

# **Influenza and Other Respiratory Diseases Surveillance Report 2015-2016 Season**

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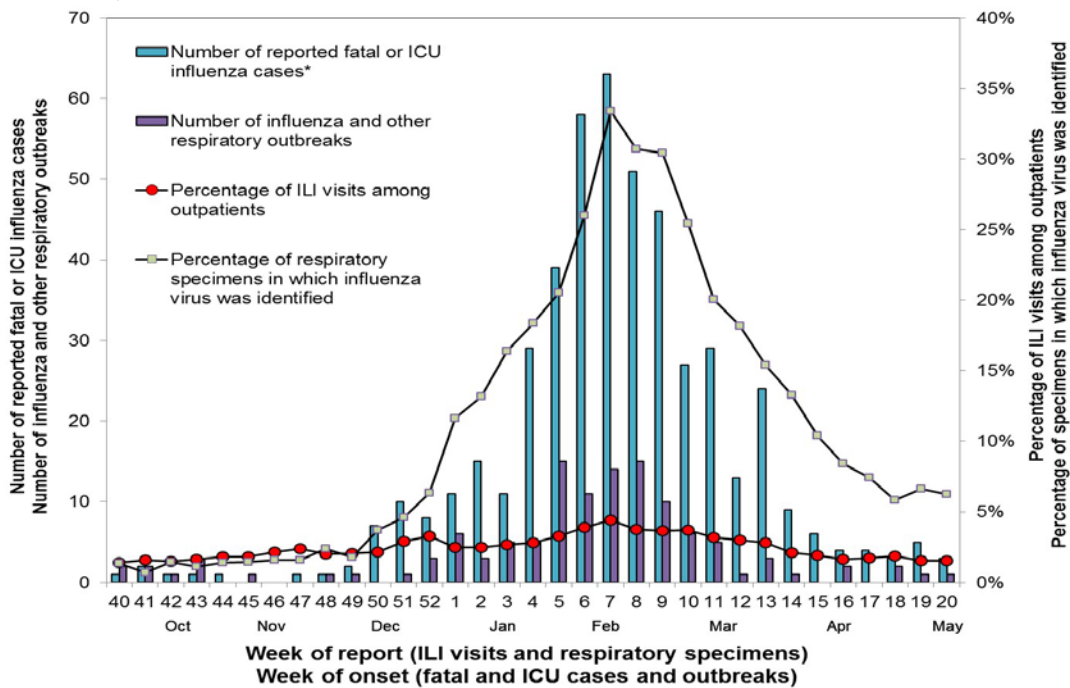
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## Synopsis

Nationally, the 2015–2016 influenza season was more moderate than the previous three seasons, with a lower percentage of outpatient visits for influenza-like illness (ILI), lower hospitalization rates, and a lower percentage of deaths among cases.<sup>1</sup> National influenza activity remained low until late December and peaked during mid-March, with 2009 influenza A (H1N1) viruses predominating overall.<sup>1,2</sup> Influenza activity in California, as measured by most clinical and laboratory parameters, was also more moderate relative to previous seasons; however, more influenza-associated deaths were reported during the 2015–2016 season than were reported during the 2014–2015 season. Influenza activity in California began increasing in late December, peaking in mid-February (Figure 1). This timing is later than the previous three influenza seasons in California, but was earlier than the peak of national influenza activity in 2015-2016. In California, influenza A and B viruses co-circulated.

**Figure 1. Selected influenza surveillance parameters, California Department of Public Health, 2015–2016**



\*includes persons <65 years of age only

The percentage of influenza-like illness (ILI) visits among outpatients and the percentage of laboratory detections for influenza peaked during the week ending February 20, 2016 (4.4% and 33.4%, respectively). These levels of activity were lower than levels seen during the peak of the 2014–2015 influenza season, which was considered to be moderately severe. A total of 121 confirmed respiratory outbreaks were reported during the 2015–2016 season; 81 were associated with influenza. Among the 81 influenza-associated outbreaks, influenza A and influenza B viruses were both commonly identified. The majority of influenza-associated outbreaks occurred in residential healthcare facilities.

Fourteen laboratory-confirmed influenza-associated pediatric deaths were reported to the California Department of Public Health (CDPH) during October 4, 2015–October 1, 2016. This number is within the range (5 in 2007–2008 to 37 in 2008–2009) of past influenza seasons since fatal pediatric influenza surveillance began in 2003. During the 2015-2016 season, CDPH had 499 cases of influenza-associated severe illness or deaths reported among persons less than 65 years of age compared to 369 cases reported in 2014–2015. However, these data may be incomplete because reporting of non-fatal ICU cases is voluntary.

## **Influenza Surveillance Data**

### **A. CDPH Virologic Surveillance**

The California Department of Public Health obtains data on laboratory-confirmed influenza and other respiratory viruses from a number of laboratories throughout the state. These laboratories include the CDPH Viral and Rickettsial Diseases Laboratory (VRDL) and 27 public health laboratories, collectively known as the Respiratory Laboratory Network (RLN), and 26 clinical, academic, and hospital laboratories, which are referred to as sentinel laboratories.

During the 2015–2016 influenza season, these 54 participating laboratories tested 106,587 specimens for influenza. Of the 106,587 specimens tested, 16,686 (15.7%) were positive for influenza; of these, 8,399 (50.3%) were influenza A and 8,287 (49.7%) were influenza B. A total of 2,242 positive influenza A specimens were subtyped; 1,501 (66.9%) were 2009 A (H1N1) and 741 (33.1%) were A (H3N2). Only a subset of RLN laboratories have the capability to lineage type influenza B viruses. Of the 918 positive influenza B specimens that were lineage typed, 647 (70.5%) were B/Yamagata and 271 (29.5%) were B/Victoria.

Overall, virologic surveillance showed co-circulation of Influenza A and B viruses in California during the 2015–2016 season. These data differ from national findings, which identified 2009 influenza A (H1N1) as the predominant circulating strain.<sup>1,2</sup> The proportion of specimens testing positive for all types of influenza first exceeded 10% – an indication that higher than normal levels of influenza virus were circulating – during the week ending January 9, 2016. The proportion of influenza-positive specimens peaked at 33.4% during the week ending February 20, 2016, and declined to less than 10% during the week ending April 23, 2016.

#### 1. Respiratory Laboratory Network (RLN) Surveillance

The RLN laboratories offer polymerase chain reaction (PCR) testing for influenza A and influenza B, including influenza A subtyping and influenza B lineage typing, and testing for respiratory syncytial virus (RSV), a common respiratory virus.

Of 9,391 specimens tested by RLN laboratories from October 4, 2015 through May 21, 2016, 3,652 (38.9%) were positive for influenza; of these, 1,964 (53.8%) were influenza

A and 1,688 (46.2%) were influenza B (Table 1). Of the 1,964 positive influenza A specimens, 1,321 (67.2%) were 2009 A (H1N1), 618 (31.5%) were A (H3N2), and 25 (1.3%) were not subtyped. Of the 1,688 positive influenza B specimens, 647 (38.3%) were B/Yamagata lineage, 271 (16.1%) were B/Victoria lineage, and 770 (45.6%) were not lineage typed. In addition to influenza testing, 1,650 specimens were tested for RSV by RLN laboratories; 51 (3.1%) were positive.

**Table 1. RLN surveillance results, October 4, 2015–May 21, 2016**

	<b>Total RLN*</b> <b>No. (%)</b>	<b>Northern CA</b> <b>No. (%)</b>	<b>Central CA</b> <b>No. (%)</b>	<b>Southern CA</b> <b>No. (%)</b>
<b>Number of specimens tested by PCR</b>	<b>9,391</b>	<b>4,233</b>	<b>499</b>	<b>4,659</b>
<b>Number of specimens negative for influenza</b>	<b>5,739 (61.1)<sup>†</sup></b>	<b>3,248 (76.7)<sup>†</sup></b>	<b>311 (62.3)<sup>†</sup></b>	<b>2,180 (46.8)<sup>†</sup></b>
<b>Number of specimens positive for influenza</b>	<b>3,652 (38.9)<sup>†</sup></b>	<b>985 (23.3)<sup>†</sup></b>	<b>188 (37.7)<sup>†</sup></b>	<b>2,479 (53.2)<sup>†</sup></b>
Influenza A	1,964 (53.8) <sup>‡</sup>	562 (57.1) <sup>‡</sup>	87 (46.3) <sup>‡</sup>	1,315 (53.0) <sup>‡</sup>
2009 A (H1N1)	1,321 (67.2) <sup>§</sup>	381 (67.8) <sup>§</sup>	64 (73.6) <sup>§</sup>	876 (66.6) <sup>§</sup>
Seasonal A (H3N2)	618 (31.5) <sup>§</sup>	173 (30.8) <sup>§</sup>	22 (25.3) <sup>§</sup>	423 (32.2) <sup>§</sup>
Subtyping not performed	25 (1.3) <sup>§</sup>	8 (1.4) <sup>§</sup>	1 (1.1) <sup>§</sup>	16 (1.2) <sup>§</sup>
Influenza B	1,688 (46.2) <sup>‡</sup>	423 (42.9) <sup>‡</sup>	101 (53.7) <sup>‡</sup>	1164 (47.0) <sup>‡</sup>
Yamagata	647 (38.3) <sup>§</sup>	68 (16.1) <sup>§</sup>	0 (0.0) <sup>§</sup>	579 (49.7) <sup>§</sup>
Victoria	271 (16.1) <sup>§</sup>	92 (21.7) <sup>§</sup>	0 (0.0) <sup>§</sup>	179 (15.4) <sup>§</sup>
Subtyping not performed	770 (45.6) <sup>§</sup>	263 (62.2) <sup>§</sup>	101 (100.0) <sup>§</sup>	406 (34.9) <sup>§</sup>
<b>Number of specimens tested for RSV</b>	<b>1,650</b>	<b>913</b>	<b>229</b>	<b>508</b>
RSV	51 (3.1)	21 (2.3)	8 (3.5)	22 (4.3)

