



National Influenza Annual Report, Canada, 2021–2022: A brief, late influenza epidemic

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Abstract

Canadian seasonal influenza circulation had been suppressed since the beginning of the coronavirus disease 2019 (COVID-19) pandemic. This suppression was reported globally and generated concern that the return of community influenza circulation could be intense and that co-circulation of influenza and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was possible and potentially severe. Community circulation of influenza returned to Canada during the 2021–2022 influenza season. The influenza epidemic began in week 16 (mid-April 2022) and lasted only nine weeks. This epidemic was driven by influenza A(H3N2) and was exceptionally late in the season, low in intensity and short in length. Community co-circulation of influenza and SARS-CoV-2 was observed in Canada for the first time during the 2021–2022 seasonal influenza epidemic. The unusual characteristics of the 2021–2022 influenza epidemic suggest that a breadth of factors moderate transmission dynamics of the two viruses. Concerns of an intense seasonal influenza epidemic did not come to fruition during the 2021–2022 season; therefore, high influenza susceptibility remains, as does predisposition to larger influenza epidemics. Ongoing circulation of SARS-CoV-2 creates uncertainty about dynamics of future influenza epidemics, but influenza vaccination remains a key public health intervention available to protect Canadians. Public health authorities need to remain vigilant, maintain surveillance and continue to plan for both heightened seasonal influenza circulation and for the potential for endemic co-circulation of influenza and SARS-CoV-2.

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Introduction

In March 2020, widespread non-pharmaceutical interventions (NPIs) such as masking, border and travel measures and physical distancing were implemented in Canada and globally to curtail the spread of coronavirus disease 2019 (COVID-19). Since their implementation, typical seasonal influenza activity has been suppressed globally, and Canadian influenza activity remained at interseasonal levels through the entire 2020–2021 influenza season (1–7).

Suppression of influenza circulation raised concern that a resurgence of influenza would be observed with relaxation of NPIs (8). Natural infection or annual vaccination is required to gain immunity to seasonal influenza strains. Waning immunity, antigenic drift and a larger cohort of young children without exposure to natural infection may have increased the population susceptible to seasonal influenza. This increased susceptibility

creates a population-level predisposition to high-intensity seasonal influenza epidemics (9).

Of additional concern, influenza resurgence could coincide with continued waves of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Co-circulation of these high burden viruses would pose a threat to public health and place pressure on health systems. Public health surveillance is essential to plan for and mitigate this threat.

Seasonal influenza activity re-emerged in Canada during the 2021–2022 influenza season. This surveillance report summarizes the 2021–2022 Canadian influenza season through analysis of FluWatch core indicators.

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Methods

Design

FluWatch is a long-standing national surveillance system that monitors the spread of influenza and influenza-like illness (ILI) in Canada. FluWatch is a composite surveillance system consisting of virological surveillance, influenza and ILI activity level surveillance, syndromic surveillance, outbreak surveillance, severe outcome surveillance and vaccine monitoring. Annually, influenza

surveillance is conducted across Canada from epidemiological week 35 to week 34 of the following year. For the 2021–2022 Canadian influenza season, this surveillance period began on August 28, 2021, and ended on August 27, 2022.

Indicator definitions and data sources

FluWatch indicator definitions and data sources are summarized in **Table 1**, as is a single external SARS-CoV-2 indicator and data source that was included in analyses.

Table 1: FluWatch components, indicators, and data sources used to describe the 2021–2022 Canadian influenza season

Component	Indicator	Operational definition	Description of data source
FluWatch			
Virological	Weekly percentage of RT-PCR influenza tests positive.	Numerator: weekly number of influenza detections. Denominator: total weekly number of influenza tests reported.	Respiratory Virus Detections Surveillance System: Laboratory test counts are reported by public health laboratories from all P/Ts, and five hospital laboratories/networks. Primary surveillance target populations are acute respiratory infection cases at emergency departments, hospitalized severe acute respiratory virus infection cases, and influenza outbreak cases. Outpatient ILI cases may be targeted, but testing is typically limited to higher-risk individuals and algorithms vary by P/T. Case-level data is available for a subset of detections.
	Counts of influenza detections by age group, type, and/or subtype.	N/A	
Influenza/ILI activity levels	Weekly influenza/ILI activity level, based on activity within each influenza surveillance region over the preceding week.	Four levels of activity used for weekly classification: No activity: no laboratory-confirmed influenza detections during reporting week. Sporadic: sporadic ILI cases and influenza detections, but no outbreaks. Localized: increased ILI cases, influenza detections, and outbreaks occurring in less than 50% of the surveillance region. Widespread: increased ILI cases, influenza detections, and outbreaks occurring in 50% or more of the surveillance region.	Epidemiologists from all P/Ts report weekly influenza/ILI activity level for influenza surveillance regions.
Syndromic	Weekly percentage of patients seen by primary healthcare providers with ILI.	ILI: acute onset of respiratory illness with fever and cough and one or more of sore throat, arthralgia, myalgia or prostration. Numerator: weekly number of patients seen with ILI. Denominator: total weekly number of patients seen.	Sentinel Primary Care Provider ILI: Primary healthcare providers across Canada report on patients presenting with ILI.
	Weekly percentage of FluWatchers participants reporting ILI.	ILI: acute cough and fever. Numerator: weekly number of participants reporting ILI. Denominator: total weekly participants reporting.	FluWatchers: Volunteer participants across Canada report episodes of cough and fever experienced in the preceding week via an online questionnaire.
Outbreaks	Number of weekly laboratory-confirmed influenza outbreaks by setting.	Outbreak: two or more cases of ILI reported in the setting during a seven-day period with at least one case laboratory-confirmed as influenza.	Epidemiologists from all P/Ts report weekly. All P/Ts report outbreaks in hospitals and long-term care facilities. Some report in additional settings such as remote/isolated communities, schools/daycare, and "other" settings (includes locations such as retirement homes, assisted living, shelters and correctional facilities).



