Influenza surveillance is conducted year-round in BC, with renewed annual monitoring typically commencing the first week of October (week 40) and ongoing through the end of September (week 39). This report summarizes surveillance data for the 2017-18 influenza season, spanning week 40 (starting October 1, 2017) through week 17 (ending April 28, 2018).

Influenza surveillance in BC consists of monitoring major trends in influenza activity and circulating viruses to inform prevention and control programs, including vaccine effectiveness. Surveillance indicators for influenza and influenza-like illness (ILI) monitoring include: (1) sentinel practitioner ILI reporting; (2) Medical Service Plan (MSP) visits with a clinical diagnosis of influenza illness; (3) facility and school outbreak notifications; (4) provincial influenza laboratory diagnosis by the BCCDC Public Health Laboratory (PHL) and BC Children’s and Women’s Health Centre Laboratory; and (5) strain characterization and antiviral resistance testing by the National Microbiology Laboratory (NML) at the Public Health Agency of Canada.

Since 2004, the BCCDC has led a national surveillance initiative to monitor annual vaccine effectiveness (VE) against medically attended, laboratory-confirmed influenza, using a test-negative case-control design overlaid upon the national Sentinel Practitioner Surveillance Network (SPSN), with additional phenotypic and genetic characterization of circulating viruses to inform VE analysis and interpretation.

Detailed surveillance bulletins are issued throughout the season, distributed weekly during the influenza season and periodically during inter-seasonal months, and are available from:


SUMMARY

The 2017-18 influenza season in BC was characterized by prolonged co-circulation of influenza A(H3N2) and B(Yamagata), the latter contributing earlier than typically expected for influenza B; by low vaccine effectiveness against the dominant A(H3N2) strain but cross-lineage protection against the dominant influenza B strain; and by a high number of long term care facility outbreaks due to both influenza A and B. Influenza activity remained at elevated levels for an extended period of time this season compared to recent seasons. During periods of peak activity, most surveillance indicators were above historical averages compared to prior recent seasons. At the BCCDC Public Health Laboratory (PHL), influenza positivity exceeded 40% during a 4-week period from weeks 52-3, with approximately equal contribution of influenza A(H3N2) and B viruses during this peak period and throughout the season. Compared to prior recent seasons, influenza B activity began earlier and made greater contributions to the overall seasonal influenza epidemic. Community influenza-like illness (ILI) activity during the 2017-18 season increased beginning around late December (weeks 50-52), peaked in January (weeks 1-3) and thereafter gradually declined with elevated levels continuing into March. Cumulatively from week 40 to week 17, 182 influenza outbreaks in long-term care facility (LTCF) were reported. This is the second highest number of reported LTCF outbreaks for the same period of the past 15 seasons (since the 2003-04 season), exceeded only by the 2016-17 A(H3N2)-dominant season (n=198). Elderly adults ≥65 years old were disproportionately represented among influenza detections during the 2017-18 season, related in part to the co-dominant A(H3N2) and B activity and high number of LTCF outbreaks, although younger age groups were also affected. Adults 20-64 years old and children aged 1-19 years old comprised a larger proportion of influenza A(H1N1)pdm09 detections. In mid-season analysis from the BCCDC-led national Sentinel Practitioner Surveillance Network (SPSN), interim estimates of vaccine effectiveness (VE) against A(H3N2) were low at 17% (95% confidence interval (CI): -14-40%); higher adjusted VE was observed for influenza B at 55% (95%CI: 38 to 68%), despite prominent use of lineage-mismatched B(Victoria) trivalent vaccine in most regions.

