

2017–2018 Influenza Hospitalization Report



Oregon Emerging Infections Program
Acute and Communicable Disease Prevention
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Background

The Oregon Emerging Infections Program (EIP) has conducted surveillance for pediatric influenza hospitalizations in collaboration with the Centers for Disease Control and Prevention (CDC) since 2003. Surveillance for adult influenza hospitalizations was added in 2005.

The objectives of EIP influenza surveillance are to:

- Estimate age-specific hospitalization rates.
- Describe the temporal trends of laboratory-confirmed influenza hospitalization, including by influenza subtype.
- Describe characteristics of persons hospitalized with severe influenza illness.
- Describe the clinical features and course of influenza disease (e.g., severe illness and influenza-associated complications) among persons hospitalized with influenza.

In Oregon, the EIP surveillance area for influenza hospitalizations comprises the tri-county (Clackamas, Multnomah, and Washington) Portland metropolitan area with a population of 1,812,766 in 2018, approximately 43% of the population of Oregon.

This report summarizes incidence and severity of influenza in Oregon's EIP surveillance area during the 2017–2018 influenza season (October 1, 2017 to April 30, 2018).

Methods

Cases are defined as laboratory-confirmed influenza hospitalizations among residents of the EIP area (Clackamas, Multnomah, and Washington counties) that test for influenza within 14 days before or 3 days after admission. Cases are reported by hospitals in the tri-county area. Health record reviews using the EIP case report form are performed by trained personnel, who collected standardized data regarding demographic characteristics, clinical manifestations, underlying conditions, and illness outcomes. Due to the high number of cases during the 2017-2018 season, 50% of cases ages 50-64 and 25% of cases ≥ 65 years in age were randomly sampled for health record reviews. These reviews were completed for all cases under the age of 50.

Surveillance Results

Between October 1, 2017 and April 30, 2018, 1,522 influenza-related hospitalizations were reported in the EIP area—1,431 adults and 91 pediatric cases. This represents a crude rate of 84.0 cases per 100,000 residents of the EIP area for the season, the highest rate since surveillance began.