Table 1: FluWatch components, indicators, and data sources used to describe the 2021–2022 Canadian influenza season (continued)

Component	Indicator	Operational definition	Description of data source
FluWatch (continued)			
Severe outcomes	Weekly/cumulative influenza-associated hospitalization rates per 100,000 population.	Hospitalization rate: Numerator: number of influenza-associated hospitalizations. Denominator: combined population of reporting P/Ts.	Provincial/Territorial Severe Outcome Surveillance: Nine P/T Ministries of Health (AB, MB, SK, NS, NB, NL, PE, YT and NT) report laboratory-confirmed influenza-associated hospitalizations, ICU admissions and deaths.
	Counts of weekly influenza-associated hospitalizations, ICU admissions and deaths.	N/A	
	Counts of weekly influenza-associated hospitalizations, ICU admissions, and deaths among paediatric population by age group, type and/or subtype.	N/A	IMPACT: Sentinel network that reports paediatric laboratory-confirmed influenza-associated hospitalizations (16 years and younger). Detailed case-level data is reported by the network's 12 paediatric hospitals across eight P/Ts (BC, AB, SK, MB, ON, QC, NS and NL).
	Counts of weekly influenza-associated hospitalizations, ICU admissions and deaths among adult population by age group, type and/or subtype.	N/A	CIRN-SOS: Sentinel hospital network that reports adult laboratory-confirmed influenza-associated hospitalizations (16 years and older). Detailed case-level data is reported by the network's nine hospitals across four P/Ts (AB, ON, QC and NS).
Viral characterization	Counts and proportions of influenza isolates antigenically similar to the vaccine strains.	N/A	National Microbiology Laboratory: P/T public health laboratories forward a subset of influenza isolates to the National Microbiology Laboratory from cases detected throughout the season. Specimens undergo genetic characterization, antigenic characterization, and/or antiviral susceptibility testing. Genetic characterization is established by sequencing the HA gene of the influenza viruses to compare their genetic properties. Antigenic characterization is established by HA inhibition assay. Drug susceptibility is determined by chemiluminescence assay.
	Counts and proportions of influenza isolates susceptible to antivirals.	N/A	
Vaccine monitoring	Percentage of Canadian adults who received the seasonal influenza vaccine during the current influenza season.	N/A	Public Health Agency of Canada's Seasonal Influenza Immunization Coverage Survey: Annual telephone survey conducted in January and February to assess seasonal influenza vaccine coverage among adults aged 18 years and older.
	Effectiveness of seasonal influenza vaccination against laboratory-confirmed influenza-associated medically attended illness and hospitalization.	VE estimates are estimated by test negative design and calculated as: $VE = 100\% \times \left(1 - \frac{O_{pos}}{O_{neg}}\right)$ where O_{pos} is the odds of vaccination among those testing positive for influenza and O_{neg} is the odds of vaccination among those testing negative.	SPSN and CIRN-SOS: These networks calculate and report vaccine effectiveness against laboratory-confirmed influenza-associated medically attended illness and hospitalization, respectively.
External			
SARS-CoV-2 virological	Seven-day moving average percentage of SARS-CoV-2 tests positive.	Numerator: number of SARS-CoV-2 detections over the previous seven days. Denominator: total SARS-CoV-2 tests over the previous seven days.	Publicly available data from the Public Health Agency of Canada (10). SARS-CoV-2 case and testing data published by provincial and territorial partners are collated and published.

Abbreviations: AB, Alberta; BC, British Columbia; CIRN-SOS, Canadian Immunization Research Network Severe Outcome Surveillance; HA, hemagglutinin; ILI, influenza-like illness; IMPACT, Canadian Immunization Monitoring Program ACTive; ICU, intensive care unit; MB, Manitoba; N/A, not applicable; NB, New Brunswick; NL, Newfoundland and Labrador; NT, Northwest Territories; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; P/T, provinces and territories; QC, Québec; RT-PCR, reverse transcription polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; SK, Saskatchewan; SPSN, Canadian Sentinel Practitioner Surveillance Network; VE, vaccine effectiveness; YT, Yukon



Statistical analysis

Data cleaning, manipulation, and analysis of counts, rates and proportions were all performed in SAS v9.4. Visualizations of analyses were prepared in Microsoft Excel. Comparisons to pre-pandemic indicator data were presented where possible. Seasons used for comparison varied by data source, depending on stability, data quality and data comparability over time (Table 2).

