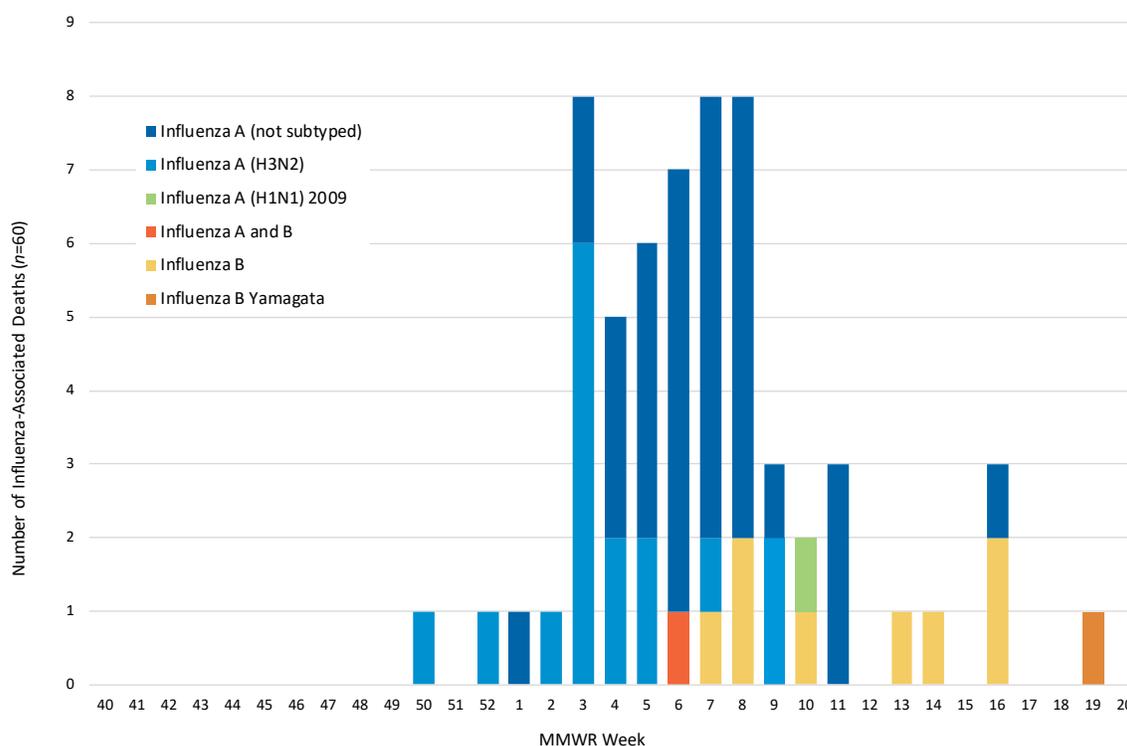
Outbreak durations for each facility were calculated by counting the number of days between the illness onset of the first patient to become ill and the illness onset of the last patient to become ill. The mean outbreak duration was 20 days and the median outbreak duration was 17 days. Outbreak durations ranged from seven days to 126 days.

Facilities with outbreaks self-reported vaccination rates among residents. Older adults are a well-vaccinated population throughout the United States, with an early 2017-2018 influenza vaccination coverage estimate of 56.6% of adults age 65 or older receiving vaccine<sup>10</sup>. Among congregate living facilities in Rhode Island, vaccine coverage was even higher. The mean reported resident vaccination rate in these settings was 87%, and the median rate was 92%. Out of the 134 outbreaks for which vaccination coverage estimates were available, 53.9% of outbreaks occurred in facilities with vaccine coverage of 90% or higher.

## INFLUENZA-RELATED MORTALITY

An influenza-associated death is defined, for surveillance purposes, as a death resulting from a clinically compatible illness confirmed as influenza by an appropriate laboratory test (molecular assay or rapid diagnostic test) where there is no period of complete recovery between the illness and death. Adult influenza-associated deaths became reportable by regulation in Rhode Island in 2013, and pediatric influenza-associated deaths have been nationally reportable since 2006.

