

2016–2017 Influenza Hospitalization Report



Oregon Emerging Infections Program
Acute and Communicable Disease Prevention
Oregon Public Health Division

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 1,809,184 in 2017—which is 44% of the population of Oregon.

This report summarizes incidence and severity of influenza in Oregon’s EIP surveillance area during the 2016–2017 influenza season (October 1, 2016 to April 30, 2017).

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.

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Surveillance Results

Between October 1, 2016 and April 30, 2017, 1,466 influenza-related hospitalizations were reported in the EIP area—1,420 adults and 46 pediatric cases. This represents a crude rate of 81.0 cases per 100,000 residents of the EIP area, a rate nearly three times that of last season (26.4 per 100,000).

Table 1 shows the sex, age, ethnicity, and race of Oregon EIP cases in 2016–2017. The median age of hospitalized cases was 74 years—older than the median age last influenza season (median=61 years). Persons aged more than 64 years were the leading age category in influenza hospitalizations (69.6%) this season. Fifty-one percent of cases were female. Over 83% percent of cases were reported as white, while Black people—5.2% of hospitalized cases—were the next most frequently reported race (where race was known). Most cases, 93.9%, were reported as non-Hispanic.

Table 1. Characteristics of all Oregon EIP influenza-associated hospitalized cases, 2016–2017.

Sex	No.	Percent
Male	712	48.6
Female	754	51.4
Age		
<6 months	6	0.4
6–23 months	9	0.6
24–59 months	7	0.5
5–10 years	10	0.7
11–17 years	14	1.0
18–49 years	128	8.7
50–64 years	272	18.6
>64 years	1020	69.6
Ethnicity		
Hispanic and Latino	61	4.2
Non-Hispanic	1377	93.9
Not specified	28	1.9
Race		
White	1226	83.6
Black	76	5.2
Asian/Hawaiian or Pacific Islander	70	4.8
American Indian/Alaska Native	12	0.8
Multiple Races	1	0.1
Unknown	81	5.5

Figure 1 shows the distribution of cases during the influenza season. The peak of influenza-associated hospitalizations occurred during MMWR week 1 of 2017 (the week ending 1/7/2017). During the peak week, 228 influenza hospitalizations were reported. During the surveillance period the first case was reported week 40 (the week ending 10/8/2016), and the last cases were reported week 18 (the week ending 5/6/2017).

Figure 1. Number of Oregon EIP influenza-associated hospitalized cases by MMWR week, 2016–2017.

