Kansas Influenza Surveillance, 2015-2016

Introduction

Influenza is not a nationally notifiable disease, nor is it a notifiable disease in Kansas. Because patient-level data is not reported to state health departments or to the Centers for Disease Control and Prevention (CDC), the burden of disease must be tracked through non-traditional methods. Influenza surveillance in Kansas consists of four components that provide data on outpatient influenza-like illness, influenza viruses, and influenza-associated deaths.

Morbidity Surveillance from the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet)

The U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet) is a collaboration between the CDC and state, local, and territorial health departments. The purpose of the surveillance is to track influenza-like illness (ILI), recognize trends in influenza transmission, determine the types of influenza circulating, and detect changes in influenza viruses. Influenza-like illness is defined by the CDC as fever (≥100°F or ≥37.8°C, measured either at the ILINet site or at the patient's home) with cough and/or sore throat, in the absence of a known cause other than influenza.

The Bureau of Epidemiology and Public Health Informatics (BEPHI) at the Kansas Department of Health and Environment (KDHE) recruited health care providers throughout Kansas to participate in ILINet. Each week, ILINet site personnel determined the total number of patients seen with ILI during the previous week by age group — preschool (0-4 years), school age through college (5-24 years), adults (25-49 years and 50-64 years), and older adults (>64 years). In addition, the total number of patients seen during the previous week for any illness was recorded. This data was submitted to the CDC via the internet or fax; sites are asked to report the previous week's data by 11:00 AM each Tuesday.

When the surveillance period began during the week ending October 4, 2015, 36 health care providers were enrolled in ILINet. These sites consisted of 20 family practice

clinics, 10 hospital emergency departments, four university student health centers, and two pediatric clinics (Figure 1).

Figure 1. Sites enrolled in the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet), Kansas, October 4, 2015 – May 21, 2016 (n=36)
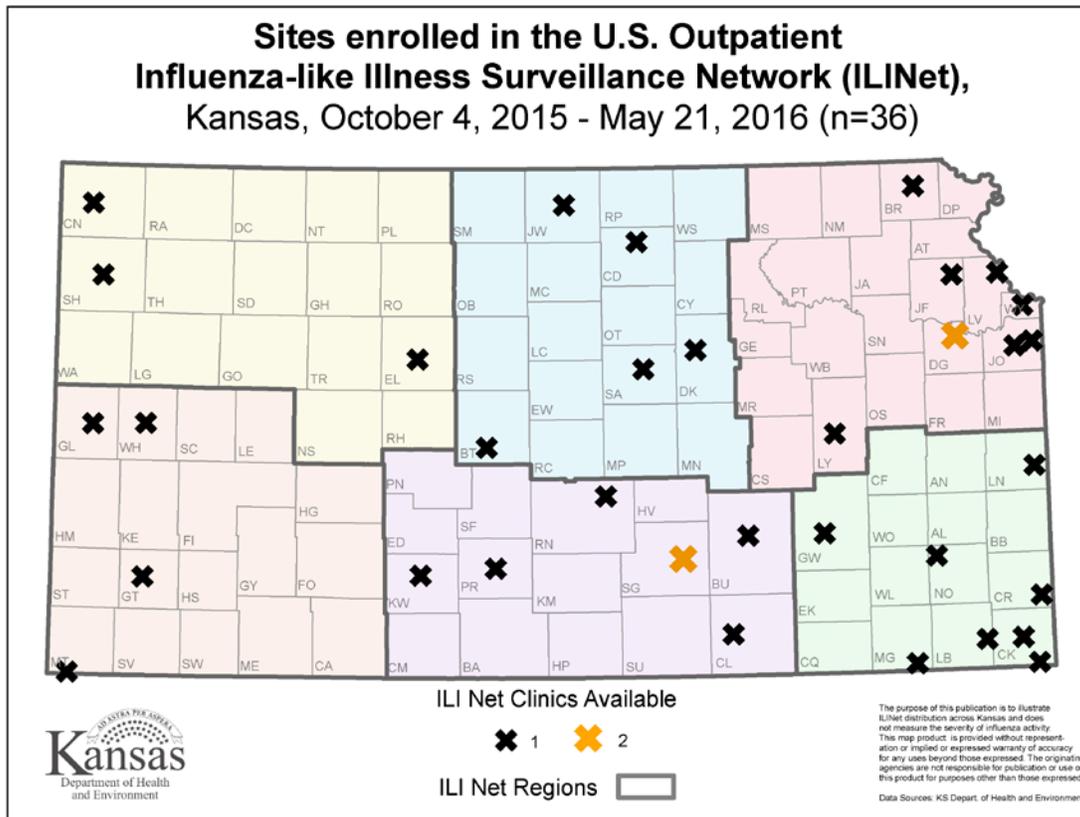
During the influenza surveillance period, starting October 4, 2015 (week 40) and ending May 21, 2016 (week 20), sites observed a total of 218,686 patients—7,306 (3.3%) sought care for ILI. The rate of ILI rose steadily from February 2016 through March 2016. The ILI rate peaked at 3.3% during the week ending March 12, 2016. The rate of ILI dropped below 2% during the week ending April 23, 2016 and remained low through the end of the surveillance period (Figure 2).