\*Participating laboratories:

Statewide: CDPH Viral and Rickettsial Diseases Laboratory.

Northern California: Alameda, Contra Costa, El Dorado, Humboldt, Placer, Sacramento, San Francisco, San Mateo, Santa Clara, Shasta, Solano, Sonoma.

Central California: Fresno, Monterey, San Joaquin, Stanislaus, Tulare.

Southern California: Kern, Long Beach, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, Ventura.

<sup>†</sup>Percent of total specimens tested for influenza by PCR

<sup>‡</sup>Percent of specimens positive for influenza

<sup>§</sup>Percent of influenza A or influenza B positives

## 2. Sentinel Laboratory Surveillance

The sentinel laboratories use various methods to test for influenza, including rapid test, direct fluorescent assay, viral culture, and PCR.

From October 4, 2015 through May 21, 2016, sentinel laboratories tested a total of 97,196 specimens for influenza, of which 13,034 (13.4%) were positive for influenza. Of the 13,034 specimens that tested positive, 6,435 (49.4%) were positive for influenza A and 6,599 (50.6%) were positive for influenza B (Table 2). Sentinel laboratories subtyped 303 positive influenza A specimens; of these, 180 (59.4%) were 2009 A (H1N1) and 123 (40.6%) were A (H3N2). The majority of positive influenza A (95.3%) specimens were not subtyped. No sentinel laboratory has the capability to lineage type influenza B positive specimens. In addition to influenza specimens, 80,400 specimens were tested for RSV by the sentinel laboratories; 6,390 (7.9%) were positive.

**Table 2. Influenza and other respiratory virus detections in Sentinel Laboratories\*, October 4, 2015–May 21, 2016**

	<b>No. (%)</b>
<b>Total specimens tested for influenza</b>	<b>97,196</b>
<b>Number of specimens negative for influenza</b>	<b>84,162 (86.6)<sup>†</sup></b>
<b>Number of specimens positive for influenza</b>	<b>13,034 (13.4)<sup>†</sup></b>
Influenza A	6,435 (49.4) <sup>‡</sup>
2009 A (H1)	180 (2.8) <sup>§</sup>
Seasonal A (H3)	123 (1.9) <sup>§</sup>
Subtyping not performed	6,132 (95.3) <sup>§</sup>
Influenza B	6,599 (50.6) <sup>‡</sup>
<b>Total specimens tested for RSV</b>	<b>80,400</b>
RSV	6,390 (7.9)

\* Participating laboratories by county: Alameda (1), Butte (1), Imperial (3), Long Beach (1), Los Angeles (5), Madera (1), Marin (1), San Diego (10), San Francisco (1), and Santa Clara (1). In addition, Kaiser Permanente has facilities in multiple counties within the Southern California region.

<sup>†</sup>Percent of total specimens tested for influenza

<sup>‡</sup>Percent of specimens positive for influenza

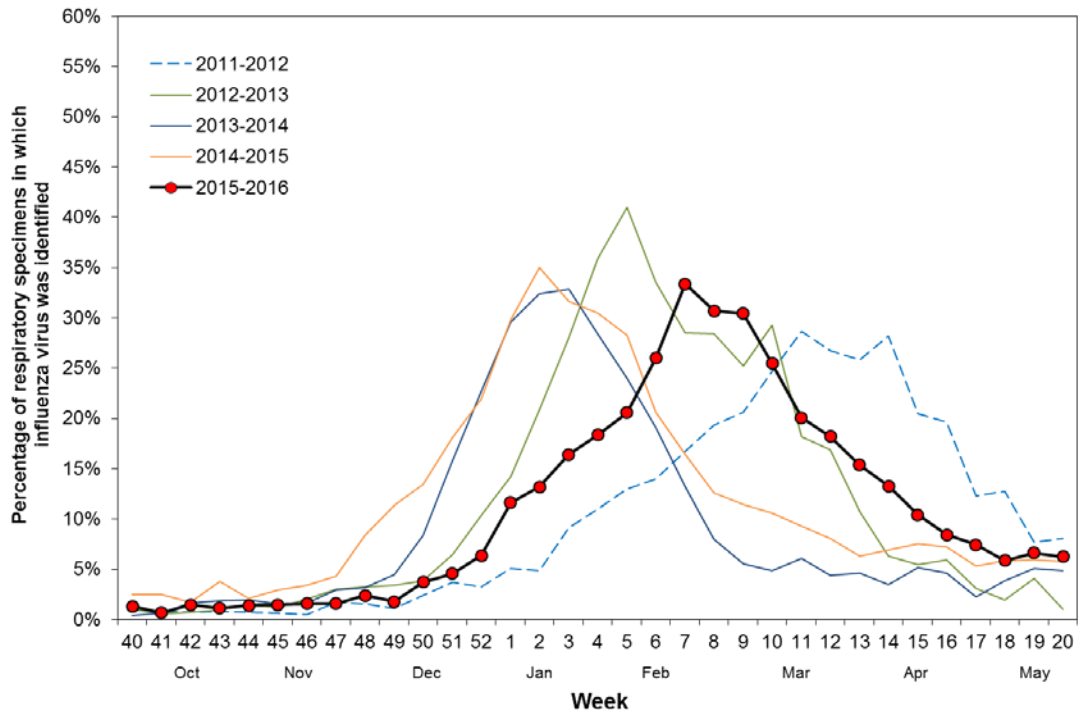
<sup>§</sup>Percent of influenza A positives

## 3. Combined RLN and Sentinel Laboratory Surveillance

Figures 2 and 3 summarize the combined laboratory data from both RLN and sentinel laboratories. The overall level of activity seen during the 2015–2016 season was similar to the activity of the 2014–2015 season; however, the peak of activity during the 2015–2016 season was 2 to 5 weeks later than the previous three seasons (Figure 2). During the 2015–2016 seasons, RLN and sentinel laboratories both detected co-circulation of influenza A and influenza B viruses (Figure 3). RSV activity preceded influenza activity;

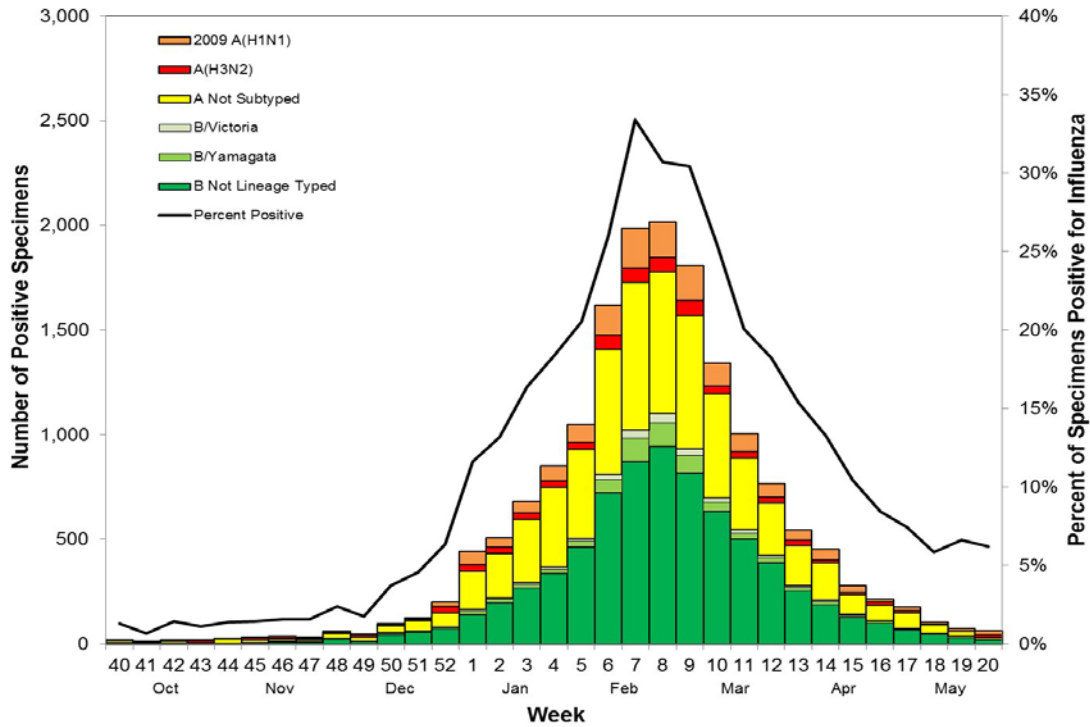
however, the overall level of RSV activity was less than the previous four seasons (Figure 4). Rhinovirus and enterovirus were the most frequently detected viruses among other tested respiratory viruses (Figure 5).