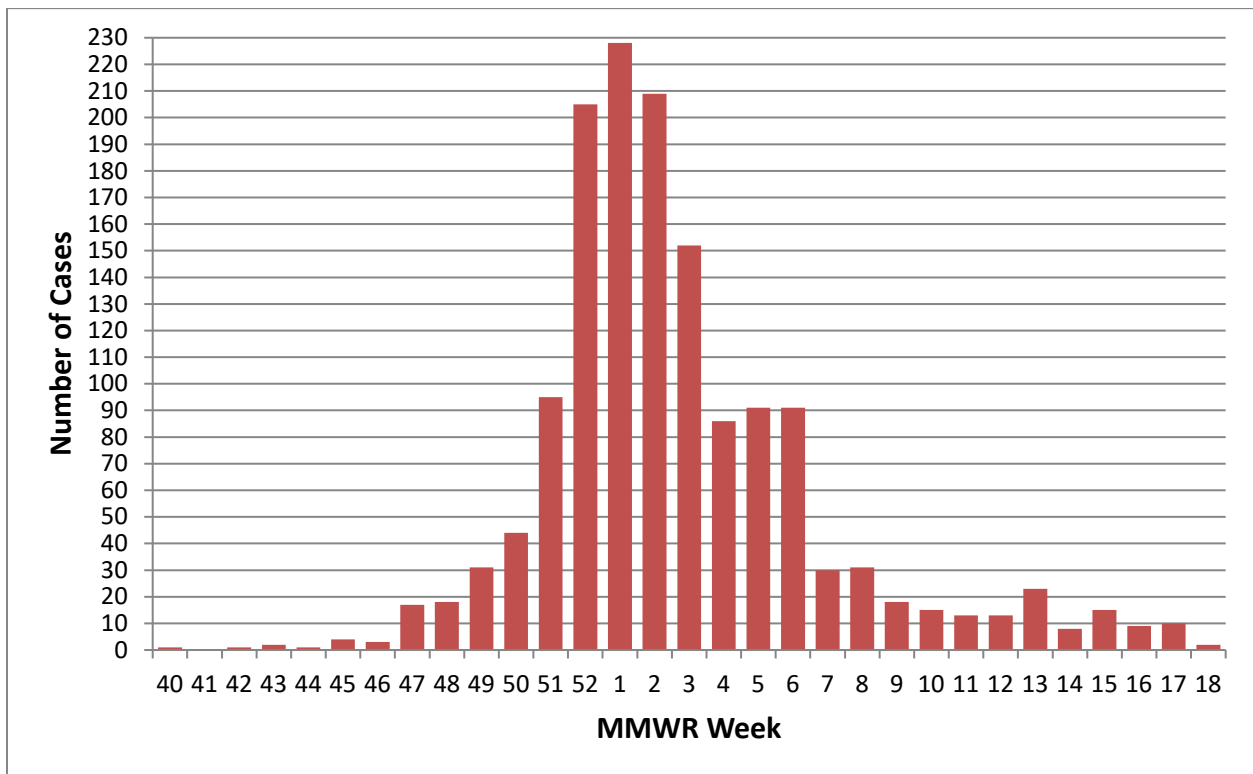


Table 2 shows procedures, conditions, antiviral use, and vaccination status. Nearly all hospitalized cases (96.2%) received a chest x-ray within 72 hours of admission. Approximately 6.0% required mechanical ventilation and 15.6% were admitted to an ICU. Most cases had at least one underlying medical condition (93.0%), with chronic metabolic disease (46.6%), cardiovascular disease (45.6%), and obesity among adults (36.0%) being the most frequently reported. About 60% of hospitalized cases were reported as vaccinated for influenza prior to hospitalization.

Table 2. Procedures, conditions, antiviral use, and vaccination status for all Oregon EIP influenza-associated hospitalized cases, 2016–2017.

Procedures, conditions, and findings*	No.	Percent
Chest x-ray within 3 days of admission	1410	96.2
Mechanical ventilation	88	6.0
ICU	228	15.6
Treated with Antivirals^{&}	1345	91.8
Any Underlying Medical Condition**	1363	93.0
Condition		
Obese***	511	36.0
Cardiovascular disease	669	45.6
Chronic metabolic disease	683	46.6
Chronic lung disease	444	30.3
Asthma	263	17.9
Renal disease	363	24.8
Neurologic disorder	374	25.5
Immunosuppressive condition	201	13.7
Hemoglobinopathy	14	1.0
Seizure disorder	71	4.8
Cancer	68	4.6
Cognitive dysfunction	36	2.5
Pregnant [†]	13	1.7 [‡]
History of Guillain-Barre Syndrome	4	0.3
Vaccinated[‡] prior to hospitalization		
Yes	864	58.9
No	421	28.7
Unknown	181	12.3

*Unknown values not shown

**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.

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

[†] Percent of females \geq 14 years.

[‡] Vaccination status as reported to the state. CDC determines vaccination status based on an algorithm.

Tables 3 and 4 show demographic characteristics, procedures, and antiviral use for adult cases (persons 18 years and older) by vaccination status. Sixty percent of hospitalized adults were reported as vaccinated prior to hospitalization. Women were somewhat more likely to be vaccinated than men (62.2% vs. 57.5%). The likelihood of vaccination among adults generally increased with age—67.7% of persons 67 years of age and older were vaccinated prior to hospitalization, compared to the lowest—40.7% among adults 18–49 years.

Table 3. Characteristics by vaccination status (vaccinated prior to admission) for adult influenza-associated hospitalized cases, Oregon EIP, 2016–2017.