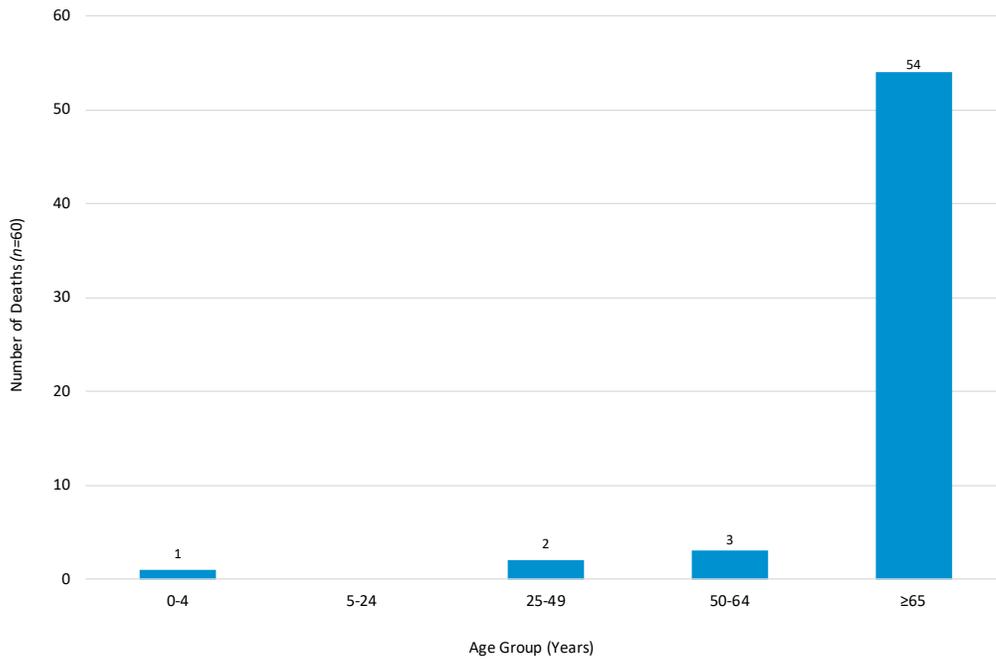
FIGURE 17. INFLUENZA-ASSOCIATED DEATHS BY STRAIN AND MMWR WEEK, RHODE ISLAND, 2017-2018 INFLUENZA SEASON



During the 2017-2018 season, 60 influenza-associated deaths were reported to RIDOH. The number of deaths per week was the greatest during a five-week period in the peak of the influenza season: MMWR Weeks 3-8 (January 14-February 24, 2018). During these weeks, between five and eight deaths were reported to RIDOH weekly. Throughout the season, 83.3% of deaths were associated with influenza A viruses, and 15.0% of deaths were associated with B viruses. Influenza A (H3N2) was the most common subtype of influenza A associated with deaths, causing 26.7% of all 60 deaths, and 94.1% of the 17 influenza A deaths that were subtyped.

The 2017-2018 influenza season had nearly twice as many deaths reported as the 2016-2017 season in which there were 33 influenza-associated deaths. The high number of deaths in the 2017-2018 season was consistent with the season's high severity, visible both in Rhode Island and in the United States as a whole. Additionally, seasons in which influenza A (H3N2) viruses are predominant are associated with higher levels of mortality. While the 2016-2017 influenza season was also an H3N2-predominant season, it had overall lower rates of deaths and hospitalizations compared with the 2017-2018 season.

FIGURE 18. INFLUENZA-ASSOCIATED DEATHS BY AGE GROUP, RHODE ISLAND, 2017-2018 INFLUENZA SEASON



Of the 60 deaths in the 2017-2018 influenza season, 90% occurred in adults age 65 or older. This is not surprising, as influenza A (H3N2) is associated with increased mortality in older adults. There was one pediatric influenza death in the 2017-2018 influenza season. The mean age of adult influenza-related deaths was 83 years, and median age was 86 years. The mean and median ages of influenza deaths in the 2017-2018 influenza season were very similar to the 2016-2017 season (mean=80 years; median=87 years).