Results

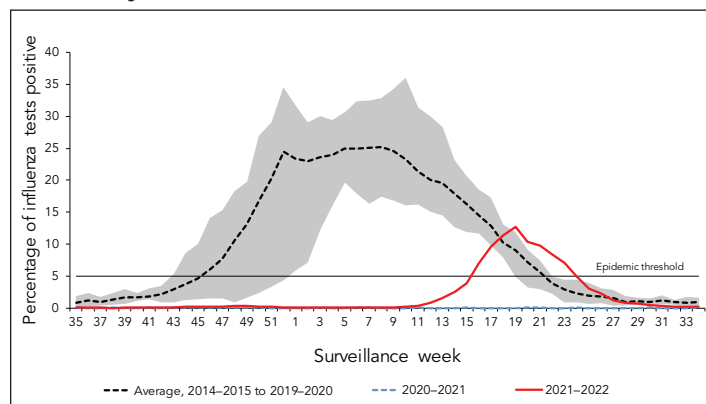
Virological

Early in the season, an increase in sporadic detections was recorded from week 48 to 51 (late-November to late-December 2021; 231 detections) but remained well below the seasonal epidemic threshold (5% or more tests positive and 15 or more detections). Detections then decreased, with fewer than 10 weekly detections reported from week 3 to 8 (late-January to late-February 2022). In week 16, influenza activity surpassed the epidemic threshold, and a national influenza epidemic was declared in Canada for the first time in two years.

The 2021–2022 seasonal influenza epidemic began exceptionally late in the season and lasted nine weeks, from week 16 to 25 (late-April to mid-June 2022; Figure 1). Nationally, in pre-pandemic seasons, epidemics have typically begun around week 47 (mid to late-November) and lasted 27 weeks on average.

During the 2021–2022 influenza season, a total of 16,126 laboratory-confirmed influenza detections were reported out of 751,900 total laboratory tests (Table 3). Considerable geographic variation was observed, as the majority of detections were recorded in Québec (47%), Alberta (17%) and British Columbia (10%). Nearly all of the detections were influenza A (99%) and the influenza A(H3N2) subtype predominated, accounting for 98% of the 5,240 subtyped influenza A specimens (Figure 2).

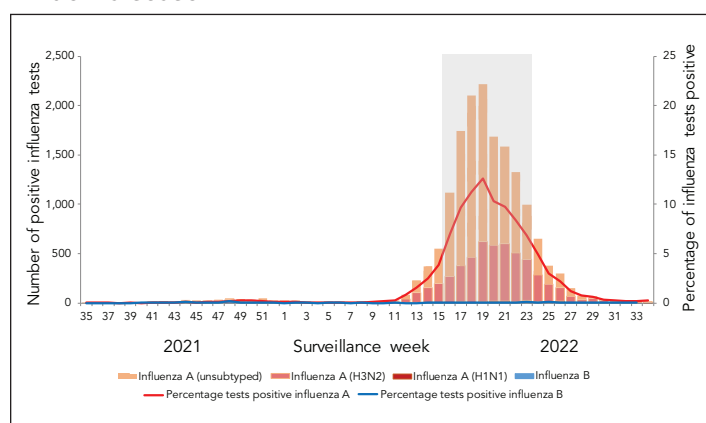
Figure 1: Percentage of influenza tests positive in Canada by surveillance week^{a,b}



^a Comparison of 2021–2022 influenza season to previous seasons, 2014–2015 to 2019–2020 and 2020–2021

^b The shaded area represents the maximum and minimum percentage of tests positive reported by week from 2014–2015 to 2019–2020. The epidemic threshold is 5% tests positive for influenza. When it is exceeded, and a minimum of 15 weekly influenza detections is reported, a seasonal influenza epidemic is declared

Figure 2: Number of positive influenza tests and percentage of tests positive in Canada, by type, subtype and surveillance week for the 2021–2022 influenza season^a



^a The shaded area indicates weeks where the positivity rate was at least 5% and a minimum of 15 positive tests were observed, representing the 2021–2022 seasonal influenza epidemic

Table 2: Summary of pre-pandemic data availability of FluWatch components for historical comparisons by influenza season

Influenza season	FluWatch component					
	Virological	Sentinel primary care provider ILI	FluWatchers	Outbreaks	P/T-SOS ^a	IMPACT
2014–2015	Yes	Yes	No	No	No	Yes
2015–2016	Yes	Yes	No	No	No	Yes
2016–2017	Yes	Yes	Yes	No	Yes	Yes
2017–2018	Yes	Yes	Yes	No	Yes	Yes
2018–2019	Yes	Yes	Yes	Yes	Yes	Yes
2019–2020 ^b	Yes	Yes	Yes	Yes	Yes	Yes

Abbreviations: ILI, influenza-like illness; IMPACT, Canadian Immunization Monitoring Program ACTIVE; P/T-SOS, Province/Territory Severe Outcomes Surveillance

^a Only cumulative end-of-season data is available prior to the 2019–2020 season

^b In weekly comparisons to the 2019–2020 season, data from week 11 onwards is excluded due to the COVID-19 pandemic

**Table 3: Number of laboratory tests, detections, and percentage positivity by province/territory for the 2021–2022 Canadian influenza season**

