

Influenza Surveillance Summary Colorado, 2018-2019

Overview

Surveillance for the 2018 -2019 influenza season officially began on September 30, 2018 and ran through May 18, 2019. The 2018-19 influenza season was less severe than the 2017-18 season in terms of hospitalizations and outbreaks. In Colorado, there were 3,832 reported hospitalizations with a rate of 68.3 per 100,000 people from 59 counties (compared to 4,650 hospitalized cases and a rate of 85.2 per 100,000 reported from 61 counties in the 2017-18 season). To date, the 2018-19 influenza season had the second highest number of influenza-associated hospitalizations reported in a season.

The 2018-19 season was unique because it had two predominating influenza A subtypes. September 30, 2018 through February 9, 2019, Influenza A, H1N1 viruses were the predominant circulating strain. Beginning the week ending February 16, 2019, there was a shift to influenza A, H3N2 viruses predominating. There was very little influenza B detected and no defined peak of influenza B. The 2018-2019 influenza season had two peaks. The first peak was associated with A, H1N1 and occurred the week ending December 29, 2018. The second peak was associated with A, H3N2 and occurred the week ending March 9, 2019.

Individuals age 65 years or older and children under 6 months of age had the highest rates of hospitalization. There were three pediatric deaths associated with influenza in children less than 18 years of age.

Components of Colorado's Influenza Surveillance

Surveillance activities during the 2018-2019 influenza season included:

- Influenza Associated Hospitalizations
- Influenza-like illness (ILI) visits at outpatient facilities and emergency departments
- Positivity data from sentinel hospital laboratories
- Virologic Surveillance
- Outbreaks of influenza in long term care facilities
- Influenza-associated Pediatric deaths
- Pneumonia and influenza mortality

Influenza-Associated Hospitalizations

A hospitalized patient with a positive influenza test (resulting from a rapid antigen, polymerase chain reaction (PCR), direct fluorescent antibody (DFA), or viral culture) was considered an influenza-associated hospitalization.



Figure 1. Influenza-Associated Hospitalizations: Number of Cases by Week of Diagnosis, Colorado 2018-19 Influenza Season

Overall, 3,832 influenza hospitalizations from 59 counties were reported between September 30, 2018 and May 18, 2019. This was the second highest end of season count for influenza-associated hospitalizations in the state of Colorado (Figure 2). Influenza activity was sporadic until the week ending December 1, 2018. Hospitalizations steadily increased until the season's first peak during the week ending December 29, 2018 with 311 hospitalizations reported that week (Figure 1). The second peak occurred the week ending March 9, 2019 with 295 hospitalizations reported that week (Figure 1). The 2018-19 season's first peak occurred the same week as the previous season (Table 1).

The first half of the influenza season had influenza A, H1N1 predominating, but the week ending February 16, 2019, the predominating strain shifted to influenza A, H3N2 (Figure 1). Among hospitalized cases, 3,693 (96.4%) were type A, 137 (3.6%) were type B, and 2 (<1%) specimens were positive but not typed. Among influenza A cases, 754 (20.4%) were where subtype A (H1N1), 656 (17.8%) were subtype A (2009 H1N1), and the remaining 2,283 (61.8%) were not subtyped. For influenza B viruses, 1 (<1%) was Yamagata lineage, 1 (<1%) was Victoria lineage, and 135 (98.5%) did not have linage testing performed.

Figure 2. Cumulative Rate of Influenza-Associated Hospitalizations: Rates by Season, Colorado 2013-14 to 2018-19 Influenza Seasons



Table 1. Week of Peak Influenza Hospitalizations by Season

Flu Season	Date of Peak
2004-05	2/19/05
2005-06	3/4/06
2006-07	3/17/07
2007-08	2/23/08
2008-09	2/28/09
2009-10	10/17/09
2010-11	2/26/11
2011-12	3/17/12
2012-13	1/4/13
2013-14	1/4/14
2014-15	12/27/14
2015-16	3/12/16
2016-17	2/11/17
2017-18	12/30/17
2018-19	12/29/18 and 3/9/19

Colorado Influenza Activity

Overall, influenza activity was moderately severe during the 2018-19 season. The 2018-19 season was the second most severe season on record in terms of hospitalizations (Figure 2). The 2017-18 season remains the most severe season in Colorado. Influenza activity steadily increased October through December. In Colorado, the peak of the season occurred during the week ending on December 29, 2018 and again the week ending March 9, 2019 (Figure 3). Nationally, influenza hospitalization trends and positivity data from World Health Organization (WHO) and National Respiratory and Enteric Virus Surveillance System (NREVSS) collaborating laboratories peaked during the week ending March 16, 2019. The first peak of influenza-

associated hospitalizations for the 2018-19 season occurred the same week as the previous season. There was very little influenza B detected during the season and we never saw a distinct B peak.



During the 2018-19 season, Colorado had a hospitalization rate of 68.3 per 100,000 people. The previous season had a rate of 85.2 per 100,000 people (Figure 2). Since Colorado began reporting influenza hospitalizations in the 2004, ten seasons have peaked in February or March (Table 1 & Figure 3).