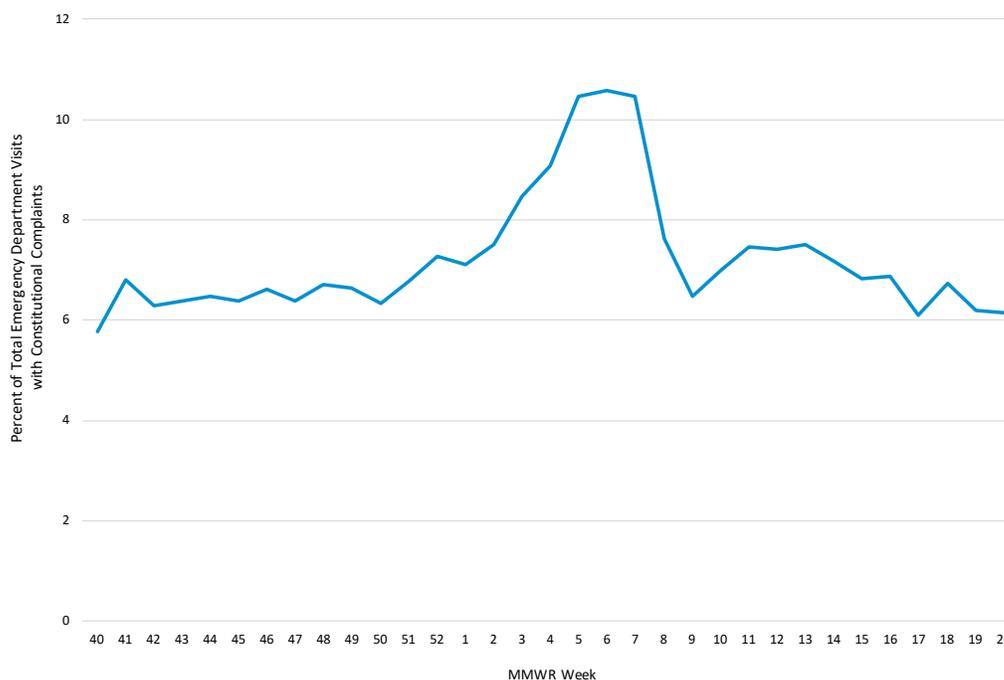
Most influenza-associated deaths in 2017-2018 occurred in individuals with underlying medical conditions. Health conditions reported at time of death included hypertension, dementia, congestive heart failure, kidney disease, chronic obstructive pulmonary disease (COPD), diabetes, atrial fibrillation, coronary artery disease, stroke, cancers, and Parkinson's disease. Individuals with these and other underlying conditions are known to be at high risk for developing influenza-related complications that may ultimately result in mortality<sup>11</sup>.

Of the 60 influenza-associated deaths, 66.7% (40 deaths) occurred in individuals who had received influenza vaccine in the 2017-2018 season. Ten percent (six deaths) were unvaccinated, and vaccination status was unknown for 23.3% of deaths (14 deaths).

## THE REAL-TIME OUTBREAK AND DISEASE SURVEILLANCE SYSTEM (RODS): SYNDROMIC SURVEILLANCE

The Real-Time Outbreak and Disease Surveillance system (RODS) monitors chief complaints from nine hospital emergency departments in Rhode Island. Data are analyzed and assigned to syndromes (i.e. gastrointestinal, neurological, respiratory). Count data for these syndromes are monitored over time to detect patterns of disease in the community. While there is no specific syndrome for influenza-related visits, an increase in ILI is most likely to trigger an alert for constitutional syndrome, which consists of chief complaints of fever, myalgia, or influenza. Therefore, constitutional syndrome is used as a proxy for ILI. RODS triggers an alert based on algorithms that detect unexpected increases in the number of visits to specific emergency departments for constitutional syndrome over baseline levels. During the 2017-2018 influenza season, there were two alerts triggered for higher-than-expected visits related to constitutional syndrome. Both alerts involved the same hospital.

