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ENHANCED EPIDEMIOLOGICAL SUMMARY

(ARCHIVED) Myocarditis and Pericarditis Following Vaccination with COVID-19 mRNA Vaccines in Ontario: December 13, 2020 to November 21, 2021

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Purpose

This report summarizes reports of myocarditis/pericarditis that have been reported as adverse events following immunization (AEFIs) in Ontario following the receipt of a COVID-19 mRNA vaccine. Data on Ontario-specific reporting rates of myocarditis/pericarditis following COVID-19 mRNA vaccines are presented.

The report includes AEFIs reported in the Public Health Case and Contact Management Solution (CCM) as of November 21, 2021 and vaccine doses administered up to and including November 21, 2021 extracted from the $COVax_{ON}$ application (see technical notes for details on data sources). For a summary of all COVID-19 AEFIs and more details on Ontario's vaccine safety surveillance system, please see Public Health Ontario's COVID-19 AEFI weekly summary.[1]

Background

Post-marketing vaccine safety surveillance has identified reports of myocarditis (inflammation of the heart muscle) and pericarditis (inflammation of the lining around the heart) following COVID-19 mRNA vaccines (Pfizer-BioNTech Comirnaty and Moderna Spikevax COVID-19 vaccines).[2,3] These events occur more commonly after the second dose, within the week following vaccination (typically within 4-5 days), mainly in adolescents/young adults and more often in males than females.[3] Several studies have suggested that there may also be mRNA vaccine product-specific differences in the reporting rates of myocarditis/pericarditis, in particular among younger individuals.[4-9]

In June 2021, Public Health Ontario (PHO) issued an Enhanced Surveillance Directive (ESD), requesting public health units (PHU) to prioritize the follow-up of myocarditis/pericarditis reports following COVID-

19 mRNA vaccines and to notify PHO on the same day of PHU notification of the report. In addition to the start of enhanced surveillance for this event, there were concurrent COVID-19 vaccine program changes that began in June 2021 including: an acceleration of second dose administration that was facilitated by increased Moderna Spikevax COVID-19 vaccine supply, the increased use of mixed vaccine product schedules, an increase in the number of young adults and adolescents immunized, and a transition from a longer interval between first and second dose to shorter intervals as recommended in the vaccine product monographs (i.e., 21 or 28 days). These are important contextual factors for the interpretation of the data presented in this summary.

Although the risk of myocarditis/pericarditis following either COVID-19 mRNA vaccine remains rare[10], Ontario announced a preferential recommendation on September 29, 2021 for the use of Pfizer-BioNTech Comirnaty COVID-19 vaccine in individuals aged 18-24 years based on an observed increase in myocarditis/pericarditis following vaccination with Moderna Spikevax COVID-19 vaccine compared to Pfizer-BioNTech Comirnaty COVID-19 vaccine in the 18-24 year old age group, particularly among males, from Ontario's vaccine safety data.[11] In December 2021, Ontario expanded this preferential recommendation to individuals 12 to 29 years of age to align with the updated guidance from the National Advisory Committee on Immunization (NACI).[12,13] As of November 2021, several countries including Norway, Sweden and Finland, have issued similar guidance for the preferential use of Pfizer-Comirnaty COVID-19 vaccine in some age groups.[14] Ontario continues to use Pfizer-BioNTech Comirnaty COVID-19 vaccine for adolescents aged 12-17 years (30 microgram (mcg) product) and children 5-11 years (10 mcg product) of age. Ontario began the immunization program for 5-11 year olds on November 23, 2021; therefore, this age group is not included in this report. Data on COVID-19 AEFIs reported in Ontario for the 5-11 year age group can be found in Public Health Ontario's COVID-19 AEFI weekly summary.[1]

Ontario is continuing to monitor these events in collaboration with its partners and weekly updates can be found in PHO's COVID-19 AEFI weekly summary and on the Public Health Agency of Canada website. For more information on this topic please see PHO's Focus On: Myocarditis and Pericarditis after COVID-19 mRNA Vaccines.[15]

Highlights

- Between the start of the COVID-19 immunization program and November 21, 2021, there have been 423 reports of myocarditis/pericarditis in Ontario that met the Brighton Collaboration case definition levels of diagnostic certainty 1, 2 or 3 for myocarditis or pericarditis.[16,17]
    - Among the 423 reports, 76.6% occurred in males and 70.4% occurred following second dose.
- The reporting rate of myocarditis/pericarditis was higher following the second dose of mRNA vaccine than after the first dose, particularly for those receiving the Moderna Spikevax COVID-19 vaccine as the second dose of the series, regardless of the product received for the first dose (Tables 2a and 2b).
- The highest reporting rate of myocarditis/pericarditis was observed in males aged 18-24 years following the Moderna Spikevax COVID-19 vaccine as the second dose; the reporting rate in this

age group following the Moderna Spikevax COVID-19 vaccine was 333.9 per million doses administered and the reporting rate following Pfizer-BioNTech Comirnaty COVID-19 vaccine as second dose was 72.5 per million doses administered.

- Similar patterns in reporting rates were observed when the analysis was restricted to individuals who received their first dose on or after June 1st, 2021, to account for enhanced awareness and surveillance of myocarditis/pericarditis that began in June and a number of other programmatic factors that occurred at that time.

- Myocarditis/pericarditis following COVID-19 mRNA vaccines remains a rare AEFI (defined by the Canadian Immunization Guide as occurring at frequency of 0.01% to less than 0.1%),[18] even among the age groups where the highest rates of this event have been observed.