**Figure 2. Percentage of specimens from which influenza was detected in Respiratory Laboratory Network and Sentinel Laboratories, 2011–2016**

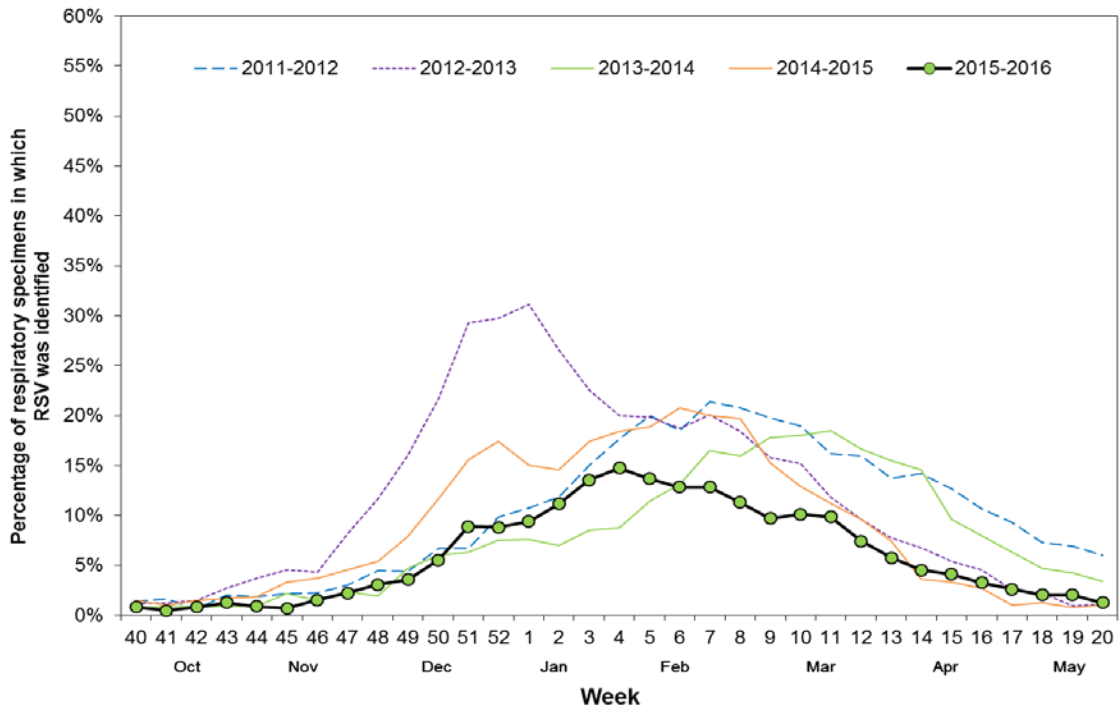


Note: The 2014–15 season contains a week 53. Data have been shifted so that week 1 aligns across years.

**Figure 3. Percentage of influenza types and subtypes in Respiratory Laboratory Network and Sentinel Laboratories, 2015–2016**



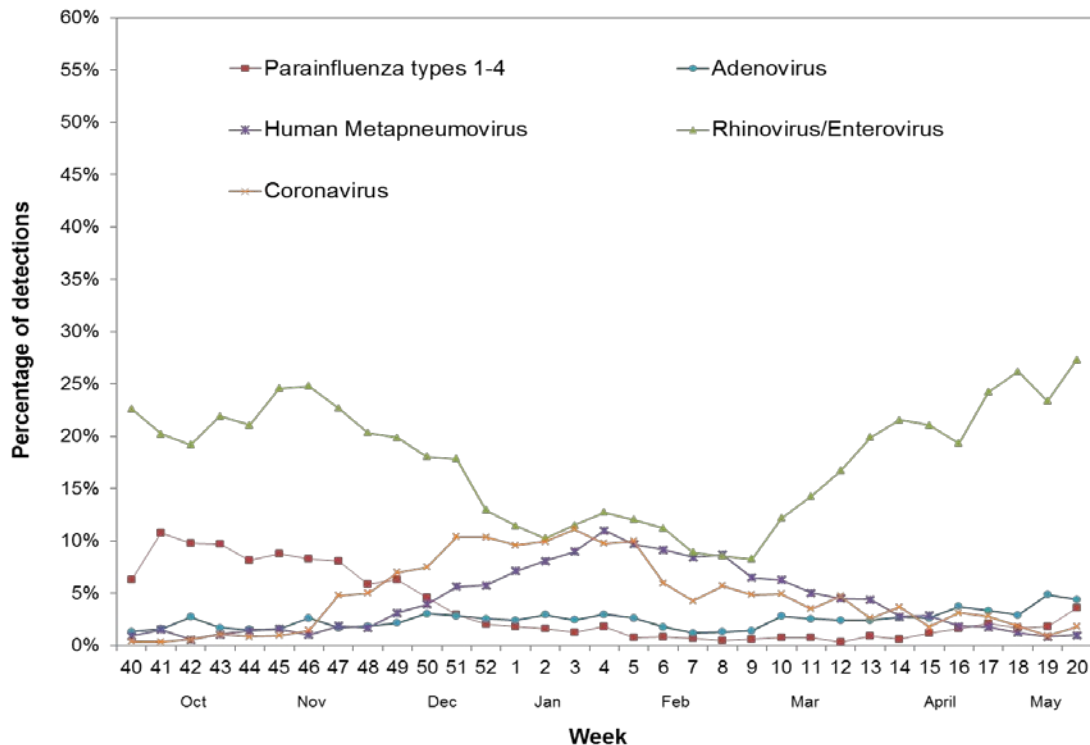
**Figure 4. RSV detections in Respiratory Laboratory Network and Sentinel Laboratories, 2011–2016**



Note: The 2014–15 season contains a week 53. Data have been shifted so that week 1 aligns across years.



**Figure 5. Non-influenza respiratory virus detections in Respiratory Laboratory Network and Sentinel Laboratories, 2015–2016**



#### 4. Influenza Virus Strain Characterization

A total of 133 influenza viruses from California were strain-typed by the Centers for Disease Control and Prevention (CDC) during the 2015–2016 influenza season (Table 3). Fifty-nine (100%) 2009 A (H1N1) viruses and 12 (85.7%) A (H3N2) viruses were characterized as A/California/07/2009-like (H1N1) and A/Switzerland/9715293/2013-like (H3N2), respectively.

These H1N1 and H3N2 components were included in the 2015–2016 influenza vaccine for the Northern Hemisphere. Nationally, 99.9% of influenza 2009 A (H1N1) viruses and 97.0% of influenza A (H3N2) viruses submitted to CDC from U.S. laboratories were well-matched to the influenza A components of the trivalent and quadrivalent vaccines.

All 42 (100.0%) B/Yamagata lineage viruses were characterized as B/Phuket/3073/2013-like (Yamagata lineage), which matched influenza B components in both the trivalent and quadrivalent influenza vaccines for the Northern Hemisphere. In addition, all 18 (100.0%) B/Victoria lineage viruses were characterized as B/Brisbane/60/2008-like (Victoria lineage), the second influenza B strain included in the quadrivalent vaccine for the Northern Hemisphere. Nationally, 100% of influenza B/Yamagata viruses and 98.1% of influenza B/Victoria viruses submitted to CDC from U.S. laboratories were well-matched to the influenza B component(s) of the trivalent (B/Yamagata only) and quadrivalent (B/Yamagata and B/Victoria) vaccines.

