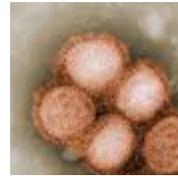


Fall 2009 H1N1 Influenza Hospitalization Report

Oregon Emerging Infections Program
Office of Disease Prevention & Epidemiology
Oregon Public Health Division
Updated: February 1, 2010



Background

Oregon Emerging Infections Program (EIP) Network conducts influenza hospitalizations surveillance in collaboration with 9 other EIP surveillance areas around the United States and Centers for Disease Control and Prevention (CDC). In Oregon, the EIP surveillance area for influenza hospitalizations comprises the Tri-County (Clackamas, Multnomah, and Washington) Portland metropolitan area with an estimated population of 1,614,465*.

The purpose of this surveillance is to determine the incidence and epidemiologic characteristics of influenza severe enough to result in hospitalization. This report outlines the burden and severity of influenza in Oregon's EIP surveillance area during the 2009 fall wave of the H1N1 pandemic.

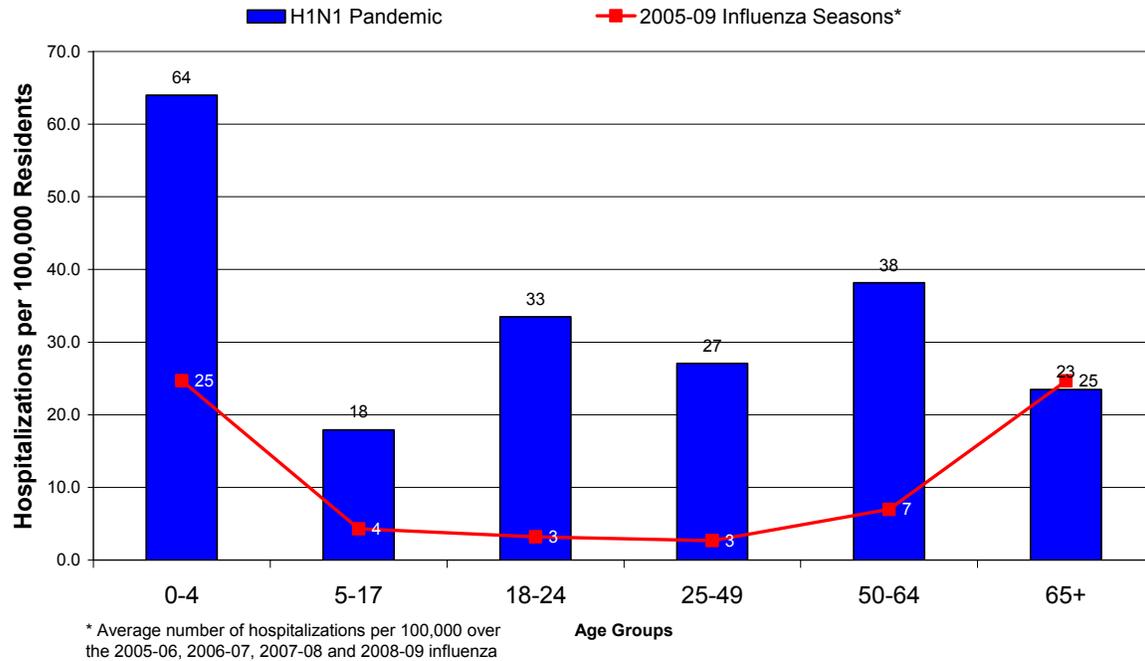
Methods

A lab-confirmed influenza hospitalization was defined as a resident of Oregon with a positive test for influenza within 14 days before and 3 days after admission. Pediatric cases are 17 years of age and younger. The definition includes any test positive for influenza and does not require confirmation for H1N1; however no seasonal influenza was confirmed among EIP hospitalizations since September 1, 2009. Health record reviews using the EIP case report form were performed by trained nurses, who collected standardized data regarding demographic characteristics, clinical manifestations, underlying conditions, and illness outcomes.

* Portland State University Population Research Center population estimates from 2008. These estimates were used to calculate rates of illness for this report.

previous four influenza seasons, rates of hospitalization during the H1N1 pandemic were considerably higher in all age groups except for those 65 years and older.