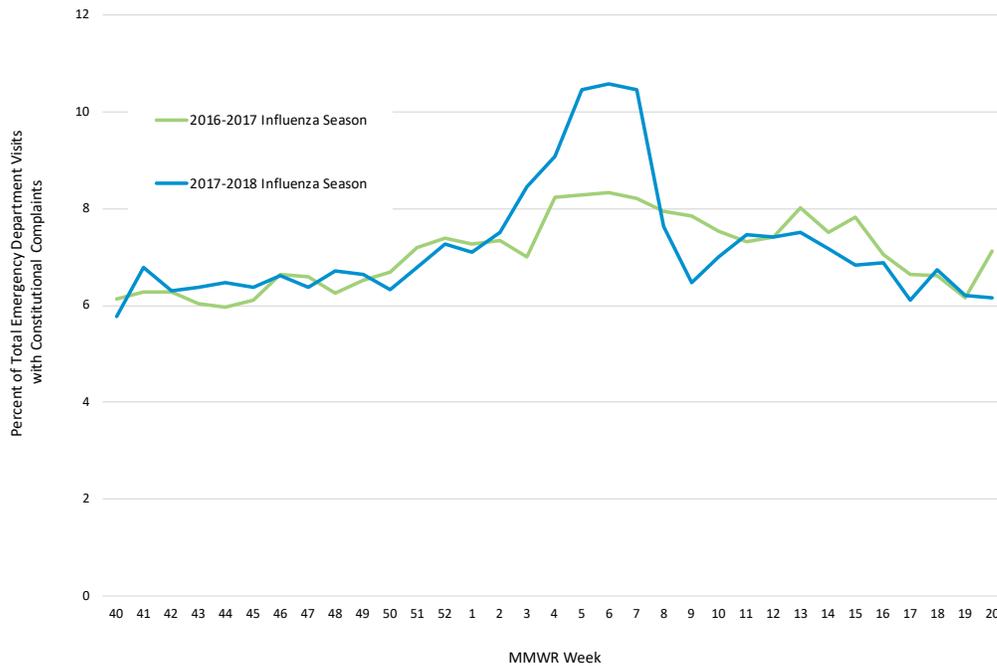
FIGURE 19. PERCENTAGE OF ALL EMERGENCY DEPARTMENT VISITS DUE TO CONSTITUTIONAL SYNDROME BY MMWR WEEK, RHODE ISLAND HOSPITALS, 2017-2018 INFLUENZA SEASON



To evaluate the burden of disease in the community, the percentage of all emergency department visits attributable to constitutional syndrome is monitored throughout the season. The baseline levels of constitutional visits are approximately 6.5-7.0%. The syndromic surveillance data for the 2017-2018 season followed the trends of the ILI and hospitalization data (Figures 1 and 7), with the percentage of constitutional syndrome visits peaking during MMWR Weeks 5-7 (January 28-February 17, 2018).

In previous years, the percentage of visits for constitutional syndrome has typically only peaked at approximately 8.3% and has had poorly defined peaks. However, in the 2017-2018 season, classified as a high severity season by CDC<sup>12,13</sup>, the maximum percentage of visits for constitutional syndrome was 10.6%, a dramatic, well-defined peak above baseline.

**FIGURE 20. PERCENTAGE OF ALL EMERGENCY DEPARTMENT VISITS DUE TO CONSTITUTIONAL SYNDROME BY MMWR WEEK, RHODE ISLAND HOSPITALS, COMPARISON OF 2017-2018 AND 2016-2017 INFLUENZA SEASONS**