1. Sentinel physician reporting of ILI

During the 2017-18 season (week 40 to week 17), 27 active sentinel sites (with one or more contributing practitioners at each site) representing all regional health authorities in BC contributed to sentinel ILI surveillance. On average, 87% of sites reported data each week with some expected variation in timeliness and completeness, such as during holiday periods. The proportion of patient visits due to ILI seen by these sentinel sites was significantly above the 10-year historical average during multiple weeks of the season, including during periods of peak activity in weeks 1-3 and 9-11 (Figure 23.1).
2. MSP visits with an influenza diagnosis

BC MSP general practitioner service claims with a clinical diagnosis of influenza illness (II) (ICD-9 code 487), as a proportion of all submitted MSP claims, increased sharply beginning in week 51, peaked in weeks 1-3 and, thereafter, gradually declined (Figure 23.2). Overall, provincial MSP rates exceeded expected seasonal values during the peak period and remained elevated for a prolonged period compared to historical data for the past 10 years. Some expected regional variation in the timing and intensity of II activity was observed across health authorities, notably in IHA where a sharper peak was observed exceeding 10-year maximums and VIHA where rates plateaued following a sharp increase but remained at median levels.

3. Facility outbreak notifications

Residential facilities, such as long-term care facilities (LTCFs), are asked to notify their local health unit when 2 or more cases of ILI occur within their setting within a 7-day period. Influenza outbreaks are defined as ILI outbreaks with at least one specimen laboratory-confirmed as influenza. Schools are asked to report when absenteeism, mostly likely due to ILI, is greater than 10% on any one day; school ILI outbreaks are generally reported without laboratory confirmation. Provincial reporting of ILI outbreaks to BCCDC is at the discretion of the local Medical Health Officer/health authority and varies regionally, with less consistent reporting for school ILI outbreaks and facility outbreaks where non-influenza respiratory viruses were detected. Provincial reports of ILI outbreaks are not generally audited to verify that patients met specific clinical criteria.

During the 2017-18 season (week 40 to week 17), 195 laboratory-confirmed influenza outbreaks in healthcare facilities were reported to BCCDC, including 182 from LTCFs, and 13 from acute care facilities. Of the 182 LTCF outbreaks reported, 62 had influenza A detected, 107 had influenza B detected, and 13 outbreaks had co-detection of both influenza A and B (Figure 23.3). Of the 38 out of 62 influenza A outbreaks where subtype information was available, 37 (97%) were influenza A(H3N2); only one outbreak with A(H1N1)pdm09 detected was reported this season. Of the 13 outbreaks with both influenza types detected, five included A(H3N2) and B and 8 included influenza A with subtype unavailable and influenza B. Two additional LTCF outbreaks [one A(H3N2) and one influenza B] had onset in week 38 (i.e., outside of the 2017-18 surveillance period) and are not shown in Figure 23.3.

The cumulative tally of LTCF outbreaks for the 2017-18 season (n=182) is the second highest for the same period of the past 15 seasons (since the 2003-04 season) (Figure 23.4). Unlike the influenza A(H3N2) and B codominant 2017-18 season, the 2014-15 and 2016-17 seasons had a comparable number of LTCF outbreaks but were associated mostly with influenza A(H3N2). Notably more outbreaks due to influenza B were reported this season. Ecologically, no discernable relationship was observed between resident or staff influenza vaccine coverage and the number of outbreaks reported in a given season.

In addition to facility outbreak reports, 31 ILI outbreaks without etiologic agent identified were reported from schools during the 2017-18 influenza season (week 40 to week 17). One additional school ILI outbreak was reported in week 19.

4. Laboratory diagnosis

a. BCCDC Public Health Laboratory

The BCCDC Public Health Laboratory (PHL) routinely conducts testing for influenza and other respiratory viruses on specimens collected from inpatients at pediatric and acute care hospitals, residents of healthcare facilities associated with outbreaks, and patients presenting to community-based sentinel sites or where otherwise clinically indicated or specifically requested. This includes specimens diagnosed with influenza A at other hospital/regional laboratories that are submitted to BCCDC PHL for influenza A subtyping. All submitted specimens are routinely tested for influenza A and B and respiratory syncytial virus (RSV), while testing for other respiratory viruses is conducted less systematically and only on a subset of influenza and RSV negative specimens.

During the 2017-18 season (week 40 to week 17), the BCCDC PHL tested 11,691 patients for respiratory viruses. Of these, 3,763 (32%) were positive for influenza, including 1,884 (50%) patients with influenza A [1,351 A(H3N2), 464 A(H1N1)pdm09, and 69 influenza A subtype unknown], 1,860 (49%) with influenza B, and 19 (1%) patients who had both influenza A [15 A(H3N2), 3 A(H1N1)pdm09, 1 influenza A subtype unknown] and B detected during the season.