Figure 2. Percentage of visits for influenza-like illness (ILI) reported by ILINet sites, Kansas, October 2015 – May 2016 and previous two surveillance periods*
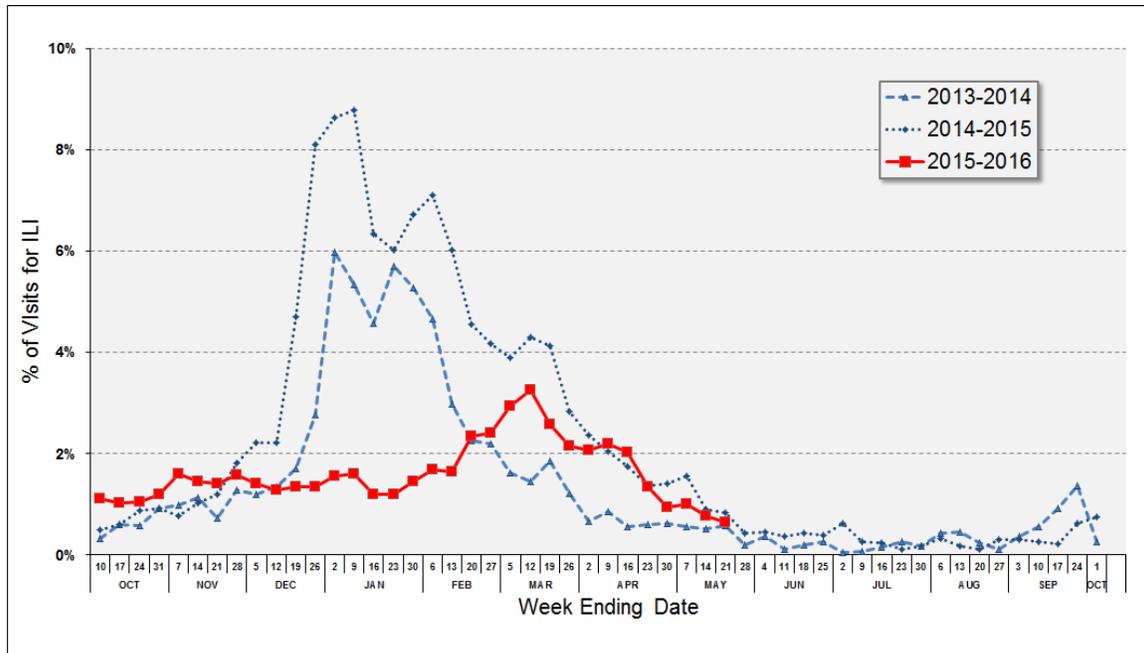
ILINet sites may vary in number and type (student health, family practice, etc.) each season. Data from the previous two surveillance years are plotted according to week number corresponding to the 2015-2016 week ending date; for example, week 40 ended October 10, 2015, week 40 of 2014 ended October 4, 2014, and week 40 of 2013 ended October 5, 2013.

Laboratory Surveillance

During the 2015-2016 surveillance period, the Kansas Health and Environmental Laboratories (KHEL) provided confirmatory testing for ILINet site patients with ILI. In an effort to reach CDC's Right Size Influenza Virologic Surveillance goals, KHEL partnered with a Kansas hospital; the hospital submitted influenza-positive specimens to KHEL, where confirmatory testing was conducted. Real-Time Polymerase Chain Reaction (RT-PCR) tests were used to analyze nasal and nasopharyngeal swabs for the presence of influenza virus. Laboratory data was sent weekly to CDC by KHEL. In addition, KHEL forwarded a subset of its specimens to CDC for subtyping, antigenic characterization, and antiviral resistance testing.