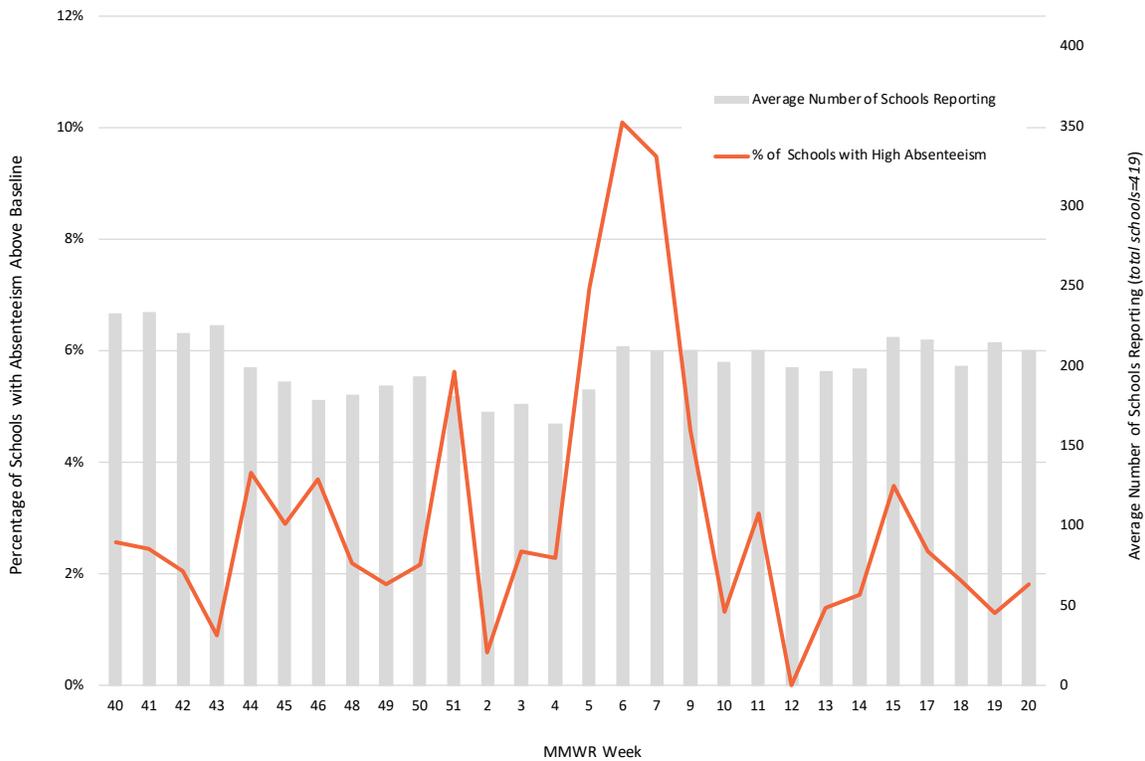
As compared to the 2016-2017 influenza season, 2017-2018 had a significantly higher magnitude peak but did peak around the same time. Both seasons demonstrated a second increase in visits for constitutional syndrome after the first peak due to type B strains, however, in 2017-2018 this peak was slightly lower than in 2016-2017.

## SCHOOL ABSENTEEISM

Increases above normal trends in absenteeism can serve as an indicator of influenza activity within a school. In an effort to detect outbreaks, RIDOH monitors school absenteeism data reported by K-12 schools (public, private, and parochial) to the Rhode Island Department of Education. If higher-than-expected school absenteeism rates are detected within a school for three consecutive days, RIDOH contacts the school nurse teacher, determines the reason for the increased absenteeism, and reviews infection control measures should influenza-like illness be the reason for the increased absenteeism.



FIGURE 21. SCHOOL ABSENTEEISM BY MMWR WEEK, RHODE ISLAND SCHOOLS, 2017-2018 INFLUENZA SEASON



In the 2017-2018 school year, an average of 201 schools out of 419 total schools reported weekly (range: 164-234 schools). A school with high absenteeism is defined as an absenteeism rate of higher than 200% of a school’s baseline absenteeism rate for a given day. During most school years, the weekly percentage of schools with high absenteeism oscillates greatly, with multiple peaks and valleys. It is often difficult to visualize any trends in school absenteeism from this data. However, during the 2017-2018 influenza season, the weekly percentage of high absenteeism demonstrated a clear peak between MMWR Weeks 5 and 7 (January 28-February 17, 2018). High absenteeism at this time was consistent with the peaks in ILL, positive influenza tests at hospitals, hospitalizations, and emergency room visits. Other peaks in absenteeism were visible in any weeks directly preceding a school vacation.