**Table 3. Influenza virus antigenic characterization, 2015–2016 season**

<b>Influenza Subtype/Lineage</b>	<b>Vaccine Strain</b>	<b>Match Vaccine Strain (California)</b>	<b>Match Vaccine Strain (United States)</b>
<b>Influenza A (H1)</b>	A/California/7/2009-like (H1N1)	59/59	900/901
<b>Influenza A (H3)</b>	A/Switzerland/9715293/2013-like (H3N2)	12/14	257/265*
<b>Influenza B/Yamagata<sup>‡</sup></b>	B/Phuket/3073/2013-like	42/42	467/467
<b>Influenza B/Victoria<sup>†</sup></b>	B/Brisbane/60/2008-like	18/18	355/362

\*The Centers for Disease Control and Prevention also performs genetic sequencing of influenza A (H3N2) viruses. A total of 265 influenza A (H3N2) viruses were genetically sequenced, and all viruses belonged to genetic groups for which a majority of

<sup>†</sup>The influenza B/Victoria lineage virus is included in only the 2015–2016 quadrivalent influenza vaccine

<sup>‡</sup>The influenza B/Yamagata lineage virus is included in both the 2015–2016 trivalent and quadrivalent influenza vaccines

### 5. Antiviral Resistance Testing

The CDPH Viral and Rickettsial Disease Laboratory (VRDL) monitors influenza viruses for antiviral resistance using two methodologies: (1) pyrosequencing and (2) the functional neuraminidase inhibition (NI) assay. Influenza 2009 A (H1N1) and influenza A (H3N2) clinical specimens are tested using pyrosequencing to detect single mutations that are known to confer oseltamivir resistance. Influenza 2009 A (H1N1), A (H3N2), and influenza B positive isolates are tested for resistance to neuraminidase inhibitors (NAIs) (oseltamivir) using the NI assay. The NI assay is the preferred method for the detection of resistance to the NAI class of drugs caused by established (e.g., H275Y) or novel mutations. Of the 233 influenza specimens tested by CDPH-VRDL during the 2015–2016 influenza season, no specimens were found to be resistant to oseltamivir (Table 4).

**Table 4. Number of specimens tested for antiviral resistance, California, 2015-2016 season**

	<b>Oseltamivir Inhibitors Resistance</b>
<b>Influenza 2009 A (H1N1)</b>	0/72
<b>Influenza A (H3N2)</b>	0/84
<b>Influenza B</b>	0/77

CDC also performs antiviral resistance testing as part of its routine national surveillance. Influenza 2009 A (H1N1), influenza A (H3N2), and influenza B virus isolates were tested for resistance to oseltamivir, zanamivir, and peramivir (all NAIs). During the 2015–2016 influenza season, a total of 3,749 specimens were tested nationally. A majority of those viruses were sensitive to oseltamivir, zanamivir, and peramivir; however, 15 (0.7%) influenza 2009 A (H1N1) viruses showed resistance to oseltamivir and peramivir.

#### 6. Novel Influenza A Viruses

No novel influenza viruses were detected by CDPH VRDL or RLN laboratories by real-time reverse transcription polymerase chain reaction (rRT-PCR) during the 2015–2016 season.

## **B. Case-Based Surveillance**

### 1. Influenza-associated Severe Illness and Mortality in Californians <65 Years of Age

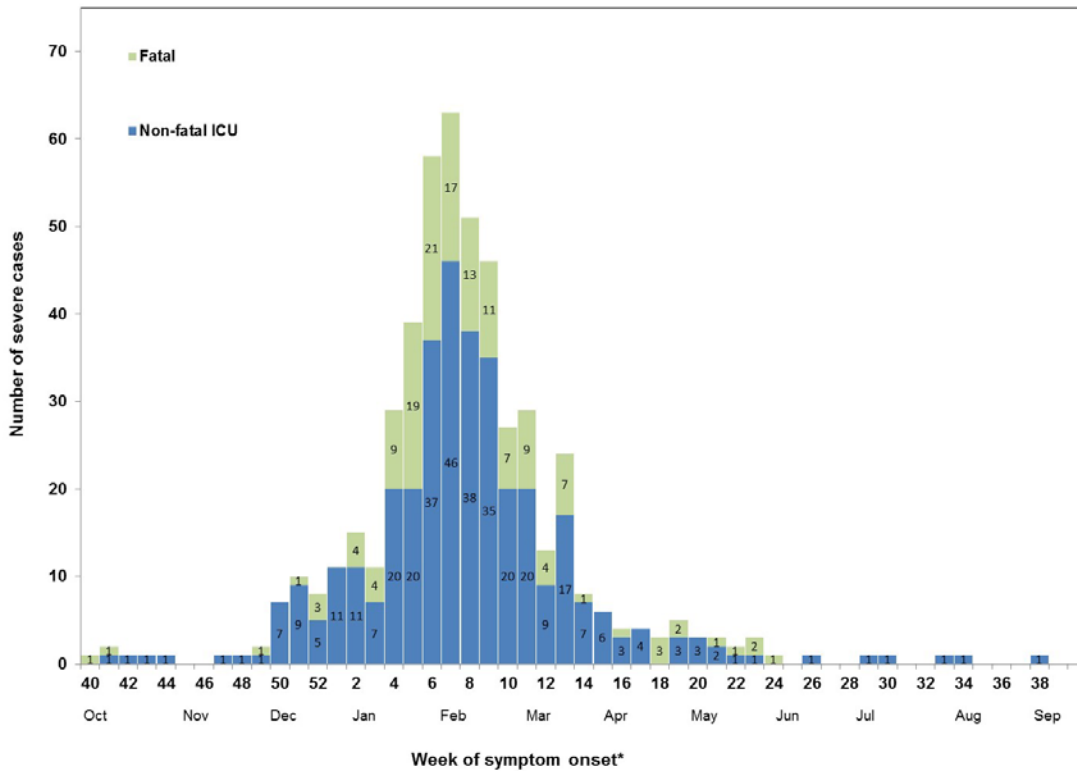
Laboratory-confirmed influenza-associated deaths among patients under 65 years of age are reportable in California [Title 17, California Code of Regulations (CCR) §2500]. Since the 2009 H1N1 influenza pandemic, LHJs have also voluntarily reported to CDPH all laboratory confirmed influenza-associated ICU hospitalizations for patients less than 65 years of age with severe illness.

#### *Epidemiologic Curve of ICU and Fatal Cases <65 Years of Age*

During 2015–2016, CDPH received 499 reports of influenza-associated severe illness or deaths among persons less than 65 years of age; 484 (97.0%) had onset during weeks 40–20 (October

4, 2015 through May 21, 2016) and 15 (3.0%) had onset during the summer months (May 22, 2016 through October 1, 2016). Of the 499 influenza-associated severe and fatal cases reported, 355 (71.1%) were non-fatal ICU cases and 144 (28.9%) were fatal cases. Figure 6 shows the number of fatal and non-fatal ICU cases by week of onset during 2015–2016. Severe influenza case counts by local health jurisdiction for the 2011-2012 through the 2015-2016 influenza season can be found in Appendix I.

**Figure 6. Number of fatal and non-fatal ICU cases (<65 years of age) of laboratory-confirmed influenza reported to the California Department of Public Health, by week of symptom onset, October 4, 2015–October 1, 2016**



\*If onset date was not available, then the earliest known date associated with the illness was used.

*Demographic Characteristics and Clinical Features of ICU and Fatal Cases <65 Years of Age*

The median age of onset for the 499 patients who had influenza-associated severe or fatal illness during the 2015–2016 season was 47 years (range: <1 week–64 years); 287 (57.5%) were male (Table 5). Fatal cases (median age: 53 years; range: <1 year–64 years) were significantly older than non-fatal ICU cases (median age: 42 years; range: <1 week–64 years) [p=<0.001]. The majority of the 499 influenza-associated severe or fatal cases reported during the 2015–2016 influenza season occurred among adults aged 18–64 years of age (393; 78.8%). Pediatric cases under the age of 18 years accounted for 21.2% (n=106) of the severe and fatal cases.

The CDPH case-based surveillance data should be interpreted with caution due to the following limitations: exclusion of cases 65 years of age and older, voluntary reporting of ICU cases, differing degrees of participation by the LHJs, and biases in testing practices (e.g., specimens may not be available for influenza testing). These data are also considered provisional as some cases may still be under investigation.

**Table 5. Demographic characteristics of non-fatal ICU and fatal cases of laboratory-confirmed influenza reported to the California Department of Public Health, October 4, 2015–October 1, 2016**

	<b>Non-fatal ICU cases* No. (%)</b>	<b>Fatal cases No. (%)</b>
Total	355	114
Sex (Male)	204 (57.4)	83 (57.6)
Median Age, in years	42	53
Age group (0-4)	50 (14.1)	6 (4.2)
Age group (5-17)	42 (11.8)	8 (5.6)
Age group (18-49)	120 (33.8)	48 (33.3)
Age group (50-64)	143 (40.)	82 (56.9)

\*Reporting of influenza-associated ICU hospitalizations is voluntary and may not be complete for all counties.