	Vaccine Status			Total
	Unvaccinated No. (%)	Vaccinated No. (%)	Unknown No. (%)	
Sex				
Male	196 (29.0)	389 (57.5)	91 (13.5)	676 (47.6)
Female	195 (26.2)	463 (62.2)	86 (11.6)	744 (52.4)
Age				
18–49 years	52 (42.3)	50 (40.7)	21 (17.1)	123 (8.8)
50–64 years	108 (40.8)	123 (46.4)	34 (12.8)	265 (19.1)
>64 years	231 (23.0)	679 (67.7)	93 (9.3)	1003 (72.1)
Ethnicity				
Hispanic and Latino	22 (44.0)	15 (30.0)	13 (26.0)	50 (3.5)
Non-Hispanic	360 (26.8)	822 (61.2)	161 (12.0)	1343 (94.6)
Not specified	9 (33.3)	15 (55.6)	3 (11.1)	27 (1.9)
Race				
White	322 (26.7)	738 (61.1)	147 (12.2)	1207 (85.0)
Black	22 (32.8)	36 (53.7)	9 (13.4)	67 (4.7)
Asian or Pacific Islander	17 (25.0)	42 (61.8)	9 (13.2)	68 (4.8)
American Indian/Alaska Native	3 (27.3)	8 (72.7)	0 (0.0)	11 (0.77)
Multiple races	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Unknown	27 (40.3)	28 (41.8)	12 (17.9)	67 (4.7)

Among adults, Asian or Pacific Islanders and whites reported similar influenza vaccination coverage (approximately 61%) and American Indian or Alaskan Natives had high vaccination coverage (72.7%, although there are small numbers of cases in this racial group) but blacks were less likely to have received the influenza vaccine (53.7%).

Table 4 shows the frequency and percent of procedures and antiviral use by vaccination status for adult cases. Most adults (94.4%) had at least one underlying condition. More than half (61.2%) 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 4. Procedures, findings and treatment by vaccination status for adult influenza-associated hospitalized cases, Oregon EIP, 2016–2017.

	Vaccine Status			Total
	Unvaccinated No. (%)	Vaccinated No. (%)	Unknown No. (%)	
Chest X-ray				
Chest X-ray within 3 days	373 (27.0)	840 (60.8)	168 (12.2)	1381 (97.3)
No Chest X-ray within 3 days	18 (46.2)	12 (30.8)	9 (23.1)	39 (2.8)
Unknown	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Mechanical ventilation				
Yes	26 (31.3)	45 (54.2)	12 (14.5)	83 (5.9)
No	364 (27.3)	803 (60.3)	165 (12.4)	1332 (93.8)
Unknown	1 (20.0)	4 (80.0)	0 (0.0)	5 (0.4)
ICU				
Yes	72 (34.0)	110 (51.9)	30 (14.2)	212 (14.9)
No	319 (26.5)	739 (61.3)	147 (12.2)	1205 (84.9)
Unknown	0 (0.0)	3 (100.0)	0 (0.0)	3 (0.2)
Treated with Antivirals^{&}				
Treated	357 (27.3)	788 (60.3)	161 (12.3)	1306 (92.0)
Not treated	34 (30.1)	63 (55.8)	16 (14.2)	113 (8.0)
Any medical condition				
None or unknown	36 (45.6)	31 (39.2)	10 (12.7)	79 (5.6)
At least one	355 (26.5)	821 (61.2)	165 (12.3)	1341 (94.4)
Type of medical condition				
Asthma	58 (22.9)	166 (65.6)	29 (11.5)	253 (17.8)
Cancer	20 (29.9)	34 (50.8)	13 (19.4)	67 (4.7)
Cardiovascular disease	177 (22.2)	533 (67.0)	86 (10.8)	796 (56.1)
Chronic lung disease	121 (27.3)	282 (63.7)	40 (9.0)	443 (31.2)
Chronic metabolic disease	160 (23.5)	446 (65.5)	75 (11.0)	681 (48.0)
Cognitive dysfunction	11 (30.6)	25 (69.4)	0 (0.0)	36 (2.5)
Hemoglobinopathy	3 (23.1)	9 (69.2)	1 (7.7)	13 (0.9)
History of Guillain-Barre Syndrome	2 (50.0)	1 (25.0)	1 (25.0)	4 (0.3)
Immunosuppressive condition	48 (24.1)	130 (65.3)	21 (10.6)	199 (14.0)
Neurologic condition	89 (24.3)	217 (59.3)	60 (16.4)	366 (25.8)
Obese**	141 (27.6)	313 (61.3)	57 (11.2)	511 (36.0)
Pregnant [‡]	6 (50.0)	6 (50.0)	0 (0.0)	12 (1.6)
Renal disease	73 (20.1)	251 (69.2)	39 (10.7)	363 (25.6)
Seizure disorder	19 (28.8)	35 (53.0)	12 (18.2)	66 (4.7)