From October 4, 2015, when the first respiratory specimen for influenza testing was received, until May 21, 2016, when the 2015-2016 surveillance period ended, KHEL tested 118 unscreened specimens for influenza. Influenza was detected in 56 (47%) of the specimens. Both influenza type A and B viruses were detected. Two influenza A subtypes, A/H3 and A/H1, and two influenza B lineages, Yamagata and Victoria, were seen. The influenza A/H1 subtype was most frequently detected, representing of 55% of all previously unscreened, positive specimens (Table 1, Figure 3).

Table 1: Laboratory-confirmed influenza viruses detected from previously unscreened specimens at Kansas Health and Environmental Laboratories by subtype, Kansas, October 4, 2015 – May 21, 2016 (n=56)

Influenza subtype	Number	Percent of Total
A/H1	31	55%
A/H3	4	7%
B (Yamagata lineage)	16	29%
B (Victoria lineage)	5	9%

From January 26, 2016 to May 16, 2016, KHEL received 90 prescreened influenza-positive specimens from a sentinel hospital in Kansas. These specimens were tested in effort to reach CDC's Right Size Influenza Virologic Surveillance goals, which include monitoring circulating viruses and novel subtypes that might be a sign of a pandemic. The majority of these specimens were A/H1 (87%), and 3 were determined to be negative by the CDC PCR assay (Table 2).

Table 2: Laboratory-confirmed influenza viruses detected from prescreened influenza-positive specimens at Kansas Health and Environmental Laboratories by subtype, Kansas, January 26, 2016 – May 16, 2016 (n=87)

Influenza subtype	Number	Percent of Total
A/H1	73	84%
A/H3	10	11%
B (Yamagata lineage)	1	1%
A (not subtyped)	3	3%

Figure 3: Influenza specimens tested at Kansas Health and Environmental Laboratories by week ending date, October 4, 2015 – May 21, 2016 (n=208)

Influenza Specimens Tested at KHEL by Week
Kansas, 2015-2016
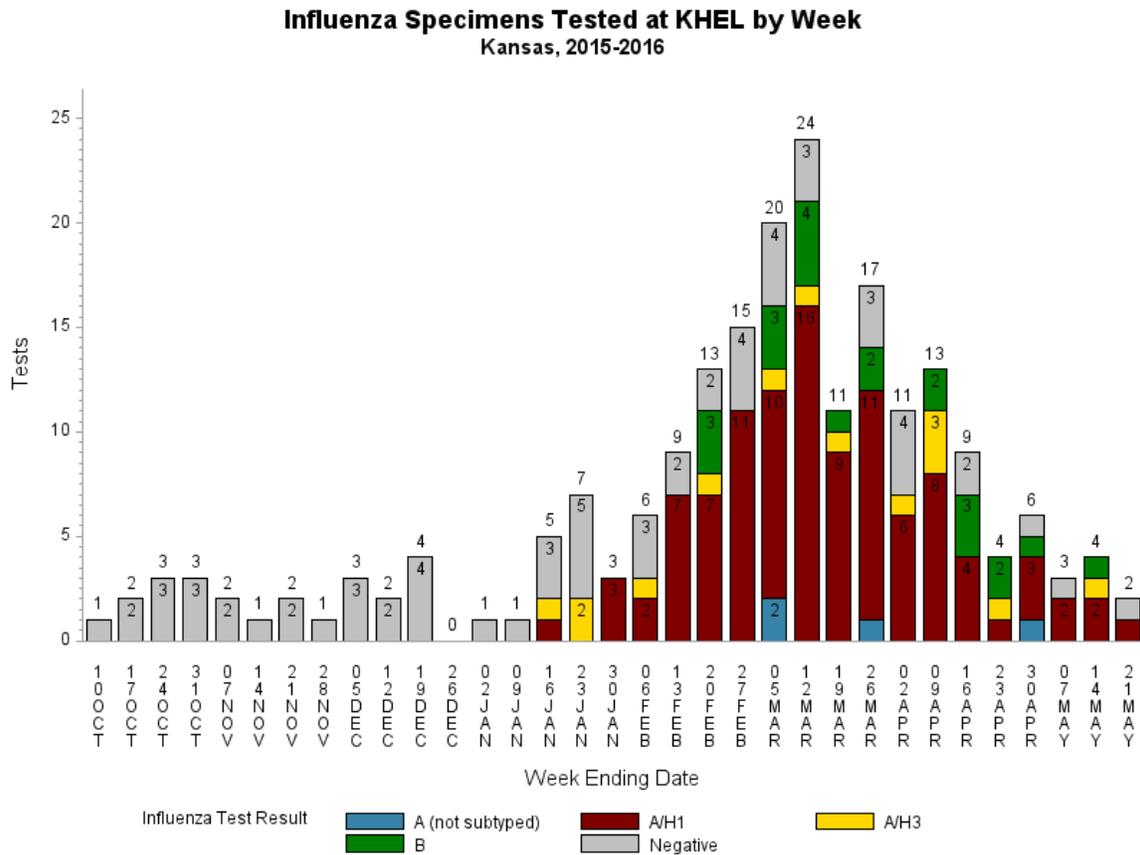
KHEL sent 41 positive influenza specimens to designated influenza reference centers for antigenic characterization. Antigenic characterization testing performed on influenza isolates submitted by all states to the CDC showed that 100% of the A/H1 isolates, 100% of the A/H3, 100% of B (Yamagata) and 98% of B (Victoria) matched their corresponding components in the 2015-2016 seasonal influenza vaccine.