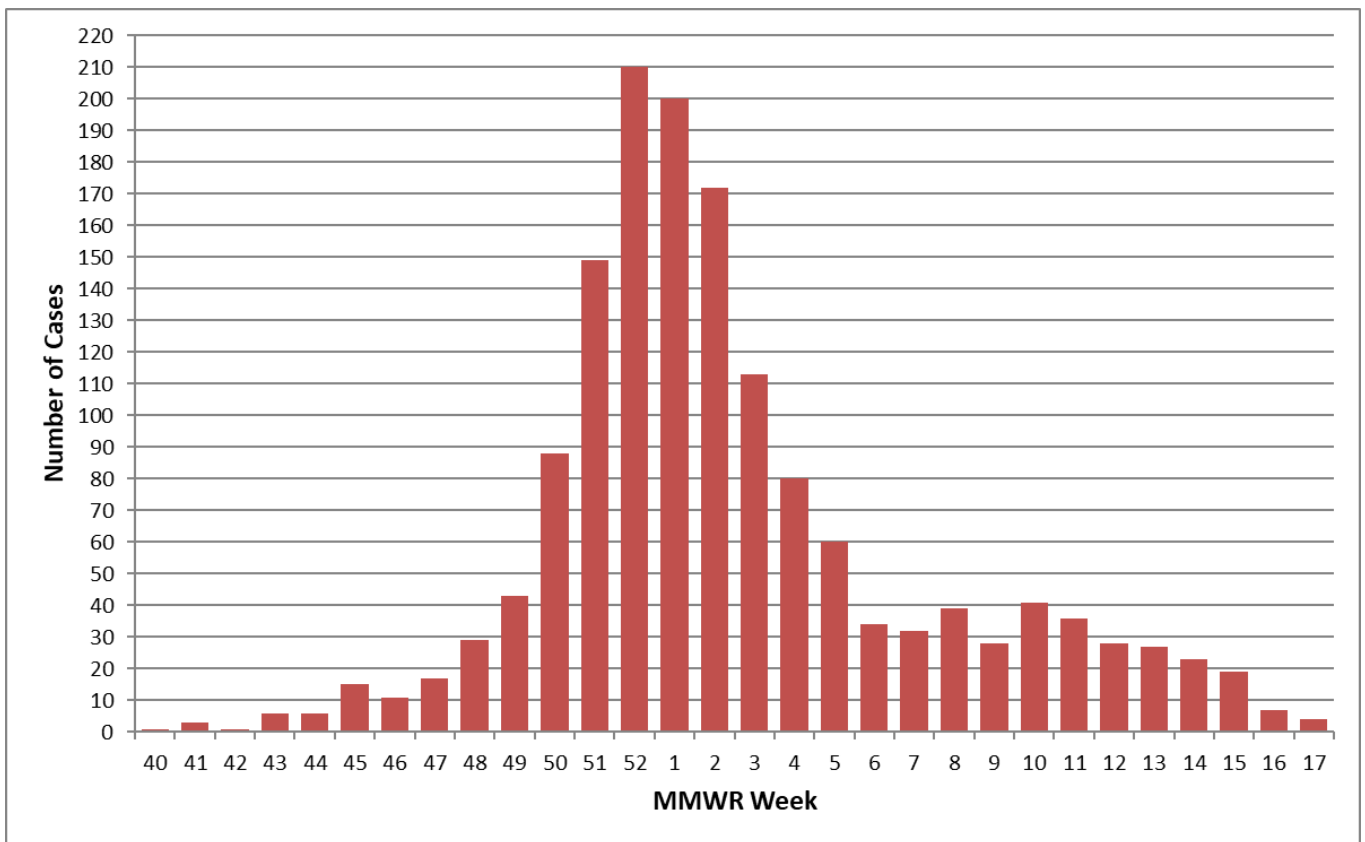
Table 1 shows the sex, age, ethnicity, and race of Oregon EIP cases in 2017–2018. The median age of hospitalized cases was 67 years (range 12 days – 102 years)—younger than the median age last influenza season (median age for the 2016-2017 season was 74 years). Persons 65 years and older accounted for the majority of influenza hospitalizations (56.0%) this season. Approximately 53% of cases were female. Nearly 76% percent of cases were reported as white; the next most commonly reported races were black (5.6%) and Asian, Hawaiian, or Pacific Islander (5.2%). The majority of cases (88.6%) were reported as non-Hispanic.

Table 1. Characteristics of all Oregon EIP influenza-associated hospitalized cases, 2017–2018.

Case Characteristics	No. N = 1,522	Percent
Sex		
Male	720	47.3
Female	802	52.7
Age		
<6 months	6	0.4
6–23 months	31	2.0
24–59 months	20	1.3
5–10 years	25	1.6
11–17 years	9	0.6
18–49 years	180	11.8
50–64 years	398	25.2
>64 years	853	56.0
Ethnicity		
Hispanic and Latino	90	5.9
Non-Hispanic	1,349	88.6
Not specified	83	5.5
Race		
White	1,155	75.9
Black	85	5.6
Asian/Hawaiian or Pacific Islander	79	5.2
American Indian/Alaska Native	14	0.9
Multiple Races	7	0.5
Unknown	182	12.0

Figure 1 shows the distribution of cases during the influenza season. The peak of influenza-associated hospitalizations occurred during MMWR week 52 of 2017 (the week ending 12/30/2017). During the peak week, 210 influenza hospitalizations were reported. During the surveillance period, the first case was reported during week 40 of 2017 (the week ending 10/7/2017), and the last cases were reported week 17 of 2018 (the week ending 4/28/2018).

Figure 1. Number of Oregon EIP influenza-associated hospitalized cases by MMWR week, 2017–2018.



A total of 666 cases were sampled and their medical records reviewed, including all 271 cases ages 49 years and under, 192 cases ages 50-64 years (50% of the total cases in this age group), and 203 cases ages 65 years and above (25% of the total cases in this age group). The percentages reported below are weighted to account for this sampling.