Province/territory	Influenza tests	Influenza detections			Peak weekly influenza percent positivity		Cumulative influenza percent positivity	
		All influenza	Influenza A	Influenza B	%	95% CI ^a	%	95% CI ^a
Newfoundland and Labrador	15,930	327	327	0	7.9	6.0–9.8	2.1	1.8–2.3
Prince Edward Island	2,807	65	65	0	25.5	13.1–38.0	2.3	1.8–2.9
Nova Scotia	27,351	431	422	9	8.3	6.1–10.4	1.6	1.4–1.7
New Brunswick	21,601	495	495	0	25.9	21.6–30.3	2.3	2.1–2.5
Québec	131,566	7,634	7,524	110	26.6	25.3–27.9	5.8	5.7–5.9
Ontario	105,633	904	897	7	6.4	5.4–7.5	0.9	0.8–0.9
Manitoba	60,920	577	577	0	9.4	7.4–11.3	0.9	0.9–1.0
Saskatchewan	32,914	781	781	0	13.5	10.8–16.2	2.4	2.2–2.5
Alberta	102,875	2,716	2,713	3	11.9	10.6–13.1	2.6	2.5–2.7
British Columbia	225,352	1,558	1,462	96	3.9	3.2–4.5	0.7	0.7–0.7
Yukon Territory	5,511	21	14	7	33.3	0.0–71.1	0.4	0.2–0.5
Northwest Territories	2,263	207	207	0	31.5	23.4–39.6	9.1	8.0–10.3
Nunavut	17,177	410	410	0	53.8	44.8–62.9	2.4	2.2–2.6
Canada	751,900	16,126	15,894	232	12.6	12.1–13.1	2.1	2.1–2.2

Abbreviation: CI, confidence interval
^aBinomial proportion Wald confidence interval

This influenza season was of low intensity, with weekly activity peaking in week 19 (mid-May 2022) at 12.6% tests positive, far below pre-pandemic seasonal peaks that averaged 31.5%. While influenza testing practices have changed during the COVID-19 pandemic, reflected by the total influenza test volume (n=751,900 vs an average of n=317,963 pre-pandemic), the elevated test volume does not account for the observed low peak epidemic percent positivity. Despite elevated testing, only 2,223 influenza detections were reported during the week 19 peak, much lower than the pre-pandemic average peak weekly detections (n=4,303). The 16,126 total detections were also quite low compared to the average 48,478 detections during pre-pandemic seasons.

Detailed information on age and influenza type/subtype was received for 14,159 laboratory-confirmed influenza detections of which 49% (n=7,169) were among individuals aged 0–19 years. Nearly half of influenza A(H3N2) detections (46%) were among individuals aged 0–19 years, an unusually young case distribution for an A(H3N2) dominant epidemic. In pre-pandemic seasons, an average of 17% of influenza A(H3N2) detections were among this age group (Table 4).

Table 4: Number and percentage of seasonal influenza A(H3N2) detections in Canada by age group^a

Age group (years)	Influenza season													
	2014–2015		2015–2016		2016–2017		2017–2018		2018–2019		2019–2020		2021–2022	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
0–4	811	7%	77	8%	839	7%	682	7%	275	5%	218	10%	573	19%
5–19	959	8%	104	10%	1,081	10%	709	7%	506	10%	267	12%	798	27%
20–44	1,686	14%	168	17%	1,816	16%	1,387	14%	660	13%	352	16%	805	27%
45–64	1,678	13%	212	21%	1,986	18%	1,597	16%	722	14%	323	15%	292	10%
65 and older	7,325	59%	457	45%	5,487	49%	5,882	57%	2,950	58%	991	46%	511	17%
Total	12,459	N/A	1,018	N/A	11,209	N/A	10,257	N/A	5,113	N/A	2,151	N/A	2,979	N/A

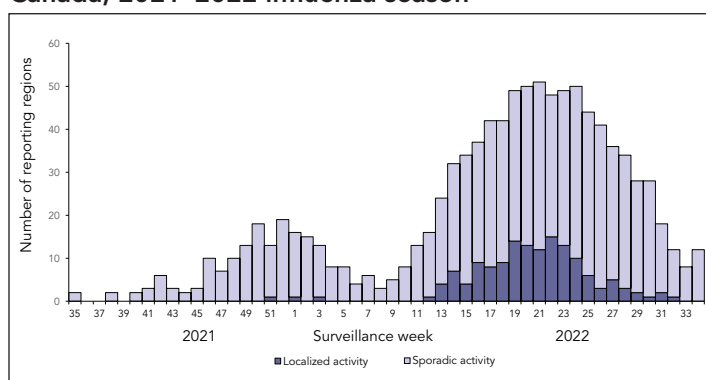
Abbreviation: N/A, not applicable
^a Comparison of 2021–2022 influenza season to previous seasons, 2014–2015 to 2019–2020



Influenza/influenza-like illness activity levels

From week 40 (early-October) onwards, sporadic influenza activity was reported by at least one region in Canada in each week of the 2021–2022 influenza season. Nationally, the number of surveillance regions reporting sporadic or localized influenza activity reached a small peak in week 52 (late-December) and a larger peak in week 21 (late-May; **Figure 3**). Activity remained within peak levels from early-May to late-June. The first small peak mostly consisted of sporadic activity, whereas localized activity was more frequently reported during the second larger peak and was reported in multiple regions across Canada. Reported levels never exceeded localized activity.