[&]Cases may have more than one underlying condition; categories are not mutually exclusive. Not all categories or subcategories shown.

**Obesity calculated using height and weight or where indicated in medical record if height or weight was unknown. Obesity defined as BMI≥30.

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

‡Percent pregnant includes only adult females in denominator.

Tables 5 and 6 show demographic characteristics, procedures, and antiviral use for pediatric cases by vaccination status. Most hospitalized children—63.9% of males and 77.8% of females—were not vaccinated prior to being hospitalized for influenza. About half of hospitalized children (22 of 45) had underlying medical conditions; only 9 (40.9%) of the children with underlying medical conditions were vaccinated.

Table 5. Case characteristics by vaccination status (vaccinated prior to admission) for pediatric influenza-associated hospitalized cases, Oregon EIP, 2016–2017.

	Vaccine Status			Total
	Unvaccinated No. (%)	Vaccinated No. (%)	Unknown No. (%)	
Sex				
Male	23 (63.9)	11 (30.6)	2 (5.6)	36 (80.0)
Female	7 (77.8)	1 (11.1)	1 (11.1)	9 (20.0)
Age				
<6 months	5 (83.3)	0 (0.0)	1 (16.7)	6 (13.3)
6–23 months	5 (62.5)	2 (25.0)	1 (12.5)	8 (17.8)
24–59 months	6 (85.7)	1 (14.3)	0 (0.0)	7 (15.6)
5–10 years	5 (50.0)	5 (50.0)	0 (0.0)	10 (22.2)
11–17 years	9 (64.3)	4 (28.6)	1 (7.1)	14 (31.1)
Ethnicity				
Hispanic and Latino	6 (54.6)	5 (45.5)	0 (0.0)	11 (24.4)
Non-Hispanic	23 (69.7)	7 (21.2)	3 (9.1)	33 (73.3)
Not specified	1 (100.0)	0 (0.0)	0 (0.0)	1 (2.2)
Race				
White	11 (57.9)	6 (31.6)	2 (10.5)	19 (42.2)
Black	9 (100.0)	0 (0.0)	0 (0.0)	9 (20.0)
Asian or Pacific Islander	1 (50.0)	1 (50.0)	0 (0.0)	2 (4.4)
American Indian/Alaska Native	0 (0.0)	0 (0.0)	1 (100.0)	1 (2.2)
Multiple Races	1 (100.0)	0 (0.0)	0 (0.0)	1 (2.2)
Unknown	8 (61.5)	5 (38.5)	0 (0.0)	13 (28.9)

Table 6. Procedures, underlying conditions, and antiviral use by vaccination status for pediatric influenza-associated hospitalized cases, Oregon EIP, 2016–2017.

