

State of Wyoming



Department of Health

Wyoming Influenza Summary Report 2015-2016 Season

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**State of Wyoming
Department of Health**

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2015-2016 Season**

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Public Health Division
Tracy D. Murphy, MD
State Epidemiologist and Public Health Sciences Section Chief

Additional information and copies may be obtained from:
Reginald C. McClinton
Infectious Disease Epidemiology Unit
Wyoming Department of Health
6101 Yellowstone Road, Suite 510
Cheyenne, WY 82002
307-777-8640
307-777-5573
reginald.mcclinton@wyo.gov

WYOMING INFLUENZA SUMMARY REPORT, 2015-2016 SEASON (September 27, 2015 – May 21, 2016)

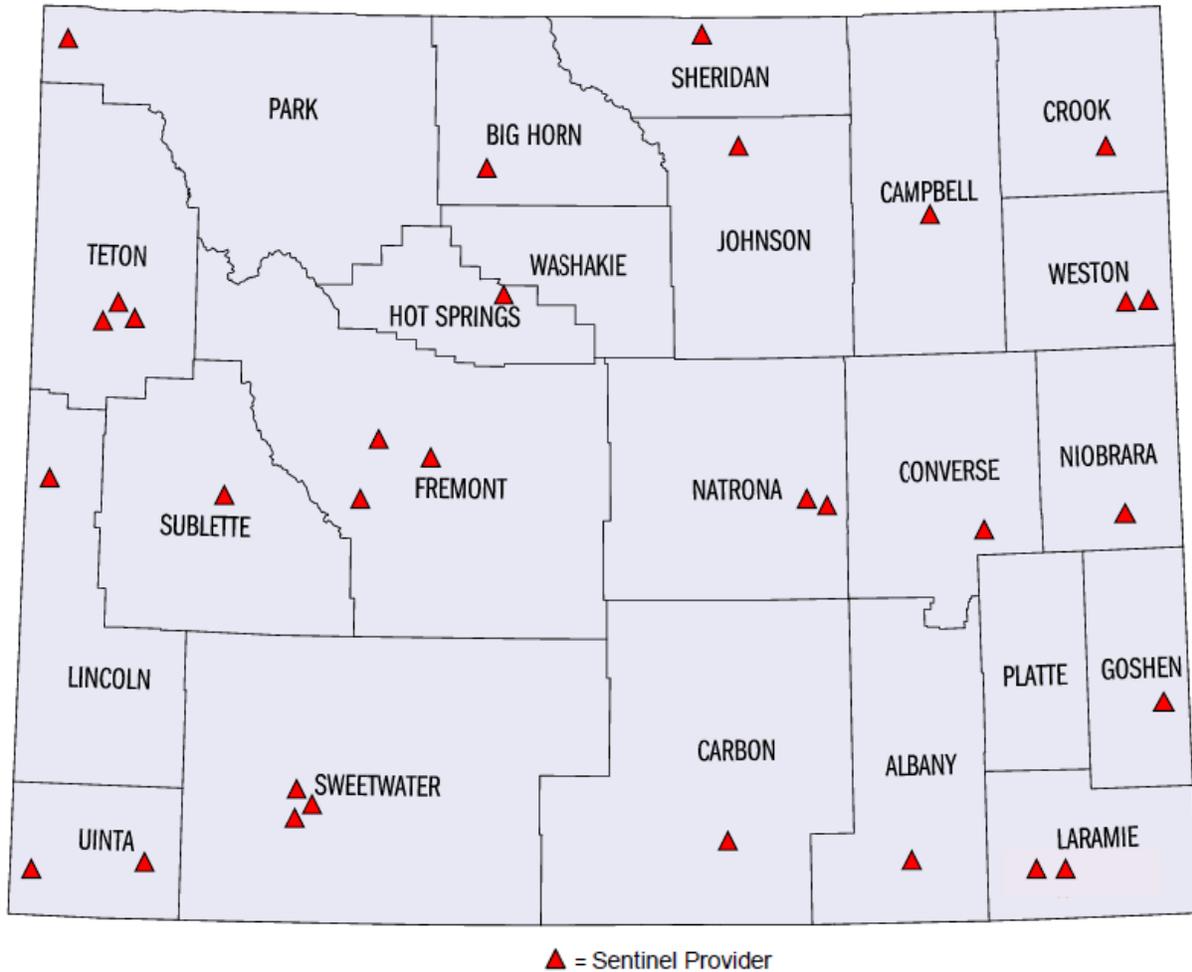
SYNOPSIS

Influenza activity was mild during the 2015-2016 influenza season, as determined by the number of influenza-associated deaths, the number of reported cases of laboratory-diagnosed influenza, and the percentage of visits to outpatient clinics or hospitals for influenza-like illness (ILI) during the influenza season. At the start of the 2015-2016 influenza season, healthcare providers across Wyoming reported low levels of influenza activity. The number of reported cases and the percentage of outpatient visits for influenza-like illness (ILI) significantly increased in February 2016. The number of reported cases in Wyoming peaked during the week ending March 26, 2016 (MMWR Week 12). Activity throughout the state remained elevated until April 2016 when influenza activity decreased gradually. For the remainder of the season, Wyoming experienced decreasing levels of influenza activity. Overall, 2009 influenza A (H1N1) viruses were the predominant influenza viruses circulating in Wyoming during the 2015-2016 influenza season. However, influenza A (H3N2) viruses and influenza B viruses co-circulated with 2009 influenza A (H1N1) viruses across Wyoming throughout most of the influenza season.

SURVEILLANCE AND THE INFLUENZA SENTINEL PROVIDER NETWORK

Influenza is a reportable disease in the State of Wyoming. Each year, the Wyoming Department of Health (WDH) receives reports of rapid influenza diagnostic test (RIDT), direct fluorescent antibody (DFA), indirect fluorescent antibody (IFA), polymerase chain reaction (PCR), and cell culture results from physicians, clinics, hospitals, and laboratories across the state and the nation. The surveillance program relies on these sectors to test and report all positive test results. In addition, Wyoming has a network of influenza sentinel providers located across the state. An influenza sentinel provider, or Influenza-like Illness Surveillance Network (ILINet) provider, conducts surveillance for ILI in collaboration with the WDH and the Centers for Disease Control and Prevention (CDC). ILINet providers submit reports each week, even when they observe no influenza or ILI activity. Additionally, the ILINet providers collect specimens from a small number of patients with ILI. The providers submit the samples to the Wyoming Public Health Laboratory (WPHL) for specialized influenza testing. This information often provides public health officials the earliest identification of circulating influenza virus types, subtypes, and strains during the influenza season. Map 1 indicates the locations of healthcare providers enrolled in the ILINet Provider - Influenza Surveillance Program during the 2015-2016 influenza season.