Figure 3: Number of influenza surveillance regions reporting sporadic or localized activity by week in Canada, 2021–2022 influenza season

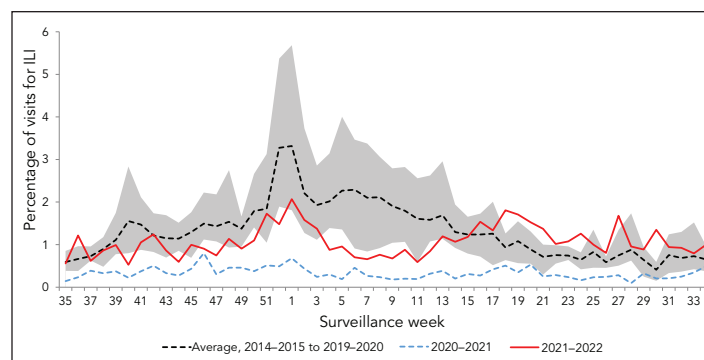


Syndromic—Sentinel primary healthcare provider influenza-like illness surveillance

During the 2021–2022 season, a weekly average of only 50 sentinel primary care providers reported to the ILI surveillance program with a weekly average of 3,769 total patients seen; both metrics were lower than historical levels. On average, in pre-pandemic seasons, 134 sentinel providers reported to the surveillance program and 7,688 total patients were seen each week.

The weekly percentage of visits to primary care providers due to ILI ranged from 0.5% to 2.1% (**Figure 4**). There was no single defined peak in ILI visits observed this season, while in pre-pandemic seasons a peak was typically observed in late-December/early-January, with an average of 3.4% visits due to ILI at this time of season. From the start of the season to mid-April (week 35 to 15), weekly percentage of visits due to ILI were almost exclusively below historical averages. From week 16 onwards (mid-April), the weekly percentage of visits due to ILI was above historical averages following an increase in weekly ILI visits at a time of typical decrease. This late increase in ILI coincided with the late seasonal influenza epidemic.

Figure 4: Percentage of visits for ILI reported by sentinel primary care providers in Canada by surveillance week^{a,b}



Abbreviation: ILI, influenza-like illness

^a Comparison of 2021–2022 influenza season to previous seasons, 2014–2015 to 2019–2020 and 2020–2021

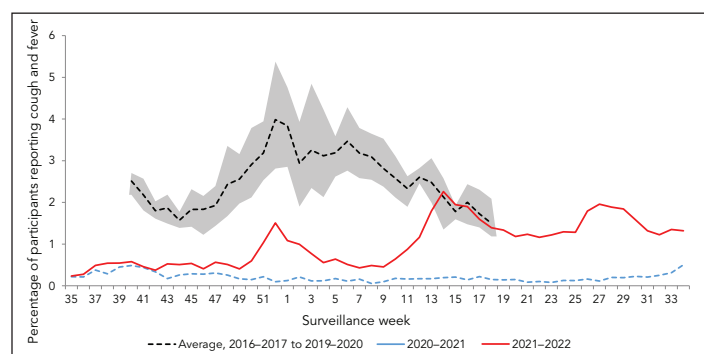
^b The shaded area represents the maximum and minimum percentage of visits for ILI reported by week from 2014–2015 to 2019–2020

Syndromic—FluWatchers

During the 2021–2022 season, an average of 12,045 FluWatchers participants reported each week. Overall, a total of 18,124 participants reported at least once this season, completing a total of 619,322 questionnaires.

The percentage of FluWatchers reporting ILI remained very low for the majority of the 2021–2022 season (**Figure 5**). From the beginning of the season to early-April (week 39 to 13), this percentage remained far below pre-pandemic levels. Despite this, a peak was observed in week 52 (early-January) at 1.5%. Five weeks later, a subsequent higher peak occurred in week 14 (early-April) at 2.3%, reaching expected levels for the first time of the season. A final peak in FluWatcher-reported ILI was observed in week 27 (early-July) at 2.0%.

Figure 5: Percentage of FluWatcher participants reporting cough and fever in Canada by surveillance week^{a,b}



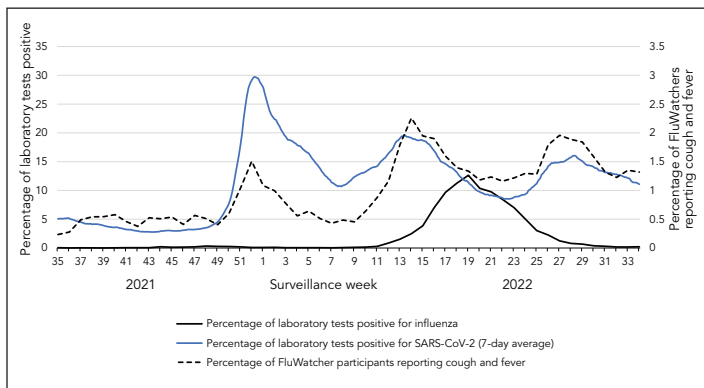
^a Comparison of 2021–2022 influenza season to previous seasons, 2016–2017 to 2019–2020 and 2020–2021

^b The shaded area represents the maximum and minimum percentage of percentage of participants reporting cough and fever by week, from 2016–2017 to 2019–2020



The percentage of FluWatchers reporting ILI aligned well with the percentage of SARS-CoV-2 laboratory tests that were positive in Canada (Figure 6). The first peak in FluWatchers ILI (week 52; 1.5%) occurred concurrently with SARS-CoV-2 activity reaching its maximum peak during the surveillance period. The highest peak in FluWatchers ILI (week 14; 2.3%) occurred during a smaller SARS-CoV-2 activity peak, and as influenza activity was approaching its highest peak of the season. During the third peak in FluWatchers ILI (week 27; 2.0%), ILI increased with SARS-CoV-2 activity while influenza positivity decreased.