Figure 2: EIP Surveillance Area Influenza Hospitalizations by Age per 100,000 Oregon Residents Past Influenza Seasons* compared to H1N1 Pandemic



Underlying Conditions

Of adult patients, 82% had any underlying condition[†], and 67% had an underlying condition for which the ACIP^{††} recommended influenza vaccine. The most common underlying conditions among adults were asthma, chronic metabolic diseases such as diabetes, and chronic lung diseases (Table 1 and Figure 3). Fifty-seven percent of pediatric cases had an EIP underlying condition, while 48% had an ACIP condition. The most common were asthma and developmental delay (Table 2 and Figure 4). Tables 1 and 2 describe the number and percent of patients hospitalized with each medical condition, whereas Figures 3 and 4 show the number of hospitalizations per 100,000 Oregon residents that have that condition.

[†] Underlying conditions collected using the EIP surveillance tool include asthma/reactive airway disease, cystic fibrosis, chronic lung disease, chronic cardiovascular disease, chronic metabolic disease, renal disease, hemoglobinopathy, neuromuscular disease, immunosuppressive condition, seizure disorder, pregnancy, obesity and morbid obesity, cognitive dysfunction (adult only), cancer diagnosis in last 12 months (adult only), history of lymphoma or leukemia (adult only), history of Guillain-Barre syndrome (adult only), history of febrile seizures (pediatric only), developmental delay (pediatric only), premature birth (pediatric only), long-term aspirin therapy (pediatric only), abnormality of the upper airway (pediatric only).

^{††} The Advisory Committee on Immunization Practices lists medical conditions for which influenza H1N1 vaccination is indicated. These conditions include chronic pulmonary, asthma, cardiovascular, renal, hepatic, cognitive, neurologic or neuromuscular, hematologic, and metabolic disorders and immunosuppression.

Table 1: Underlying conditions* among adults hospitalized with influenza (n=362), September 1, 2009 – January 29, 2010.

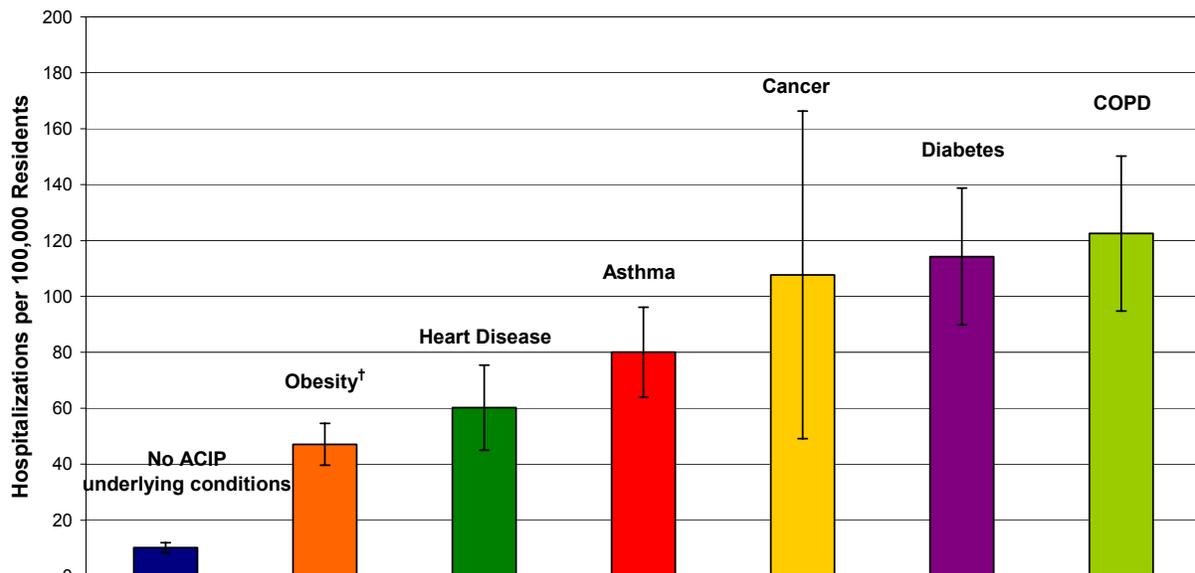
	N (%)
Any underlying condition	290 (80)
ACIP underlying condition	244 (67)
Asthma	95 (26)
Chronic metabolic disease	90 (25)
Chronic lung disease	82 (23)
Cardiovascular Disease	60 (17)
Immunosuppressive condition	50 (14)
Renal disease	32 (9)
Cognitive dysfunction	19 (5)
Neuromuscular disorder	16 (4)
Hemoglobinopathy	3 (1)
Other Conditions of Interest	
Obesity**	90 (25)
Morbid Obesity**	62 (17)
Seizure disorder	18 (5)
No underlying conditions	72 (20)