	Vaccine Status			Total
	Unvaccinated No. (%)	Vaccinated No. (%)	Unknown No. (%)	
Chest X-ray				
Chest X-ray within 3 days	17 (60.7)	9 (32.1)	2 (7.1)	28 (62.2)
No Chest X-ray within 3 days	13 (76.5)	3 (17.7)	1 (5.9)	17 (37.8)
Unknown	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Mechanical ventilation				
Yes	4 (80.0)	1 (20.0)	0 (0.0)	5 (11.1)
No	26 (65.0)	11 (27.5)	3 (7.5)	40 (88.9)
Unknown	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
ICU				
Yes	10 (66.7)	4 (26.7)	1 (6.7)	15 (33.3)
No	20 (66.7)	8 (26.7)	2 (6.7)	30 (66.7)
Unknown	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Treated with Antivirals^{&}				
Treated	27 (71.1)	9 (23.7)	2 (5.3)	38 (84.4)
Not treated	3 (42.9)	3 (42.9)	1 (14.3)	7 (15.6)
Any medical condition				
None or unknown	18 (78.3)	3 (13.0)	2 (8.7)	23 (51.1)
At least one	12 (54.6)	9 (40.9)	1 (4.6)	22 (48.9)
Type of medical condition[*]				
Asthma	4 (40.0)	6 (60.0)	0 (0.0)	10 (22.2)
Chronic lung disease	1 (100.0)	0 (0.0)	0 (0.0)	1 (2.2)
Cardiovascular disease	1 (100.0)	0 (0.0)	0 (0.0)	1 (2.2)
Chronic metabolic disease	0 (0.0)	2 (100.0)	0 (0.0)	2 (4.4)
Renal disease	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cancer	0 (0.0)	1 (100.0)	0 (0.0)	1 (2.2)
Immunosuppressive condition	0 (0.0)	2 (100.0)	0 (0.0)	2 (4.4)
Neurologic condition	5 (62.5)	3 (37.5)	0 (0.0)	8 (17.8)
Seizure disorder	4 (80.0)	1 (20.0)	0 (0.0)	5 (11.1)
Hemoglobinopathy	1 (100.0)	0 (0.0)	0 (0.0)	1 (2.2)

[&] 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 2016–2017 influenza season, the predominant virus that circulated in Oregon was influenza A (H3). Of H3 viruses tested at the CDC, 94.9% were A/Hong Kong/4801/2014-like, a component of the 2016-17 influenza vaccine. 86.5% of influenza B/Victoria viruses tested at CDC were B/Brisbane/60/2008-like, which was also a component of the 2016-17 vaccine. Of influenza B/Yamagata viruses tested at CDC, 100% were B/Phuket/3073/2013-like, which was a component of the 2016–2017

quadrivalent influenza vaccine. CDC estimated that getting a flu vaccine during the 2016–2017 season reduced the risk of having to go to the doctor because of the flu by 42% for both children and adults.¹

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 91.7% of all hospitalizations. Influenza A (H3) predominated and was detected in 98.6% of Flu A specimens subtyped. Influenza A (2009 H1N1) was detected in 1.4% of the specimens that were subtyped. 8.2% of hospitalizations were associated with influenza B.

Table 7. Influenza virus types and subtypes among Oregon EIP influenza-associated hospitalized cases, 2016–2017.

Virus	No.	Percent
Influenza A	1346	91.7
H3	574	39.1
2009 H1N1	8	0.5
Unknown subtype*	886	60.4
Influenza B	120	8.2
Both A and B	0	0.0
Type unknown ⁺	2	0.1
Total	1468	100

⁺type unknown: influenza type not reported in medical records.

*Specimen not subtyped.

The age distribution of hospitalized cases in 2016–2017 (Figure 2) shows that in 2016–2017 the highest rate of hospitalization occurred among persons 65 years and older. During 2009–2010 (pandemic year) and 2008–2009 the highest rates of hospitalization occurred among children 0–4 years of age. Other than these two years, influenza has had the greatest rate of hospitalization in the elderly. The rate of hospitalization among those 65 or older was higher than in any previous season at 403 cases per 100,000 people.

Deaths: There were 53 deaths among adults hospitalized in 2016–2017, which was 3.6% of all hospitalizations. This percentage of deaths among hospitalized patients is less than that seen in the 2015–2016 season (4.3). There were no pediatric deaths among patients hospitalized in the Oregon EIP catchment area. Data on deaths includes only those who died while hospitalized.

¹ CDC. Flannery B, Chung J. Influenza vaccine effectiveness, including LAIV vs IIV in children and adolescents, U.S. Flu VE Network 2015–16, June 22, 2016. Available at: <https://www.cdc.gov/vaccines/acip/meetings/downloads/min-archive/min-2016-06.pdf>. Accessed 06/25/2018

Figure 2. Oregon EIP influenza-associated hospitalized cases by age group, comparison by influenza season, 2010–2011 to 2016–2017.

