

**Manitoba Health, Seniors and Active Living**

## **ANNUAL INFLUENZA REPORT**

---

**2016–2017**

**Epidemiology and Surveillance**

Active Living, Population and Public Health

**Cadham Provincial Laboratory**

March 2018

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## Executive Summary

Seasonal influenza can cause severe morbidity and mortality, especially in vulnerable populations, and the burden is highly variable. In Manitoba, influenza is a reportable disease under *The Public Health Act*. Routine monitoring and reporting of influenza is performed by Epidemiology and Surveillance (E&S) in collaboration with Cadham Provincial Laboratory (CPL) at Manitoba Health, Seniors and Active Living (MHSAL) through a variety of indicators. During each season, which typically occurs between November and May, the influenza activity in Manitoba is reported weekly in [seasonal influenza reports](#). Annual report summarizes all the influenza related information between July 1, 2016 and June 30, 2017.

In 2016–2017, the influenza A(H3N2) virus was the predominant circulating strain in Manitoba. As would be expected with an influenza A(H3N2)-predominant season, higher rates of illness were observed in older populations than in the younger populations, especially in those 65 years of age and older.

The 2016–2017 influenza season in Manitoba was characterized by a lower activity level and was less severe compared with 2015–2016, an influenza A(H1N1)-predominant season, or with 2014–2015, the last influenza A(H3N2)-predominant season. In 2016–2017, there were fewer influenza-positive cases and fewer cases who were severely ill after infection of influenza. Activity remained low through November and December 2016, increased in January 2017, and peaked in late February 2017, similar to 2015–2016.

Influenza B viruses also co-circulated in 2016–2017. The majority of viruses characterized this season were antigenically similar to the reference viruses representing the recommended components in the 2016–2017 Northern Hemisphere quadrivalent influenza vaccine. Three quadrivalent influenza vaccine products were available in Manitoba for the 2016–2017 season. It was estimated that 22.3% of all Manitoba residents had been immunized with the influenza vaccine as of March 31, 2017, similar to the coverage rate in the three seasons prior.

## Reporting Weeks

Time trends in this report are presented in epidemiology weeks. This schedule is used by the national FluWatch program at the Public Health Agency of Canada (PHAC).

Week	Start	End
27	2016-07-03	2016-07-09
28	2016-07-10	2016-07-16
29	2016-07-17	2016-07-23
30	2016-07-24	2016-07-30
31	2016-07-31	2016-08-06
32	2016-08-07	2016-08-13
33	2016-08-14	2016-08-20
34	2016-08-21	2016-08-27
35	2016-08-28	2016-09-03
36	2016-09-04	2016-09-10
37	2016-09-11	2016-09-17
38	2016-09-18	2016-09-24
39	2016-09-25	2016-10-01
40	2016-10-02	2016-10-08
41	2016-10-09	2016-10-15
42	2016-10-16	2016-10-22
43	2016-10-23	2016-10-29
44	2016-10-30	2016-11-05
45	2016-11-06	2016-11-12
46	2016-11-13	2016-11-19
47	2016-11-20	2016-11-26
48	2016-11-27	2016-12-03
49	2016-12-04	2016-12-10
50	2016-12-11	2016-12-17
51	2016-12-18	2016-12-24
52	2016-12-25	2016-12-31

Week	Start	End
1	2017-01-01	2017-01-07
2	2017-01-08	2017-01-14
3	2017-01-15	2017-01-21
4	2017-01-22	2017-01-28
5	2017-01-29	2017-02-04
6	2017-02-05	2017-02-11
7	2017-02-12	2017-02-18
8	2017-02-19	2017-02-25
9	2017-02-26	2017-03-04
10	2017-03-05	2017-03-11
11	2017-03-12	2017-03-18
12	2017-03-19	2017-03-25
13	2017-03-26	2017-04-01
14	2017-04-02	2017-04-08
15	2017-04-09	2017-04-15
16	2017-04-16	2017-04-22
17	2017-04-23	2017-04-29
18	2017-04-30	2017-05-06
19	2017-05-07	2017-05-13
20	2017-05-14	2017-05-20
21	2017-05-21	2017-05-27
22	2017-05-28	2017-06-03
23	2017-06-04	2017-06-10
24	2017-06-11	2017-06-17
25	2017-06-18	2017-06-24
26	2017-06-25	2017-07-01

## Acronyms

AEFI	Adverse event following immunization
CI	Confidence Interval
CPL	Cadham Provincial Laboratory
DPIN	Drug Programs Information Network
E&S	Epidemiology and Surveillance, unit of MHSAL
EIA	Enzyme immunoassay
ICU	Intensive Care Unit
ILI	Influenza-like illness
IRVS	Influenza and Respiratory Viruses Section
LTC	Long Term Care
MHSAL	Manitoba Health, Seniors and Active Living
MIMS	Manitoba Immunization Monitoring System
MOH	Medical Officer of Health
NML	National Microbiology Laboratory
PCR	Polymerase chain reaction
PHCC	Provincial Health Contact Centre
PHAC	Public Health Agency of Canada
RHA	Regional Health Authority
RSV	Respiratory Syncytial Virus
RTPCR	Reverse transcription polymerase chain reaction

## Introduction

Epidemiology and Surveillance (E&S) of the Active Living, Population and Public Health Branch of Manitoba Health, Seniors and Active Living (MHSAL) monitors disease activity including seasonal influenza throughout Manitoba and year-round. During the 2016–2017 influenza season, E&S produced [weekly influenza reports](#) to provide timely updates on the influenza activity within the province as well as national and international updates with support from Cadham Provincial Laboratory (CPL). This annual report further analyzes information on the influenza activity in Manitoba between July 1, 2016 and June 30, 2017.

Overall:

- In total, 4,413 respiratory specimens were tested by Cadham Provincial Laboratory (CPL) for pathogens. 15.5% of those specimens tested were positive for the influenza virus.
- Laboratory testing of respiratory specimens occurred year-round. The test volume was higher between October 2016 and May 2017 with a peak in Week 3 (January 15–21, 2017), five weeks before the peak of positive influenza detections.
- Laboratory testing confirmed 462 influenza A patients and 123 influenza B patients.
- Influenza A(H3N2) was the predominant circulating strain. Older populations were affected more than younger populations in 2016–2017.
- The influenza A season started in Week 1 (January 1–7, 2017) and peaked in Week 8 (February 19–25, 2017). The influenza B season started in Week 6 (February 5–11, 2017) and peaked in Week 13 (March 26–April 1, 2017).
- In total, 153 influenza cases were hospitalized including 23 admissions to intensive care units (ICU), and 14 influenza cases died. Of those hospitalized and deceased, 57% were aged 65 years and older.
- The five regional health authorities (RHAs) in Manitoba reported 46 laboratory-confirmed influenza outbreaks. The majority occurred in long term care (LTC) facilities.
- The influenza immunization coverage in Manitoba in 2016–2017 was 22.3% as of March 31, 2017, similar to the three previous seasons.
- Physicians were the most common immunization provider. Pharmacists became the second most common provider by delivering 25.4% of all immunizations.

- Following seasonal influenza immunization, 37 clients with adverse events were reported in Manitoba, which resulted in a rate of 11.9 cases per 100,000 doses administered, lower than the previous two seasons.

A variety of data sources and surveillance indicators were evaluated to monitor the arrival, intensity and severity of seasonal influenza including characterization of those infected and the broader trends. Surveillance data analyzed for this report include data for:

- Influenza-related calls to Health Links–Info Santé;
- Sentinel surveillance of influenza-like illness (ILI) in the community;
- Antiviral dispensing;
- Laboratory testing of respiratory specimens and positive influenza detections;
- Hospitalizations, ICU admissions, and deaths associated with laboratory-confirmed influenza detections;
- Respiratory and laboratory-confirmed influenza outbreaks;
- Influenza immunizations;
- Adverse events following immunization (AEFI);
- Strain characterization of influenza viruses and antiviral resistance.

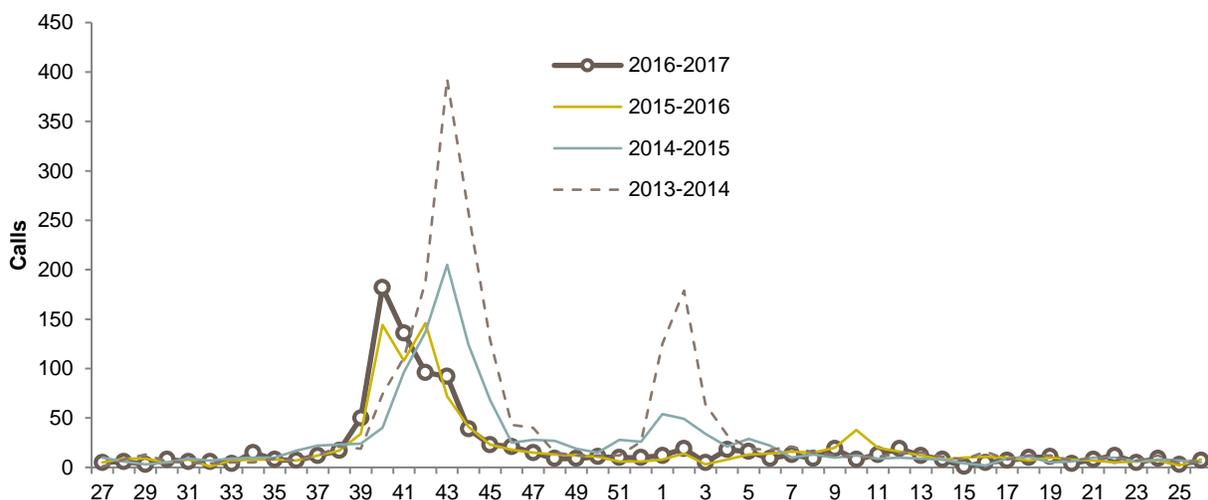
## Syndromic Surveillance

### *Health Links – Info Santé*

[Health Links–Info Santé](#) is a province-wide around-the-clock telephone medical triage service in Manitoba. It is staffed by 80 full-time and part-time nurses, with interpreters available for over 100 languages. This service is open at all times to any person in Manitoba.