School absenteeism can be a marker of circulating illness in school-aged children, but not all increases in absenteeism are due to influenza, or to illness at all. Impending school vacations, adverse weather, “Senior Skip” days, and terror threats can all impact school attendance. In addition, the school year is interspersed with school holidays, and, at times, snow days. To control for these factors, weeks with school vacations or multiple days of weather cancellation were omitted from analysis. Analysis of school absenteeism data helps RIDOH maintain situational awareness of trends within the student population.

## CONCLUSION

The 2017-2018 influenza season (October 1, 2017-May 19, 2018) was a high severity season with unusually elevated ILI, hospitalizations, respiratory outbreaks, and deaths. In Rhode Island and throughout the country, the 2017-2018 season saw the highest level of ILI in any influenza season since the 2009 H1N1 influenza pandemic. At its peak, Rhode Island ILINet providers reported that 7.82% of all healthcare visits to their practices were due to ILI. Across multiple surveillance systems, the 2017-2018 influenza season peaked between MMWR Weeks 5 and 7 (January 28-February 17, 2018), with individual systems peaking at different weeks.

The predominant influenza virus circulating during the 2017-2018 influenza season was influenza A (H3N2), although influenza A (H1N1) 2009 co-circulated more than is typical during an H3N2-predominant season. Additionally, influenza B viruses circulated throughout the season, driving up influenza levels at the peak of the season, rather than causing a secondary peak in late season.

During the 2017-2018 influenza season, Rhode Island saw high rates of hospitalization and deaths associated with influenza. All data in Rhode Island and throughout the country showed a severe influenza season that started early and lasted for many weeks.

In partnership with community agencies, RIDOH maintains a strong, multi-faceted influenza surveillance system that informs understanding and decision-making, both within Rhode Island and across the United States.

## LIMITATIONS

This report is subject to several limitations. Unlike many other infectious diseases, individual cases of influenza are not reportable to RIDOH; only outbreaks of respiratory illness and influenza-associated deaths are reportable. An exact count of the number of influenza cases in Rhode Island is not collected. Instead, data are gathered from several sources using a group of surveillance systems, each with its own strengths and limitations. Data from ILINet illustrate geographic spread of ILI within the state but do not provide data on severity of disease or laboratory-confirmed influenza. In contrast, hospitalization data describe severity of influenza illness, but do not provide information on geographic spread. Respiratory outbreak surveillance provides data on the impact of influenza on Rhode Island's congregate living facility residents. The Rhode Island State Health Laboratories provide highly accurate molecular testing, but the samples it receives are often pre-screened, and thus the percent of positive tests does not have a meaningful denominator. Finally, RODS data are syndromic, providing data on trends in emergency department chief complaints, but they do not monitor influenza or ILI specifically.

While each component of the surveillance system is vital, no single component can be solely relied upon to gather comprehensive data on influenza in Rhode Island. To perform complete surveillance of influenza, RIDOH draws upon the strengths of each system to compensate for the limits of others.

## APPENDIX A. DESCRIPTION OF DATA SOURCES

*RIDOH maintains a network of influenza surveillance systems. These surveillance systems are designed to monitor influenza activity and influenza-like illness (ILI), assess and measure the burden of influenza infections within the community, characterize circulating influenza strains, and detect novel influenza viruses. In Rhode Island, the following surveillance systems are used to accomplish these goals:*

**Outpatient Influenza-Like Illness Surveillance Network (ILINet):** RIDOH participates in an influenza sentinel surveillance program known as the US Outpatient Influenza-like Illness Surveillance Network, or ILINet. It is a collaborative effort among the Centers for Disease Control and Prevention (CDC), state health departments, and ILINet sites within each state. Providers for ILINet are recruited annually by state health departments. For the 2017-2018 influenza season, 23 community-based healthcare practices geographically dispersed throughout Rhode Island were enrolled as ILINet sentinel providers. Rhode Island's ILINet sentinel providers consisted of eight CVS MinuteClinic locations, five family practices, four student health centers, three pediatric practices, two internal medicine practices, and one urgent care center (Appendix B).