Overall, the 2017-18 season was characterized by approximately equal co-circulation of influenza A(H3N2) and B(Yamagata). Influenza positivity at the
BCCDC PHL began to increase in week 45, peaking around weeks 52-3 when positivity rates exceeded 40% (Figure 23.5). Influenza B viruses comprised an approximately equal proportion of influenza detections during this peak period and exceeded influenza A detections in most weeks thereafter. Influenza B activity began earlier and remained elevated throughout the season as compared to recent seasons, which were more typically characterized by late-season influenza B detections.

Elderly adults ≥65 years old were disproportionately represented among influenza detections during the 2017-18 season, related in part to the co-dominant A(H3N2) and B activity and high number of LTCF outbreaks, although younger age groups were also affected (Figure 23.6 and 23.7). Adults 20-64 years old and children aged 1-19 years old comprised a larger proportion of the lesser influenza A(H1N1)pdm09 detections.

Among other respiratory viruses, RSV co-circulated at low levels with influenza viruses, with RSV positivity peaking at 9% in mid-February (week 7). Enteroviruses were detected throughout the season, most notably at the beginning of the season (weeks 40-46) before influenza activity began to increase. Human metapneumovirus (HMPV) positivity became elevated beginning in week 9 and peaked in week 17. For the period spanning week 40 to week 17, the 2017-18 season had the highest absolute number of HMPV detections compared to the same period of any other season since 2006-07, and the highest proportionate positivity compared to any other season since 2015-16.

b. BC Children's and Women's Health Centre Laboratory

During the 2017-18 season (week 40 to week 17), the BC Children's and Women's Health Centre Laboratory conducted 2,261 tests for influenza A and B. Of these, 136 (6%) were positive for influenza A and 116 (5%) were positive for influenza B. Influenza activity fluctuated around 10-20% from weeks 52-12, with co-circulation of influenza A and B throughout the season (Figure 23.8).

RSV was the dominant respiratory virus detected at the BC Children's and Women's Health Centre Laboratory during the 2017-18 season with 371 out of 2,254 (16%) tests positive cumulatively during the season. RSV positivity ranged from 12-30% from weeks 52-12.

c. Strain characterization by the National Microbiology Laboratory

Select influenza isolates are routinely sent by the BCCDC PHL to the National Microbiology Laboratory (NML) for strain characterization by haemagglutination inhibition (HI) assay. Recognizing that only a small proportion of dominant A(H3N2) viruses could be successfully characterized antigenically, BC contributed a smaller number of viruses for HI characterization this season compared to previously. We have thus summarized HI characterization findings based on viruses submitted to the NML from all provinces which, for the period September 1, 2017 to April 26, 2018, included 3,317 influenza viruses from Canadian laboratories.

Of the 1,420 influenza A(H3N2) viruses, only 369 (26%) had sufficient haemagglutination titre for antigenic characterization by HI assay. Of the 369 viruses characterized by HI assay, 287 (78%) were considered antigenically similar to a cell culture-propagated A/Hong Kong/4801/2014-like virus while 82 (22%) viruses (all belonging to genetic clade 3C.3a) showed reduced titre with ferret antisera raised against cell culture-propagated A/Hong Kong/4801/2014. Of the 359 of 369 viruses that were antigenically characterized with available sequencing information, 251 (70%) belonged to genetic clade 3C.2a, 26 (7.2%) belonged to subclade 3C.2a1 and 82 (23%) belonged to clade 3C.3a. Of the 1,051 viruses genetically characterized, 942 (90%) were reported to belong to genetic clade 3C.2a, which includes the A/Hong Kong/4801/2014 vaccine strain, while 107 (10%) belonged to subclade 3C.2a1 and 2 belonged to clade 3C.3a.

All of the 247 A(H1N1)pdm09 viruses characterized were antigenically similar to an A/Michigan/45/2015-like virus.