Respiratory Viral Panel Testing

A subset of specimens which test negative for influenza by RT-PCR at the Kansas Health and Environmental Laboratories (KHEL) were tested using the BioFire multiplex PCR instrument. The BioFire FilmArray Respiratory Panel probed for the following 17 viral targets and 3 bacterial targets per specimen listed below. The goal of BioFire testing was to better understand which respiratory viruses were circulating in Kansas during influenza season.

Viral Targets
- Adenovirus
- Coronavirus HKU1
- Coronavirus NL63
- Coronavirus 229E
- Coronavirus OC43
- Human Metapneumovirus
- Influenza A
- Influenza A/H1

- Influenza A/H1-2009
- Influenza A/H3
- Influenza B
- Parainfluenza 1
- Parainfluenza 2
- Parainfluenza 3
- Parainfluenza 4
- Respiratory Syncytial Virus

Bacterial Targets
- *Bordetella pertussis*
- *Chlamydophila pneumoniae*
- *Mycoplasma pneumoniae*

For the 2015-16 season, Via Christi Laboratories in Sedgwick County shared its RVP data with KDHE. RVP results were sent to KDHE monthly and represented the majority of respiratory virus surveillance in the south central region of Kansas. The resources available at KHEL focused on the remaining five regions of the state.

A total of 28 specimens were tested on the KHEL BioFire assay, 19 of which were negative for all viral targets. Adenovirus was the most common virus found (n=3). The other viruses identified included parainfluenza 1 (n=2), rhinovirus/enterovirus (n=1), coronavirus NL63 (n=1), human metapneumovirus (n=1), and respiratory syncytial virus (n=1). The KHEL RVP specimens showed no time-specific disease trends over this surveillance period.

Via Christi saw many respiratory virus trends during the flu season (Figure 5). The most common virus found was rhinovirus/enterovirus, which increased with influenza activity. They also reported high numbers of respiratory syncytial virus and human metapneumovirus during peak flu season. Other viruses detected were adenovirus, coronavirus, and parainfluenza.