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

**Obesity and morbid obesity calculated using height and weight.

Obesity defined as BMI>30 and morbid obesity defined as BMI>40.

Figure 3: EIP Surveillance Area Adult Influenza Hospitalization Rates and Confidence Intervals by Underlying Condition per 100,000 Oregon Residents September 1, 2009-January 29, 2010



Diseases are not mutually exclusive

Denominator: BRFSS 2007 (Obesity, Heart Disease, Diabetes); NHIS 2003 (COPD, Cancer)

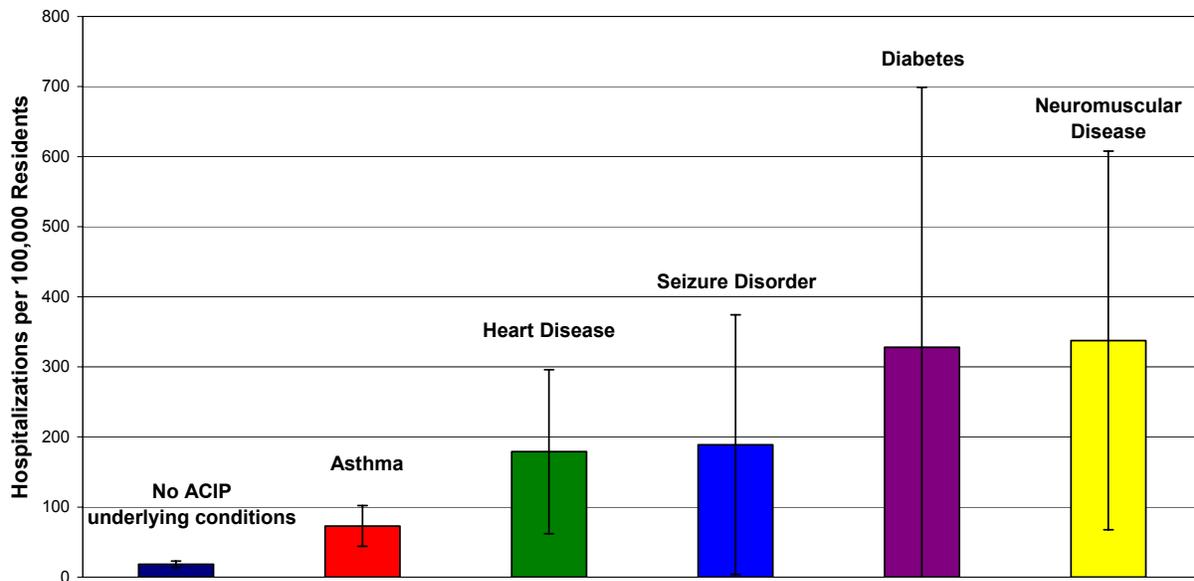
† Based on 71% of adult patients with height and weight information available; Obesity is not an ACIP underlying condition

Table 2: Underlying conditions among pediatrics hospitalized with influenza (n=122), September 1, 2009 – January 29, 2010.

	N (%)
Any underlying condition	70 (57)
ACIP underlying condition	59 (48)
Asthma	24 (20)
Developmental Delay	14 (11)
Immunosuppressive condition	10 (8)
Cardiovascular Disease	9 (7)
Neuromuscular disorder	6 (5)
Renal disease	4 (3)
Chronic metabolic disease	3 (2)
Other pulmonary disease	3 (2)
Hemoglobinopathy	2 (2)
Other Conditions of Interest	
Obesity**	12 (10)
Seizure disorder	4 (3)
None	52 (43)

* Cases may have more than one underlying condition; categories are not mutually exclusive.
 **Obesity is calculated using height and weight. Obesity is defined as having a BMI percentile >95%.