Of the 1,650 influenza B viruses characterized, 69 (4%) belonged to the B(Victoria) lineage and 1,581 (96%) belonged to the B(Yamagata) lineage. Among the 69 B(Victoria) viruses, 20 (29%) were characterized as antigenically similar to a B/Brisbane/60/2008(Victoria)-like virus while 49 (71%) viruses showed reduced titre with ferret antisera produced against cell-propagated B/Brisbane/60/2008. Sequence analysis showed that 48 of the viruses that showed reduced titre had a two-amino acid deletion in the hemagglutinin (HA) gene; sequence is pending for the remaining 1 isolate. Among the 1,581 B(Yamagata) viruses, all were antigenically similar to a B/Phuket/3073/2013(Yamagata lineage)-like virus.

For context, the WHO-recommended components for the 2017-18 and upcoming 2018-19 northern hemi-
sphere trivalent (TIV) and quadrivalent (QIV) vaccines are listed below:

<table>
<thead>
<tr>
<th>2017-18*</th>
<th>2018-19**</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/Michigan/45/2015 (H1N1)pdm09-like virus†</td>
<td>A/Michigan/45/2015 (H1N1) pdm09-like virus</td>
</tr>
<tr>
<td>A/Hong Kong/4801/2014(H3N2)-like virus</td>
<td>A/Singapore/INFIMH-16-0019/2016 (H3N2)-like virus‡</td>
</tr>
<tr>
<td>B/Brisbane/60/2008 (Victoria)-like virus</td>
<td>B/Colorado/06/2017 (Victoria)-like virus§</td>
</tr>
<tr>
<td>B/Phuket/3073/2013 (Yamagata)-like virus (QIV only)</td>
<td>B/Phuket/3073/2013 (Yamagata)-like virus (QIV only)</td>
</tr>
</tbody>
</table>

* These recommended strains represent a change for one of the three components used for the 2016-17 northern hemisphere vaccine.
† Recommended strain represents a change from an A/California7/2009-like virus, which had been retained as the A(H1N1)pdm09 component since the 2009 pandemic, to an A/Michigan/45/2015-like virus belonging to the phylogenetic subclade 6B.1.
** Recommended strains represent a change for two of the four components used for the 2017-18 northern hemisphere vaccines.
‡ Recommended strain for the A(H3N2) component represents a phylogenetic clade-level change from a clade 3C.2a virus to a clade 3C.2a1 virus.
§ Recommended strain for the influenza B component represents a change for the B(Victoria)-lineage component compared to the 2017-18 northern hemisphere and 2018 southern hemisphere vaccines from a B/Brisbane/60/2008-like virus, which had been retained since the 2009-10 season, to a B/Colorado/06/2017-like virus, belonging to the clade 1A antigenic drift variant with a two-amino acid deletion at positions 162-163.

5. Sentinel influenza vaccine effectiveness (VE) monitoring

Interim estimates of 2017-18 vaccine effectiveness (VE) against medically attended, laboratory-confirmed influenza A(H3N2) and influenza B illness were derived in February 2018. Respiratory specimens and epidemiological information were collected from patients presenting with ILI to sentinel sites participating in the BCCDC-led Canadian Sentinel Practitioner Surveillance Network (SPSN) in British Columbia, Alberta, Ontario and Quebec.

Adjusted VE against A(H3N2), driven by a single genetic subgroup of clade 3C.2a (called 3C.2a2), was low at 17% (95% confidence interval (CI): -14-40%). Higher adjusted VE was observed for influenza B at 55% (95%CI: 38 to 68%), despite prominent use of lineage-mismatched B(Victoria) trivalent vaccine (but with some variation by province) whereas B(Yamagata) viruses comprised the vast majority of circulating strains. These findings are similar to the US CDC’s mid-season analysis which observed an A(H3N2) VE estimate of 25% (95%CI: 13-36%) and an influenza B VE estimate of 42% (95% CI: 25-56%), despite prominent use of quadrivalent vaccine containing both influenza B lineages. However, differences in study settings and populations should be taken into account when comparing across study findings. Overall, the A(H3N2) VE estimate is lower than expected generally for A(H3N2) vaccines (~30%) but higher than in the 2014-15 A(H3N2)-dominant season where no vaccine protection was found.