**MAP 1: NETWORK OF ILINET PROVIDERS BY COUNTY
WYOMING, 2015-2016 INFLUENZA SEASON**



Thirty-one healthcare organizations enrolled as ILINet providers during the 2015-2016 influenza season. A major goal of the WDH-Infectious Disease Epidemiology Unit is to recruit and maintain ILINet providers from every county in the state, including multiple municipalities and various types of practices within each county. This season, 21 of the 23 counties in Wyoming had ILINet providers enrolled in the program, including ILINet providers at the Wind River Indian Reservation and Yellowstone National Park. Data from the network of ILINet providers are critical for monitoring the impact of influenza. Additionally, public health officials can utilize the data in combination with other influenza surveillance data, to guide prevention and control activities, vaccine strain selection, and patient care. Providers of any specialty (e.g., family practice, internal medicine, or pediatrics) in any type of practice (e.g., private practice, emergency room, or university student health center) are eligible to be ILINet providers. The sentinel provider program involves two major components: weekly ILI reporting and laboratory specimen collection.

The first component, weekly ILI reporting, consists of recording and reporting summary data (total number of patient visits for any reason and the number of patient visits for ILI by age group) each week to CDC via the ILINet website. The influenza sentinel provider program, also known as the ILINet provider program, consists of approximately 3,000 healthcare providers in all 50 states and several United States Territories. The program provides public health officials with a source of outpatient illness surveillance during the influenza season. The ILI case definition used for national surveillance is {1} a fever ($\geq 100.0^{\circ}$ F or 37.8° C) and {2} a cough and/or sore throat in the absence of a known cause other than influenza. The design of the ILI case definition is to capture patients with influenza-like illnesses; therefore, providers are not capturing only influenza cases. Consequently, some patients will meet the ILI case definition without having the disease of influenza. ILINet providers submitted reports weekly through the ILINet website beginning September 27, 2015 (MMWR Week 40); the reports continue until October 1, 2016 (MMWR Week 39). Some of the ILINet providers discontinued reporting on May 21, 2016 (MMWR Week 20). Historically, the twentieth week of the year marks the end of the influenza season. However, in recent years, CDC requested that ILINet providers continue to report throughout the summer. Year-round influenza surveillance provides a baseline level of influenza activity; this process functions to establish the annual epidemic thresholds of influenza.

The second component, laboratory specimen collection, involves collecting specimens from a small number of patients with ILI each influenza season. Healthcare providers submit specimens to the WPHL for specialized influenza testing. The WPHL performs reverse transcriptase – polymerase chain reaction (RT-PCR). In addition, WPHL forwards a subset of the specimens submitted by ILINet providers to CDC for additional testing. This testing often provides the earliest identification of circulating influenza virus types, subtypes, and strains during the current influenza season. During a typical influenza season, laboratory and epidemiology officials will utilize the ILINet provider program as a major part of influenza surveillance for the WDH. In addition, the WPHL is a World Health Organization (WHO) Collaborating Laboratory. As a WHO Collaborating Laboratory, the WPHL reports the total number of respiratory specimens tested and the number of positive influenza specimens to CDC each week. The participating ILINet providers are offered summaries of state and national influenza data, free subscriptions to CDC's *Morbidity and Mortality Weekly Report*, *Emerging Infectious Diseases Journal*, and viral isolation test kits for free influenza testing at the WPHL. Finally, the most important consideration is the data provided by ILINet providers are critical for protecting the public's health. For more information on the Influenza Sentinel Surveillance Network, or if you are interested in becoming an ILINet provider, please contact the WDH-Infectious Disease Epidemiology Unit at (307) 777-8640.

REPORTED CASES

Wyoming reported 2,474 laboratory-confirmed influenza cases (RIDT, DFA, PCR, or cell culture positive test results) during the 2015-2016 influenza season. Healthcare providers reported the first positive cases for the 2015-2016 influenza season during the week ending October 10, 2015 (MMWR Week 40). Reporting of influenza peaked the week ending March 26, 2016 (MMWR Week 12) when providers reported 340 cases. In comparison, during the 2014-2015 influenza season, reporting of influenza peaked the week ending January 17, 2015 (MMWR Week 02) when providers reported 438 cases. Chart 1 and Table 1 display the number of cases reported by week. The WDH requires healthcare providers and laboratories to report all positive influenza laboratory tests; however, not all providers report these results. Additionally, many ill persons do not seek medical care, and not all healthcare providers test for the disease during a medical visit. Therefore, comparing reported cases of influenza from week-to-week or season-to-season may not be valid, as many factors influence both testing and reporting.