Figure 4: EIP Surveillance Area Influenza Pediatric Hospitalization Rates and Confidence Intervals by Underlying Condition per 100,000 Oregon Residents September 1, 2009-January 29, 2010

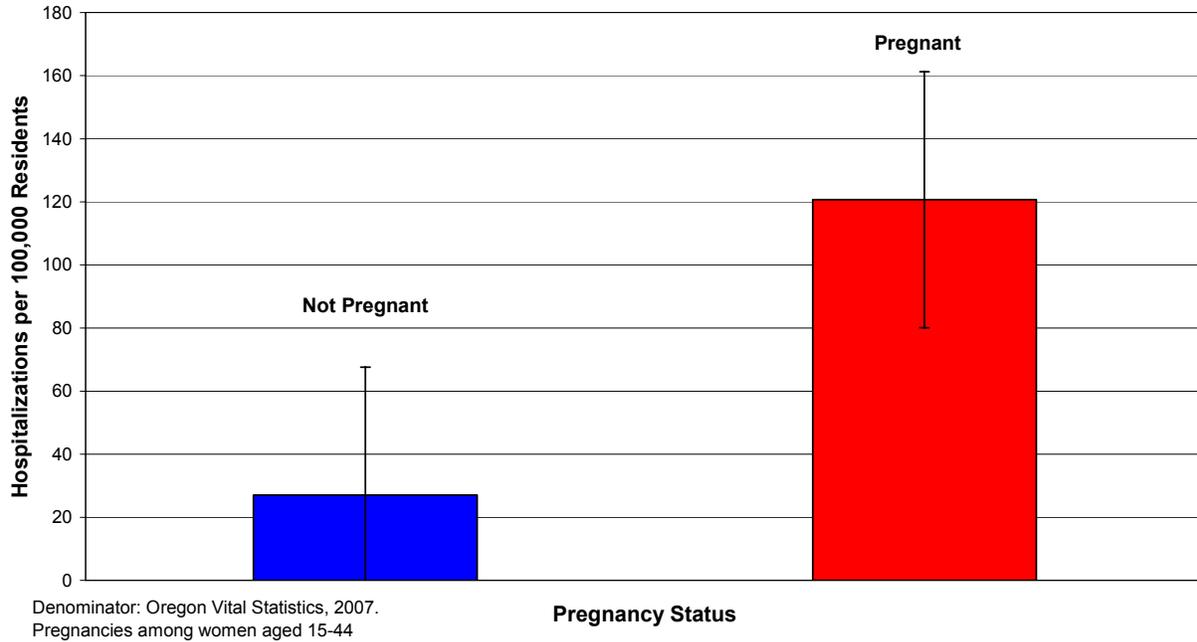


Diseases are not mutually exclusive
 Denominator: NHIS, 2003 & OR DHS, 2009

Pregnancy

Since September 1, 2009, 34 pregnant women ages 15–44 years of age (117/100,000, or about one of every thousand) have been hospitalized with lab-confirmed influenza in the tri-county area — 4.4 times the incidence among non-pregnant women of the same age (Figure 5). In the previous 4 seasons combined, 4 pregnant women were hospitalized with influenza.

Figure 5: EIP Surveillance Area Influenza Hospitalization Rates and Confidence Intervals by Pregnancy Status per 100,000 Oregon Residents September 1, 2009-January 29, 2010



Only six (18%) of the pregnant women had underlying chronic medical conditions; 5 had asthma and 1, additionally, had diabetes. Four (14%) of the pregnant women were admitted to the ICU during their hospitalizations; none of these had chronic medical conditions. No deaths from influenza have been recorded among pregnant women in the Tri-County area since surveillance among adults began in 2005.

Severity of Illness and Outcomes

Clinical Complications

Of pediatric cases, 29% were diagnosed with pneumonia, 6% had seizures, 1% had bronchiolitis, 1% had encephalitis, and 2% had acute respiratory distress syndrome (ARDS).