Table 2 shows procedures, conditions, antiviral use, and vaccination status among sampled cases. Nearly all hospitalized cases (94.8%) received a chest x-ray within 72 hours of admission. Approximately 8.4% required mechanical ventilation and 16.8%

were admitted to an ICU. Most cases had at least one underlying medical condition (90.8%), with cardiovascular disease (47.2%), chronic metabolic disease (40.1%), and obesity among adults (35.7%) being the most frequently reported. Less than half (48.6%) of hospitalized cases were reported as vaccinated for influenza prior to hospitalization.

Table 2. Procedures, conditions, antiviral use, and vaccination status for sampled Oregon EIP influenza-associated hospitalized cases, 2017–2018.

Procedures, conditions, and findings*	No. (n=666)	Weighted Percent^o
Chest x-ray within 3 days of admission	600	94.8
Mechanical ventilation	62	8.4
ICU	127	16.8
Treated with Antivirals^{&}	614	92.6
Any Underlying Medical Condition**	568	90.8
Condition		
Obese***	220	35.7
Cardiovascular disease	227	47.2
Chronic metabolic disease	208	40.1
Chronic lung disease	148	27.2
Asthma	136	18.2
Renal disease	99	20.1
Neurologic disorder	134	24.1
Immunosuppressive condition	90	14.3
Hemoglobinopathy	11	0.9
Seizure disorder	50	6.0
Cancer	39	6.7
Cognitive dysfunction	13	2.1
Pregnant [†]	14	13.6
History of Guillain-Barre Syndrome	1	0.3
Vaccinated[‡] prior to hospitalization		
Yes	273	48.6
No	224	26.7
Unknown	169	24.7

*Unknown values not shown

^o Data are reported as raw counts among sampled cases and weighted percents calculated based on sampling scheme.

[&] Treated with antivirals defined as antiviral treatment during the course of illness.

**Cases may have more than one underlying condition; categories are not mutually exclusive.

***Obesity among adults aged 18 years and older. Calculated using height and weight or where indicated in medical record if height or weight was unknown. Obesity defined as BMI \geq 30.

[†] Percent of females 14-49 years (n=103).

[‡] Vaccination status determined according to CDC algorithm using available information from medical records, vaccine registry, and patient and provider contact.

Tables 3 and 4 show demographic characteristics, procedures, and antiviral use for adult cases (persons 18 years and older) by vaccination status. Fifty percent of hospitalized adults were reported as vaccinated prior to hospitalization. Women were somewhat more likely to be vaccinated than men (52.4% vs. 45.8%). The likelihood of vaccination among adults generally increased with age—60.1% of persons 65 years of age and older were vaccinated prior to hospitalization, compared to the lowest—25.0% among adults 18–49 years.

Table 3. Characteristics by vaccination status (vaccinated prior to admission) for sampled adult influenza-associated hospitalized cases, Oregon EIP, 2017–2018.

	Vaccine Status			Total No. (%) ^o n=575
	Unvaccinated No. (%) ^o n=178	Vaccinated No. (%) ^o n=238	Unknown No. (%) ^o n=159	
Sex				
Male	91 (27.5)	101 (45.8)	78 (26.7)	270 (47.6)
Female	87 (23.1)	137 (52.4)	81 (24.5)	305 (52.5)
Age				
18–49 years	81 (45.0)	45 (25.0)	54 (30.0)	180 (27.8)
50–64 years	60 (31.3)	71 (37.0)	61 (31.8)	192 (27.8)
>64 years	37 (18.2)	122 (60.1)	44 (21.7)	203 (59.6)
Ethnicity				
Hispanic and Latino	14 (35.7)	13 (33.8)	6 (30.5)	33 (3.6)
Non-Hispanic	156 (24.4)	221 (50.8)	145 (24.8)	522 (92.5)
Not specified	8 (35.1)	4 (26.1)	8 (38.9)	20 (3.9)
Race				
White	120 (23.6)	179 (51.1)	122 (25.2)	421 (77.9)
Black	22 (42.6)	18 (38.3)	10 (19.1)	50 (6.4)
Asian or Pacific Islander	7 (17.1)	16 (58.1)	7 (24.7)	30 (5.9)
American Indian/ Alaska Native	4 (83.5)	0 (0.0)	1 (16.5)	5 (0.4)
Multiple races	2 (50.0)	1 (33.7)	1 (16.3)	4 (0.4)
Unknown	23 (28.0)	24 (37.9)	18 (34.1)	65 (9.0)

^o Data are reported as raw counts among sampled cases and weighted percents calculated based on sampling scheme.