**CHART 1: REPORTED CASES OF INFLUENZA (RIDT, DFA, PCR, & LAB CULTURE)
WYOMING, (2011-2012 TO 2015-2016)**

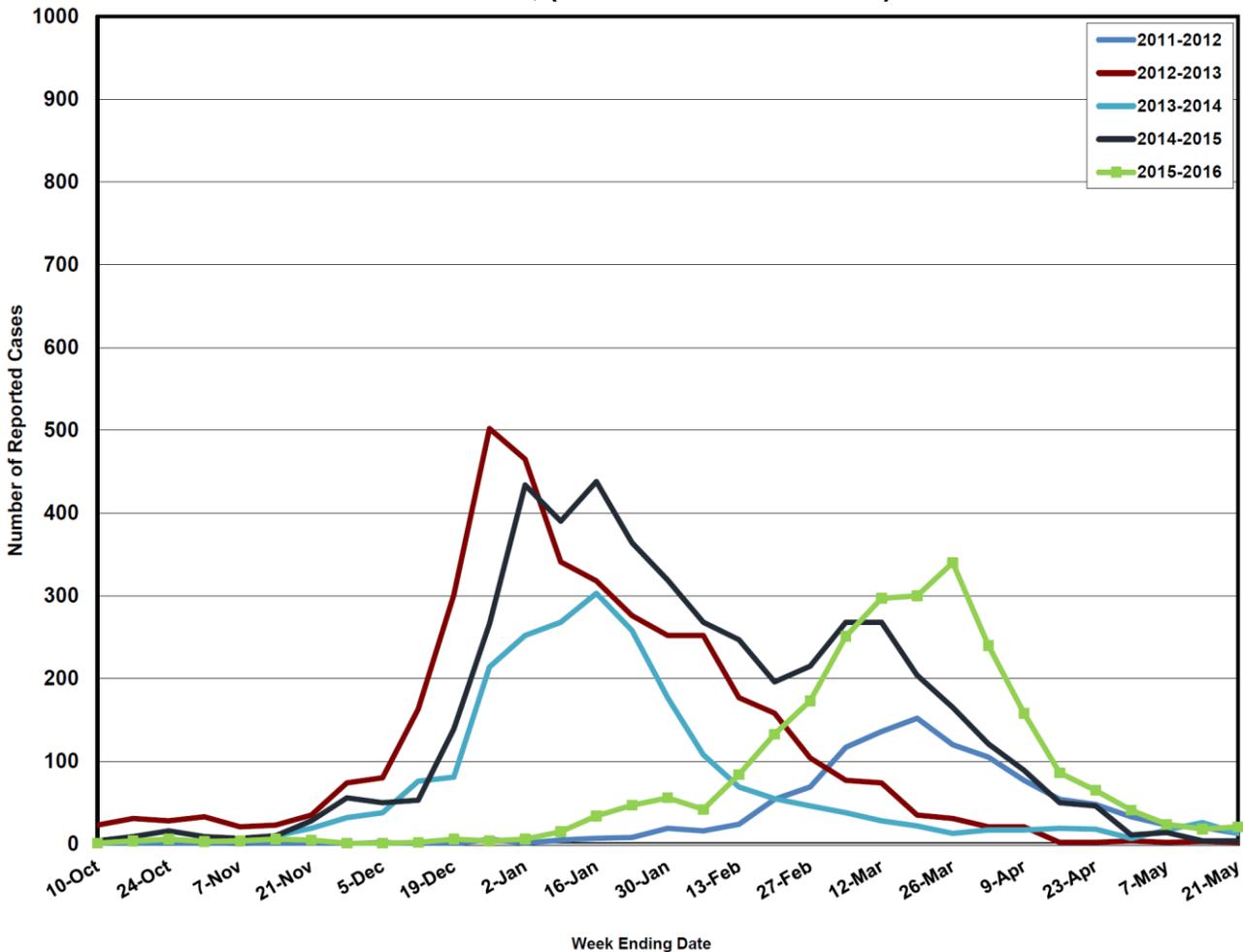


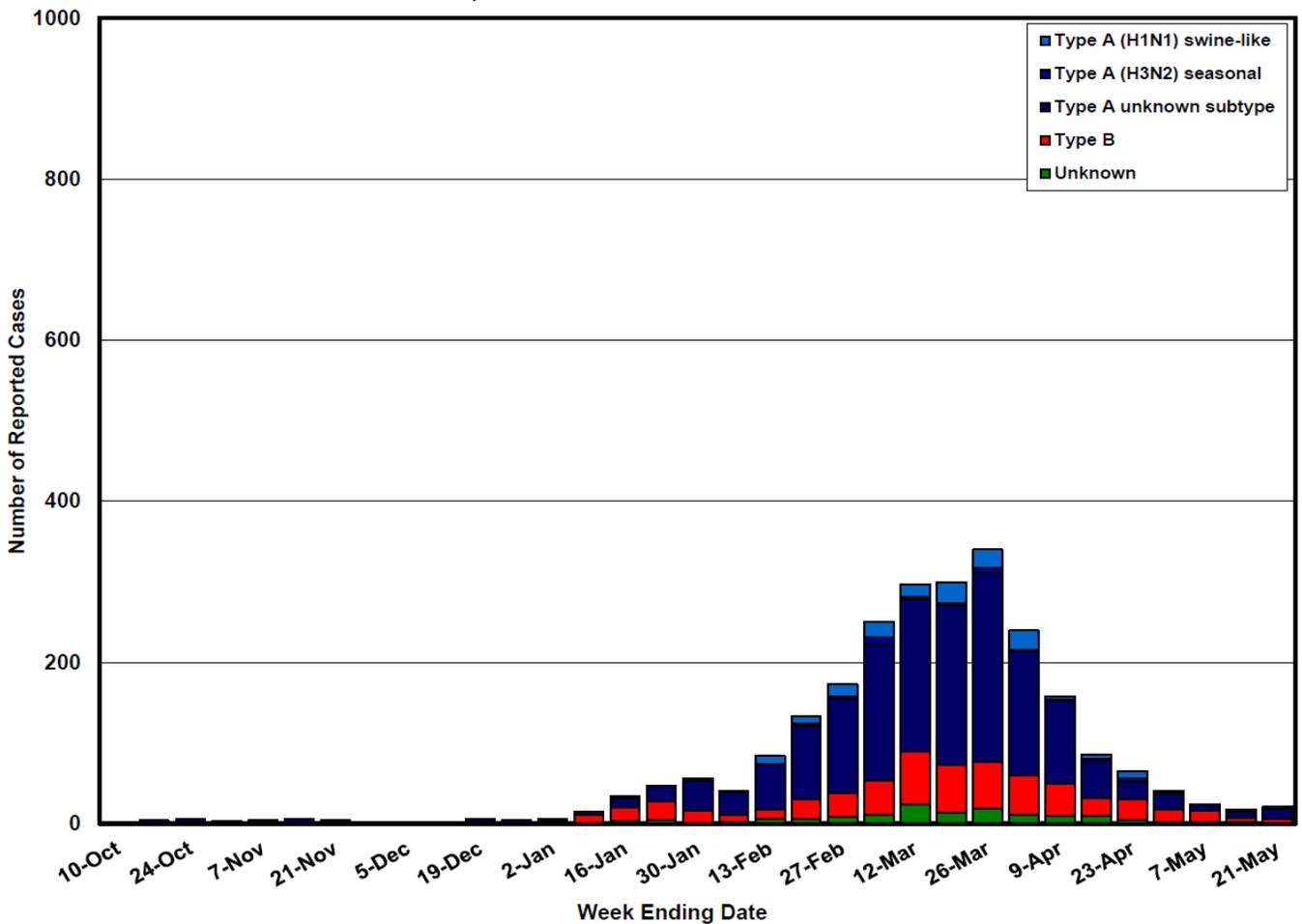
TABLE 1: REPORTED CASES OF INFLUENZA; WYOMING, 2015-2016 INFLUENZA SEASON

Week Ending	Number	County	Number	Age	Number
10-Oct	1	Albany	200	0-4	412
17-Oct	4	Big Horn	31	5-10	466
24-Oct	6	Campbell	386	11-19	307
31-Oct	3	Carbon	33	20-39	546
07-Nov	4	Converse	90	40-59	506
14-Nov	6	Crook	20	60+	237
21-Nov	5	Fremont	68	Unknown	0
28-Nov	1	Goshen	55	Total	2474
05-Dec	1	Hot Springs	12		
12-Dec	2	Johnson	19		
19-Dec	6	Laramie	323		
26-Dec	4	Lincoln	37		
02-Jan	6	Natrona	443	Gender	Number
09-Jan	15	Niobrara	2	Male	1174
16-Jan	34	Park	53	Female	1300
23-Jan	47	Platte	40	Total	2474
30-Jan	56	Sheridan	178		
06-Feb	42	Sublette	60		
13-Feb	84	Sweetwater	207		
20-Feb	133	Teton	58	Type	Number
27-Feb	173	Uinta	90	A	1776
05-Mar	251	Washakie	47	B	549
12-Mar	297	Weston	22	A & B Dual	1
19-Mar	300	Unknown	0	Unknown	148
26-Mar	340	Total	2474	Total	2474
02-Apr	240				
09-Apr	158				
16-Apr	86				
23-Apr	65				
30-Apr	41				
07-May	24				
14-May	18				
21-May	21				
Total	2474			Subtype (A)	Number
				A (H3N2)	33
				A (H1N1) 2009	178
				A & B Dual	1
				A Unknown	1565
				Total	1777