Among adults, 2% had encephalitis, 8% had ARDS and 49% were diagnosed with pneumonia. The percent diagnosed with pneumonia is significantly higher than what was reported for previous influenza seasons (p=0.0004).

Table 3: Clinical complications recognized before discharge, by season (2005-2009* and September 1, 2009 – January 29, 2010) among hospitalized influenza cases.

	Pediatric		Adult	
	2005–2009* (n=157)	Fall 2009 H1N1 Pandemic (n=122)	2005–2009* (n=330)	Fall 2009 H1N1 Pandemic (n=362)
Diagnosis	N (%)	N (%)	N (%)	N (%)
Pneumonia	35 (22)	36 (30)	115 (35)	174 (48)
Stroke	---	---	4 (1)	3 (1)
Guillain-Barré Syndrome	---	0	0	2 (1)
Acute encephalopathy	2 (1)	1 (1)	2 (1)	7 (2)
ARDS	---	2 (2)	---	29 (8)
Seizures	9 (6)	7 (6)	---	---
Reye Syndrome	0	0	---	---
Bronchiolitis	11 (7)	1 (1)	---	---
Hemophagocytic Syndrome	0	0	---	---

* Influenza seasons: October–April for 2005–06, 2006–07, 2007–08 and 2008–09

Bacterial Co-infections

Bacterial co-infections were less common among pediatric cases (6%) than adult cases (11%). Bacterial co-infections among adults were mostly *Streptococcus pneumoniae* or *Staphylococcus aureus* (Table 4).

Table 4: Bacterial co-infections, by season (2005–2009* and September 1, 2009 – January 29, 2010) among hospitalized influenza cases.

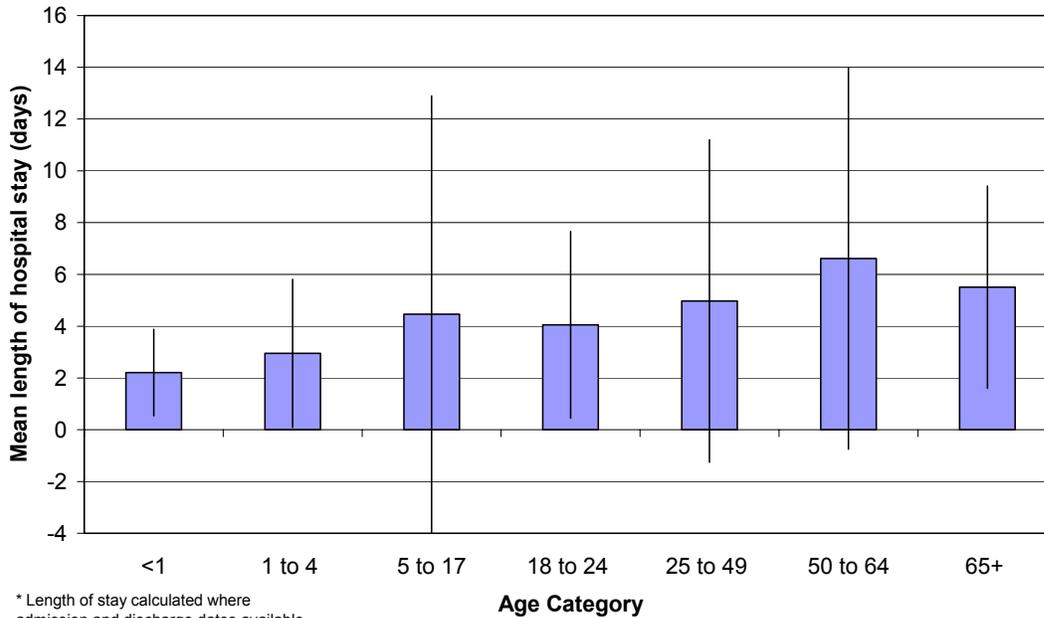
	Pediatric		Adult	
	2005–2009* (n=157)	Fall 2009 H1N1 Pandemic (n=122)	2005–2009* (n=330)	Fall 2009 H1N1 Pandemic (n=362)
n (%) of cases with bacterial co-infections	n=6 (4%)	n=7 (6%)	n=13 (4%)	n=40 (11%)
Bacteria	N (%)	N (%)	N (%)	N (%)
<i>Streptococcus pneumoniae</i>	2 (33)	3 (43)	5 (56)	15 (39)
Group A streptococcus	0	0	1 (11)	0
<i>Haemophilus influenzae</i>	0	1 (14)	1 (11)	2 (5)
<i>Neisseria meningitidis</i>	1 (17)	0	0	0
<i>Staphylococcus aureus</i>	1 (17)	0	2 (22)	17 (44)
methicillin-resistant	0	0	0	8 (47)
methicillin-sensitive	0	0	0	9 (53)