Figure 5: Positive Respiratory Viral Panel Results, Via Christi Laboratories, October 2015 – May 2016
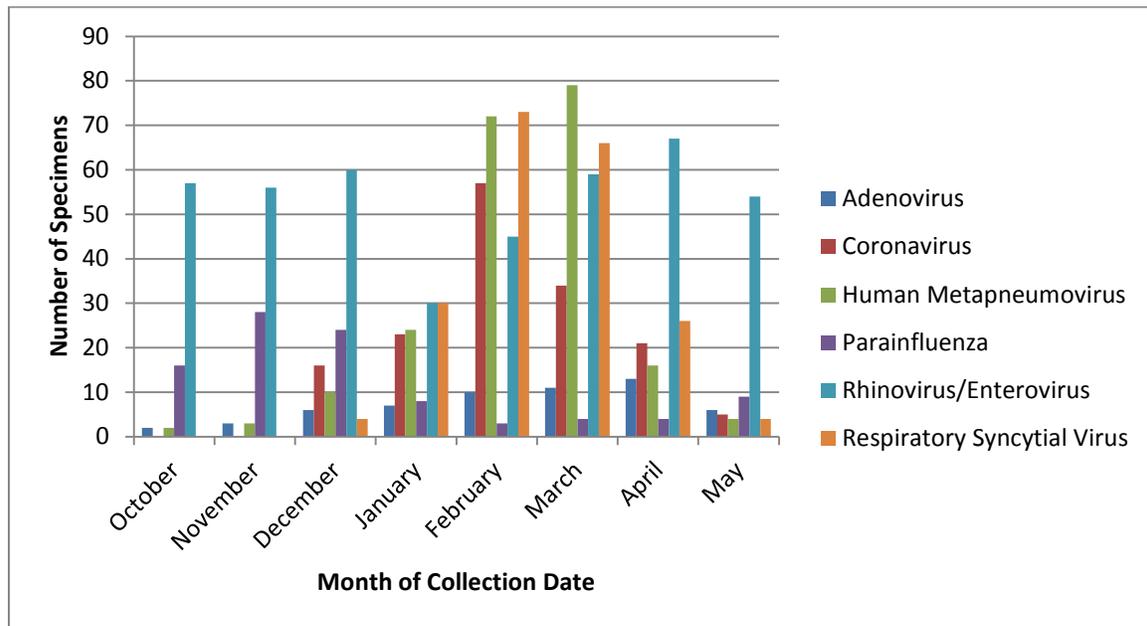

Syndromic Surveillance

KDHE's Vital and Health Statistics Data Analysis section participates in the National Syndromic Surveillance Program and receives data from emergency departments (EDs) across Kansas. These de-identified records can be queried to detect disease trends and outbreaks. ED records were queried by diagnosis codes related to influenza-like illness. ICD 10 codes included and excluded in the search are detailed in the table below (Table 3).

Table 3: ILI ICD 10 Diagnosis Codes Included and Excluded in Search Criteria, Kansas, 2015-2016

Included ICD 10 Codes		Excluded ICD 10 Codes	
J09	Influenza due to certain identified influenza viruses	J82	Allergic or eosinophilic pneumonia
J10	Influenza due to other identified influenza virus	J69.0	Aspiration pneumonia NOS
J11	Influenza due to unidentified influenza virus	P24.01	Meconium pneumonia
J12	Viral pneumonia, not elsewhere classified	P24.-	Neonatal aspiration pneumonia
J13	Pneumonia due to Streptococcus pneumoniae	J69.-	Pneumonia due to solids and liquids
J14	Pneumonia due to Hemophilus influenzae	P23.9	Congenital pneumonia
J15	Bacterial pneumonia, not elsewhere classified	I00	Rheumatic pneumonia
J16	Pneumonia due to other infectious organisms, not elsewhere classified	J95.851	Ventilator associated pneumonia
J17	Pneumonia in diseases classified elsewhere		
J18	Pneumonia, unspecified organism		

The percentage of ED visits with ILI diagnosis codes increased from September through December, fell slightly in January, then increased to its peak (3.3%) in March. While the percent of visits due to ILI at ILINet providers dropped to background levels in April, the syndromic surveillance data continued to show an elevated percentage through June (Figure 6). This elevated percentage may represent a change in the background level of the syndromic surveillance during this period; 29 new EDs were onboarded into the program throughout this time period. Because of the changing denominator over time, ILI diagnosis codes were calculated as a percentage of total visits received by KDHE's Syndromic Surveillance Program during each month