LABORATORY DATA

Of the 2,474 reported cases, 1,776 (71.8%) were influenza A viruses, 549 (22.2%) were influenza B viruses, 148 (6.0%) were unknown influenza viruses and one case was a dual infection with an influenza A virus and influenza B virus. Healthcare providers and laboratories confirmed 11 cases by DFA; 400 cases by PCR; and 2,063 cases by RIDT only. During the 2015-2016 influenza season, the WPHL tested a total of 383 specimens for influenza viruses and 157 (41.0%) were positive. However, eleven were out-of-state residents not counted in the Wyoming database. The WPHL confirmed the first positive PCR specimen during the week ending November 3, 2015 (MMWR Week 44), and confirmed the last positive specimen during the week ending May 16, 2015 (MMWR Week 19). Among the 157 positive influenza specimens tested at the WPHL, 88 (56.1%) were 2009 influenza A (H1N1) viruses; 28 (17.8%) were influenza A (H3N2) viruses; 38 (24.8%) were Influenza B viruses; and two (1.3%) were either an unknown influenza A virus or a dual infection with an influenza A virus and influenza B virus (see chart 2).

**CHART 2: REPORTED CASES OF INFLUENZA BY VIRUS TYPE & SUBTYPE
WYOMING, 2015-2016 INFLUENZA SEASON**



On a national level, WHO and the National Respiratory and Enteric Virus Surveillance System collaborating laboratories tested a total of 705,337 specimens for influenza viruses during the 2015-2016 influenza season and 91,105 (12.9%) were positive. Among the 91,105 influenza viruses, 62,794 (68.9%) were influenza A viruses and 28,311 (31.1%) were influenza B viruses. The collaborating laboratories subtyped 18,302 (29.1%) of the 62,794 influenza A viruses: 14,778 (80.7%) were influenza A (H3N2) viruses and 3,524 (19.3%) were 2009 influenza A (H1N1) viruses. This influenza season, influenza A (H3N2) viruses, 2009 influenza A (H1N1) viruses, and influenza B viruses co-circulated in the United States. However, the relative proportion of each type and subtype of influenza virus varied by region and week. Influenza A viruses were the most commonly reported influenza virus type throughout most of the influenza season and 2009 influenza A (H1N1) viruses were the overall predominant influenza subtype circulating across the United States. Additionally, 2009 influenza A (H1N1) viruses were predominant in Region 8 of the U.S. Department of Health and Human Services (DHHS) during the weeks preceding the influenza peak; Wyoming is located within DHHS Region 8. Although 2009 influenza A (H1N1) viruses predominated, influenza A (H3N2) and influenza B viruses co-circulated across the state.

As of May 21, 2016, CDC antigenically characterized 2,616 influenza viruses collected by United States laboratories since October 1, 2015. CDC characterized 996 of the 2009 influenza A (H1N1) viruses as A/California/7/2009-like, the influenza A (H1N1) component of the 2015-2016 influenza vaccine for the Northern Hemisphere. One of the 2009 influenza A (H1N1) viruses tested showed a reduced titer to A/California/7/2009. All of the recent 2009 influenza A (H1N1) viruses belong to hemagglutinin genetic group 6B; however, two genetic subgroups have emerged: 6B.1 and 6B.2. The majority of U.S. viruses belong to the 6B.1 subgroup. The viruses from these genetic subgroups remain antigenically similar to the A/California/7/2009 virus component in the vaccine. All 625 of the genetically sequenced influenza A (H3N2) viruses belonged to genetic groups for which a majority of viruses antigenically characterized were similar to the cell-propagated A/Switzerland/9715293/2013 viruses, the influenza A (H3N2) virus representing the 2015-2016 Northern Hemisphere vaccine component. A subset of 318 viruses were antigenically characterized; 309 of the 318 (97.2%) influenza A (H3N2) viruses were characterized as A/Switzerland/9715293/2013-like by hemagglutination inhibition testing. Laboratories characterized 548 of the 994 (55.1%) B/Yamagata-lineage viruses as B/Phuket/3073/2013-like, the influenza B component of the 2015-2016 Northern Hemisphere influenza vaccine. Also, 439 of the 446 (98.4%) remaining influenza B viruses were influenza B/Victoria-lineage viruses. The viruses were antigenically characterized as B/Brisbane/60/2008-like, which is included as an influenza B component of the 2015-2016 Northern Hemisphere quadrivalent influenza vaccine.