During each call, a nurse will obtain information about symptoms and follow clinical protocols to offer advice on whether to treat the symptoms at home, see a family doctor, or visit an emergency room. Calls range from concerns about abdominal pain to Sentinel surveillance of influenza-like illness (ILI) symptoms. Callers to Health Links–Info Santé who select “Influenza Service” are given five options: (1) to obtain information to assist with arranging an influenza vaccination, (2) to learn who is at increased risk of serious illness from influenza, (3) to obtain information about the influenza vaccine, (4) to obtain information about the management of influenza symptoms and possible complications, and (5) to speak with a nurse. E&S receives aggregate data from Health Links–Info Santé weekly.

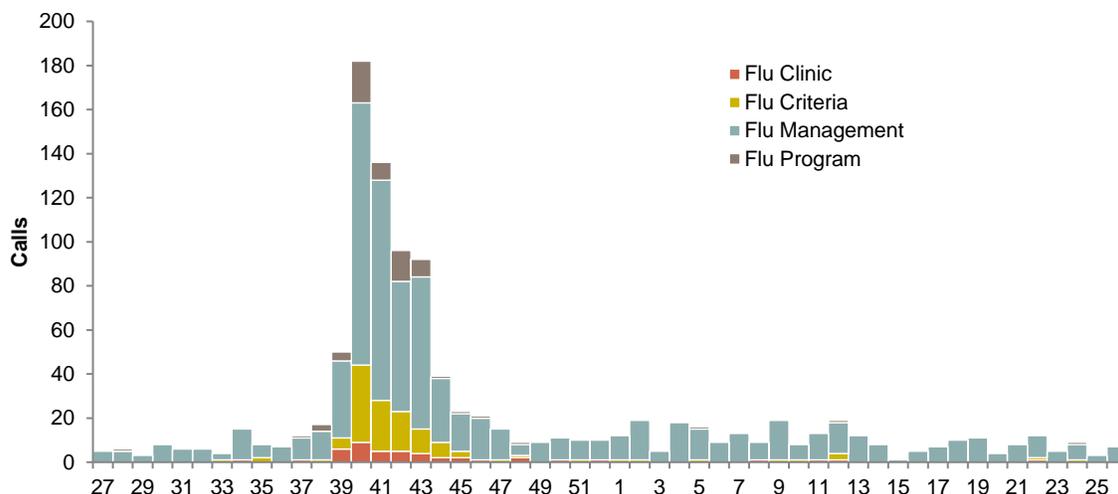
Unlike in previous seasons, in 2016–2017, there was only one peak in influenza-related calls to Health Links–Info Santé (Figure 1). The only peak in Week 40 (October 2–8, 2016) coincided with the onset of the annual influenza immunization campaign.



**Figure 1 Weekly influenza related calls to Health Links–Info Santé, Manitoba, 2013–2014 to 2016–2017**

The proportion of calls attributed to questions related to the influenza clinics and influenza program also peaked in Week 40 (Figure 2). The lack of additional peaks during the

seasonal epidemics in 2016–2017 suggests a low degree of public concern for the onset of the 2016–2017 influenza season.



**Figure 2** Types of influenza related calls to Health Links–Info Santé, Manitoba, 2016–2017

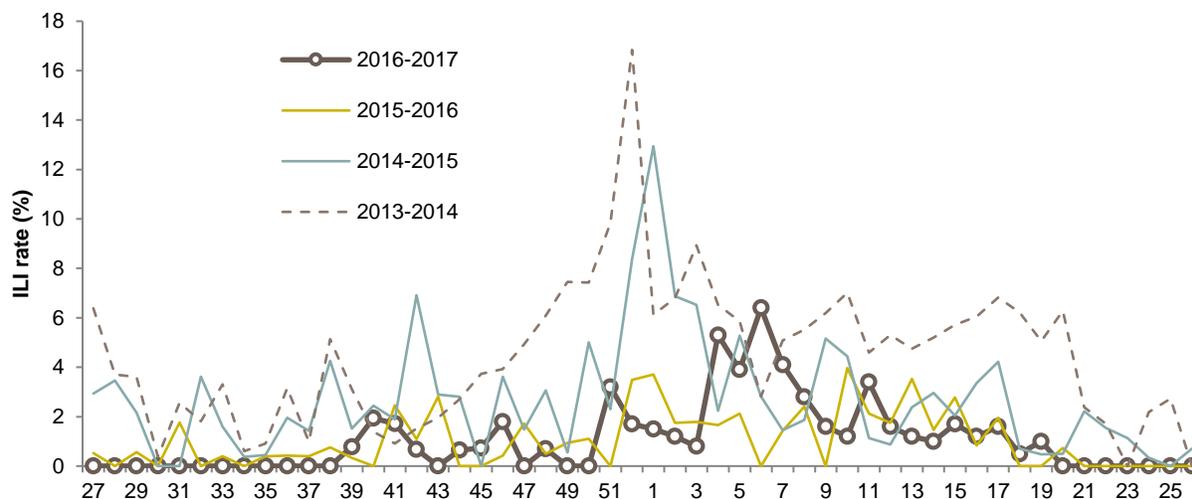
**Sentinel Program**

ILI in the general population is defined as acute onset of respiratory illness with fever and cough and with one or more of the symptoms, sore throat, joint or muscle pain, or fatigue, that are likely due to influenza. In children under the age of 5 years, gastrointestinal symptoms may also be present. In patients under 5 or over 65 years of age, fever may not be prominent.

*FluWatch*, Canada’s national surveillance system co-ordinated by the Public Health Agency of Canada (PHAC), monitors ILI and influenza activity on a year-round basis. A network of laboratories, hospitals, sentinel physicians, and provincial and territorial ministries of health routinely provide information to this system.

In Manitoba, sentinel physicians have been recruited throughout the province. They report ILI related visits to *FluWatch* weekly. They can also opt into the voluntary specimen collection component of the sentinel program. This consists of the submission of either two posterior pharyngeal swabs or two nasopharyngeal swabs within 48 hours of symptom onset from patients presenting with ILI. Requisitions, swabs, and viral transport media are available from CPL. E&S receives a weekly report from *FluWatch* on the ILI rate from participating sentinel physicians in Manitoba.

In 2016–2017, there were 19 sentinel physicians in Manitoba. ILI related visits to sentinel physicians occurred year-round. However, the percentage of ILI related visits in all visits to sentinel physicians increased from the beginning of January 2017, when laboratory-confirmed influenza activity also increased, and peaked at 6.4% in Week 6 (February 05–11, 2017), two weeks before laboratory-confirmed influenza activity peaked. Compared with 2015–2016, this indicator in 2016–2017 demonstrated more seasonal changes (Figure 3).

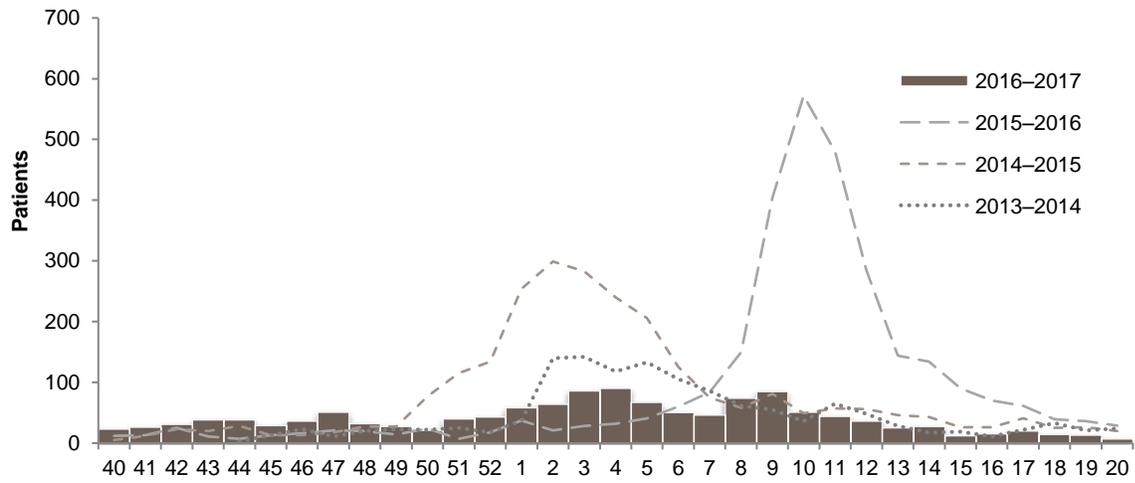


**Figure 3 Weekly percentage of visits to sentinel physicians due to ILI, Manitoba, 2013–2014 to 2016–2017**

### *Antiviral Dispensing*

The number of patients who received the antiviral drug, Oseltamivir (Tamiflu®), dispensed to Manitoba residents from community retail pharmacies after October 1 were obtained from the Drug Programs Information Network (DPIN) on a weekly basis during each influenza season. Those dispensed in hospitals or nursing stations could not be included in this report as DPIN does not contain such data.

Between October 1, 2016 and May 21, 2017, a total of 1,348 patients received Oseltamivir dispensed from community retail pharmacies. The number of patients treated with Oseltamivir each week peaked twice, once in Week 4 (January 22–28, 2017) and again in Week 9 (February 26–March 4, 2017). The second peak was almost aligned with the peak of laboratory detections of influenza (Figure 4). Compared with previous seasons, especially 2015–2016, considerably fewer patients were treated with Oseltamivir in 2016–2017, likely an indication of a lower influenza activity level.



**Figure 4 Weekly patients receiving Oseltamivir, Manitoba, 2016–2017**

## Laboratory Surveillance

CPL is Manitoba's public health laboratory. It provides laboratory investigative services that include screening, diagnosis, disease and pathogen characterization, and outbreak response support to:

- Physicians and other practitioners;
- MHSAL to support disease control programs;
- Medical Officers of Health (MOH), Public Health Inspectors, and Public Health Nurses in investigating outbreaks and cases of public health significance; and
- Other laboratories that use CPL as a reference centre for special investigations.

The Virus Detection Section at CPL is responsible for detection, surveillance and laboratory epidemiology of respiratory, vaccine-preventable, enteric and sexually transmitted infection of viral etiology, including influenza. Different techniques are available to detect and characterize influenza as well as other respiratory viruses. In 2016–2017, the investigative protocols at CPL for respiratory viral specimens employed one or more of the following approaches:

- Triplex real time Reverse Transcription Polymerase Chain Reaction (RTPCR) for influenza A/B and Respiratory Syncytial Virus (RSV);
- Tissue culture for a variety of respiratory viral infections;
- Rapid antigen detection for influenza A/B and RSV;
- Cepheid Xpert® FLU/RSV XC kit; and
- Seegene Allplex™ Respiratory Panel Assays.