Figure 6: Percent of ED Visits Reported to KDHE's Syndromic Surveillance Program with ILI Diagnosis Codes by Month, Kansas, 2015-2016
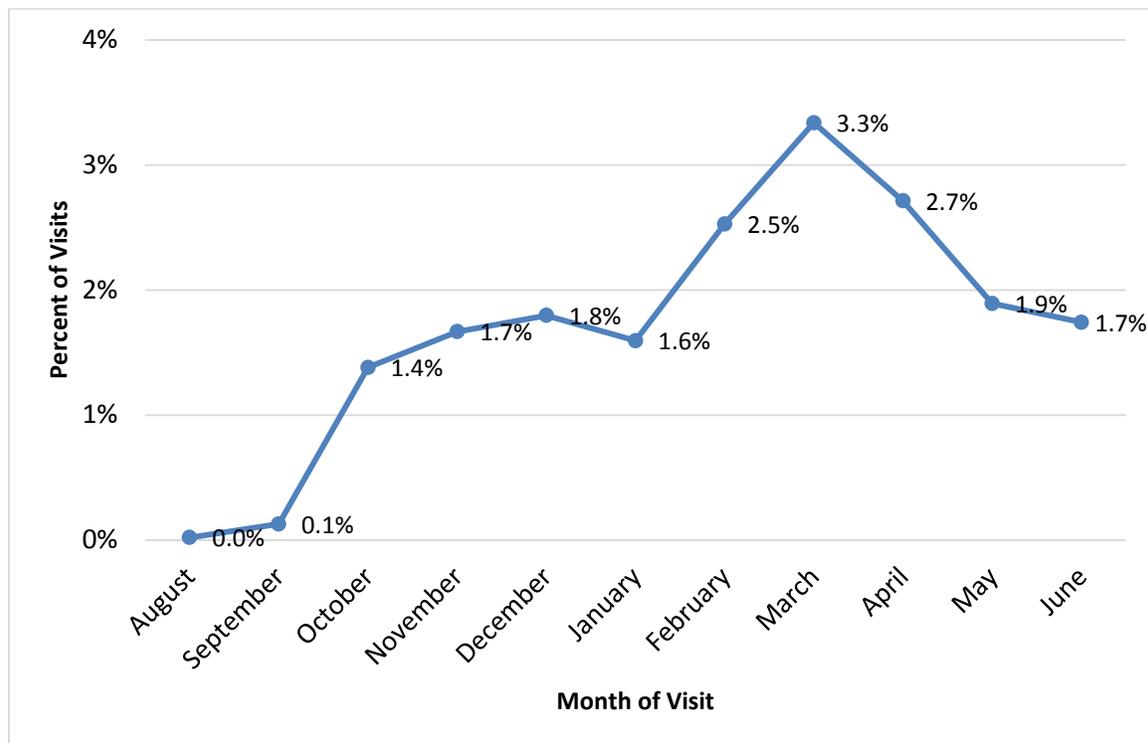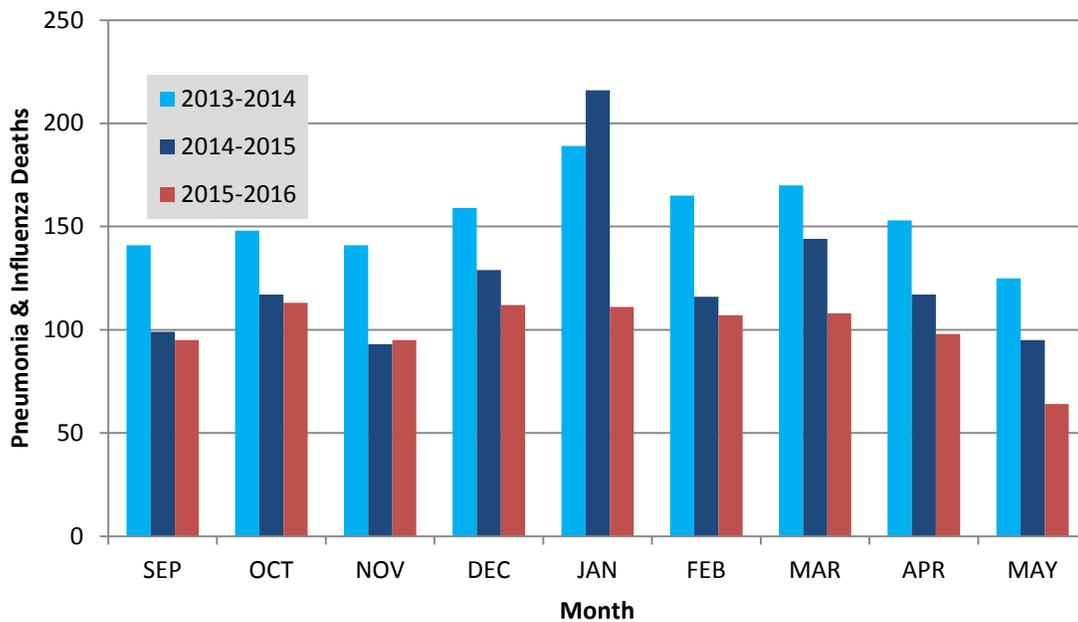