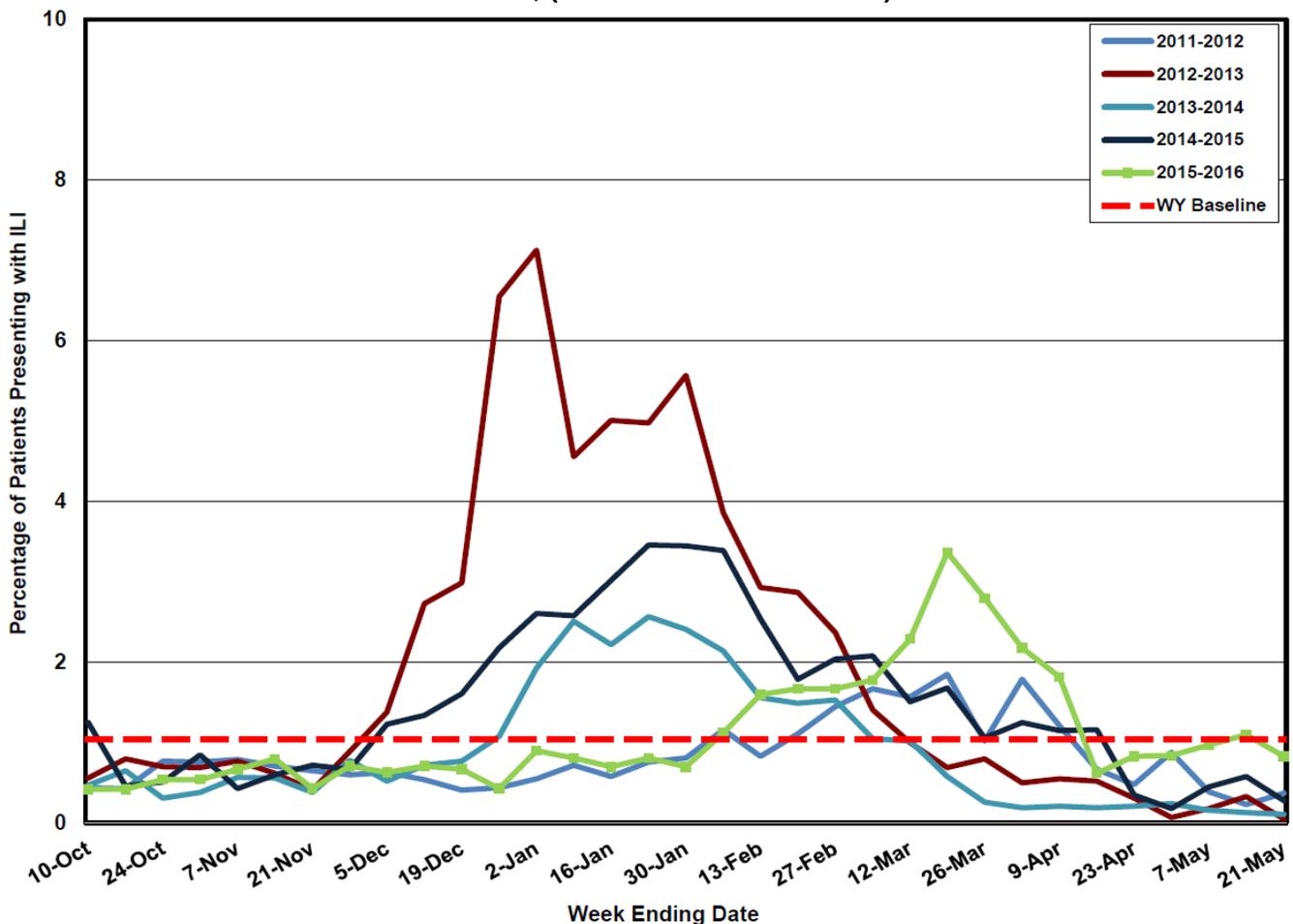
Overall, the 2015-2016 influenza vaccine matched the circulating strains of influenza in the United States. All of the influenza A (H1N1) pandemic viruses and most of the influenza B viruses sent to CDC for further characterization were antigenically similar to their components in the 2015-2016 Northern Hemisphere vaccines. The findings are comparable to past estimates for seasons when circulating influenza viruses and vaccine viruses are similarly matched. Both influenza A virus subtypes and both influenza B virus lineages circulated in the United States and Wyoming. As stated earlier, 2009 influenza A (H1N1) viruses were the predominant circulating influenza viruses during the 2015-2016 influenza season. However, Wyoming experienced limited circulation of the influenza A (H3N2) viruses. The majority of influenza B specimens submitted to CDC for antigenic characterization were B/Yamagata-lineage of the viruses as B/Phuket/3073/2013-like. Although the 2009 influenza A (H1N1) and influenza B components of the vaccine matched the circulating strains of their corresponding viruses, there were not enough isolates and data to determine the vaccine effectiveness against influenza A (H3N2) viruses. Additionally, there were not enough isolates and data to determine the vaccine effectiveness against B/Victoria-lineage viruses.

Laboratorians at CDC routinely use hemagglutination inhibition assays to antigenically characterize influenza viruses year-round to compare how similar currently circulating influenza viruses are to those included in the influenza vaccine, and to monitor for changes in circulating influenza viruses. The information CDC collects from studying genetic changes in viruses (substitutions, variants, or mutations) are an important part of public health. The information assists public health officials in determining whether existing vaccines and medical countermeasures such as antiviral drugs are effective against influenza viruses. Additionally, the information is useful to determine the potential for influenza viruses in animals to infect humans. During the 2015-2016 influenza season, the majority of the viruses characterized were antigenically similar to the reference viruses' components of the 2015-2016 Northern Hemisphere influenza vaccine. Antigenic characterization continues to provide important data for assessing the similarity between reference viruses and circulating viruses. Field studies on vaccine effectiveness are conducted to determine how well vaccines work. Consequently, the laboratory data evaluates whether the changes in the viruses impacted vaccine effectiveness. During the 2014-2015 and 2015-2016 influenza seasons, a proportion of influenza A (H3N2) viruses did not yield sufficient hemagglutination titers for antigenic characterization by hemagglutination inhibition. For the vast majority of viruses characterized at CDC laboratories, next-generation whole genome sequencing was performed to determine the genetic identity of circulating viruses. For the subset of viruses that did not yield sufficient hemagglutination titers, antigenic properties were inferred using results obtained from viruses within the same genetic group as those that have been characterized antigenically.

OUTPATIENT INFLUENZA-LIKE ILLNESS (ILI) REPORTS FROM WYOMING SENTINEL SITES

The ILINet website is a data repository for healthcare providers to record aggregated data on patients with ILI symptoms. Each week, ILINet providers reported the total number of patients seen and the number of those patients with ILI by age group. Chart 3 illustrates ILI reported by Wyoming ILINet providers. Influenza and ILI morbidity started the influenza season below the baseline level (0 - 1.04%); ILI activity among the network of ILINet providers extensively remained below the baseline until the week ending February 6, 2016 (MMWR Week 5). The peak percentage of patient visits for ILI was 3.37%, which occurred the week ending March 19, 2016 (MMWR Week 11). Conversely, the number of reported cases peaked the following week, March 26, 2016 (MMWR Week 12). Additionally, ILI activity among the ILINet providers remained above the baseline until the week ending April 16, 2016 (MMWR Week 15). In comparison, during the 2014-2015 influenza season the peak percentage of patient visits for ILI was 3.46%, which occurred the week ending January 24, 2015 (MMWR Week 03).

**CHART 3: WEEKLY ILI REPORTING BY ILINET PROVIDERS
WYOMING, (2011-2012 TO 2015-2016)**



REPORTED INFLUENZA-ASSOCIATED DEATHS

Influenza-associated deaths are reportable conditions in the State of Wyoming. Influenza-associated deaths are defined as deaths occurring in Wyoming residents, in which an influenza infection was the primary cause or a contributing cause of mortality listed on an individual's death certificate. Tracking death certificates is currently the best surveillance system to capture and identify influenza-associated deaths in Wyoming. However, according to CDC, influenza is infrequently listed on death certificates and testing for seasonal influenza infections is usually not done, particularly among the elderly who are at greatest risk of seasonal influenza complications and death. Therefore, public health officials may not identify influenza-associated deaths in many instances; consequently, this surveillance system may underestimate the true impact of influenza-associated deaths in the state.