* Influenza seasons: October–April for 2005–06, 2006–07, 2007–08 and 2008–09

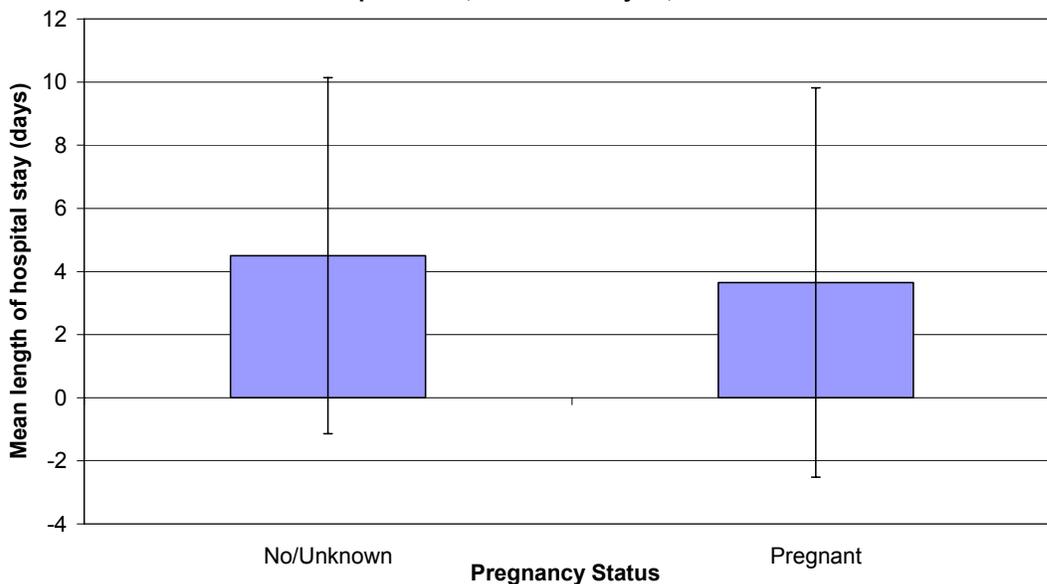
Length of Stay

Length of hospital stay tended to increase with age (Figure 5). We also looked at length of stay by pregnancy status to determine if rates of hospitalization were higher in pregnant women because they were severely ill or whether they were more likely admitted for observation out of caution. Among women 15–44 years of age, the average length of stay did not differ significantly by pregnancy status (Figure 6), suggesting a similar level of severity between pregnant and non-pregnant women.

**Figure 6: EIP Surveillance Area
Length of hospital stay by age category
September 1, 2009 - January 29, 2010**



**Figure 7: EIP Surveillance Area
Length of Stay* by Pregnancy Status**
September 1, 2009 - January 29, 2010**



Pregnancy Outcomes

Birth outcomes for pregnant women aged 15-44 years are shown in Table 5. All women gave birth prior to discharge had healthy newborns.

Table 5: Pregnancy outcomes among women 15–44 years of age. September 1, 2009–January 29, 2010.

	Fall 2009 H1N1 Pandemic
	n=34
Pregnancy Outcome	N (%)
Still Pregnant*	24 (71)
No longer pregnant	7 (21)
Healthy newborn	7 (100)
Miscarriage	0
Ill newborn	0
Newborn died	0
Unknown	0
Unknown pregnancy status	3 (9)

* Pregnancy status at time of discharge

ICU admissions

Since September 1, 2009, 111 individuals were admitted to intensive care units (ICUs). Sixty-one percent of children and 70% of adults admitted to ICU had at least one underlying condition. The most commonly reported underlying condition in children was asthma. The most common underlying conditions in adults included diabetes, COPD and asthma (Appendix Tables A5 and A6).