During each influenza season, CPL produces weekly reports on respiratory viral disease activity to public health and key program authorities, and also contributes to the weekly FluWatch and national respiratory viral surveillance structure.

Detections of influenza nucleic acid, culture isolation and enzyme immunoassay (EIA) from CPL and occasionally other laboratories were routinely forwarded to E&S within 24 hours of confirmation. Additionally, a subset of influenza isolates were subtyped by RTPCR and approximately 10% of isolates were selected and sent to the National Microbiology Laboratory (NML) for strain typing and antiviral susceptibility testing.

### Testing

The respiratory virus specimen submission and test volumes at CPL for each season is reported in Table 1. Note that multiple specimens might be submitted for one case during a season. From 2013–2014 to 2016–2017, CPL tested between 4,000 and 5,000 respiratory specimens each season, and overall between 18.9% and 25.7% of specimens were tested positive for influenza. In 2016–2017, CPL tested 4,413 respiratory specimens, and 15.5% respiratory specimens were tested positive for influenza.

**Table 1 Volume of viral respiratory specimens and testing at Cadham Provincial Laboratory, Manitoba, 2013–2014 to 2016–2017**

Season	2016–2017	2015–2016	2014–2015	2013–2014
<b>Specimens</b>	<b>4,413</b>	<b>4,549</b>	<b>5,084</b>	<b>3,905</b>
<b>Influenza Positivity (%)</b>	<b>15.5%</b>	<b>22.2%</b>	<b>25.7%</b>	<b>18.9%</b>
<b>Tests</b>	<b>5,833</b>	<b>9,610</b>	<b>14,287</b>	<b>9,009</b>
RTPCR flu A pandemic	N/A	1,946	5,097	4,072
RTPCR flu B	N/A	1,766	5,090	2,856
RTPCR flu A/B/RSV	2,886	2,182	N/A	N/A
XPERT flu A/B	109	364	167	N/A
Xpert flu A/B/RSV	444	101	N/A	N/A
Culture (MDCK)	472	406	870	539
Rapid flu A/B	189	200	582	205
Allplex	1,640	1919	N/A	N/A
RV15	N/A	666	2,357	1,273
Referred out	93	60	124	64

Note. N/A=Not available

Depending on seasonal, clinical and epidemiological criteria, a varying number of tests might be conducted on one specimen. From 2013–2014 to 2015–2016, CPL conducted between 9,000 and 14,000 tests each season. In 2016–2017, only 5,833 tests were conducted. Besides the lower influenza activity in 2016–2017, the reduction in tests was also largely due to the replacement of two separate assays, RTPCR for pandemic influenza A(H1N1) 2009 and

RTPCR for influenza B, by one assay, RTPCR for influenza A/B and RSV, in 2016–2017. To maximize efficiency and effectiveness in detection, response and surveillance, new technologies are adopted in some years that result in new viral detection platforms. Confirmatory assays are used at differing rates depending largely on the prevalence of disease due to influenza in Manitoba. As a result, not all test platforms are used in all years and some platforms are no longer available. When they are used, they may be used to varying degrees.

The laboratory activity to detect respiratory pathogens including influenza occurs year-round. The test volume is higher in fall and winter when activity of most respiratory viruses increases (Figure 5). In 2016–2017, specimen submissions slowly increased from October 2016 to a peak in Week 3 (January 15–21, 2017) which was lower than in the three previous seasons. The positivity for influenza detections is usually close to zero during summer and increases in fall and winter. In seasons 2013–2014 to 2015–2016, influenza positivity peaked between 36% and 57%. In 2016–2017, the peak positivity for influenza at 36% in Week 8 (February 19–25, 2017) when at least 100 specimens were tested, was lower than in 2014–2015 and 2015–2016, but similar to 2013–2014. It is noted that, unlike in the three previous seasons, the volume of specimen submissions peaked five weeks before the peak of positive influenza detections. In the previous seasons, peaks of positivity usually occurred one or two weeks before peaks of specimen submissions.

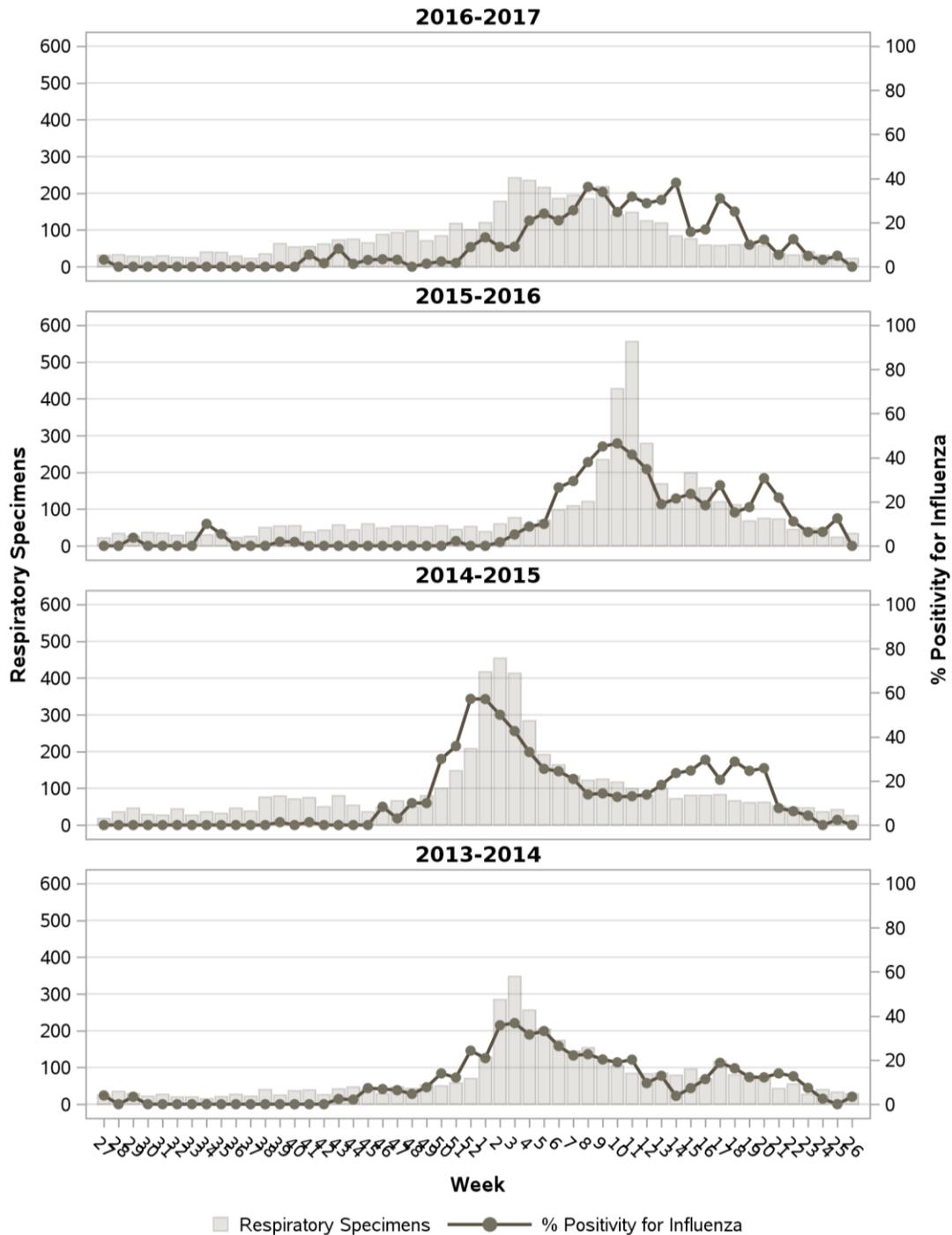
### *Detection*

In 2016–2017, there were 462 laboratory-confirmed influenza A and 123 influenza B patients in Manitoba residents who registered with MHSAL for health care coverage, much fewer than in the previous three seasons. Specifically:

- A(unsubtyped): 272 (46.5%)
- A(H1N1): 1 (0.1%)
- A (H3): 154 (26.3%)
- A(H3N2): 35 (6.0%)
- B: 123 (21.0%)

The 2016–2017 season was predominated by the influenza A(H3N2) subtype and a smaller number of influenza B subtypes. Note that not all individuals experiencing symptoms will

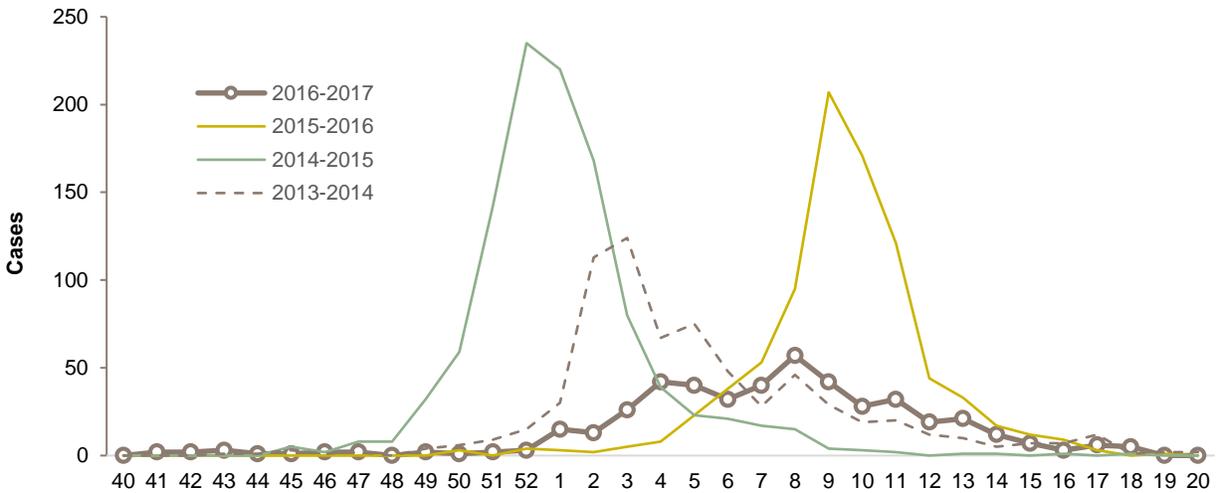
seek medical attention and not all clinicians will routinely test symptomatic patients for influenza. As such, reported cases represent only a proportion of influenza cases in the community.