Influenza-Associated Hospitalizations by Age Group

The highest rates of hospitalization are in older adults over 65 years of age (204.2 per 100,000 people), followed by children 0-4 years of age (123.4 per 100,000 people) which is a typical pattern demonstrated by influenza (Table 2 & Figure 4).

Age	Number	Percentage	CO population	Rate per 100,000
0-4 years	412	10.8%	333912	123.4
5-17 years	253	6.6%	930496	27.2
18-49 years	665	17.4%	2514998	26.4
50-64 years	924	24.1%	1056972	87.4
65+ years	1578	41.2%	772792	204.2
Total	3832	100.0%	5609170	68.3

Table 2. Influenza-Associated Hospitalizations by Age Group, Colorado

Figure 4. Influenza- Associated Hospitalizations: Rates by Age Group, Colorado 2018-2019 Influenza Season



Influenza-like Illness (ILI) from Outpatient Facilities

Kaiser Permanente and Primary Care Partners report influenza-like illness (ILI) visits for outpatient encounters based on ICD-10 diagnostic codes. Kaiser Permanente includes providers from the North Central, Northeast, Northwest, South and South Central regions of the state. Primary Care Partners, includes providers in the Northwest region.

ILI activity from outpatient providers peaked the week ending December 29, 2018 at 7.9% and during the week ending February 9, 2019 at 9.8% (Figure 5). The peak percentage of outpatient ILI visits was lower during the 2018-19 season than the 2017-18 season.

The 2018-19 season was the first season that CDPHE started tracking ILI activity in Emergency Departments. This information is provided through syndromic surveillance, an integrated electronic health information system which collects information from hospital emergency departments and standalone emergency departments in the following counties: Adams, Arapahoe, Boulder, Denver, Douglas, and Jefferson. ILI is defined by both ICD-10 codes and chief complaint codes. ILI activity in emergency departments peaked the week ending December 29, 2018 at 7.01% and during the week ending March 9, 2019 with 5.19% (Figure 6).

Baseline levels for both ILI datasets are calculated using an average of non-influenza weeks for the past three seasons plus two standard deviations. A non-influenza week is defined as periods of two or more consecutive weeks in which each week accounted for less than 2% of the season's total number of influenza-associated hospitalizations.





Figure 6.

Influenza-Like Illness: Percentage of Emergency Room Visits in the Denver-Metro Area by Week 2017-18 vs. 2018-19 Season



Positivity Data from Sentinel Hospital Laboratories

During the influenza season, 23 clinical hospital laboratories report how many influenza tests they perform and how many are positive (figure 7). The percentage of respiratory specimens that tested positive for

influenza peaked twice. During the week ending December 29, 2018 at 23% of influenza specimens tested were positive. During the first peak week, 2,085 specimens were tested and 693 were positive. The second peak occurred the week ending February 23, 2019 at 27% of influenza specimens tested were positive. During this week, 3,175 specimens were tested and 882 were positive. Type A viruses predominated for the entire season.





Virologic Surveillance

Clinical Laboratories

For typing and subtyping performed on specimens from hospitalized patients throughout the state of Colorado, 3286 (71%) of positive specimens were positive for influenza A, and 1,363 (29%) were positive for influenza B. For influenza A specimens, 2,158 (66%) were not subtyped, 1,003 (30%) were H3N2 and 124 (4%) were H1N1. For influenza B specimens, 1,240 (91%) did not have lineage performed, 123 (9%) were Yamagata lineage and 1 (<1%) were Victoria lineage (Table 3).

National viral surveillance and characterization data can be accessed at: https://www.cdc.gov/mmwr/volumes/68/wr/mm6824a3.htm

	CO Cumulative Data	National Cumulative Data*
	(September 30, 2018- May	(September 30, 2018- May 11,
	18, 2019)	2019)
Total Positive Specimens	3,832	41,837
Influenza A	3,693 (96.4%)	40,209 (96.1%)
H1N1	754 (20.4%)	21,951 (54.6%)
H3N2	656 (17.8%)	16,688 (41.5%)
Subtyping not performed	2,283 (61.8%)	1,570 (3.9%)
Influenza B	137 (3.6%)	1,628 (3.9%)
Yamagata lineage	1 (0.7%)	393 (24.1%)
Victoria lineage	1 (0.7%)	663 (40.7%)
Lineage not performed	135 (98.5%)	572 (35.1%)
A/B not Distinguished	2 (0.05%)	n/a

Colorado Department of Public Health and Environment Laboratory

Colorado Department of Public Health and Environment collects influenza specimens for further testing through a right sizing strategy. Ten clinical laboratories were recruited from all regions of the state to participate in the program. Each site was asked to send up to five influenza specimens to the public health lab per week during non-peak weeks and up to ten specimens per week during the peak weeks.