Figure 6: Percentage of influenza and SARS-CoV-2 laboratory tests positive and percentage of FluWatchers reporting cough and fever in Canada by surveillance week, 2021–2022 influenza season



Abbreviation: SARS-CoV-2, severe acute respiratory syndrome coronavirus 2

Outbreaks

During the 2021–2022 season, 91 laboratory-confirmed influenza outbreaks were reported. The majority of laboratory-confirmed outbreaks (88%) were reported from week 11 to 24 (mid-March to mid-June), with the highest number of outbreaks in any given week (n=9) reported in week 16. Of reported laboratory-confirmed outbreaks, 49% were in long-term care facilities (n=45) and 38% were in facilities categorized as “other” (e.g. retirement homes, correctional facilities). All but one laboratory-confirmed outbreak were due to influenza A, and 96% (n=44) of outbreaks with subtype information were due to influenza A(H3N2).

This season, there were fewer laboratory-confirmed influenza outbreaks reported and a lower proportion of outbreaks occurred in long-term care facilities compared to recent pre-pandemic seasons. In the 2018–2019 and 2019–2020 seasons respectively, there were 978 and 1,038 total laboratory-confirmed outbreaks reported with 64% and 62% of outbreaks occurring in long-term care facilities.

Severe outcomes—Provincial/Territorial Severe Outcome Surveillance

During the 2021–2022 influenza season, 776 influenza-associated hospitalizations were reported by participating provinces and territories. Nearly all hospitalizations were associated with

influenza A (99.6%), and among hospitalizations with subtype information, 99.5% (n=407) were associated with influenza A(H3N2).

The annual seasonal hospitalization incidence was nine hospitalizations per 100,000 population, much lower than rates recorded in pre-pandemic seasons where on average 42 hospitalizations per 100,000 population were recorded (Table 5). Similar to previous seasons, the annual seasonal hospitalization rates were highest among adults aged 65 years and older (21 per 100,000) and children aged 0–4 years (19 per 100,000). However, in past seasons of predominant influenza A(H3N2) circulation, hospitalization rates have been much higher among adults aged 65 years and older, relative to younger age groups (Table 5).

Table 5: Estimated annual seasonal incidence of influenza hospitalizations (per 100,000 population) in Canada by age group^a

Age group (years)	Influenza season (predominant influenza of season)				
	2016–2017 (H3N2)	2017–2018 (H3N2 & B)	2018–2019 (H1N1)	2019–2020 (H1N1 & B)	2021–2022 (H3N2)
0–4	46	70	98	77	19
5–19	9	17	21	16	7
20–44	5	12	15	14	5
45–64	15	41	40	23	6
65 and older	128	280	127	76	21
Overall	30	64	45	30	9

^a Comparison of 2021–2022 season to previous seasons, 2016–2017 to 2019–2020

The majority of this season’s influenza-associated hospitalizations (94%) occurred from week 14 to 26, corresponding to the brief influenza epidemic experienced this season. While brevity contributes to this season’s lower annual hospitalization incidence, weekly incidence peaked at 1.2 hospitalizations per 100,000; lower than the 2019–2020 season, which peaked at 2.9 hospitalizations per 100,000 and featured 13 consecutive weeks with a hospitalization rate greater than 1.2 per 100,000.

A total of 69 intensive care unit (ICU) admissions and 22 deaths were reported this season by participating provinces and territories. Of hospitalized cases, 9% were admitted to ICU; which is comparable to pre-pandemic seasons (average 11%; range 4%–17%). The ICU admissions were most common among adults 65 years of age and older (30%) and 45–64 years of age (26%). Deaths were most common among adults 65 years of age and older (59%).

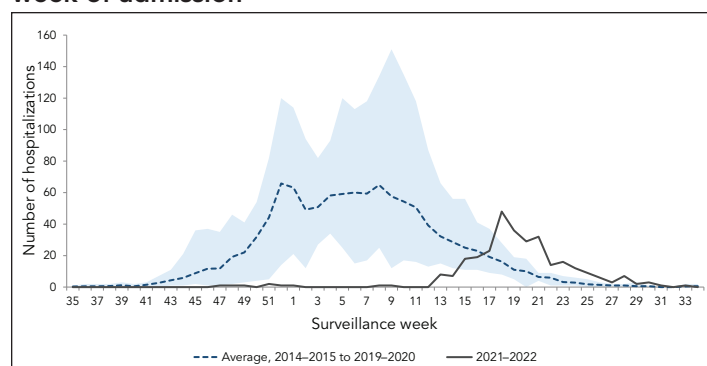


Severe outcomes—Canadian Immunization Monitoring Program ACTIVE

The Canadian Immunization Monitoring Program ACTIVE (IMPACT) network preliminarily reported 303 influenza-associated paediatric hospitalizations during the 2021–2022 influenza season—far fewer than reported in pre-pandemic seasons. From 2014–2015 to 2019–2020, an average of 1,057 paediatric hospitalizations were reported, with 593 hospitalizations during the 2016–2017 season being the lowest reported in a single season.