**Figure 5 Weekly respiratory specimens tested and influenza positivity (%) at Cadham Provincial Laboratory, Manitoba, 2013–2014 to 2016–2017**

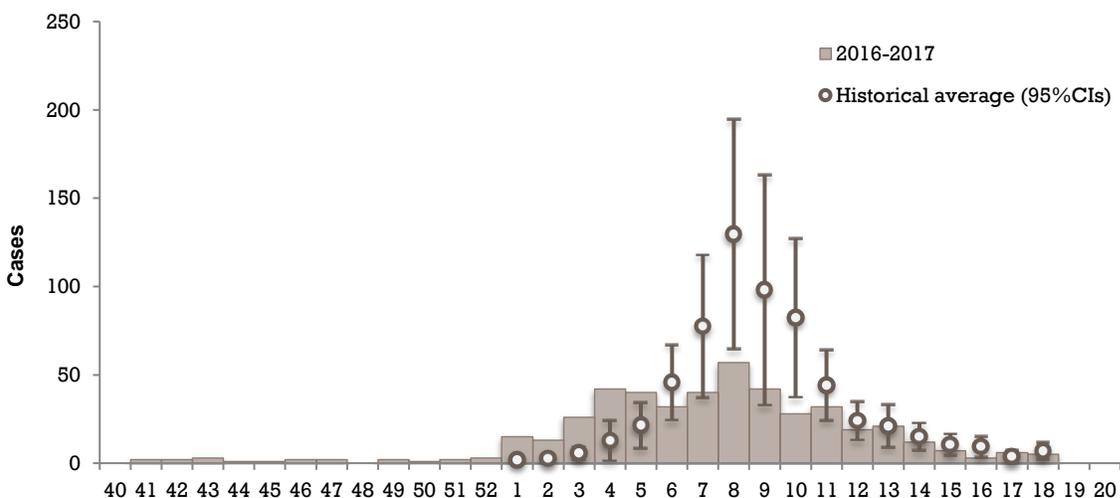
**Influenza A**

The season of influenza A in 2016–2017 began in Week 1 (January 1–7, 2017) and peaked in Week 8 (February 19–25, 2017). Compared to the three previous seasons, this season increased slowly and to a lesser peak (Figure 6). Note that the 2015–2016 and 2013–2014 seasons were predominated by influenza A(H1N1) and the 2014–2015 season was predominated by influenza A(H3N2).



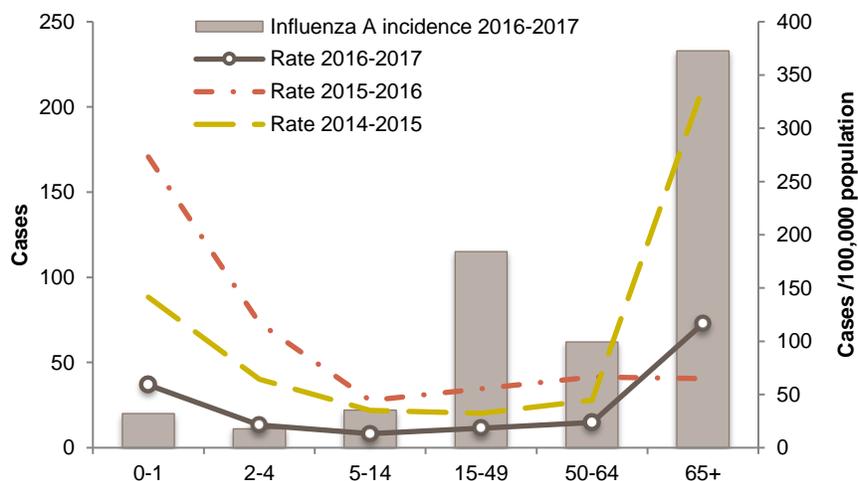
**Figure 6 Weekly incidence of laboratory-confirmed influenza A infection, Manitoba, 2013–2014 to 2016–2017**

Peak activity varies widely by season. To compare the 2016–2017 season to past seasons, the incidence curves of influenza A in seasons 2010–2011 to 2015–2016 were aligned with the curve in 2016–2017 by aligning their peaks on the peak of 2016–2017. Subsequently, the average weekly incidence of influenza A and 95% confidence intervals (CIs) were calculated (Figure 7). In 2016–2017, the incidence during peak weeks was lower than the historical average and was slightly above the lower end within the expected range or just below. Specifically, 57 influenza A cases were reported in Week 8 while the average influenza A incidence in a peak week was 129 and the lowest expected incidence was 64.



**Figure 7 Weekly incidence of laboratory-confirmed influenza A infection, Manitoba, 2016–2017 and historical average**

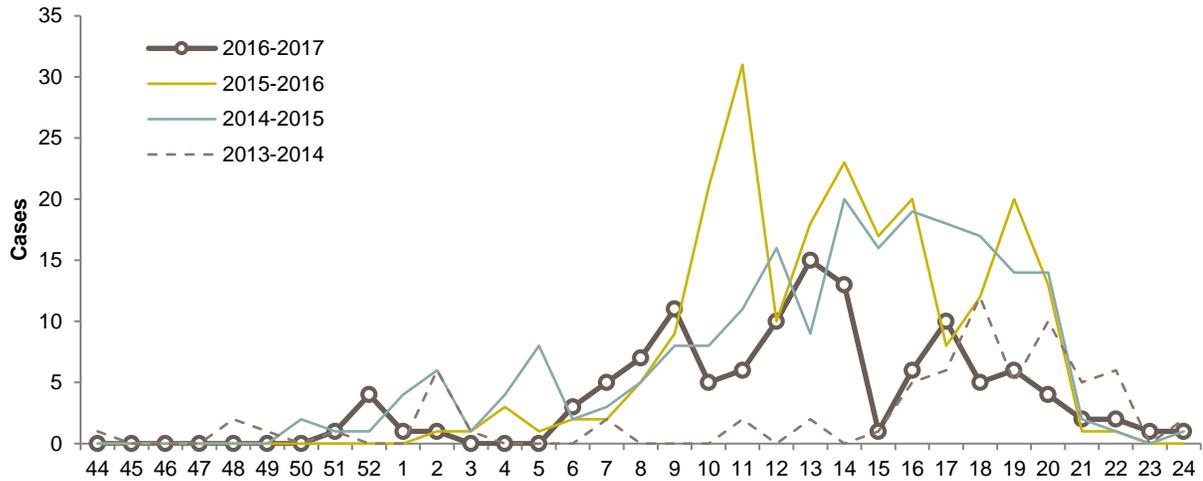
Older populations were affected more by influenza A than younger populations in the 2016–2017 season (Figure 8). The highest incidence rate was observed in the age group of 65 years and older (117 cases per 100,000 population). Almost 50% of all cases were reported from this age group. The second highest incidence rate was observed among children below two years of age (59 cases per 100,000 population). Compared to 2014–2015, the last influenza A(H3N2)-predominant season, the disease burden in those two age groups in 2016–2017 was much lower.



**Figure 8 Incidence and incidence rate (/100,000) of laboratory-confirmed influenza A infection by age group, Manitoba, 2016–2017**

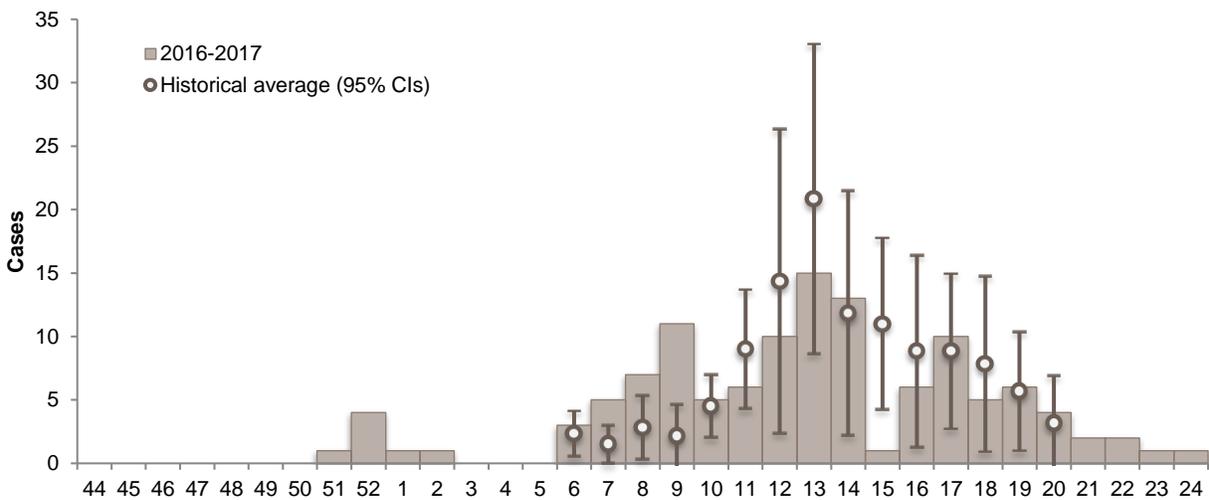
**Influenza B**

In 2016–2017, there were 123 laboratory-confirmed influenza B cases in Manitoba. The season of influenza B began in Week 6 (February 5–11, 2017) and peaked in Week 13 (March 26–April 1, 2017), five weeks after the peak of influenza A this season (Figure 9).