Each week, ILINet providers report data to RIDOH and CDC on the total number of patients seen for any reason and the number of those patients presenting with ILI. ILI is defined as a fever ( $\geq 100^{\circ}$  F or  $37.8^{\circ}$  C) and cough and/or sore throat in the absence of a known cause other than influenza. These data are aggregated by age group (0-4 years, 5-24 years, 25-49 years, 50-64 years, and  $\geq 65$  years).

Providers participating in ILINet are also responsible for submitting nine nasopharyngeal swabs per influenza season from ILI patients to the Rhode Island State Health Laboratories for clinical confirmation, molecular subtyping, and lineage testing.

**RISHL Virology Surveillance:** The RISHL, a World Health Organization (WHO) accredited laboratory, types, subtypes, and performs lineage testing on influenza specimens from ILINet providers, congregate living facilities, and the Office of the State Medical Examiners. The RISHL maintains the capacity to detect all circulating strains of influenza, using the CDC Human Influenza Virus Real-Time RT-PCR Diagnostic Panel (CDC Flu rRT-PCR DX Panel Catalog #FluIVD03) and the Influenza B Genotyping Assay (#FluIVD03-4). Any specimen unable to be subtyped is perceived to be a variant strain and is forwarded to the CDC for testing.

**Hospital Surveillance:** Hospital laboratories throughout the state conduct routine diagnostic tests for influenza via molecular assays and rapid diagnostic tests. Demographic and clinical information on influenza-positive patients, and aggregate numbers of influenza tests conducted are sent to RIDOH on a weekly basis. Inpatient hospitalization data are also collected as part of this surveillance.

**Respiratory Outbreak Surveillance:** All influenza and respiratory illness outbreaks in congregate living settings are reportable to RIDOH. For surveillance purposes, a respiratory outbreak is defined as one case of laboratory-confirmed influenza, or two cases of ILI in a congregate living setting. When a facility reports an outbreak, RIDOH provides infection control recommendations and communicates regularly to obtain updated case counts. In addition RIDOH collects data on influenza strain, numbers of ill residents and staff, census counts of the facility, and antiviral use. A facility experiencing an outbreak is monitored until 10 days have passed following the last new case of influenza or respiratory illness. The outbreak is then officially closed and monitoring discontinued. Facilities submit three to five nasopharyngeal specimens to the RISHL for testing, subtyping, and lineage identification.

**Influenza-Associated Mortality:** An influenza-associated death is defined, for surveillance purposes, as a death resulting from a clinically compatible illness that was confirmed to be influenza by an appropriate laboratory or rapid diagnostic test, where there is no period of complete recovery between the illness and death. Since 2006, influenza-associated pediatric deaths have been reportable to CDC. Adult influenza-associated deaths became reportable by regulation in Rhode Island in 2013. RIDOH collects information on influenza strain, age and demographics, vaccination status, and underlying medical conditions.

**Real-time Outbreak and Disease Surveillance system (RODS):** This syndromic surveillance system allows real-time monitoring of chief complaint data from patients upon arrival in emergency departments. Chief complaints are categorized into several syndromes that include respiratory, constitutional, gastrointestinal, hemorrhagic and neurologic. While there is no specific syndrome for influenza-related visits, an increase in ILI is most likely to trigger an alert for constitutional syndrome, which consists of chief complaints of fever, myalgia, or influenza. Therefore, constitutional syndrome is used as a proxy for ILI and percentage of total visits categorized as constitutional are monitored throughout the season.

**School Absenteeism:** In an effort to detect outbreaks, RIDOH monitors school absenteeism data reported to the Rhode Island Department of Education. RIDOH calculates baseline rates of absenteeism for each school, based on previous years and months of absenteeism rates. If higher-than-expected baseline school absenteeism rates are detected for three consecutive days, RIDOH contacts the school nurse teacher, asks about the reason for the increased absenteeism, and reviews infection control measures should influenza-like illness be the reason for the increased absenteeism.