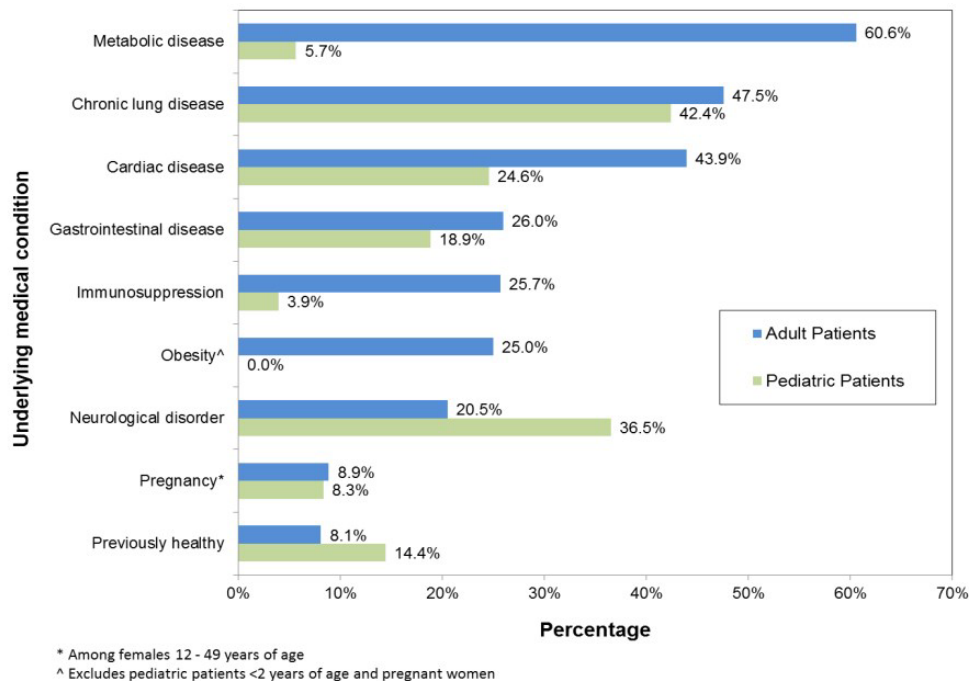
ICU - intensive care unit

Information on underlying medical conditions, including those conditions defined by the Advisory Committee for Immunization Practices (ACIP) as being associated with severe influenza, was collected for severely ill and fatal influenza cases.<sup>3</sup> The most frequently reported underlying medical conditions among adults aged 18–64 years with available information were metabolic disease (e.g., diabetes mellitus, renal disease; 149/246; 60.6%), chronic lung disease (e.g., asthma, chronic obstructive pulmonary disease; 116/244; 47.5%), and cardiac disease (e.g., coronary artery disease; 101/230; 43.9%) [Figure 7]. Among women 18–49 years of age with severe or fatal influenza, seven (7/79; 8.9%) pregnant women were reported, all of whom were ICU cases.

Among pediatric patients with available information, the most frequently reported underlying medical condition was chronic lung disease (28/66; 42.4%); 21 (75.0%) of the 28 children with chronic lung disease had underlying asthma. Other frequently reported underlying medical conditions among pediatric patients include neurological disorders (e.g., seizure disorder, cerebral palsy; 23/63; 36.5%) and cardiac disease (14/57; 24.6%). Fifty-six (52.8%) of the severe and fatal pediatric cases reported were <5 years of age, including 16 infants <6 months of age at the time of illness onset (14 non-fatal ICU admissions and two deaths). Among female pediatric cases 12–17 years of age with severe or fatal influenza, one (1/12; 8.3%) pregnant ICU case was reported.

Fifteen (14.4%) of the pediatric patients and 30 (8.1%) of the adult patients with information available were reported to be previously healthy. Influenza vaccination information was available for 209 (41.9%) of all cases reported with severe or fatal influenza; 72 (34.4%) received the 2015–2016 influenza vaccine. Among pediatric patients ≥6 months of age, 21 (38.9%) of 54 with known vaccination status received the 2015–2016 influenza vaccine.

**Figure 7. Selected underlying medical conditions in non-fatal ICU and fatal cases of laboratory confirmed influenza reported to the California Department of Public Health, October 4, 2015– October 1, 2016**



### Influenza Types and Subtypes

Of the 499 severely ill and fatal influenza cases reported, 321 (64.3%) were influenza A, 169 (33.9%) were influenza B, and 5 (1.0%) were influenza A and influenza B co-infections. Of the 326 influenza A detections, 182 were subtyped; 152 (83.5%) were 2009 A (H1N1) and 29 (15.9%) were A (H3N2). Lineage was determined for 33 of the 174 influenza B detections; 20 (60.6%) were B/Yamagata lineage and 13 (39.4%) were B/Victoria lineage. During the 2015– 2016 season, a higher proportion of pediatric patients (52/106; 49.1%) were attributed to influenza B compared to adult patients (122/393; 31.0%).

### 2. California Emerging Infections Program Data: Influenza-associated Hospitalizations

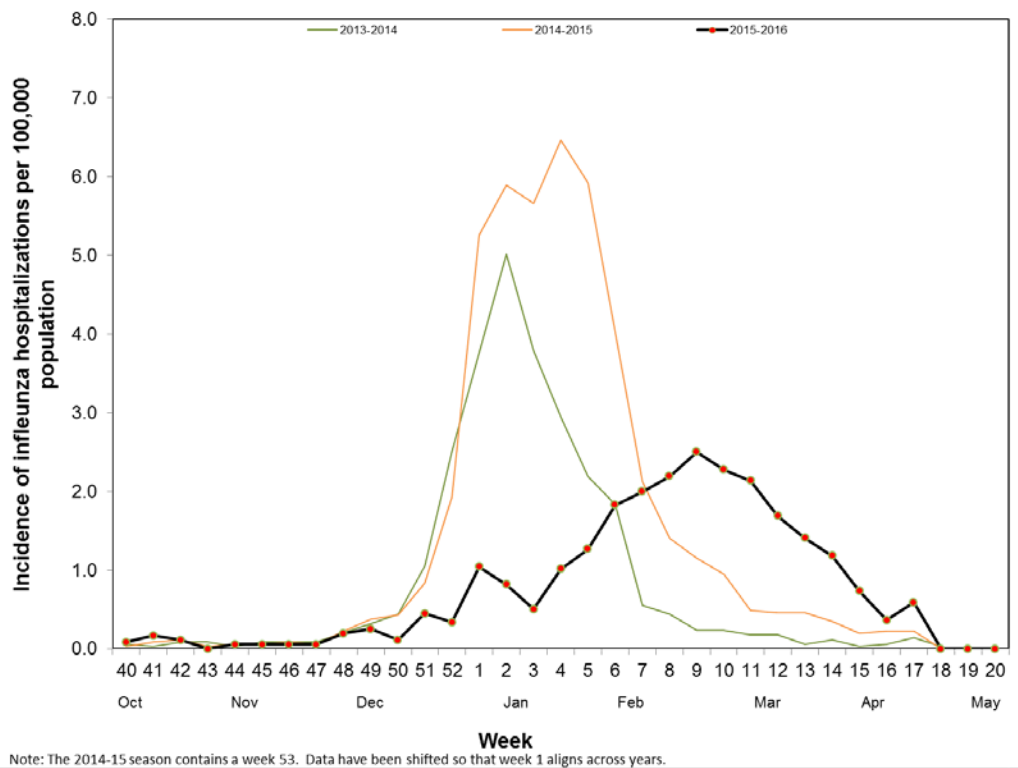
The California Emerging Infections Program (CEIP), Influenza Surveillance Network (FluSurvNET) conducts population-based surveillance for laboratory-confirmed influenza-associated hospitalizations in all ages in Alameda, Contra Costa and San Francisco counties. FluSurv-NET is a national network which covers over 80 counties in the 10 Emerging Infections Program (EIP) states (CA, CO, CT, GA, MD, MN, NM, NY, OR, and TN) and five additional states (IA, MI, OH, RI, and UT). The network represents approximately 9% of the U.S. population (~28 million people).