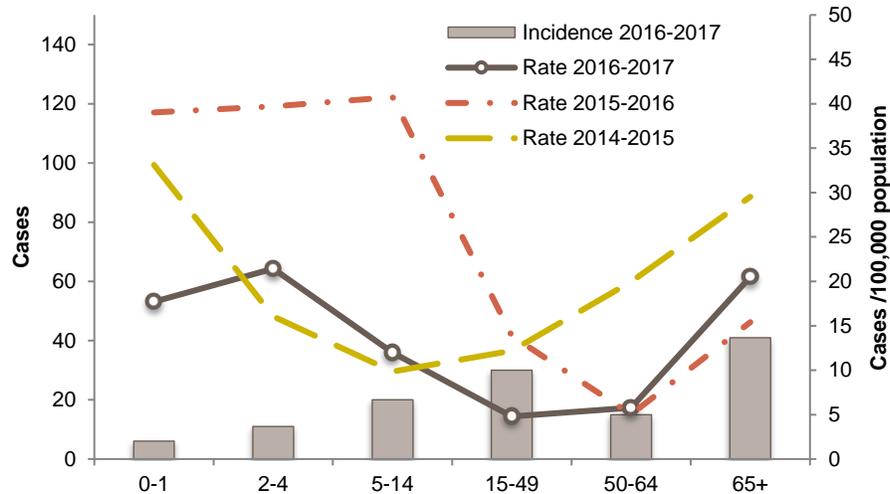
**Figure 9 Weekly incidence of laboratory-confirmed influenza B infection, Manitoba, 2013–2014 to 2016–2017**

A similar method was used to calculate the historical average incidence each week for influenza B (Figure 10). In 2016–2017, the incidence of laboratory-confirmed influenza B during peak weeks was lower than but close to the historical average except in Week 15 (April 9–15, 2017).



**Figure 10 Weekly incidence of laboratory-confirmed influenza B infection, Manitoba, 2016–2017 and historical average**

In 2016–2017, only one third of the influenza B cases were aged 65 years and older. The disease burden was similar in young children aged 2–4 years and seniors aged 65 and older with an incidence rate of 21 cases per 100,000 population (Figure 11).



**Figure 11 Incidence and incidence rate (/100,000) of influenza B infection by age group, Manitoba, 2016–2017**

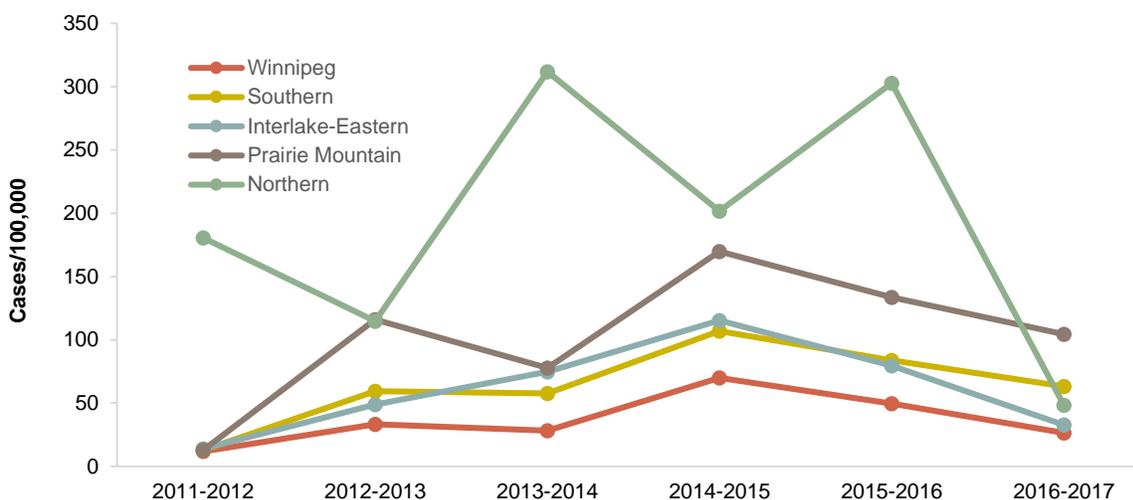
### *Regional Variance*

Manitoba has five regional health authorities ([RHAs](#)) that largely represent the five geographic regions in Manitoba with the exception that Churchill is in Winnipeg Regional Health Authority. Similar to previous seasons, there were regional differences in 2016–2017 (Table 2). Prairie Mountain Health had the highest incidence rate of both influenza A (80 cases per 100,000 population) and B (24 cases per 100,000 population). Southern Health-Santé Sud and Northern Health Region had the second highest incidence rate of influenza A (43 cases per 100,000 population). Southern Health-Santé Sud also had the second highest incidence rate of influenza B (20 cases per 100,000 population).

**Table 2 Incidence and incidence rate (/100,000) of laboratory-confirmed influenza A and B infection by RHA, Manitoba, 2016–2017**

Region	Influenza A		Influenza B		Total	
	Cases	Incidence rate (/100,000)	Cases	Incidence rate (/100,000)	Cases	Incidence rate (/100,000)
<b>Winnipeg</b>	174	22.7	30	3.9	204	26.6
<b>Southern</b>	85	43.0	40	20.3	125	63.3
<b>Interlake-Eastern</b>	34	26.5	8	6.2	42	32.8
<b>Prairie Mountain</b>	136	80.1	41	24.2	177	104.3
<b>Northern</b>	33	43.2	4	5.2	37	48.4
<b>Manitoba</b>	462	34.5	123	9.2	585	43.7

Generally, Winnipeg Regional Health Authority had the lowest incidence rate of influenza infection each season except for 2011–2012, the influenza B-predominant season, when four RHAs had almost the same low incidence rate (Figure 12). Prairie Mountain Health had the highest incidence rate among all RHAs in 2016–2017 (104 cases per 100,000 population). In the past, the incidence rate was usually the highest in Northern Health Region.



**Figure 12 Incidence rate (/100,000) of laboratory-confirmed influenza infection by RHA, Manitoba, 2011–2012 to 2016–2017**

## Hospitalizations, ICU Admissions and Deaths

E&S also routinely monitors severe illness associated with influenza. Each influenza season on a weekly basis, the central public health office in each RHA is requested to submit a line list of hospitalizations, ICU admissions and deaths for laboratory-confirmed influenza cases who were admitted to hospitals in the reporting RHA, or deceased as the registered residents of the reporting RHA.

Influenza-associated deaths may also be reported from other sources including:

- Chief Medical Examiner;
- MOHs in RHAs; and
- Infection Control Practitioners in LTC facilities.

The reason for the admission of hospitals and ICUs or the cause of death may not be attributable to influenza. A temporal association with a positive influenza laboratory result is sufficient for reporting. Submissions are validated by E&S to remove duplicate reports for the same case within the same illness episode. In addition to provincial surveillance, aggregate numbers of cases admitted to hospitals and ICUs respectively, and deceased in a reporting week and cumulative for the season are submitted to PHAC for national surveillance on a weekly basis.

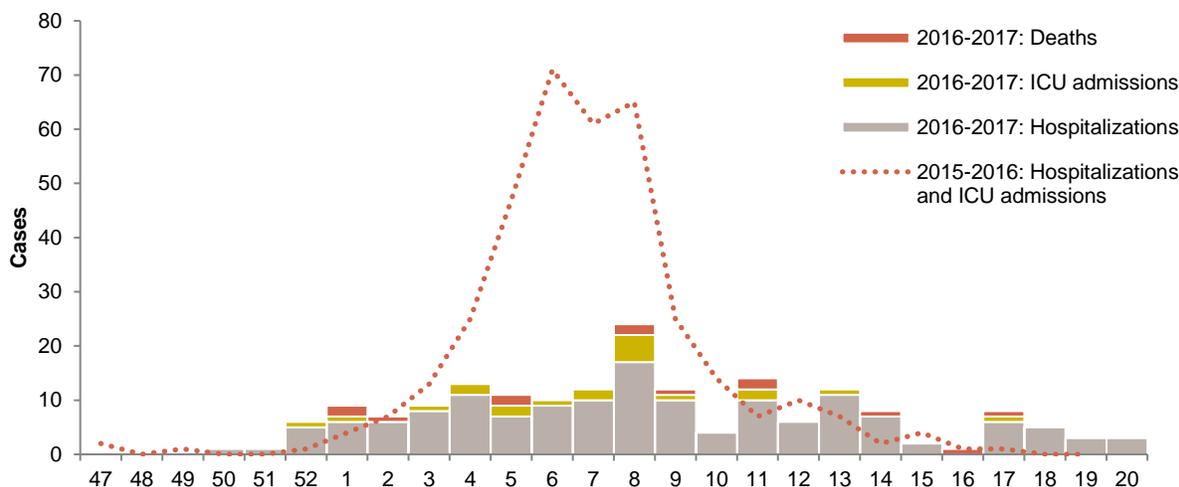
Amongst Manitoba residents, there were 153 influenza-associated hospitalizations in 2016–2017 (Table 3), fewer than in 2015–2016 (291) and 2014–2015 (346), but more than in 2013–2014 (127). Among those hospitalized cases, only 23 were admitted to ICUs, fewer than in 2015–2016 (78), 2014–2015 (62) and 2013–2014 (44).

In 2016–2017, 26.2% of all influenza cases were reported to have been admitted to hospitals, similar to 2015–2016 (26.6%) and 2014–2015 (27.1%), and 3.9% of all influenza cases were admitted to ICUs, lower than in 2015–2016 (7.1%) and 2014–2015 (4.8%). A total of 14 influenza-associated deaths were reported, most of which occurred in hospital. The majority of influenza-associated hospitalizations (n=120, 78.4%), ICU admissions (n=18, 78.3%), and deaths (n=13, 92.9%) were associated with influenza A.