Among adults, Asians and Pacific Islanders had the highest influenza vaccination coverage (58.1%), followed by whites (51.1%). Adults who were black or multiracial were less likely to have received the influenza vaccine (38.3% and 33.7%, respectively).

Table 4. Procedures, findings and treatment by vaccination status for adult influenza-associated hospitalized cases, Oregon EIP, 2017–2018.

	Vaccine Status			Total No. (%)° n=575
	Unvaccinated No. (%)° n=178	Vaccinated No. (%)° n=238	Unknown No. (%)° n=159	
Chest X-ray				
Chest X-ray within 3 days	170 (25.4)	225 (49.3)	144 (25.3)	539 (96.5)
No Chest X-ray within 3 days	8 (20.8)	13 (48.4)	14 (30.8)	35 (3.4)
Unknown	0 (0.0)	0 (0.0)	1 (100.0)	1 (0.1)
Mechanical ventilation				
Yes	27 (43.2)	12 (20.9)	20 (35.9)	59 (8.7)
No	151 (23.6)	225 (51.8)	139 (24.6)	515 (91.0)
Unknown	0 (0.0)	1 (100.0)	0 (0.0)	1 (0.3)
ICU				
Yes	42 (32.7)	31 (33.5)	35 (33.8)	108 (16.5)
No	136 (23.8)	206 (52.2)	124 (24.0)	466 (83.2)
Unknown	0 (0.0)	1 (100.0)	0 (0.0)	1 (0.3)
Treated with Antivirals^{&}				
Treated	163 (25.0)	222 (49.7)	143 (25.3)	528 (92.5)
Not treated	15 (27.8)	16 (43.5)	16 (28.7)	47 (7.5)
Any medical condition				
None or unknown	25 (38.6)	9 (21.7)	24 (39.7)	58 (7.0)
At least one	153 (24.2)	229 (51.4)	135 (24.5)	517 (93.0)
Type of medical condition				
Asthma	40 (26.0)	55 (51.8)	25 (22.3)	120 (18.3)
Cancer	9 (23.8)	12 (40.3)	12 (35.9)	33 (6.7)
Cardiovascular disease	57 (22.2)	123 (58.2)	43 (19.6)	223 (49.9)
Chronic lung disease	41 (25.1)	72 (53.5)	31 (21.4)	144 (28.7)
Chronic metabolic disease	56 (22.8)	105 (55.4)	45 (21.8)	206 (42.5)
Cognitive dysfunction	2 (9.8)	8 (80.3)	2 (9.8)	12 (2.2)
Hemoglobinopathy	4 (41.5)	0 (0.0)	5 (58.5)	9 (0.9)
History of Guillain-Barre Syndrome	0 (0.0)	0 (0.0)	1 (100.0)	1 (0.3)
Immunosuppressive condition	22 (24.3)	42 (53.3)	17 (22.4)	81 (14.6)
Neurologic condition	24 (14.8)	68 (65.5)	25 (19.7)	117 (24.5)
Obese**	76 (30.6)	85 (43.8)	59 (25.6)	220 (35.7)
Pregnant [‡]	5 (12.2)	7 (20.6)	2 (7.1)	14 (13.6)
Renal disease	19 (18.1)	58 (60.0)	21 (21.9)	98 (21.3)
Seizure disorder	11 (18.7)	16 (49.7)	13 (31.6)	40 (5.7)

° Data are reported as raw counts among sampled cases and weighted percents calculated based on sampling scheme.