During the 2015–2016 season, the incidence of influenza-associated hospitalizations per 100,000 population began increasing in early January and peaked during Week 9

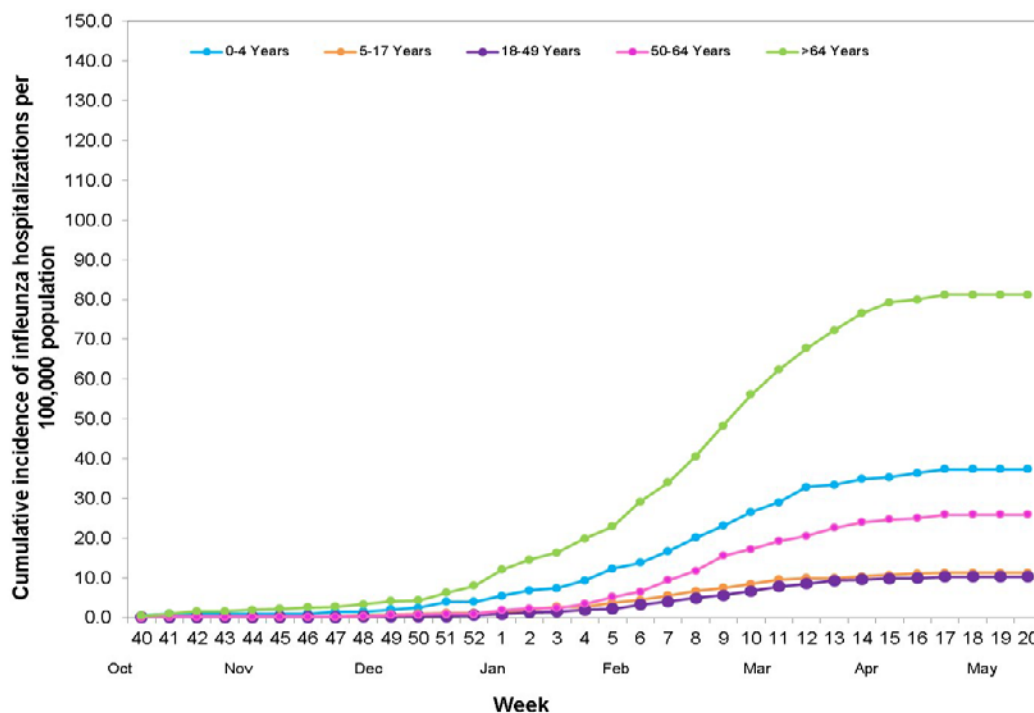
(February 28– March 5, 2016) with an incidence of 2.5 influenza hospitalizations per 100,000 population

(Figure 8). This rate was substantially lower than the peak rate during the 2013–2014 and 2014–2015 influenza seasons (5.0 and 6.5 influenza hospitalizations per 100,000, respectively). Five hundred ten (56.2%) of the 907 patients hospitalized for influenza had influenza A infections and 397 (43.8%) had influenza B infections. The highest cumulative rate of hospitalization was among adults aged >64 years, followed by the 0–4 year and 50–64 year age groups (Figure 9). Patients >64 years of age accounted for nearly half of the total reported hospitalized cases.

**Figure 8. Incidence of influenza-associated hospitalizations in CEIP counties, 2013–2016**



**Figure 9. Cumulative incidence of influenza hospitalizations in CEIP counties by age group, 2015-2016**



## C. Syndromic Surveillance

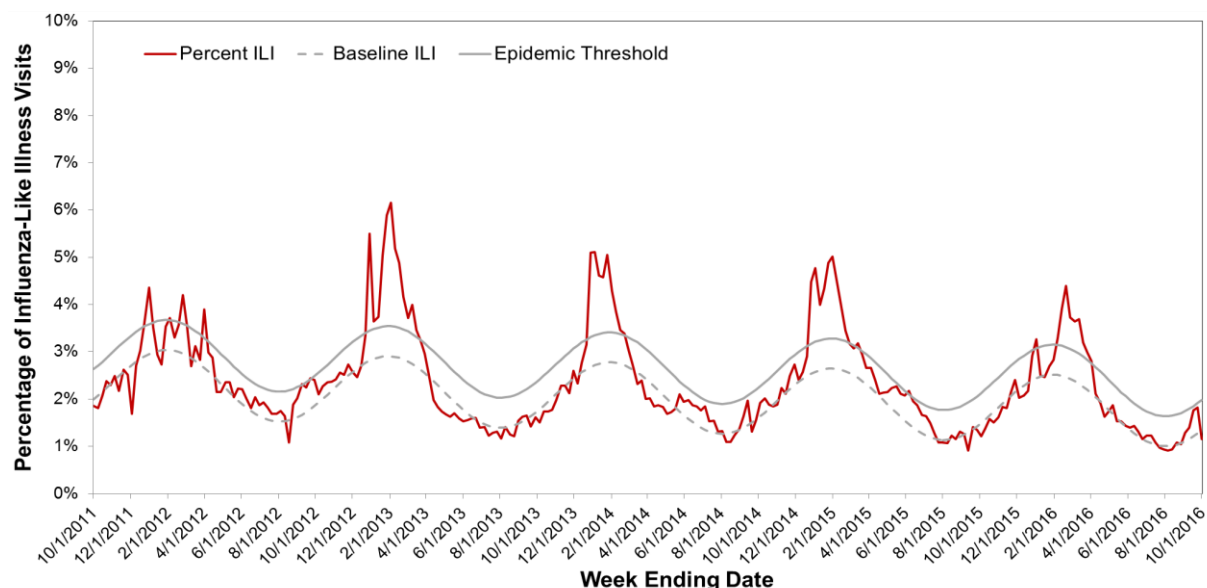
### 1. Influenza-like Illness Outpatient Surveillance (Sentinel Providers)

In collaboration with CDC, CDPH works with volunteer sentinel providers throughout the state to conduct year-round surveillance for ILI in outpatients. Sentinel providers may be individual practitioners or represent whole healthcare systems in a variety of outpatient settings including, but not limited to, hospital outpatient clinics, emergency departments, and student health services. Sentinel providers report on a weekly basis the number of patients with ILI and the total number of patients seen for any reason. Influenza-like illness is defined as any illness with (1) fever ( $\geq 100^{\circ}\text{F}$  or  $37.8^{\circ}\text{C}$ ) and (2) cough and/or sore throat, in the absence of a known cause other than influenza.

In California, 143 sentinel providers reported ILI activity on a regular basis (i.e. at least 17 of the 33 weeks from October 4, 2015 to May 21, 2016). There was minimal ILI activity until late December, when sentinel providers began reporting increases in patients with ILI (Figure 10). Influenza-like illness activity peaked in Week 7 (February 14, 2016–February 20, 2016) and remained elevated through March, returning to seasonal baseline levels during early April. The percentage of visits for ILI exceeded the epidemic threshold during Weeks 5 through 13 (January 31, 2016 – April 2, 2016).



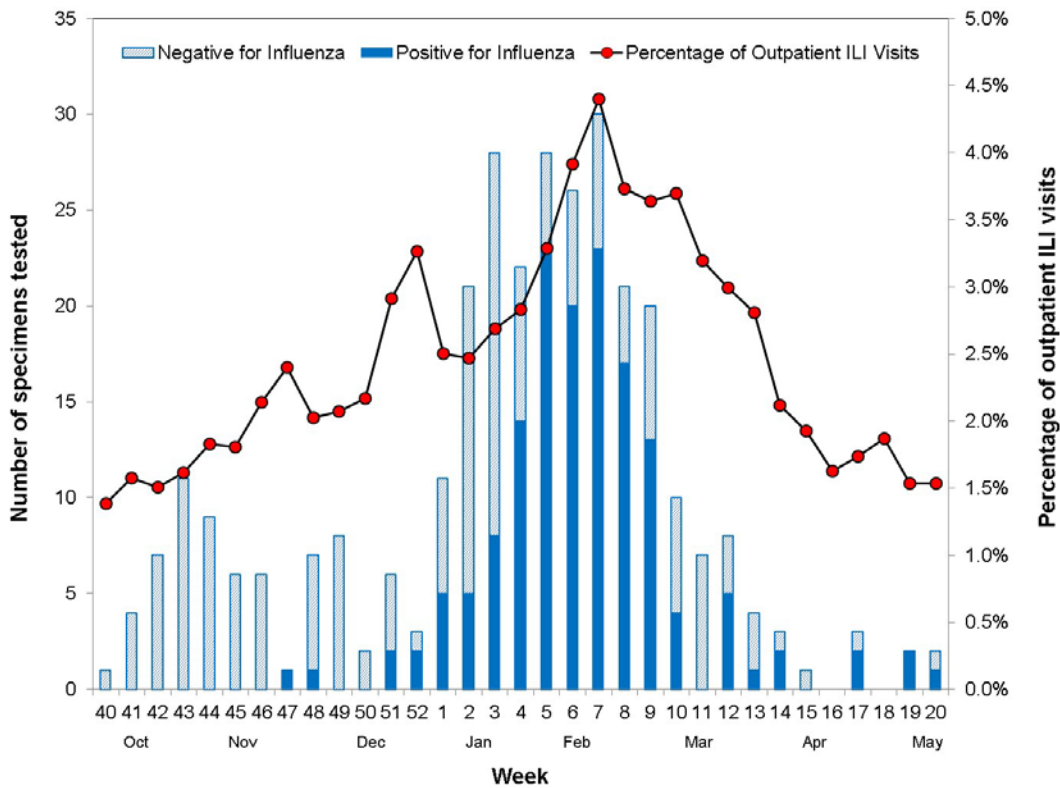
**Figure 10. Percentage of influenza-like illness visits among patients seen by California Sentinel Providers, 2011–2016\***



\*The seasonal baseline was calculated using a regression model applied to data from the previous five years. The epidemic threshold is two standard deviations above the seasonal baseline and is the point at which the observed percentage of ILI is significantly higher than would be expected at that time of the year.