This season, the WDH-Vital Statistics Services Unit reported ten influenza-associated deaths (1.71 per 100,000). In contrast, during the 2014-2015 influenza season, the WDH-Vital Statistics Services Unit reported 29 influenza-associated deaths (4.96 per 100,000). The reported deaths during the 2015-2016 influenza season was lower than the number of influenza-associated deaths reported during the previous influenza season. Several factors may have contributed to the decrease in influenza-associated deaths during the 2015-2016 influenza season. The median age of the ten influenza-associated deaths was 72 years, with five (50.0%) of the deaths occurring in individuals 65 years of age or older. The remaining five (50.0%) influenza-associated deaths occurred in individuals under the age of 65 years. In comparison, during the 2014-2015 influenza season, the median age of influenza-associated deaths was 75 years, with twenty (71.4%) of the deaths occurring in individuals 65 years of age or older. 2009 influenza A (H1N1) viruses were the predominant circulating influenza virus in Wyoming during the 2015-2016 influenza season. Consequently, public health officials linked the majority of reported influenza-associated deaths with influenza A (H1N1) virus infections. According to CDC, influenza seasons during which influenza A (H3N2) viruses predominate are typically associated with higher rates of hospitalizations and deaths among the elderly; this may partially explain the decreased rate of influenza-associated deaths in individuals over the age of 65 years and the increased rate of influenza-associated deaths in individuals under the age of 65 years during the 2015-2016 influenza season. Wyoming public health officials linked one influenza-associated death with an influenza B virus infection. The influenza-associated death linked to an influenza B virus infection occurred after the influenza peak. Five (50.0%) influenza-associated deaths, both influenza A and B viruses, occurred after the influenza peak, the week ending March 26, 2016 (MMWR Week 12).

COMPOSITION OF THE 2016-2017 VACCINE

Researchers study the strains of viruses infecting humans and how they are changing. Public health officials select the influenza viruses for seasonal influenza vaccines each year based on information gathered over previous influenza seasons. One hundred forty-one National Influenza Centers (NIC), located in 111 different countries, gather circulating influenza strains and information on disease trends. The four WHO Collaborating Centers for Reference and Research on Influenza analyze the combined data. Based on this information, experts forecast which viruses are likely to circulate during upcoming influenza seasons, and WHO recommends specific virus strains to make the vaccine. Each February, the WHO makes the final recommendations for vaccines produced for the Northern Hemisphere. Each country then uses the recommendations made by the WHO to assist with national decisions of what virus strains to include in the influenza vaccine supply for their country. In the United States, an advisory committee convened by the Food and Drug Administration (FDA) makes the final decision about vaccine strains in February. Manufacturers grow vaccine strains based on these recommendations.

Currently, there are primarily three types of influenza viruses circulating in humans: influenza A (H1N1) viruses, influenza A (H3N2) viruses, and influenza B viruses. Each year, vaccine manufacturers use influenza virus strains from each of the three circulating viruses to produce the trivalent seasonal influenza vaccine. The WHO recommended the vaccine virus strains for the 2016-2017 Northern Hemisphere Trivalent Influenza Vaccine. The FDA - Vaccines and Related Biological Products Advisory Committee (VRBPAC) agreed with the recommendations for the United States influenza vaccine supply. Both agencies recommend that the trivalent vaccine contain A/California/7/2009 (H1N1) pandemic 2009-like virus; an A/Hong Kong/4801/2014 (H3N2)-like virus; and a B/Brisbane/60/2008-like (B/Victoria lineage) virus. The upcoming vaccine formulation represents a change in the influenza A (H3N2) virus and the influenza B (B/Victoria lineage) components of the vaccine compared with the composition of the 2015-2016 influenza vaccine. Additionally, the influenza B component of the trivalent vaccine switched from the Yamagata lineage to the Victoria lineage. Hemagglutination inhibition tests indicated that the vast majority of A/California/7/2009 (H1N1) pandemic 2009-like viruses remained antigenically homogeneous and closely related to the vaccine virus. Therefore, the A/California/7/2009 (H1N1) pandemic 2009-like virus vaccine component remained unchanged since the original production in 2009. Researchers based the new vaccine recommendations on global influenza virus surveillance data related to antigenic characteristics, serological responses to 2015-2016 seasonal vaccines, and the availability of candidate strains and reagents.

VACCINE EFFECTIVENESS

Vaccine effectiveness depends on how closely related, or matched, the viruses in the vaccine are to the viruses circulating during the influenza season and on how well a vaccinated person responds to the vaccine in terms of producing protective antibody. In years when the vaccine strains and the virus strains are well-matched, public health officials measure substantial benefits from vaccination in terms of preventing influenza illness. According to CDC, even during years when the vaccine match is very good, the benefits of vaccination will vary across the population, depending on characteristics of the person being vaccinated and even, potentially, which vaccine was used. In the United States, public health officials recommend annual vaccinations against influenza for all persons aged 6 months and older. Since the 2004-2005 influenza season, CDC has conducted studies to estimate how well the seasonal influenza vaccine protects against influenza-associated medical visits. Researchers conducted an early season estimate during the 2015-2016 influenza season to evaluate the effectiveness of the influenza vaccine for preventing laboratory confirmed influenza infections. Although the current data is limited, researchers will publish future studies to examine the effectiveness of the 2015-2016 influenza vaccine.

In February 2016, CDC presented interim vaccine effectiveness estimates for the 2015-2016 influenza season during the Advisory Committee on Immunization Practices (ACIP) meeting. The estimates represent U.S. Influenza Vaccine Effectiveness Network enrollees from the 2015-2016 influenza season; however, the information only represents early season estimates and as a result, interim estimates. The early estimates of influenza vaccine effectiveness were incomplete because of the limited nature and the late-season circulation of influenza viruses during the 2015-2016 influenza season. The vast majority of states were reporting widespread influenza activity by the end of February 2016. Researchers based the interim vaccine effectiveness estimates on patients enrolled through February 12, 2016. The early estimates of vaccine effectiveness indicate that seasonal influenza vaccines provided significant protection against influenza viruses circulating during the first half of the influenza season. Overall, the estimated vaccine effectiveness against influenza A and influenza B was 59% (95% confidence interval [CI]: 44% to 70%). According to CDC, the interim vaccine effectiveness estimate is similar to previous seasons when circulating viruses and vaccine viruses are well-matched. Consequently, this illustrates the fact that the majority of circulating influenza viruses during the 2015-2016 influenza season were antigenically and genetically similar to the influenza vaccine component of the 2015-2016 Northern Hemisphere seasonal influenza vaccines. The vaccine effectiveness estimates highlights the importance of continued influenza prevention and aggressive treatment measures.