& Treated with antivirals defined as antiviral treatment during the course of illness.

**Obesity among adults aged 18 years and older. Calculated using height and weight or where indicated in medical record if height or weight was unknown. Obesity defined as BMI≥30.

‡Percent of females 14-49 years (n=103).

Table 4 shows the frequency and percent of procedures and antiviral use by vaccination status for adult cases. Most adults (93.0%) had at least one underlying condition. Half (51.4%) of cases with at least one underlying medical condition were vaccinated prior to admission. Persons with underlying medical conditions are at high risk for adverse medical outcomes related to influenza infection.

Table 5. Case characteristics by vaccination status (vaccinated prior to admission) for pediatric influenza-associated hospitalized cases, Oregon EIP, 2017–2018.

Sex	Vaccine Status			Total No. (%) n=91
	Unvaccinated No. (%) n=46	Vaccinated No. (%) n=35	Unknown No. (%) n=10	
Male	29 (49.2)	24 (40.7)	6 (10.2)	59 (64.8)
Female	17 (53.1)	11 (34.4)	4 (12.5)	32 (35.2)
Age				
<6 months	6 (100.0)	0 (0.0)	0 (0.0)	6 (6.6)
6-23 months	9 (29.0)	18 (58.1)	4 (12.9)	31 (34.1)
24-59 months	15 (75.0)	4 (20.0)	1 (5.0)	20 (22.0)
5-10 years	14 (56.0)	8 (32.0)	3 (12.0)	25 (27.5)
11-17 years	2 (22.2)	5 (55.6)	2 (22.2)	9 (9.9)
Ethnicity				
Hispanic and Latino	14 (46.7)	14 (46.7)	2 (6.7)	30 (33.0)
Non-Hispanic	32 (53.3)	21 (35.0)	7 (11.7)	60 (65.9)
Not specified	0 (0.0)	0 (0.0)	1 (100.0)	1 (1.1)
Race				
White	27 (58.7)	16 (34.8)	3 (6.5)	46 (50.6)
Black	1 (50.0)	0 (0.0)	1 (50.0)	2 (2.2)
Asian or Pacific Islander	3 (27.3)	7 (63.6)	1 (9.1)	11 (12.1)
American Indian/ Alaska Native	1 (100.0)	0 (0.0)	0 (0.0)	1 (1.1)
Multiple races	1 (33.3)	1 (33.3)	1 (33.3)	3 (3.3)
Unknown	13 (46.4)	11 (39.3)	4 (14.3)	28 (30.8)

Tables 5 and 6 show demographic characteristics, procedures, and antiviral use for pediatric cases by vaccination status. Only a little over a third of hospitalized children—40.7% of males and 34.4% of females—were vaccinated prior to being hospitalized for

influenza. About half of hospitalized children (51 of 91) had underlying medical conditions; only 23 (45.1%) of the children with underlying medical conditions were vaccinated.

Table 6. Procedures, underlying conditions, and antiviral use by vaccination status for pediatric influenza-associated hospitalized cases, Oregon EIP, 2017–2018.