Sentinel providers voluntarily submit specimens from patients with ILI to CDPH-VRDL for influenza testing. Many of these specimens are sent to CDC for further characterization, providing important information about what influenza virus strains are circulating in the community. From October 4, 2015 through May 21, 2016, 318 respiratory specimens were submitted by sentinel providers; 151 (47.5%) were positive for influenza. Of these, 70 (46.4%) were influenza A and 81 (53.6%) were influenza B. Of the 70 positive influenza A specimens subtyped, 45 (64.3%) were 2009 A (H1N1) and 24 (34.3%) were A (H3N2). The number of specimens submitted by sentinel providers that tested positive for influenza peaked in Week 7 (February 14, 2016 – February 20, 2016) coinciding with the period of increased reported ILI activity (Figure 11).

**Figure 11. Sentinel Provider specimens tested by week of collection and influenza result and percentage of influenza-like illness visits by week of visit, October 4, 2015–May 21, 2016**

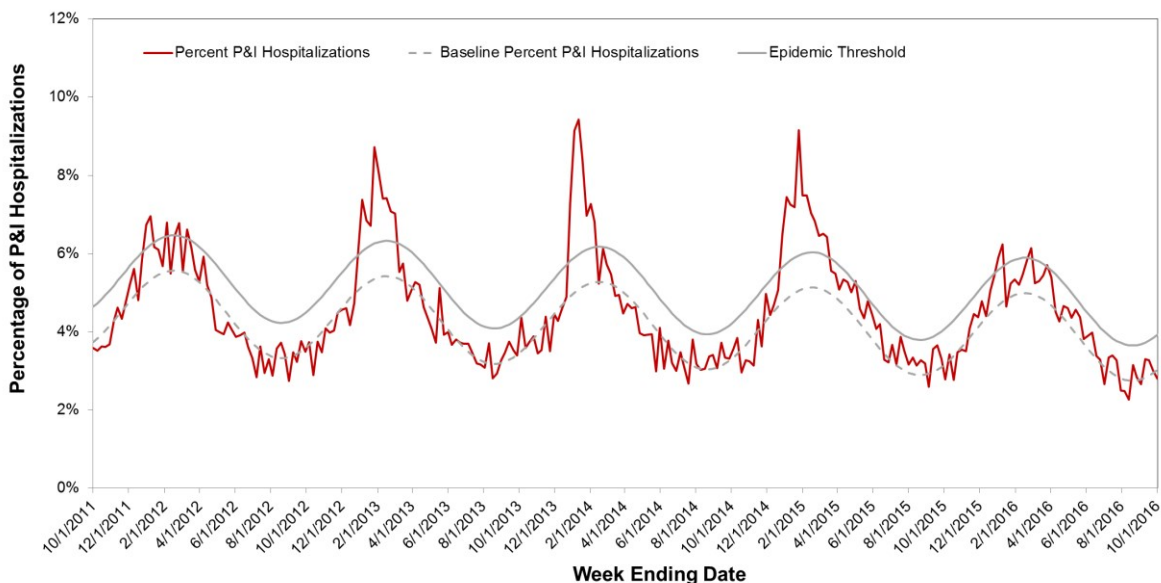


**2. Kaiser Permanente Northern California and Southern California Pneumonia and Influenza Admission Data**

CDPH collaborates with Northern California Kaiser Permanente to monitor trends in pneumonia and influenza-related hospitalizations. Patients with admission diagnoses of “flu,” “pneumonia,” or “influenza” are defined as pneumonia and influenza (P&I) admissions. The number of P&I admissions is divided by the total number of hospital admissions occurring in the same time period to estimate the percentage of P&I admissions. Admissions for pregnancy, labor and delivery, birth, and outpatient procedures are excluded from the denominator.

During the 2015–2016 influenza season, the burden of P&I hospitalizations in Northern California Kaiser Permanente hospitals was substantially lower than the previous three influenza seasons. The percentage of P&I hospitalizations remained minimal throughout the season and only exceeded the epidemic threshold during Weeks 52–1, 8 and 12. In addition, there was no discernible peak in activity during the 2015–2016 season.

**Figure 12. Percentage of pneumonia and influenza admissions in Kaiser Permanente hospitals, 2011–2016\***



\*The seasonal baseline was calculated using a regression model applied to data from the previous six years. The epidemic threshold is two standard deviations above the seasonal baseline and is the point at which the observed percentage of pneumonia and influenza hospitalizations in Kaiser Permanente hospitals in Northern California is significantly higher than would be expected at that time of the year.

## D. Outbreaks of Respiratory Illness, Including Influenza

Outbreaks are required to be reported to the local health authority under Title 17, CCR 2500. In general, respiratory, non-tuberculosis outbreaks are defined as a sudden increase of acute respiratory illnesses over the normal background rate.

From October 4, 2015 to May 21, 2016 local health departments reported a total of 121 confirmed non-tuberculosis respiratory outbreaks to CDPH. The outbreaks were reported from 20 local health jurisdictions throughout the state. There was a substantial decrease in the number of outbreaks reported during the 2015–2016 season compared to the 2014–2015 influenza season (n=338). Of the 121 confirmed respiratory outbreaks, influenza was the most commonly identified pathogen (81; 66.9%). Twenty-seven (22.3%) confirmed respiratory outbreaks had no identified etiology. The remaining 13 (10.8%) outbreaks identified RSV (1), pertussis (2), rhinovirus/enterovirus (2), rhinovirus (1), RSV/rhinovirus (1), coronavirus/rhinovirus (1), coronavirus/parainfluenza (1), parainfluenza (1), and unspecified streptococcal infection (3).

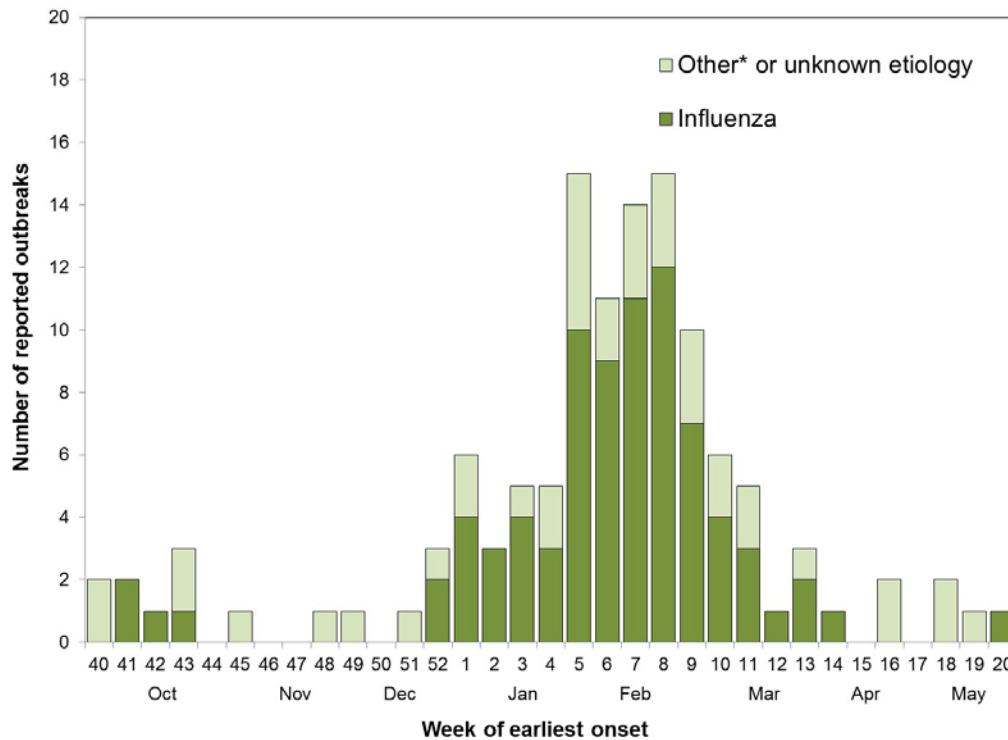
The first influenza-associated outbreak identified during the 2015–2016 influenza season occurred in mid-October 2015 (Figure 13). Influenza outbreaks continued to occur through the end of the season, with peak activity occurring in late-February 2016. Since May 21, 2016, two confirmed influenza outbreaks have been reported to CDPH

with initial case onset dates in early June and late July. Both outbreaks occurred in residential healthcare facilities.