Influenza activity remained relatively low in most regions of the United States from the start of the season until December 2015. However, in late December, influenza activity continued to increase slowly until February 2016. In February, influenza activity began to significantly increase until activity peaked in March 2016. Therefore, the majority of the viruses used to estimate vaccine effectiveness did not include circulating viruses collected during elevated activity. The CDC continued to recommend influenza vaccinations because, although limited, it helped to prevent infections with the circulating influenza viruses and prevented infections with influenza viruses that circulated later in the season. The fact that nearly 60% of circulating influenza viruses analyzed at CDC indicated vaccine effectiveness against medically attended influenza. The vaccine effectiveness estimates indicated that the 2015-2016 Northern Hemisphere seasonal influenza vaccine provided significant protection against circulating influenza viruses, specifically the 2009 influenza A (H1N1) viruses and influenza B viruses. However, the CDC could not estimate the vaccine effectiveness of influenza A (H3N2) viruses due to the small number of viruses reported during the 2015-2016 influenza season.

Laboratory data verifies that most of the circulating influenza viruses were similar to the viruses recommended for the 2015-2016 influenza vaccines. The 2009 influenza A (H1N1) viruses have continued to circulate each season since the 2009 pandemic, but the 2015-2016 influenza season is the first season since the 2013-2014 influenza season that the viruses have predominated. This season is only the second influenza season since the 2009 pandemic to have 2009 influenza A (H1N1) viruses predominant. Interim vaccine effectiveness estimates for the 2015-2016 influenza vaccine for prevention of 2009 influenza A (H1N1) virus-associated outpatient acute respiratory illness (ARI) visits were similar to vaccine effectiveness estimates for monovalent pandemic and seasonal influenza vaccines for prevention of outpatient medical visits associated with 2009 influenza A (H1N1) virus infections during previous influenza seasons. Additionally, over 99% of the 2009 influenza A (H1N1) viruses tested by CDC, including viruses from the U.S. Influenza Vaccine Effectiveness Network, were antigenically similar to A/California/7/2009, the influenza A (H1N1) component of the 2015-2016 influenza vaccine. Since the emergence of the 2009 influenza A (H1N1) virus during the 2008-2009 influenza season, the virus has remained antigenically similar to the vaccine formulation. However, since the information in this section reflects early season vaccine effectiveness, it is likely that end-of-season vaccine effectiveness estimates could change as additional patient data becomes available to researchers. Also, the vaccine effectiveness estimates in this section are limited to the prevention of outpatient medical visits, rather than more severe illness outcomes, such as hospitalizations or death. Therefore, this lack of data warrants additional studies to measure vaccine effectiveness against more severe outcomes.

HEALTH ADVISORY AND UPDATE

The Health Alert Network (HAN) is CDC's primary method of sharing cleared information about urgent public health incidents with public health partners. The HAN collaborates with federal, state, territorial, and city/county partners to develop protocols and stakeholder relationships that will ensure a robust interoperable platform for the rapid distribution of public health information. There are several different HAN message types: *Health Alert*, *Health Advisory*, *Health Update*, and *Info Service*. CDC released one influenza related HAN notice during the 2015-2016 influenza season, a *Health Advisory*. A *Health Advisory* provides important information for a specific incident or situation; contains recommendations or actionable items to be performed by public health officials, laboratorians, and/or clinicians; and it may not require immediate action. The HAN, (HAN 00387), was an official CDC *Health Advisory* released on February 1, 2016. The CDC Health Advisory, *Flu Season Begins: Severe Influenza Illness Reported*, provided recommendations for the 2015-2016 influenza season.

CDC issued the HAN to alert healthcare providers and public health officials of the increase in influenza activity across the country. Additionally, CDC received increasing reports of severe influenza illness from around the country. The Health Advisory reminded clinicians to treat suspected influenza in high-risk outpatients, those with progressive disease, and all hospitalized patients with antiviral medications as soon as possible, regardless of negative rapid influenza diagnostic test results and without waiting for RT-PCR testing results. It specifically emphasized the importance of early antiviral treatment to help reduce influenza morbidity and mortality. During the 2015-2016 season, the CDC received reports of severe respiratory illness among young adults to middle-aged adults with 2009 influenza A (H1N1) viruses. Some of the reported cases required intensive care unit (ICU) admissions and fatalities have been reported. Healthcare providers reported negative RIDT results for some of the patients with ILI symptoms; their influenza diagnosis was made later with molecular assays. Many of these patients were reportedly unvaccinated. In the past, 2009 influenza A H1N1 virus infections have caused severe illness in children and adults. Therefore, CDC issued the Health Advisory urging rapid antiviral treatment of very ill and suspected influenza patients in high-risk categories regardless of laboratory testing. The HAN provided three objectives: a summary of influenza antiviral drug treatment recommendations, an update for clinicians about approved treatment drugs and supply for the influenza season, and background information for patients regarding anti-influenza treatment. The Health Advisory is available at the following link: <http://emergency.cdc.gov/han/index.asp>.

ANTIVIRAL AGENTS FOR INFLUENZA

The FDA approved and recommended three antiviral drugs for use against influenza: oseltamivir, zanamivir, and peramivir. Table 2 presents an overview of the indications, administration, and use of antiviral medications. Oseltamivir, zanamivir, and peramivir are a class of medication known as neuraminidase inhibitors and are active against both influenza A and B viruses. Antiviral resistance to the neuraminidase inhibitors among circulating influenza viruses is currently low. Additionally, antiviral resistance can emerge during or even after treatment of certain patients with influenza, specifically patients that are immunosuppressed. Clinical trials and observational data show that early antiviral treatment can shorten the duration of fever and illness symptoms, may reduce the risk of complications from influenza, and shorten the duration of hospitalization. Clinical benefit is greatest with early administration of antiviral treatment, especially within 48 hours of influenza illness onset. For additional information on antiviral medications during the 2015-2016 influenza season, please visit: <http://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm>.