Weekly preliminary paediatric hospitalizations remained below expected pre-pandemic levels for most of the 2021–2022 season

Figure 7: Preliminary number of influenza-associated paediatric hospitalizations reported by IMPACT, by week of admission^{a,b}



Abbreviation: IMPACT, Canadian Immunization Monitoring Program ACTIVE
^a Comparison of 2021–2022 influenza season to previous seasons, 2014–2015 to 2019–2020
^b The shaded area represents the maximum and minimum hospitalizations reported by week of admission, from 2014–2015 to 2019–2020

but increased late in the season peaking in week 18 (early-May; $n=48$; **Figure 7**). This peak was of low intensity and late compared to prior seasons; on average, pre-pandemic paediatric hospitalizations peaked at 93 weekly hospitalizations, and peak weekly hospitalizations occurred no later than week 9.

Almost all hospitalizations were associated with influenza A (99%), and among the 96 hospitalizations with subtype information, 98% were associated with influenza A(H3N2). Age distribution of paediatric hospitalizations was similar to pre-pandemic seasons, with hospitalized cases most commonly reported in patients younger than two years of age (32%).

There were 30 ICU admissions and fewer than five deaths reported this season. Of hospitalized cases, 10% were admitted to ICU; lower than pre-pandemic seasons (average 18%). The highest proportion of ICU admissions was reported among patients 10–16 years (30%) and 2–4 years of age (23%).

Severe outcomes—Canadian Immunization Research Network Severe Outcome Surveillance

A total of 30 influenza-associated hospitalizations were reported through the Canadian Immunization Research Network Severe Outcome Surveillance (CIRN-SOS) during the 2021–2022 influenza season. There were too few hospitalizations to analyze temporality or severity trends.

Viral characterization

From September 1, 2021 to August 27, 2022, the National Microbiology Laboratory (NML) characterized 277 influenza viruses, far fewer than during a typical influenza surveillance season (1,171 to 3,857 viruses from 2014–2015 to 2019–2020). All 277 influenza viruses were influenza A (266 A(H3N2), 11 A(H1N1)).

Of the 266 influenza A(H3N2) viruses genetically characterized, sequence analysis of the hemagglutinin gene indicated that 100% of these viruses belonged to genetic clade 3C.2a1b.2a.2.

A total of 277 influenza viruses were antigenically characterized ($n=266$ influenza A(H3N2) and 11 influenza A(H1N1)). Among these viruses, 19% of A(H3N2) viruses ($n=51$) were antigenically similar to the egg-propagated A(H3N2) reference virus used in the production of the 2021–2022 Northern Hemisphere influenza vaccine, while 91% of A(H1N1) viruses ($n=10$) were similar to the cell-propagated A(H1N1) reference virus.

Two-hundred and fifty-nine influenza viruses (246 A(H3N2) and 11 A(H1N1)) were tested for antiviral resistance, with 100% of viruses sensitive to each oseltamivir and zanamavir.

Vaccine monitoring—Vaccine coverage

Vaccine coverage for the 2021–2022 influenza season was similar to the previous season. Thirty percent of adults 18–64 years of age received their influenza vaccine. Vaccine coverage was higher among seniors aged 65 years and older (71%) and adults aged 18–64 years with chronic medical conditions (38%). Overall vaccine coverage was higher amongst females compared to males.

Vaccine monitoring—Vaccine effectiveness

Using a test-negative design, the Canadian Sentinel Practitioner Surveillance Network (SPSN) reports adjusted vaccine effectiveness (VE) of 36% (95% confidence interval (CI): –38–71) against medically-attended illness due to late-season influenza A(H3N2) clade 3C.2a1b.2a.2 viruses (11). This estimate is adjusted for age group, province, comorbidity and calendar month, and is based on 327 specimens collected from week 10 to 26 (early-March to early-July 2022).

Given the low-intensity community circulation of influenza this season, estimates of seasonal influenza vaccine effectiveness in



preventing hospitalization for laboratory-confirmed influenza are not available for the 2021–2022 season.

Discussion

The 2021–2022 Canadian influenza season saw the return of community influenza circulation. A national seasonal influenza epidemic was declared for the first time since the 2019–2020 season. Starting in mid-April and lasting only nine weeks, the 2021–2022 Canadian influenza season was later and shorter than usual and dominated by influenza A(H3N2).

The COVID-19 pandemic and response disrupted seasonal transmission patterns of influenza and other respiratory viruses. The NPIs put in place to address the COVID-19 pandemic, such as masking, border and travel measures and physical distancing, contributed to these disruptions. Associations between NPIs and decreased transmission of influenza and SARS-CoV-2 have been demonstrated (12–16). The aforementioned factors, as well as other factors such as antagonistic viral interference, which has been observed between influenza and other seasonal respiratory viruses (17,18), may have contributed to the early-season suppression of influenza. The breadth of these factors continues to create uncertainty about the dynamics of influenza and SARS-CoV-2 co-circulation.