Of the 81 influenza-associated outbreaks, 39 (48.2%) were associated with influenza A and 33 (40.7%) were associated with influenza B. An additional eight (9.9%) outbreaks were associated with both influenza A and influenza B, and one (1.2%) outbreak was associated with influenza but the type was not known. Of the 47 outbreaks where influenza A viruses were identified, 19 had subtyping information available; 10 (52.6%) were 2009 A (H1N1) and nine (47.4%) were A (H3N2). Of the 41 outbreaks where influenza B viruses were identified, 10 had lineage typing performed; eight (80.0%) were B/Yamagata lineage and two (20.0%) were B/Victoria lineage. Most influenza A (28; 59.6%) and influenza B (31; 75.6%) specimens were not subtyped or lineage typed.

Of the 81 influenza-associated outbreaks, 37 (45.7%) occurred in residential healthcare facilities, such as skilled nursing facilities, and 19 (23.5%) occurred in independent living facilities (congregate residential facilities not providing routine healthcare). Local health departments also reported influenza outbreaks in schools (15; 18.5%), correctional facilities (4; 4.9%), and other congregate settings (4; 4.9%).

**Figure 13. Reported respiratory outbreaks by week of earliest onset, October 4, 2015–May 21, 2016**



\*Other etiologies identified by laboratory confirmation included RSV (1), pertussis (2), enterovirus and rhinovirus (2), rhinovirus (1), rhinovirus and RSV (1), coronavirus and rhinovirus (1), coronavirus and parainfluenza (1), parainfluenza (1), and unspecified streptococcal infection (3).

## References

1. Davlin SL, Blanton L, Kniss K, Mustaquim D, Smith S, Kramer N, Cohen J, Cummings CN, Garg S, Flannery B, Fry AM, Grohskopf LA, Bresee J, Wallis T, Sessions W, Garten R, Xu X, Elal AIA, Gubareva L, Barnes J, Wentworth DE, Burns E, Katz J, Jernigan D, Brammer L. Influenza activity – United States, 2015–16 season and Composition of the 2016–17 Influenza Vaccine. *Morb Mortal Wkly Rep.* 2016 June 10; 65(22); 567–575.
2. Centers for Disease Control and Prevention (CDC). FluView: A Weekly Influenza Surveillance Report Prepared by the Influenza Division [Internet]. Updated 2016 July 9; cited 2016 Aug 4. Available from: <http://www.cdc.gov/flu/weekly/>.
3. Grohskopf LA, Sokolow LZ, Olsen SJ, Bresee JS, Broder KR, Karron RA, Jernigan D. Prevention and control of seasonal influenza with vaccines: Recommendations of the Advisory Committee on Immunization Practices, United States, 2015–16 Influenza Season. *Morb Mortal Wkly Rep.* 2016 Aug 26; 65(5);1-54.

**Appendix I. Number of fatal and non-fatal ICU cases of laboratory-confirmed influenza in persons <65 years of age reported to the California Department of Public Health, by local health jurisdiction, 2011–2012 influenza season through 2015–2016 influenza season**

Jurisdiction	Fatal (2011-2012)*	Non-fatal ICU (2011-2012)*	Fatal (2012-2013)*	Non-fatal ICU (2012-2013)*	Fatal (2013-2014)*	Non-fatal ICU (2013-2014)*	Fatal (2014-2015)*	Non-fatal ICU (2014-2015)*	Fatal (2015-2016)*	Non-fatal ICU (2015-2016)*
CALIFORNIA	51	166	116	241	416	837	79	290	144	355
Alameda†	6	9	3	3	12	26	2	12	5	19
Berkeley City, Alameda	0	0	0	0	0	1	0	0	0	1
Alpine	0	0	0	0	0	0	0	0	0	0
Amador	0	0	0	0	0	3	0	1	0	1
Butte	0	2	0	1	3	3	0	0	0	1
Calaveras	0	0	0	0	2	2	0	0	0	0
Colusa	0	0	0	0	0	1	0	0	0	0
Contra Costa	0	9	1	12	9	40	1	8	1	11
Del Norte	0	0	1	0	0	0	0	0	0	0
El Dorado	0	0	0	0	3	8	0	1	0	3
Fresno	3	10	7	14	22	18	4	14	5	8
Glenn	0	0	0	0	1	1	0	0	0	0
Humboldt	0	0	0	3	1	6	1	1	1	1
Imperial	0	0	0	0	2	6	0	0	0	1
Inyo	0	0	0	0	0	0	0	0	0	1
Kern	1	2	2	0	11	23	0	5	1	1
Kings	0	0	0	0	7	5	0	2	1	2
Lake	0	2	0	0	1	5	0	3	0	1
Lassen	0	0	0	0	1	1	0	0	0	0

Jurisdiction	Fatal (2011-2012)*	Non-fatal ICU (2011-2012)*	Fatal (2012-2013)*	Non-fatal ICU (2012-2013)*	Fatal (2013-2014)*	Non-fatal ICU (2013-2014)*	Fatal (2014-2015)*	Non-fatal ICU (2014-2015)*	Fatal (2015-2016)*	Non-fatal ICU (2015-2016)*
Los Angeles†	12	0	32	0	75	22	16	7	36	0
Long Beach										
City, Los Angeles	1	2	1	0	8	4	1	5	1	10
Pasadena City, Los Angeles	0	0	0	0	0	0	0	0	0	0
Madera	0	0	2	1	3	6	1	1	1	1
Marin	0	0	0	1	2	1	0	2	0	0
Mariposa	0	0	0	0	0	0	0	1	0	0
Mendocino	0	1	0	1	4	12	0	0	0	1
Merced	0	1	0	0	5	6	0	0	0	1
Modoc	0	0	0	0	0	0	0	0	0	0
Mono	0	0	0	0	0	0	0	0	0	0
Monterey	0	1	0	4	7	12	2	6	1	2
Napa	0	0	0	0	0	7	1	1	0	3
Nevada	1	0	0	0	1	4	0	2	0	0
Orange	2	18	6	31	22	35	11	23	14	40
Placer	0	0	0	2	1	9	1	3	1	3
Plumas	0	0	0	0	0	0	0	1	0	0
Riverside	0	16	6	14	23	43	2	14	9	22
Sacramento	3	25	10	40	29	96	4	27	8	42
San Benito	0	0	0	1	0	0	0	0	0	1
San Bernardino	5	15	7	13	31	52	4	15	6	32
San Diego	5	10	17	43	44	112	8	59	28	64
San Francisco	0	1	2	1	4	28	1	0	0	0

Jurisdiction	Fatal (2011-2012)*	Non-fatal ICU (2011-2012)*	Fatal (2012-2013)*	Non-fatal ICU (2012-2013)*	Fatal (2013-2014)*	Non-fatal ICU (2013-2014)*	Fatal (2014-2015)*	Non-fatal ICU (2014-2015)*	Fatal (2015-2016)*	Non-fatal ICU (2015-2016)*
San Joaquin	2	5	0	8	8	23	3	8	2	9
San Luis Obispo	0	0	2	2	1	7	0	3	0	3
San Mateo	2	10	1	3	6	18	5	12	2	6
Santa Barbara	0	2	1	4	3	9	2	6	4	10
Santa Clara	1	8	9	10	20	45	2	14	6	17
Santa Cruz	0	1	0	4	5	6	0	6	0	4
Shasta	0	0	0	0	3	10	0	1	0	5
Sierra	0	0	0	0	0	0	0	0	0	0
Siskiyou	0	0	0	0	2	5	0	0	0	0
Solano	0	1	0	7	3	14	2	10	2	6
Sonoma	0	0	0	1	7	19	1	2	5	4
Stanislaus	2	6	1	3	13	31	2	2	1	2
Sutter	0	0	0	1	1	3	0	0	0	0
Tehama	0	0	1	2	0	2	0	0	0	1
Trinity	0	0	0	0	0	0	1	0	0	0
Tulare	1	1	1	2	5	25	0	2	0	3
Tuolumne	0	0	0	0	1	1	0	0	0	0
Ventura	4	7	3	6	3	11	1	9	3	7
Yolo	0	1	0	3	1	10	0	1	0	4
Yuba	0	0	0	0	0	0	0	0	0	1

\*2011-2012: October 2, 2011-September 29, 2012; 2012-2013: September 30, 2012-September 28, 2013; 2013-2014: September 29, 2013-September 27, 2014; 2014-2015: September 28, 2014-October 3, 2015; 2015-2016: October 4, 2015-October 2, 2016

†Does not include city counts