Deaths

Between September 1, 2009, and January 29, 2010, there were 13 deaths among hospitalized patients in the EIP catchment area (Table 6). Two of the deaths occurred in children (one aged 0-4; one aged 5–17), and eleven of the deaths occurred in adults (3 aged 25–49; 7 aged 50–64; 1 aged ≥65). Eighty-five percent of deceased cases had an underlying medical condition, most commonly asthma (28.6%) (Appendix Table A6). The case fatality rates among pediatric and adult patients hospitalized with lab-confirmed influenza in the Portland area were 2% and 3%, respectively, which is comparable to previous seasons.

Table 6: Outcomes for pediatric and adult hospitalized influenza cases by Season (2005–2009* and September 1, 2009 – January 29, 2010) among hospitalized influenza cases.

	Pediatric		Adult	
	2005–2009*	Fall 2009 H1N1 Pandemic	2005–2009*	Fall 2009 H1N1 Pandemic
	n=157	n=122	n=330	n=362
Outcome	N (%)	N (%)	N (%)	N (%)
Length of stay, days (mean)*	3.5	3.4	4.9	5.4
ICU	27 (17)	18 (15)	66 (20)	94 (26)
Mechanically ventilated	12 (8)	8 (7)	34 (10)	56 (15)
ECMO	0	1 (1)	0	3 (1)
Died	1 (1)	2 (2)	14 (4)	11 (3)

* Due to missing LOS information for pediatrics and adults for the 09-10 season, n=120 and n=358 respectively.

Appendix

**Table A1: Race and Ethnicity of pediatric hospitalized influenza cases
September 1, 2009 – January 29, 2010.**

Race/Ethnicity	All N (%)	Missing/Unknown Excluded N (%)	Missing/Unknown Recorded N (%)*
Race	N=122	N=88	
White	69 (57)	69 (78)	
Black	9 (7)	9 (10)	
Asian	7 (6)	7 (8)	
AI/AN	1 (1)	1 (1)	
Hawaiian/PI	0	0	
Multiracial	3 (3)	3 (3)	
Unknown	33 (27)	---	
Ethnicity	N=122	N=94	N=99
Hispanic	37 (30)	37 (39)	37 (37)
Non-Hispanic	57 (47)	57 (61)	62 (64)
Unknown	28 (23)	---	---

* Unknown ethnicity where race is known has been coded as non-Hispanic.

**Table A2: Race and Ethnicity of adult hospitalized influenza cases
September 1, 2009 – January 29, 2010.**

Race/Ethnicity	All N (%)	Missing/Unknown Excluded N (%)	Missing/Unknown Recorded N (%)*
Race	N=362	N=188	
White	151 (42)	151 (80)	
Black	17 (5)	17 (9)	
Asian	11 (3)	11 (6)	
AI/AN	3 (1)	3 (2)	
Hawaiian/PI	5 (1)	5 (3)	
Multiracial	1 (0)	1 (1)	
Unknown	174 (48)	---	
Ethnicity	N=362	N=161	N=167
Hispanic	41 (11)	41 (25)	41 (20)
Non-Hispanic	120 (33)	120 (75)	167 (80)
Unknown	201 (56)	---	---

* Unknown ethnicity where race is known has been coded as non-Hispanic.