Overall, the virology trends in Colorado followed a similar trend to the national trends. Based on typing and subtyping at the CDPHE laboratory, both influenza A, H3N2 and H1N1 viruses predominated. Among 1,001 influenza-positive specimens tested at the CDPHE laboratory, 477 (47.7%) were type A, H1N1; 405 (40.5%) were A, H3N2; 72 (7.2%) were negative, 28 (2.8%) were A, no subtype available (the viral titer was too low to detect a subtype); 15 (1.5%) were positive for B, Victoria; 3 (0.3%) were positive for B, Yamagata; 1 (0.1%) was inconclusive.

Centers for Disease Control (CDC)

A sample of specimens tested at the CDPHE laboratory are then forwarded to CDC for further genetic and antigenic characterizations. Hemagglutinin inhibition (HI) assays are used to antigenically characterize the viruses. 25 specimens from Colorado were antigenically characterized at CDC:

- 4 (16%) of viruses were A/SINGAPORE/INFIMH-16-0019/2016-LIKE (H3N2), which means they were similar to the H3N2 viruses in the influenza vaccine
- 3 (12%) of viruses were not antigenically similar to A/SINGAPORE/INFIMH-16-0019/2016-LIKE (H3N2), which means they were different than the H3N2 viruses in the influenza vaccine
- 7 (28%) of viruses were A/MICHIGAN/45/2015-LIKE (H1N1)pdm09, which means they were similar to the H1N1 viruses in the influenza vaccine
- 3 (12%) of viruses were B/PHUKET/3073/2013-LIKE (Yamagata), which means they were similar than the H3N2 viruses in the influenza vaccine
- 8 (32%) of viruses were B/COLORADO/06/2017-LIKE , which means there were different than the B-Victoria strain that was in the influenza vaccine

CDC uses Next Generation Sequencing (NGS) to genetically characterize influenza viruses. 62 Colorado viruses were genetically characterized at CDC:

- 2 (3%) H3N2 viruses were part of the 3C.2a clade/ subclade
- 5 (8%) H3N2 viruses was part of the 3C.2a1 clade/ subclade
- 13 (21%) H3N2 viruses were part of the 3C.3a clade/ subclade
- 29 (47%) H1N1 viruses were part of the 6B.1 clade/ subclade
- 2 (3%) B, Victoria virus was part of the V1A-2del clade/subclade
- 3 (5%) B, Yamagata viruses were part of the Y3 clade/subclade

Influenza-associated Pediatric Deaths

Pediatric influenza-associated deaths have been a reportable condition in Colorado since the 2004-05 influenza season. The highest number of influenza-associated deaths occurred during the 2008-2009 season with 12 pediatric deaths. The 10-year average is 3.7 deaths per year (Table 4). During the 2018-2019 season, there were 3 pediatric deaths. Colorado had 2 more influenza-associated pediatric deaths compared to the preceding season of 2017-18 in which there was 1 influenza-associated pediatric deaths. Nationally, there were 130 influenza-associated pediatric deaths reported during the 2018-19 season, which was also lower than the 187 influenza-associated pediatric deaths reported for the preceding season.

Table 4. Influenza-Associated Pediatric Deaths

Flu Season	Pediatric Deaths
2008-09	7*
2009-10	12**
2010-11	3
2011-12	0
2012-13	5
2013-14	0
2014-15	6
2015-16	1
2016-17	2
2017-18	1
2018-19	3

Influenza-Associated Pediatric Deaths, Colorado 2003-04 through 2018-19 Influenza Seasons

*Includes death reported in 2008-09 but after defined season dates which may have been acquired on domestic and/or international travel

**2009 H1N1 Pandemic

Influenza Outbreaks in Long-term Care Facilities

While all influenza-associated outbreaks in any setting are reportable to public health per state regulations, for the purpose of this surveillance report, we report on influenza outbreaks that occur in residential settings (such as long-term care facilities, correctional facilities, and group homes). An outbreak is defined as at least one resident with a positive test for influenza among two or more residents with ILI.

During the 2018-19 influenza season, 85 influenza-associated outbreaks were reported. Of those outbreaks, 80 occurred in long-term care facilities (LTCF) and 5 in correctional facilities. The highest number of outbreaks occurred during the 2017-18 season, with 183 outbreaks reported.



Pneumonia and Influenza Mortality

Pneumonia and influenza mortality data comes from the National Center for Health Statistics mortality surveillance. This information comes from death certificate data provided by state and vital statistics offices (Figure 9).

The seasonal baseline was calculated by using data applied from the previous 5 years. The epidemic threshold represents the point at which the observed proportion of deaths attributed to pneumonia or influenza was significantly higher than what is expected for that time of year in absence of substantial influenza-related mortality.

During the 2018-19 season, the highest percentage of deaths due to pneumonia and influenza occurred during the week ending January 12, 2019. This week had 8.2% of deaths related to pneumonia and influenza. National levels did not have a distinct peak, but the highest percentage (7.6%) was reported the week ending February 23, 2019 and March 16, 2019.

Figure 9. Pneumonia & Influenza Mortality from the National Center for Health Statistics Colorado vs. National, 2018-19 Influenza Season