As in the past several years, these findings were submitted to the WHO in February 2018 to inform
their selection of the vaccine components for the 2018-19 northern hemisphere influenza vaccine. VE estimates for other types, subtypes and variants will also be explored in end-of-season analyses.

Mid-season findings by the Canadian SPSN were published in EuroSurveillance, an open-access peer-reviewed journal, on February 1, 2018: http://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2018.23.5.18-00035. Mid-season findings by the US Flu VE network were published in MMWR on February 16, 2018: https://www.cdc.gov/mmwr/volumes/67/wr/mm6706a2.htm?s_cid=mm6706a2_e.
23.1 Percent of Patient Visits to Sentinel Practitioners Due to Influenza-Like Illness (ILI) per Week Compared to Historical 10-Season Average, British Columbia, 2017-18 Season

Surveillance period includes week 40 (starting October 1, 2017) to week 17 (ending April 28, 2018), inclusive. Ten-year historical average includes 2005-06 to 2016-17 seasons, excluding 2008-09 and 2009-10 seasons due to atypical seasonality.

23.2 BC MSP General Practitioner Service Claims for Influenza Illness (II) as a Proportion of All Submitted Service Claims (7-day Moving Average), British Columbia, 2017-18 Season

Influenza illness is tracked as the percent of all submitted MSP service claims for selected general practitioner services with a diagnosis of influenza (ICD-9 code 487). Data are provided by Population Health Surveillance and Epidemiology, BC Ministry of Health Services. Data for the period August 1, 2009 to July 31, 2010 have been excluded from the 10-year median calculation due to atypical seasonality during the 2009-10 H1N1 pandemic year. MSP week beginning August 1, 2017 corresponds to sentinel ILI week 31; data are current to June 4, 2018.
23.3 Number of Lab-Confirmed Influenza Outbreaks in Long-term Care Facilities (LTCF) Reported to BCCDC per Week, British Columbia, 2017-18 Season

LTCF influenza outbreaks are defined as 2 or more cases of ILI within 7-day period, with at least one specimen laboratory-confirmed as influenza.

23.4 Number of Laboratory-Confirmed Influenza Outbreaks in Long-Term Care Facilities (LTCF) reported to BCCDC per Season, British Columbia, 2003-04 - 2017-18 Season

The 2014-15 season’s outbreak tally includes one laboratory-confirmed influenza outbreak reported in an assisted living facility. Influenza vaccination coverage among care facility residents and staff adapted from: http://www.bccdc.ca/health-info/immunization-vaccines/immunization-coverage. Vaccine coverage estimates for 2017-18 have not yet been posted. Historic outbreak tallies are from the BC Annual Summary of Reportable Diseases: http://www.bccdc.ca/resource-gallery/Documents/Statistics%20and%20Research/Statistics%20and%20Reports/Epid/Annual%20Reports/2016CDAnnualReportFinal.pdf. Tallies for 2017-18 are preliminary and may be adjusted with final data reconciliation. Influenza outbreaks are defined according to the national FluWatch case definition of two or more cases of influenza-like illness within a 7 day period including at least one laboratory-confirmed case: https://www.canada.ca/en/public-health/services/diseases/flu-influenza/influenza-surveillance/influenza-definitions.html#b.
23.5 Influenza and Other Respiratory Virus Detections Among Respiratory Specimens Submitted to the BCCDC Public Health Laboratory, British Columbia, 2017-18 Season

Data are current to June 5, 2018.

23.6 Cumulative number of influenza detections by type/subtype and age group, BCCDC Public Health Laboratory, 2017-18 season

Data are current to June 5, 2018; figure includes cumulative influenza detections for specimens collected from weeks 40-17.
23.7 Age Distribution of Influenza Detections by Type/Subtype, BCCDC Public Laboratory, 2017-18 Season

Data are current to June 5, 2018; figure includes cumulative influenza detections for specimens collected from weeks 40-17.
23.8 Influenza and Other Respiratory Virus Detections Among Respiratory Specimens Submitted to the BC Children’s and Women’s Health Centre Laboratory, British Columbia, 2017-18 Season

Positive rates were calculated using aggregate data. The denominators for each rate represent the total number of tests; multiple tests may be performed for a single specimen and/or patient.