**Table A3: Influenza Hospitalizations by Age and Season
2005-2009* and September 1, 2009 – January 29, 2010.**

	2005-2009*	Fall 2009 H1N1 Pandemic
Age group	N (%)	N (%)
Pediatric (<18 years)	157	122
0–4 years	105 (67)	68 (56)
≤ 1 year	74 (70)	45 (66)
2 years	13 (12)	7 (10)
3 years	10 (10)	9 (13)
4 years	8 (8)	7 (10)
5–17 years	52 (33)	54 (44)
Adult (≥18 years)	330	362
18–24 years	16 (5)	42 (12)
25–49 years	66 (20)	166 (46)
50–64 years	84 (25)	115 (32)
≥65 years	164 (50)	39 (11)

*Influenza seasons: October-April for 2005-06, 2006-07, 2007-08 and 2008-09

**Table A4: Demographic Characteristics of Pediatric ICU Admissions for
H1N1 Pandemic, September 1, 2009 – January 29, 2010.**

	Fall 2009 H1N1 Pandemic n=18
Characteristic	N (%)
Sex	
Male	15 (83)
Female	3 (17)
Age	
0–4 years	9 (50)
5–17 years	9 (50)
Underlying Medical Conditions*	
ACIP Condition	11 (61)
Asthma	5 (28)
Pulmonary Disease excluding Asthma	0
Diabetes	0
Metabolic Disease excluding Diabetes	1 (6)
Renal Disease	2 (11)
Neuromuscular Conditions	1 (6)
Cardiovascular Disease	1 (6)
Immunosuppressive Condition	0
Seizure Disorder	1 (6)
Developmental Delay	3 (17)
Obesity**	2 (11)
Treatment*	
Received antivirals	18 (100)
Mechanical Ventilation	6 (33)
ECMO	1 (6)
Outcome*	
Pneumonia	10 (56)
ARDS	1 (6)
Died	1 (6)

* Not mutually exclusive

**Obesity is calculated using height and weight. Obesity is defined as having a BMI percentile >95%.

Table A5: Demographic Characteristics of Adult ICU Admissions for H1N1 Pandemic, September 1, 2009 – January 29, 2010.

	Fall 2009 H1N1 Pandemic n=94
Characteristic	N (%)
Sex	
Male	43 (46)
Female	51 (54)
Age	
18–24 years	6 (6)
25–49 years	43 (46)
50–64 years	36 (38)
≥65 years	9 (10)
Underlying Medical Conditions*	
ACIP Condition	66 (70)
Asthma	25 (27)
COPD	22 (23)
Diabetes	27 (29)
Renal Disease	10 (11)
Cancer	5 (5)
Neuromuscular Conditions	3 (3)
Cardiovascular Disease	14 (15)
Immunosuppressive Condition	16 (17)
Seizure Disorder	5 (5)
Cognitive Dysfunction	8 (9)
Obesity**	30 (32)
Morbid Obesity**	18 (19)
Treatment*	
Received antivirals	86 (91)
Mechanical Ventilation	52 (56)
ECMO	2 (2)
Outcome*	
Pneumonia	62 (66)
ARDS	29 (31)
Died	9 (10)

* Not mutually exclusive

** Obesity and morbid obesity calculated using height and weight. Obesity defined as BMI>30 and morbid obesity defined as BMI>40.

Table A6: Demographic Characteristics for Influenza Deaths (EIP surveillance area only), September 1, 2009 – January 29, 2010.

	Fall 2009 H1N1 Pandemic n=13
Characteristic	N (%)
Sex	
Male	9 (69)
Female	4 (31)
Age*	
0–4 years	1 (8)
5–17 years	1 (8)
18–24 years	0
25–49 years	3 (23)
50–64 years	7 (54)
≥65 years	1 (8)
Underlying Medical Conditions*	
Any underlying condition	11 (85)
Asthma	4 (31)
COPD	2 (15)
Diabetes	2 (15)
Metabolic Disease excluding Diabetes	1 (8)
Renal Disease	3 (23)
Neuromuscular Conditions	2 (15)
Cardiovascular Disease	2 (15)
Immunosuppressive Condition	0
Seizure Disorder	1 (8)
Developmental Delay	2 (15)
Cognitive Dysfunction	3 (23)
Obesity**	2 (15)
Morbid Obesity**	2 (15)
Treatment	
Received antivirals	12 (92)
Mechanical Ventilation	10 (77)
ECMO	2 (15)
Outcome*	
Pneumonia	8 (62)
ARDS	5 (38)

* Not mutually exclusive.

**Obesity is calculated using height and weight. Obesity for adults is defined as BMI>30 and morbid obesity defined as BMI>40. Obesity for children is defined as having a BMI percentile >95%. No pediatric deaths occurred in obese children.