**Table 3 Influenza-associated hospitalizations, ICU admissions and deaths by influenza type, Manitoba, 2016–2017**

Type/subtype	Hospitalizations		ICU admissions		Deaths	
	N	%	N	%	N	%
<b>Influenza A(unsubtyped)</b>	59	38.6%	2	8.7%	5	35.7%
<b>Influenza A(H3)</b>	61	39.9%	16	69.6%	8	57.1%
<b>Influenza B</b>	33	21.6%	5	21.7%	1	7.1%
<b>Total</b>	153		23		14	

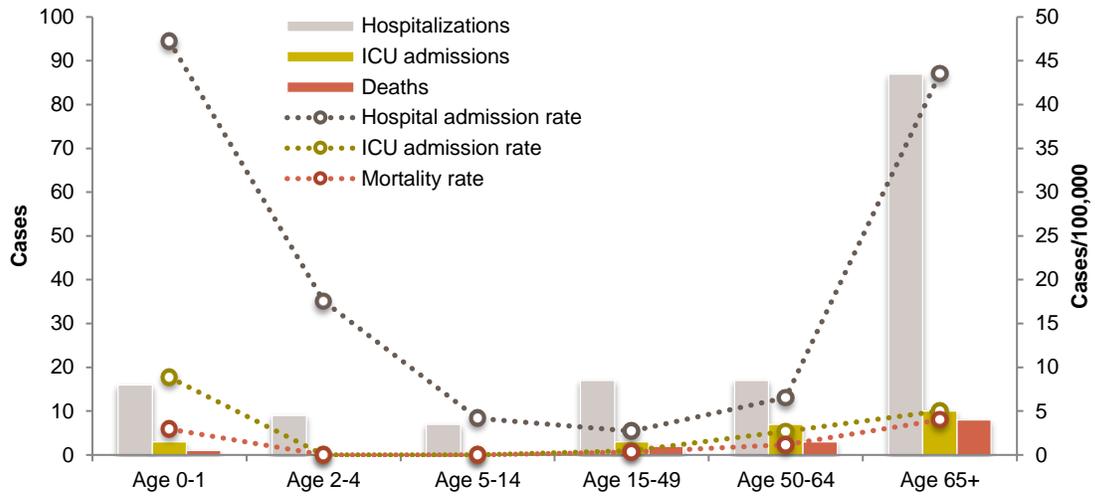
Unlike in 2015–2016, a higher incidence of influenza-associated severe outcomes in 2016–2017 (Figure 13) occurred only in one week, Week 8 (February 19–25, 2017).



**Figure 13 Weekly incidence of influenza-associated hospitalizations, ICU admissions, and deaths, Manitoba, 2016–2017**

*Note. ICU admissions are not included in the hospitalizations*

In 2016–2017, younger populations and those aged 65 years and older were more vulnerable to severe influenza-associated illness (Figure 13). The incidence rate of influenza-associated hospitalization was highest in the population under two years old (47 hospitalizations per 100,000 population) and the population aged 65 years and older (43 hospitalizations per 100,000 population). The highest influenza mortality rate was observed in the population aged 65 years and older (4 deaths per 100,000 population).



**Figure 14 Incidence and incidence rate (/100,000) of influenza-associated hospitalizations, ICU admissions, and deaths by age group, Manitoba, 2016–2017**

## Outbreaks

As outlined in Manitoba's [Communicable Disease Management Protocol–Seasonal Influenza](#), an institutional outbreak is defined as:

*Two or more cases of ILI (including at least one laboratory–confirmed case) occurring within a seven-day period in an institution. An institution includes but is not limited to hospitals, long-term care facilities for both adults and children (e.g., personal care homes, nursing homes, chronic care facilities) and correctional facilities.*

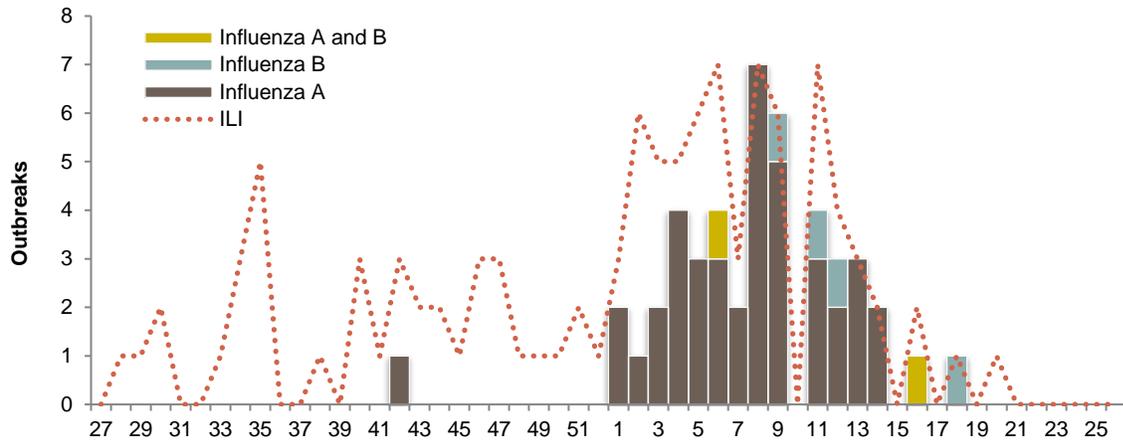
CPL notifies E&S of outbreaks, for which specimens have been collected and submitted to CPL for laboratory confirmation. CPL submits both positive and negative laboratory results related to CPL-registered outbreaks to E&S. A small number of outbreaks may be notified by RHAs to E&S directly for which specimens may not be submitted to CPL. Outbreak investigations are reported from RHAs to E&S by completing an outbreak summary report form electronically through the Canadian Network for Public Health Intelligence, or on paper. In this report, an outbreak was considered an influenza outbreak if an ILI outbreak had at least one laboratory confirmed influenza case.

Between July 1, 2016 and June 30, 2017, there were 46 influenza outbreaks reported in Manitoba: 40 outbreaks of influenza A, 4 outbreaks of influenza B, and 2 mixed outbreaks of influenza A and B. The majority of those outbreaks occurred in LTC facilities.

All five RHAs reported influenza outbreaks:

- Winnipeg Regional Health Authority: 12
- Southern Health-Santé Sud: 10
- Interlake-Eastern Regional Health Authority: 4
- Prairie Mountain Health: 19
- Northern Health Region: 1

ILI or respiratory outbreaks are reported year-round but are more frequently reported in the fall and winter months. In 2016–2017, the weekly outbreak reports increased in alignment with influenza activity (Figure 15) to peak in Week 8 (February 19–25, 2017). During the seasonal epidemic of influenza, the majority of ILI outbreaks were laboratory confirmed to be influenza outbreaks, such as in Week 8 and 9 (February 19–March 4, 2017).



**Figure 15 Weekly institutional outbreaks of ILI and influenza, Manitoba, 2016–2017**

## Immunizations

### *Uptake*

In 2016–2017, the seasonal influenza vaccine was available free-of-charge to all Manitoba residents over 6 months of age. As in previous seasons, MHSAL conducted a [Seasonal Influenza Immunization Program](#) that focused on those at increased risk of serious illness from influenza, their caregivers and close contacts, including:

- Seniors aged 65 and older,
- Residents of a LTC facility,
- Health care workers and first responders,
- Children 6 to 59 months of age,
- Individuals of Aboriginal ancestry,
- Those with chronic illness, such as:
  - Cardiac or pulmonary disorders (including bronchopulmonary dysplasia, cystic fibrosis and asthma),
  - Diabetes mellitus and other metabolic disorders,
  - Cancer, immune compromising conditions (due to underlying disease and/or therapy),
  - Renal disease,
  - Anemia or hemoglobinopathy,
  - Conditions that compromise the management of respiratory secretions and are associated with an increased risk of aspiration, and
  - Children 6 months to adolescents 18 years of age on long-term acetylsalicylic acid (i.e. Aspirin) therapy,
- People who are severely overweight or obese,
- Healthy pregnant women.

In addition, international students, visitors and newcomers were eligible to receive the seasonal influenza vaccine free-of-charge regardless of the third party insurance or MHSAL coverage.

As per the World Health Organization (WHO), all seasonal quadrivalent influenza vaccines for the 2016–2017 season in the northern hemisphere contained:

- A/Hong Kong/4801/2014 (H3N2)-like virus

- A/California/7/2009 (H1N1)pdm09-like virus
- B/Brisbane/60/2008-like virus
- B/Phuket/3073/2013-like virus

In 2016–2017, three vaccine products were included in the province’s Publicly-Funded Seasonal Influenza Immunization Program:

- Quadrivalent inactivated vaccine (QIV)
  - Fluzone® Quadrivalent (Sanofi Pasteur)
  - FluLaval® Tetra (GlaxoSmithKline)
- Quadrivalent live attenuated influenza vaccine (QLAIV)
  - FluMist® Quadrivalent (AstraZeneca)

Immunization data for previous annual influenza reports were extracted from the Manitoba Immunization Monitoring System (MIMS). MIMS contains all childhood immunizations administered to children born in 1980 or later since 1988 and all adult immunizations since 2000. Since 2015–2016, immunization data for an annual influenza report have been extracted from the new provincial immunization registry residing in [Panorama](#). Panorama is an electronic Public Health application for disease surveillance and management. It contains five modules. Two modules are related to the Manitoba Immunization Program and both became fully functional in 2015:

- Immunization Management – records immunization events. All the immunization data in MIMS have been imported into Panorama.
- Vaccine Inventory Management – manages and monitors vaccine storage, distribution and inventories.

Seasonal influenza immunizations were captured in Panorama in one of three ways:

- Immunizations administered by fee-for-service physicians were imported into Panorama from the Manitoba Physician Billing System.
- Immunizations administered by certified pharmacists were imported into Panorama from DPIN.
- Immunizations provided by all other health care providers including public health nurses were entered directly into Panorama by immunization providers or data entry staff.

In facilities where Panorama has not yet been implemented, immunizations were entered into MIMS and loaded from MIMS to Panorama weekly. Immunization data in Panorama are considered comprehensive. However, it has been identified that some immunizations may not be captured in either Panorama or MIMS, typically in facilities without access to either system and/or access to the Manitoba Physician Billing system or DPIN. Additionally, doses administered to clients who were not registered residents with MHSAL were not captured in Panorama. The impact of missing records on immunization assessment is under investigation.

Between September 1, 2016 and March 31, 2017, a total of 311,123 influenza vaccine doses were administered and 304,895 clients received at least one dose. Only a small number of clients received more than one dose due to medical or unknown reasons. For example, clients under the age of nine years who were not previously immunized with the seasonal influenza vaccine should receive two doses, four weeks apart.

The overall influenza vaccine uptake rate in Manitoba was 22.3% as of March 31, 2017 in active Manitoba residents. The age group of 65 years and older had the highest uptake rate (53.9%) followed by the age groups of 50–64 (26.3%) and 0–4 (19.8%). In comparison, the age group of 15–49 had the lowest uptake, only 13.1% (Table 4).