## APPENDIX B: MAP OF SENTINEL REPORTING SITES

RIDOH greatly appreciates the efforts of all our ILINet providers and their staff. These ILINet providers generate data for much of the influenza surveillance program and for the information presented in this report. Participating providers for the 2017-2018 influenza season are listed below.

### SENTINEL PROVIDERS

1. Anchor Medical Associates  
Lincoln
2. Well One Primary Medical  
Burrillville
3. Rhode Island College Health Services  
Providence
4. Bryant University Health Center  
Smithfield
5. Brown University Health Center  
Providence
6. Blackstone Valley Pediatrics  
Cumberland
7. East Greenwich Pediatrics, Inc.  
East Greenwich
8. Warren Family Practice  
Warren
9. Aquidnick Medical Associates, Inc.  
Newport
10. East Bay Family Health Care  
Newport
11. South County Internal Medicine  
South Kingstown
12. University of Rhode Island Health Services  
South Kingstown
13. South County Walk-in & Primary Care  
Narragansett
14. Well One Primary Medical and Dental  
North Kingstown
15. Dr. Stuart Demirs  
Charlestown
16. CVS Minute Clinic - (CVS Drive)  
Woonsocket
17. CVS Minute Clinic  
Cranston
18. CVS Minute Clinic  
East Greenwich
19. CVS Minute Clinic  
North Smithfield
20. CVS Minute Clinic  
Providence
21. CVS Minute Clinic - Wakefield  
South Kingstown
22. CVS Minute Clinic  
Westerly
23. CVS Minute Clinic - (Cass Ave.)  
Woonsocket



## APPENDIX C. INFLUENZA ACTIVITY LEVEL DEFINITIONS

The statewide influenza activity, also known as geographic spread, is reported to CDC each week. The determination of the activity is made using the following algorithm, provided by CDC.

### ACTIVITY LEVEL DEFINITIONS

Activity Level	ILI activity*/Outbreaks		Laboratory data
<b>No activity</b>	Low	AND	No lab confirmed cases†
<b>Sporadic</b>	Not increased	AND	Isolated lab-confirmed case(s)
		OR	
<b>Local</b>	Not increased	AND	Lab confirmed outbreak in one institution‡
	Increased ILI in 1 region**; ILI activity in other regions is not increased	AND	Recent (within the past 3 weeks) lab evidence of influenza in region with increased ILI
<b>Regional (doesn't apply to states with ≤4 regions)</b>		OR	
	2 or more institutional outbreaks (ILI or lab confirmed) in 1 region; ILI activity in other regions is not increased	AND	Recent (within the past 3 weeks) lab evidence of influenza in region with the outbreaks; virus activity is no greater than sporadic in other regions
<b>Regional (doesn't apply to states with ≤4 regions)</b>	Increased ILI in ≥2 but less than half of the regions	AND	Recent (within the past 3 weeks) lab confirmed influenza in the affected regions
		OR	
<b>Regional (doesn't apply to states with ≤4 regions)</b>	Institutional outbreaks (ILI or lab confirmed) in ≥2 and less than half of the regions	AND	Recent (within the past 3 weeks) lab confirmed influenza in the affected regions
		OR	
<b>Widespread</b>	Increased ILI and/or institutional outbreaks (ILI or lab confirmed) in at least half of the regions	AND	Recent (within the past 3 weeks) lab confirmed influenza in the state

\*ILI activity can be assessed using a variety of data sources including ILINet providers, school/workplace absenteeism, and other syndromic surveillance systems that monitor influenza-like illness.

† Lab confirmed case: case confirmed by rapid influenza diagnostic test, antigen detection, culture, or PCR.

‡ Institution includes nursing home, hospital, prison, school, etc.

\*\*Region: population under surveillance in a defined geographical subdivision of a state.

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