Pneumonia and Influenza (P&I) Mortality

BEPHI monitored influenza-related mortality. Death certificate data was collected to determine the number of deaths caused by pneumonia or influenza (P&I). Mortality was divided among three categories: pneumonia or influenza recorded as a contributing factor of death, influenza recorded as the direct cause of death, and pneumonia recorded as the direct cause of death.

Traditionally, P&I mortality data includes deaths that occurred from September through May. During the 2015-2016 period, the largest number of P&I deaths (n=113) were recorded in the month of October (Figure 7).

Figure 7: Deaths attributed to pneumonia or influenza by month, Kansas, September 2013-May 2016*

** 2015-2016 data is provisional and subject to change.*

A total of 903 pneumonia and influenza deaths occurred during the 2015-2016 surveillance period. The observed mortality was below the 20-year median of 1,782 (Figure 8). During the 2015-2016 surveillance period, 12 deaths (1%) were directly attributed to influenza—this number was below the 20-year median (18 deaths) observed since the 1996-1997 surveillance period, and below the 20-year mean (27 deaths). The majority of these deaths occurred in individuals aged 45-64 years old with 5 deaths (42%) (Figure 9).

Figure 8: Pneumonia and influenza mortality by surveillance period, Kansas, 1996-2016 *
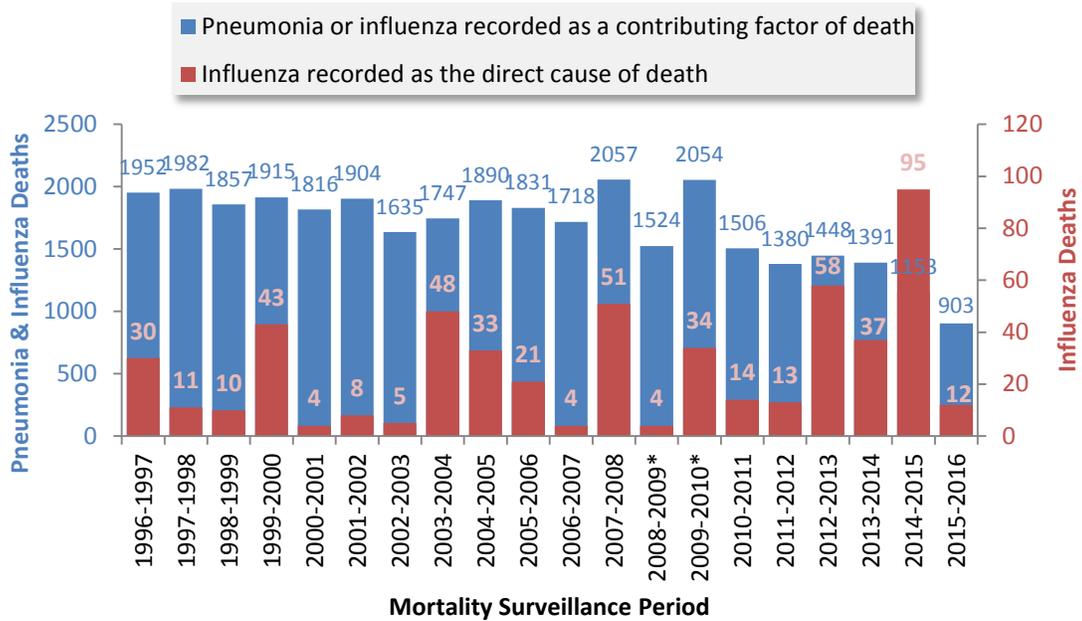
Each influenza season begins September 1 and ends May 31 of the following year, with the exception of 2008-2009 (September 1, 2008 through April 30, 2009) and 2009-2010 (May 1, 2009 through May 31, 2010). This time shift is due to the emergence of pandemic H1N1 in May 2009. The 2015-2016 data is provisional and subject to change.