TABLE 2: RECOMMENDED DOSAGE & SCHEDULE OF INFLUENZA ANTIVIRAL MEDICATIONS FOR TREATMENT OR CHEMOPROPHYLAXIS, 2015-2016 INFLUENZA SEASON

Antiviral Agent	Activity Against	Use	FDA Approved For	Not Recommended for Use in	Adverse Events
Oseltamivir (Tamiflu®)	Influenza A and B	Treatment	Any age	Not Applicable	Adverse events: nausea, vomiting. Post-marketing reports of serious skin reactions and sporadic, transient neuropsychiatric events (self-injury or delirium; mainly reported among Japanese adolescents and adults).
		Chemoprophylaxis	3 months and older	Not Applicable	
Zanamivir (Relenza®)	Influenza A and B	Treatment	7 years and older	People with underlying respiratory disease (e.g., asthma or COPD)	Allergic reactions: oropharyngeal or facial edema. Adverse events: diarrhea, nausea, sinusitis, nasal signs and symptoms, bronchitis, cough, headache, dizziness, and ear, nose and throat infections.
		Chemoprophylaxis	5 years and older	People with underlying respiratory disease (e.g., asthma or COPD)	
Peramivir (Rapivab®)	Influenza A and B	Treatment	18 years and older	Not Applicable	Adverse events: diarrhea. Post-marketing reports of serious skin reactions and sporadic, transient neuropsychiatric events (self-injury or delirium; mainly reported among Japanese adolescents and adults).
		Chemoprophylaxis	Not Applicable	Not Applicable	

ANTIVIRAL SUSCEPTIBILITY OF INFLUENZA VIRUSES COLLECTED IN WYOMING

Since October 1, 2015, the Wyoming Public Health Laboratory submitted 34 influenza isolates to the CDC for antiviral susceptibility testing to neuraminidase inhibitors. One isolate was an influenza A (H3N2) virus; 14 were 2009 influenza A (H1N1) viruses; and the remaining 19 were influenza B viruses. All of the influenza B viruses and the influenza A (H3N2) virus tested were susceptible to oseltamivir, zanamivir, and peramivir. Among the 2009 influenza A (H1N1) viruses tested for susceptibility, one was found to be resistant to oseltamivir and peramivir. However, all 19 of the 2009 influenza A (H1N1) viruses tested were susceptible to zanamivir. The influenza isolates from Wyoming contributed significantly towards improving virus surveillance, developing improved assays for detection of antiviral resistance, and enhancing the overall recommendations for control of influenza. The assessment of influenza isolates for their susceptibility to neuraminidase inhibitors is performed in the fluorescent neuraminidase inhibition assay. Table 3 presents the antiviral susceptibility of influenza isolates from Wyoming. The influenza viruses were tested against three FDA approved neuraminidase inhibitors: oseltamivir, zanamivir, and peramivir. For the viruses identified as resistant, sequence analysis of the neuraminidase is performed to detect molecular markers associated with resistance to the neuraminidase inhibitors. The resistant 2009 influenza A (H1N1) virus showed highly reduced inhibition by oseltamivir and peramivir in the neuraminidase inhibition assay. Since the 2013-2014 influenza season, all resistant 2009 influenza A (H1N1) virus infections identified to date have been associated with the H275Y mutation in neuraminidase.

TABLE 3: ANTIVIRAL SUSCEPTIBILITY OF INFLUENZA VIRUSES WYOMING, 2015-2016 INFLUENZA SEASON

Virus Collection Period: October 1, 2015 - September 30, 2016						
Type and Subtype	Oseltamivir		Zanamivir		Peramivir	
	Viruses Tested	Viruses Resistant	Viruses Tested	Viruses Resistant	Viruses Tested	Viruses Resistant
2009 Influenza A (H1N1)	14	1*	14	0	14	1*
Influenza A (H3N2)	1	0	1	0	1	0
Influenza B	19	0	19	0	19	0

* The H275Y substitution, a marker of oseltamivir and peramivir resistance, was detected in the neuraminidase of the 2009 influenza A (H1N1) virus.

AVIAN INFLUENZA A VIRUSES IN HUMANS

Influenza A viruses have been identified in various animals species around the world. Typically, certain subtypes of influenza A viruses are specific to certain species. However, avian species are the exception; birds are hosts to all known subtypes of influenza A viruses. Currently, influenza A H3N2 and H1N1 viruses are the main subtypes of influenza A viruses circulating in humans. Occasionally, public health officials receive reports of sporadic human infections with avian influenza A viruses. The reported illnesses in humans associated with avian influenza A virus infections have ranged from mild to severe. The symptoms are usually similar to infections with human influenza viruses. Therefore, it is difficult for healthcare providers to diagnose avian influenza infections by clinical signs and symptoms alone. Laboratory testing is necessary to confirm suspected cases of avian influenza virus infections. Public health officials continue to monitor and track cases of avian influenza A viruses due to the unpredictable nature of viruses. Specifically, avian influenza A viruses have the potential to change and possibly even gain the ability to spread easily from person-to-person. As avian influenza A viruses continue to evolve in unpredictable ways, it is important for public health officials to monitor the epidemiology of circulating viruses in order to understand the risk of avian influenza in human populations.

During the 2015-2016 influenza season, the WHO reported a human infection with highly pathogenic avian influenza A (H5N6) viruses. The virus is highly contagious and deadly among birds, especially domestic poultry. The viruses began circulating in poultry in Asia during the 2013-2014 influenza season. Genomic analysis by Chinese researchers showed that H5N6 viruses circulating in poultry were reassortants, and derived their genes from H5 and H6 subtype viruses found in poultry in China. Highly pathogenic avian influenza A (H5N6) viruses in humans are rare and typically do not spread easily from person-to-person. Only one reported human case occurred during the 2015-2016 influenza season; China reported the case. Also during the 2015-2016 influenza season, the WHO reported new human infections with avian influenza A (H7N9) viruses. China reported the first human infections with the novel avian influenza A viruses during the 2012-2013 influenza season. Public health officials identified the new avian influenza virus as avian influenza A (H7N9) virus. Additionally, researchers detected the virus in birds within China. Available evidence indicated that most people contracted the disease after exposure to birds or environments contaminated with bird flu viruses. Clinically, some of the cases had mild illness; however, many patients had severe respiratory illness. The human cases of H7N9 infections were predominately isolated to Asia; however, public health officials detected the avian influenza A (H7N9) virus in North America after two individuals travel through China before arriving in Canada.

REPORTING REMINDER

All of the following are reportable to the WDH-Infectious Disease Epidemiology Unit: laboratory confirmed cases of influenza and influenza-associated deaths. Furthermore, state statutes require attending healthcare providers, clinics, hospitals, and laboratories performing influenza diagnostic testing to report cases of influenza. Healthcare providers can fax reports to the WDH secure fax line at (307) 777-5573. In addition, WDH requests that hospitals submit respiratory specimens to the WPHL on all hospitalized patients with ILI or clinical suspicion of influenza regardless of the laboratory results. Typically, influenza cases that require hospitalization are severe influenza cases. In an effort to understand the epidemiology of circulating influenza strains in the community, WDH requests respiratory specimens for testing at the state's public health laboratory. Influenza and other infectious diseases listed on the reportable disease list are located at the following link: <https://health.wyo.gov/publichealth/infectious-disease-epidemiology-unit/reporting/>.