**Table 4 Influenza immunization uptake rate (%) by RHA and age group, Manitoba, 2016–2017**

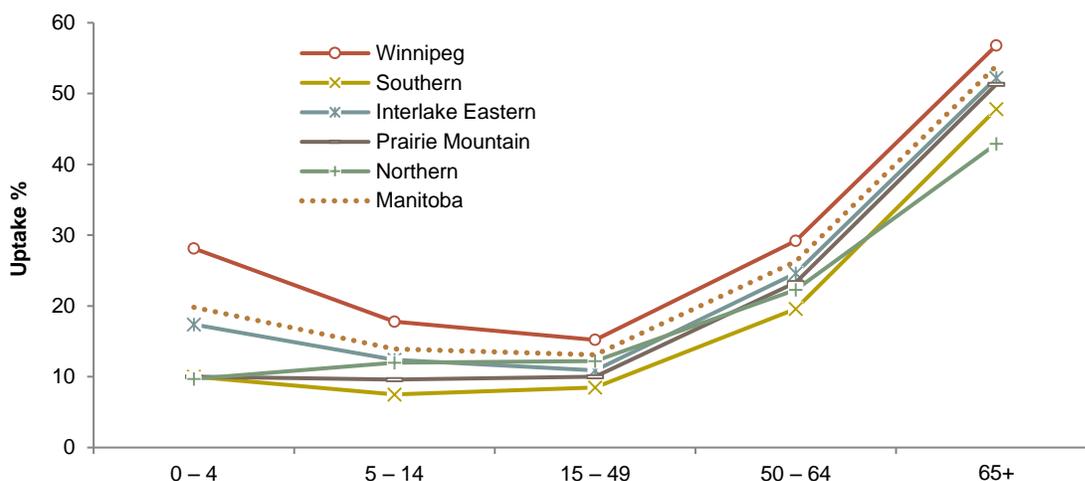
Age	Winnipeg	Southern	Interlake-Eastern	Prairie Mountain	Northern	Manitoba
0 – 4	28.1	10.0	17.4	10.0	9.7	19.8
5 – 14	17.8	7.5	12.4	9.6	12.0	13.9
15 – 49	15.2	8.5	10.9	10.0	12.2	13.1
50 – 64	29.2	19.6	24.6	23.3	22.3	26.3
65+	56.8	47.8	52.2	51.3	42.9	53.9
<b>Total</b>	<b>25.3</b>	<b>15.6</b>	<b>22.0</b>	<b>20.1</b>	<b>15.6</b>	<b>22.3</b>

*Note. Immunization uptake on the date of March 31, 2017.*

Regional variance continued to be observed in immunization uptake. Winnipeg Regional Health Authority had the highest uptake, 25.3%. In contrast, Southern Health-Santé Sud and Northern Health Region had the same and lowest uptake, 15.6%. This regional variance was

not even across age groups (Figure 16). In some age groups, the variance was more prominent. In young children below the age of five years, the uptake in Winnipeg Regional Health Authority (28.1%) was almost three times the uptake in Northern Health Region (9.7%), Southern Health-Santé Sud (10.0%), and Prairie Mountain Health (10.0%).

In Northern Health Region, the uptake in the age group of 5–49 was similar to the provincial average. However, the uptake in young children aged below five, and seniors aged 65 and older, was the lowest among all regions.



**Figure 16 Influenza immunization uptake rate (%) by RHA and age group, Manitoba, 2016–2017**

### ***Immunization Providers***

Immunization providers in this report were categorized by the organizations or programs that the providers belonged to when delivering immunizations. More information pertaining to the provider and the regional program the provider worked for was captured if an immunization record was entered directly into Panorama as opposed to being transmitted from other systems. For this report, providers were categorized as:

- Physician,
- Pharmacist,
- RHA–Public health,
- RHA–Occupational,
- RHA–Long term care (LTC),

- RHA–Other programs,
- Other providers including private physicians and correction facilities,
- Unknown providers due to missing values.

In 2016–2017, physicians, pharmacists, and various RHA programs delivered 96.5% of all influenza immunizations. More specifically, physicians, pharmacists and public health nurses were the most common service providers by delivering 40.9%, 25.4% and 21.3% of all influenza immunizations respectively (Table 5). Compared with 2015–2016, physicians administered 8,377 more immunizations in 2016–2017. In their third year eligible to administer the seasonal influenza vaccines to clients over the age of seven years, pharmacists became the second most common service providers. They delivered 78,885 immunizations, an increase of 19,970 immunizations from the previous season. In contrast, this season, public health nurses administered 9,219 fewer influenza immunizations.

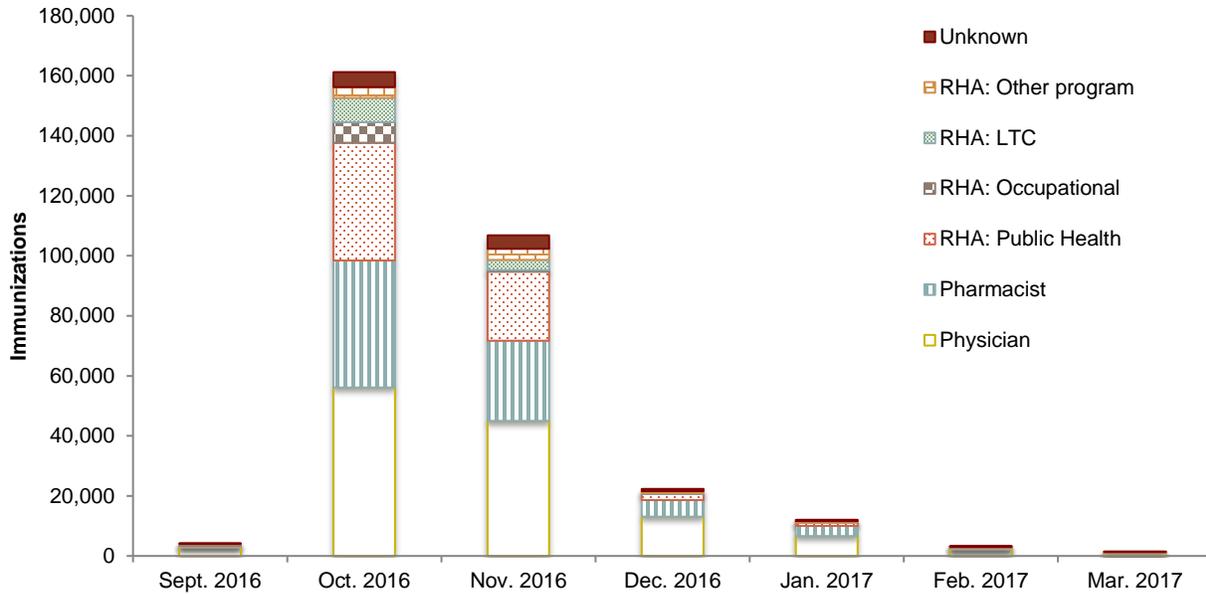
**Table 5 Influenza immunizations by client age and provider type, Manitoba, 2016–2017**

Age	Public Health	Physician	Pharmacist	Occupational	LTC	Other Programs	Unknown	Total
<b>0-4</b>	19.3%	72.0%	0.2%	0.01%	0.0%	4.9%	3.5%	22,342
<b>5-14</b>	29.5%	48.5%	15.4%	0.1%	0.1%	3.6%	2.8%	23,444
<b>15-49</b>	18.8%	37.2%	27.3%	5.3%	3.1%	2.9%	5.4%	84,566
<b>50-64</b>	19.2%	37.1%	30.5%	3.8%	3.2%	2.5%	3.8%	70,245
<b>65+</b>	23.1%	38.2%	27.8%	0.5%	6.2%	2.1%	2.0%	110,526
<b>Total</b>	<b>66,130</b> 21.3%	<b>127,195</b> 40.9%	<b>78,885</b> 25.4%	<b>7,783</b> 2.5%	<b>11,851</b> 3.8%	<b>8,438</b> 2.7%	<b>10841</b> 3.5%	<b>311,123</b>

*Note. As per The Manitoba Pharmaceutical Act and Regulations, pharmacists are authorized to administer seasonal influenza immunizations to people 7 years of age and older.*

The immunization season began in September 2016, and up until March 2017, a small number of immunizations continued to be provided, but the majority of immunizations (86%) were delivered in October and November 2016, before the seasonal activity became apparent (Figure 17). Three RHA programs including Public Health, Occupational Health, and LTC facilities delivered 94%–97% of their influenza immunization service in October

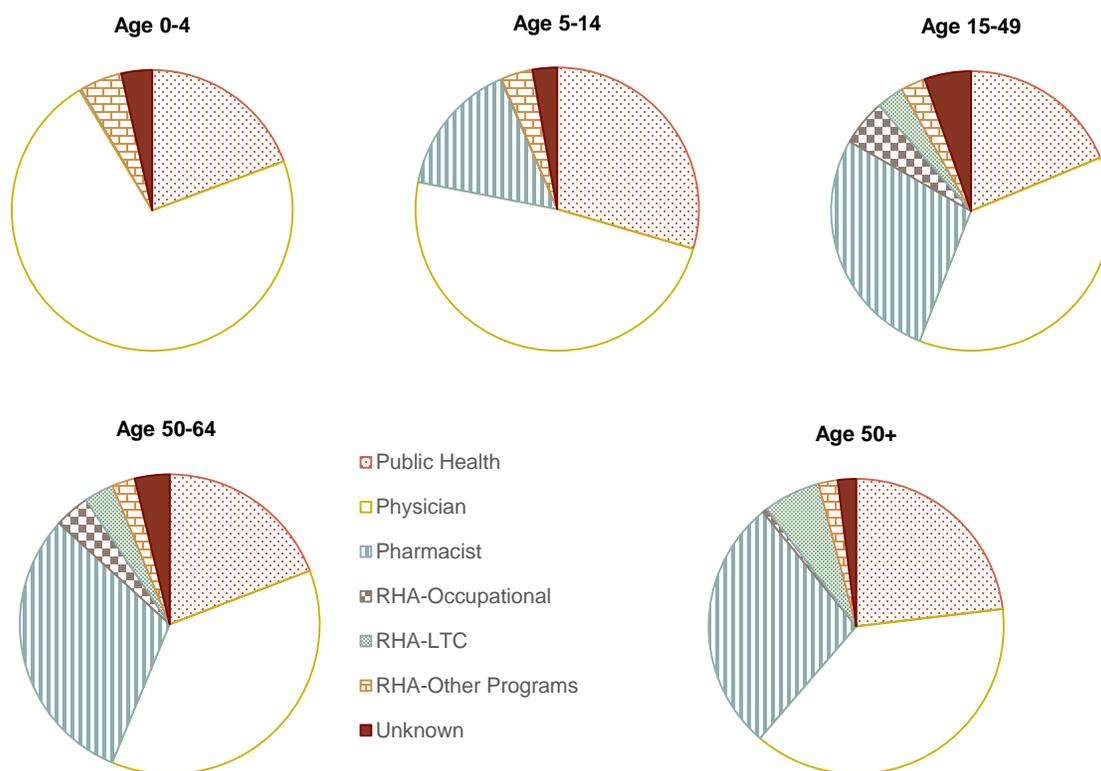
and November 2016. Physicians also delivered close to 80% of their influenza immunization service in those two months.