Figure 9: Influenza recorded as direct cause of death by age group, Kansas, September 2015 – May 2016
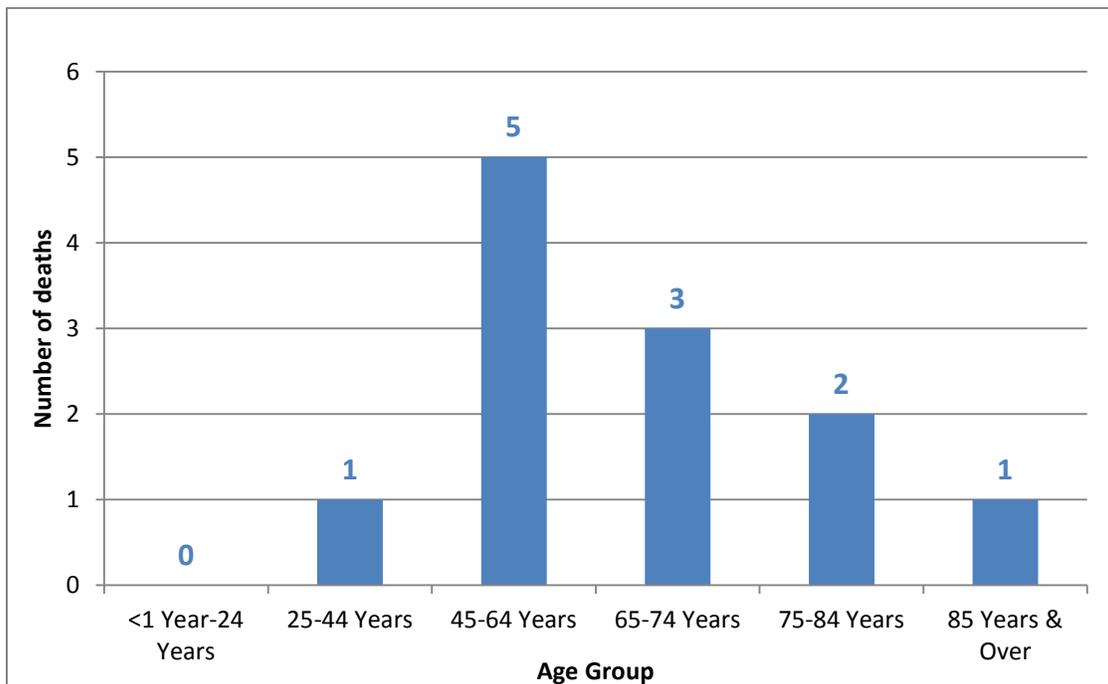
Influenza-Associated Pediatric Mortality

Since 2004, CDC has requested information on influenza-associated pediatric deaths; the condition was added to the list of reportable diseases in Kansas in 2006. For surveillance purposes, pediatric deaths were considered influenza-related if there was no period of complete recovery between the clinically compatible illness and death, and if the diagnosis was confirmed to be influenza by an appropriate laboratory or rapid diagnostic test.

During the 2015-2016 surveillance period, no confirmed influenza-associated pediatric deaths were reported in Kansas.

Influenza Outbreaks

Four outbreaks were identified and investigated during the 2015-2016 surveillance period. One occurred in February and the other three occurred during April. The average number of cases was 39 (range 10-58); the average number of hospitalizations was 2 (range 0-6). There was one death associated with these outbreaks. All occurred in long-term care facilities.

Summary

Typically, ILI in Kansas has peaked in December, January, or February. The ILI rate peaked in Kansas at 3.3% during the week ending March 12, 2016. The peak rate was lower than what was observed during the previous two surveillance periods; ILI peaked at 8.8% during 2014-15, and 6.0% during 2013-14. Four influenza viruses were detected in Kansas: A/H1, A/H3, and two B lineages. The predominant strain in Kansas and the U.S. was A/H1. Antigenic characterization performed by CDC indicated the 2015-2016 seasonal influenza vaccine was a good match for all circulating viruses.

During the 2015-16 influenza season, 12 deaths were directly attributed to influenza. This was a sharp decline from the previous season with 95 deaths. Of the Kansas deaths, 42% were among those between the ages of 45-64 years. Four influenza outbreaks in long-term care facilities were investigated during the 2015-16 influenza season.