	Vaccine Status			Total No. (%) n=91
	Unvaccinated No. (%) n=46	Vaccinated No. (%) n=35	Unknown No. (%) n=10	
Chest X-ray				
Chest X-ray within 3 days	30 (49.2)	25 (41.0)	6 (9.8)	61 (67.0)
No Chest X-ray within 3 days	16 (53.3)	10 (33.3)	4 (13.3)	30 (33.0)
Mechanical ventilation				
Yes	1 (33.3)	2 (66.7)	0 (0.0)	3 (3.3)
No	45 (51.1)	33 (37.5)	10 (11.4)	88 (96.7)
ICU				
Yes	10 (52.6)	5 (26.3)	4 (21.1)	19 (20.9)
No	36 (50.0)	30 (41.7)	6 (8.3)	72 (79.1)
Treated with Antivirals^{&}				
Treated	43 (50.0)	34 (39.5)	9 (10.5)	86 (94.5)
Not treated	3 (60.0)	1 (20.0)	1 (20.0)	5 (5.5)
Any medical condition				
None or unknown	25 (62.5)	12 (30.0)	3 (7.5)	40 (44.0)
At least one	21 (41.2)	23 (45.1)	7 (13.7)	51 (56.0)
Type of medical condition[*]				
Asthma	10 (62.5)	6 (37.5)	0 (0.0)	16 (17.6)
Cancer	1 (16.7)	4 (66.7)	1 (16.7)	6 (6.6)
Cardiovascular disease	2 (50.0)	2 (50.0)	0 (0.0)	4 (4.4)
Chronic lung disease	1 (25.0)	3 (75.0)	0 (0.0)	4 (4.4)
Chronic metabolic disease	0 (0.0)	1 (50.0)	1 (50.0)	2 (2.2)
Cognitive dysfunction	0 (0.0)	0 (0.0)	1 (100.0)	1 (1.1)
Hemoglobinopathy	1 (50.0)	0 (0.0)	1 (50.0)	2 (2.2)
History of Guillain-Barre Syndrome	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Immunosuppressive condition	2 (22.2)	5 (55.6)	2 (22.2)	9 (9.9)
Neurologic condition	6 (35.3)	9 (52.9)	2 (11.8)	17 (18.7)
Pregnant [†]	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Renal disease	1 (100.0)	0 (0.0)	0 (0.0)	1 (1.1)
Seizure disorder	3 (30.0)	6 (60.0)	1 (10.0)	10 (11.1)

[&] Treated with antivirals defined as antiviral treatment during the course of illness.

^{*} Cases may have more than one underlying condition; categories are not mutually exclusive. Not all categories or subcategories shown.

During the 2017–2018 influenza season, influenza A predominated in Oregon, with both flu A (H3) and flu A (H1N1) co-circulating. Table 7 shows the frequency of virus types and subtypes detected among influenza-associated hospitalized cases in the Oregon EIP area. Influenza A was detected in 64.8% of all hospitalizations. Among influenza A specimens that were subtyped, 53.7% were flu A (H3) and 46.3% were flu A (2009 H1N1). Influenza B was detected in 35.2% of hospitalizations. Influenza B Yamagata accounted for 99% of specimens for which B lineage testing was performed. One hospitalized individual was coinfecting with both flu A and flu B.

Table 7. Influenza virus types and subtypes among Oregon EIP influenza-associated hospitalized cases, 2017–2018.

Virus	No. N=1,522	Percent
Influenza A	986	64.8
H3	151	15.3
2009 H1N1	130	13.2
Unknown subtype*	705	71.5
Influenza B	535	35.2
Yamagata Lineage	156	29.2
Victoria Lineage	1	0.2
Unknown Lineage*	378	70.6
Both A and B	1	0.1

*Specimen not subtyped or lineage not performed.

The age distribution of influenza cases hospitalized during the 2017–2018 season (Figure 2) shows that the highest rate of hospitalization occurred among persons 65 years and older, at 336 cases per 100,000 population over the 2017-2018 season. During 2008–2009 and 2009–2010 (pandemic year), the highest rates of hospitalization occurred among children 0–4 years of age (40 and 68 cases per 100,000 population, respectively). Other than these two years, the rate of influenza hospitalization has consistently been greatest among the elderly. Over the 2017-2018 season, the rate of hospitalization among those 0–4 years was the highest it had been since the pandemic at 55 cases per 100,000 population.

Deaths: Among all individuals hospitalized for flu during the 2017-2018 flu season, 53 (3.5%) died during their hospitalization. Adults accounted for 51 of these deaths (3.6% of all flu-associated adult hospitalizations) and children aged 17 and under accounted for 2 deaths (2.2% of all flu-associated pediatric hospitalizations). This overall

percentage of deaths among hospitalized patients is similar to that seen in the 2016–2017 season (3.6%). Data on deaths includes only those who died while hospitalized.

Figure 2. Oregon EIP influenza-associated hospitalized cases by age group, comparison by influenza season, 2010–2011 to 2017–2018.