Seasonal influenza activity increased late in the season to reach the epidemic threshold at a time that corresponded to elevated SARS-CoV-2 transmission, demonstrating that community-level co-circulation of these viruses is possible. When influenza activity reached 5% of tests positive in Canada, the SARS-CoV-2 7-day average of test positivity was 17.6% and never dropped below 8.5% during the influenza epidemic (Figure 6). However, the 2021–2022 Canadian seasonal influenza epidemic peaked when SARS-CoV-2 percentage positivity was decreasing. Globally, peaks in influenza percentage positivity have thus far occurred at times when SARS-CoV-2 percentage positivity is relatively low or declining; a trend observed at some World Health Organization regional levels as well (19). Factors that modulate transmission of both viruses, such as viral interference, NPIs, vaccination, social mixing patterns and climatic conditions, require further study in combination to explain these trends.

There was evidence of influenza and SARS-CoV-2 co-circulation activity in ILI reports from FluWatchers. Reported ILI activity broadly aligned with SARS-CoV-2 laboratory activity, but the magnitude of the two indicators did not align precisely. Fluwatchers ILI activity increased but remained below expected levels during the most intense SARS-CoV-2 activity peak. The highest peak in FluWatchers ILI activity was later reported during a period of influenza and SARS-CoV-2 co-circulation. These findings highlight potential usefulness of FluWatchers for signal detection, but also highlight the lack of specificity of the case definition.

In Canada, the seasonal epidemic was driven by the spread of influenza A(H3N2). Influenza A(H3N2) case distribution tends to skew towards older adults, but this was not observed during the 2021–2022 season. The proportion of A(H3N2) infections detected among children and teenagers was nearly three times higher than typical, and hospitalization rates were similar among children aged 0–4 years and adults aged 65 years and older— atypical for a season dominated by A(H3N2). This unusual age distribution has a complex set of possible explanations, including more restrictive NPIs among vulnerable older adults differentially impacting influenza transmission in this group. Immunologic factors including increased susceptibility among the large cohort of young children unexposed to influenza infection may also play a role.

There was no evidence of increased severity of influenza cases among FluWatch indicators. The proportion of hospitalized cases admitted to ICU was either within or below expected levels. While a scarcity of documented cases has limited assessment, there was some early evidence of synergistic effects on severity of cases co-infected with influenza and SARS-CoV-2 (20–23). FluWatch surveillance indicators are not well equipped to assess these effects.

Increased population-level influenza susceptibility was a concern coming into the 2021–2022 season. Several modelling studies demonstrated that pandemic-related conditions could cause greater seasonal influenza epidemic intensity, but that the complexity of transmission dynamics cause uncertainty in both the magnitude and timing (8,24,25). The 2021–2022 influenza epidemic highlighted this uncertainty, being late and low intensity. Influenza susceptibility remains higher than typical pre-pandemic years, and predisposition to larger influenza epidemics also remains (9); however, the likelihood of an intense influenza season is influenced by the ongoing COVID-19 pandemic and response, and population susceptibility to influenza cannot be considered in isolation.

With influenza susceptibility remaining high, the importance of seasonal influenza vaccination to reduce susceptibility is highlighted. The SPSN reported 36% VE against illness due to the influenza A(H3N2) clade 3C.2a1b.2a.2 viruses that predominated this season (95% CI: –38–71). These viruses are considered antigenically-distinct from the 2021–2022 vaccine strain instead belonging to clade 3C.2a1b.2a.1, but the estimate is very similar to VE estimates against influenza A(H3N2) recently reported from the United States (35%; 95% CI: 19–47) for the period spanning October 2021 to April 2022 (26) and from Europe (35%; 95% CI: 6–54) spanning October 2021 to March 2022 (27). Findings from SPSN, as well as strain characterization results from NML, reinforce the World Health Organization's decision to switch to a more representative clade 3C.2a1b.2a.2 strain for the northern hemisphere 2022–2023 A(H3N2) vaccine component (28).



Conclusion

The 2021–2022 Canadian influenza season was highlighted by the return of epidemic-level influenza activity. The 2021–2022 influenza epidemic was late, low-intensity and brief, and was influenced by the ongoing COVID-19 pandemic. Over the past two years, relatively few Canadians have been infected with influenza, rendering the population more susceptible to the seasonal influenza strains that are likely to circulate in the upcoming years. Ongoing circulation of SARS-CoV-2 creates great uncertainty regarding when an intense influenza epidemic may reoccur in Canada. Public health authorities need to remain vigilant and continue to plan for seasonal influenza circulation and to maintain laboratory diagnostics and surveillance capacity to help prevent the spread and impact of influenza. Influenza vaccination remains a key public health intervention available to protect Canadians.

Authors' statement

The FluWatch team in the Centre for Immunization and Respiratory Infectious Diseases developed the first draft collaboratively; all authors contributed to the conceptualization, writing and revision of the manuscript.

Competing interests

None.

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