**Figure 17 Influenza immunizations by provider type and month of service, Manitoba, 2016–2017**

Each type of immunization provider appears to focus their service in different age groups. Physicians were the most common service provider for all age groups, especially for young children. Of the total immunizations, 72% in the age group of 0–4 and almost 50% in the age group of 5–14 were delivered by physicians. As the second most common immunization provider in 2016–2017, pharmacists delivered more immunizations than public health nurses. In the age group older than 14 years (Figure 18).

There was an increase of 5,233 immunizations by unknown providers compared with 2015–2016, indicating an increased amount of incomplete data entries.



**Figure 18 Influenza immunizations by provider type and client age group, Manitoba, 2016–2017**

***Adverse Events Following Immunization (AEFI)***

Per *The Food and Drugs Act* and Regulations, vaccine manufacturers are required to report to PHAC all serious AEFI reports with vaccines for which they are the Market Authorization Holder, within 15 days of knowledge of their occurrence. No other legal requirement for reporting AEFI exists nationally.

In Manitoba, an AEFI is reportable under *The Public Health Act* as prescribed in the Immunization Regulation (C.C.S.M. c.P210) if it is temporally associated with an immunizing agent, cannot be attributed to a co-existing condition, and if it meets at least one of the following criteria:

- a. The event is serious in nature:
  - Life-threatening,
  - Could result in permanent disability,

- Requires hospitalization or urgent medical attention,
  - Or for any other reason considered to be of a serious nature.
- b. The event is unusual or unexpected, including but without limitation:
- An event not previously identified,
  - An event previously identified but with an increased frequency.
- c. At the time of the report, the event cannot be explained by anything in the patient's medical history, such as a recent disease or illness, or the taking of medication.

Health care professionals who become aware of reportable AEFIs are required to report an event within seven days by creating an AEFI report in Panorama or completing the [AEFI form](#) and submitting to their regional MOHs. Data for this report were extracted from Panorama.

A total of 37 influenza immunizations between October 7, 2016 and January 7, 2017 were associated with 45 AEFIs in Manitoba. A few cases experienced more than one adverse events. Overall, the incidence rate for having AEFI was 11.9 cases per 100,000 immunizations. Clients at higher risk for AEFI were children under the age of fifteen years (Table 6).

**Table 6 Adverse events following influenza immunization by age group, Manitoba, 2016–2017**

Age group	Cases	Rate (/100, 000)
0–4	7	31.3
5–14	6	25.6
15–49	7	8.3
50–64	11	15.7
65+	6	5.4
<b>Total</b>	<b>37</b>	<b>11.9</b>

The majority of those adverse events (Table 7) were local reactions (48.9%), followed by allergic or allergic-like reactions (31.1%).

**Table 7 Adverse events following influenza immunization by event type, Manitoba, 2016–2017**

	Events	% of 37 cases
Allergic or allergic-like event	14	31.1%
Local reaction	22	48.9%
Neurologic event	1	2.2%
Other defined event of interest	8	17.8%
<b>Total events</b>	<b>45</b>	

Overall, AEFIs in 2016–2017 were not serious. The majority of cases required only low-level care or no care. Only six cases were treated in emergency rooms and none were hospitalized (Table 8).

**Table 8 Adverse events following influenza immunization by level of care, Manitoba, 2016–2017**

	Care required	Cases	%
	None	15	40.5%
	Non-urgent visit	11	29.7%
	Telephone advice from health professional	2	5.4%
	Emergency visit	6	16.2%
	Hospitalization	0	0.0%
	Prolongation of existing hospitalization	0	0.0%
	Unknown	3	8.1%
	<b>Total cases</b>	<b>37</b>	

At the time of reporting, there were no deaths associated with AEFIs and 16 cases had fully recovered (Table 9).

**Table 9 Adverse events following influenza immunization by outcome, Manitoba, 2016–2017**

Outcome	Cases	%
Fully recovered	16	43.2%
Not yet recovered	14	37.8%
Permanent disability	0	0.0%
Death	0	0.0%
Unknown	7	18.9%
<b>Total cases</b>	<b>37</b>	

## Strain Characterization and Antiviral Resistance

The Influenza and Respiratory Viruses Section (IRVS) at NML performs enhanced surveillance, investigations and research on influenza and other respiratory pathogens, in close partnership with provincial public health laboratories. As a routine practice, IRVS at NML antigenically characterizes influenza viruses received from Canadian provincial laboratories. Routine testing for antiviral resistance is also performed at NML. Aggregate results of strain characterization and antiviral resistance are shared with Canadian provinces and territories on a weekly basis. In Manitoba, a selected sample of influenza isolates retrieved by culture is referred from CPL to NML for strain characterization and antiviral resistance testing.

Similar to elsewhere in Canada, the 2016–2017 season in Manitoba was predominated by the A/Hong Kong/4801/2014(H3N2)-like strain, the influenza A(H3N2) component in the 2016–2017 Northern Hemisphere influenza vaccine (Table 10). Influenza viruses of the B/Yamagata lineage predominating the influenza B detections were characterized as B/Phuket/3073/2013-like, one of the influenza B components in the quadrivalent vaccine.

NML also performed genetic characterization to 1,229 influenza A(H3N2) viruses that did not grow to sufficient hemagglutination titers for antigenic characterization by hemagglutination inhibition (HI) assays. Sequence analysis of the hemagglutinin (HA) gene of these viruses showed that 1,228 influenza A(H3N2) viruses belonged to a genetic group in which most viruses were antigenically related to A/Hong Kong/4801/2014. Of those viruses, 49 were from Manitoba.

**Table 10 Strain characterization of influenza isolates, Manitoba and Canada, 2016–2017**

Influenza Strain	Canada	Manitoba
<b>A/Hong Kong/4801/2014(H3N2)-like</b>	390	12
<b>A/California/7/2009(H1N1)-like</b>	56	1
<b>B/Phuket/3073/2013-like</b>	456	24
<b>B/Brisbane/60/2008-like</b>	114	5

*Note. Reports between September 1, 2016 and June 29, 2017*

Between September 1, 2016 and June 29, 2017, NML reported that all influenza isolates submitted from Manitoba were sensitive to Oseltamivir and Zanamivir. Nationally, two influenza A(H3N2) isolates and one influenza B isolate demonstrated resistance to Oseltamivir (Tables 11). In comparison, all viruses tested in Canada were resistant to Amantadine.

**Table 11 Antiviral resistance of influenza isolates, Manitoba and Canada, 2016–2017**

Virus	Zanamivir		Oseltamivir		Amantadine	
	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive
<b>Manitoba</b>						
<b>A(H3N2)</b>	0	35	0	37	14	0
<b>A(H1N1)</b>	0	1	0	1	1	0
<b>B</b>	0	29	0	29	N/A	N/A
<b>Canada</b>						
<b>A(H3N2)</b>	0	755	2	754	217	0
<b>A(H1N1)</b>	0	49	0	49	50	0
<b>B</b>	0	418	1	416	N/A	N/A

*Note. Reports between September 1, 2016 and June 29, 2017*

## Discussion

Overall, the 2016–2017 season demonstrated lower activity and was less severe compared with the three previous influenza seasons. There were fewer laboratory confirmed influenza cases and fewer cases were severely ill. Influenza A(H3N2) was the predominating virus in 2016–2017. There were higher rates of illness in older populations than in younger populations in 2016–2017.

The majority of influenza viruses characterized this season were antigenically similar to the reference viruses representing the recommended components for the 2016–2017 Northern Hemisphere quadrivalent influenza vaccine. As a result, the vaccine effectiveness, though lower than in 2015–2016, an influenza A(H1N1)-predominant season, was higher than in 2014–2015, the last influenza A(H3N2)-predominant season when there was a mismatch between the circulating strains and the composition of the vaccine. In 2016–2017, the mid-season estimate of vaccine effectiveness against medically attended and laboratory-confirmed influenza infection in Canada was 42% (95% ICs: 18–59%)[1]. In the United States, between November 28, 2016 and April 14, 2017, the influenza vaccination this season reduced the overall risk for influenza-associated medical visits by 42% (95% CIs: 35%–48%)[2].

The population coverage of influenza immunizations has been relatively stable over the past several seasons including 2016–2017, lying between 20% and 23%. Regional variance continued to be present in 2016–2017, especially in certain age groups. In young children 0–4 years of age, the coverage rate in Winnipeg Regional Health Authority was almost three times the coverage rate in Northern Health Region, Prairie Mountain Health, and Southern Health-Santé Sud. Of course, the large amount of vaccine doses shipped to service providers or facilities but not captured in the immunization registry need to be addressed before a more concrete conclusion could be made.

This annual influenza report aims to summarize the season in its broad trends while being cautious about alternative explanations to changes in data. There are a number of challenges in influenza surveillance. First, influenza surveillance is inherently biased towards more severe outcomes. The real burden of influenza is likely underestimated because not all individuals experiencing symptoms will seek medical attention and not all symptomatic patients will be tested for influenza. As such, a set of indicators monitoring different severity levels of illness were selected for surveillance. Second, surveillance data

can be affected by multiple factors, such as public awareness, laboratory technique, test ordering pattern, circulating strains, vaccine formulation, and staff or behaviour change, etc. The change in data caused by those factors may or may not represent a real change in seasonal activity.

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1. Skowronski, D.M., et al., *Interim estimates of 2016/17 vaccine effectiveness against influenza A(H3N2), Canada, January 2017*. Euro Surveill, 2017. **22**(6).
2. Blanton, L., et al., *Update: Influenza Activity in the United States During the 2016-17 Season and Composition of the 2017-18 Influenza Vaccine*. MMWR Morb Mortal Wkly Rep, 2017. **66**(25): p. 668-676.

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