- The National Advisory Committee on Immunization (NACI) continues to recommend vaccination with mRNA COVID-19 vaccines for adolescents and adults of all ages since the vaccines are highly effective at preventing symptomatic infection and severe outcomes (i.e., hospitalization, death) from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, which also includes an increased risk of developing myocarditis.[10,19]

Summary of Findings

Characteristics of myocarditis/pericarditis reports following COVID-19 mRNA vaccines

- There have been 423 reports of myocarditis/pericarditis following receipt of COVID-19 mRNA vaccines in Ontario as of November 21, 2021 that met the Brighton Collaboration case definition levels of diagnostic certainty 1, 2 or 3 for myocarditis or pericarditis (Table 1). Among these:

    - 76.6% of all reports occurred in males

    - 70.4% of all reports occurred following second dose

    - The median time from vaccine administration to symptom onset was three days for those reports with known time to onset (n=420). Of those, 72.4% occurred within 7 days of vaccine administration (Figure 3).

Reporting rates of myocarditis/pericarditis following COVID-19 mRNA vaccines

- The reporting rate of myocarditis/pericarditis was higher following the second dose than after the first dose for both the Pfizer-BioNTech Comirnaty and Moderna Spikevax COVID-19 vaccines (Tables 2a and 2b).

    - The overall reporting rate of myocarditis/pericarditis following the Pfizer-BioNTech Comirnaty COVID-19 vaccine was 19.8 per million doses administered following second dose, compared to 11.7 per million doses following first dose.

- For the Moderna Spikevax COVID-19 vaccine, the overall reporting rate was 43.1 per million doses administered following second dose and 12.1 per million following first dose.
- The trend of higher reporting rates following second dose was most pronounced in the younger age groups.
- While reporting rates were lower, overall trends were similar when restricting outcomes to the subset of reports that met the Brighton Collaboration definition for myocarditis only (Appendix C).

- The reporting rate of myocarditis/pericarditis was highest for individuals aged 18-24 years following Moderna Spikevax COVID-19 vaccine as the second dose (Figure 4, Tables 2a and 2b). Following the 18-24 year age group, the highest reporting rates were in individuals aged 25-29 years following Moderna Spikevax COVID-19 vaccine as the second dose and in individuals aged 12-17 years following Pfizer-BioNTech Comirnaty COVID-19 vaccine as the second dose.
  - The reporting rate of myocarditis/pericarditis for males aged 18-24 years following Moderna Spikevax COVID-19 vaccine as the second dose was approximately 4.6 times higher than males in the same age group following Pfizer-BioNTech Comirnaty COVID-19 vaccine as the second dose (333.9 versus 72.5 reports per million doses administered, respectively).
  - This difference in the reporting rates persisted when the analysis was restricted to those AEFIs reported in individuals who received their first dose on or after June 1, 2021 to control for the period of enhanced surveillance (Tables 3a and 3b).

Program changes over time and impact on the reporting rates of myocarditis/pericarditis

- The number of reported events of myocarditis/pericarditis began to increase in early June of 2021. This period of time coincided with increased vaccine supply, administration of second doses, program expansion to younger age groups, and release of the ESD (Figures 1 and 2).
  - Further details on Ontario's vaccine roll-out over time, including by age, sex, dose number, and product can be found in PHO's COVID-19 Vaccine Uptake and Program Impact in Ontario report.[20]
  - Although the ESD was activated on June 4, 2021, increased clinician and public awareness of myocarditis/pericarditis as a possible rare AEFI began prior to this date. We used June 1, 2021 as a cut off to examine potential increases in reporting rates due to an increase in detection and/or stimulated reporting following heightened awareness of this issue and the ESD (Tables 3a and 3b).
- When restricting only to those AEFIs reported in individuals who received their first dose on or after June 1, 2021, the overall rates of myocarditis/pericarditis followed a similar pattern as for the full surveillance period (Tables 2 and 3).

- A difference in reporting rates between products continued to be observed for the group with the highest reporting rate of myocarditis/pericarditis, males aged 18-24 years following the second dose (314.6 versus 96.8 reports per million doses administered, for Moderna Spikevax and Pfizer-BioNTech Comirnaty COVID-19 vaccines respectively).

- Owing to a smaller number of AEFIs in the restricted analysis, many strata include small numbers of events (i.e., less than five). Thus, reporting rates presented in Tables 3a and 3b should be interpreted with caution.

- The preferential recommendation for the use of Pfizer-BioNTech Comirnaty COVID-19 vaccine in individuals aged 18-24 years was announced on September 29, 2021. The reporting rate of myocarditis/pericarditis in this age group was lower in the post-recommendation period (i.e., on or after September 29, 2021) compared to the reporting rate in the pre-recommendation period (i.e., between December 13, 2020 and September 28, 2021), especially after the second dose.

    - There were 127 reports of myocarditis/pericarditis in the 18-24 year age group who received the vaccination before September 29, 2021. Based on doses administered before September 29, 2021, the reporting rate of myocarditis/pericarditis was 22.7 and 103.8 per million doses administered for first dose and second dose, respectively, for both mRNA products combined.

    - There were six reports of myocarditis/pericarditis in the 18-24 year age group who received the vaccination on or after September 29, 2021. Based on doses administered on or after September 29, 2021, the reporting rate of myocarditis/pericarditis was 21.4 and 47.6 for first dose and second dose, respectively, for both mRNA vaccine products combined.

Table 1. Characteristics of myocarditis/pericarditis reports following COVID-19 mRNA vaccines: Ontario, December 13, 2020 to November 21, 2021

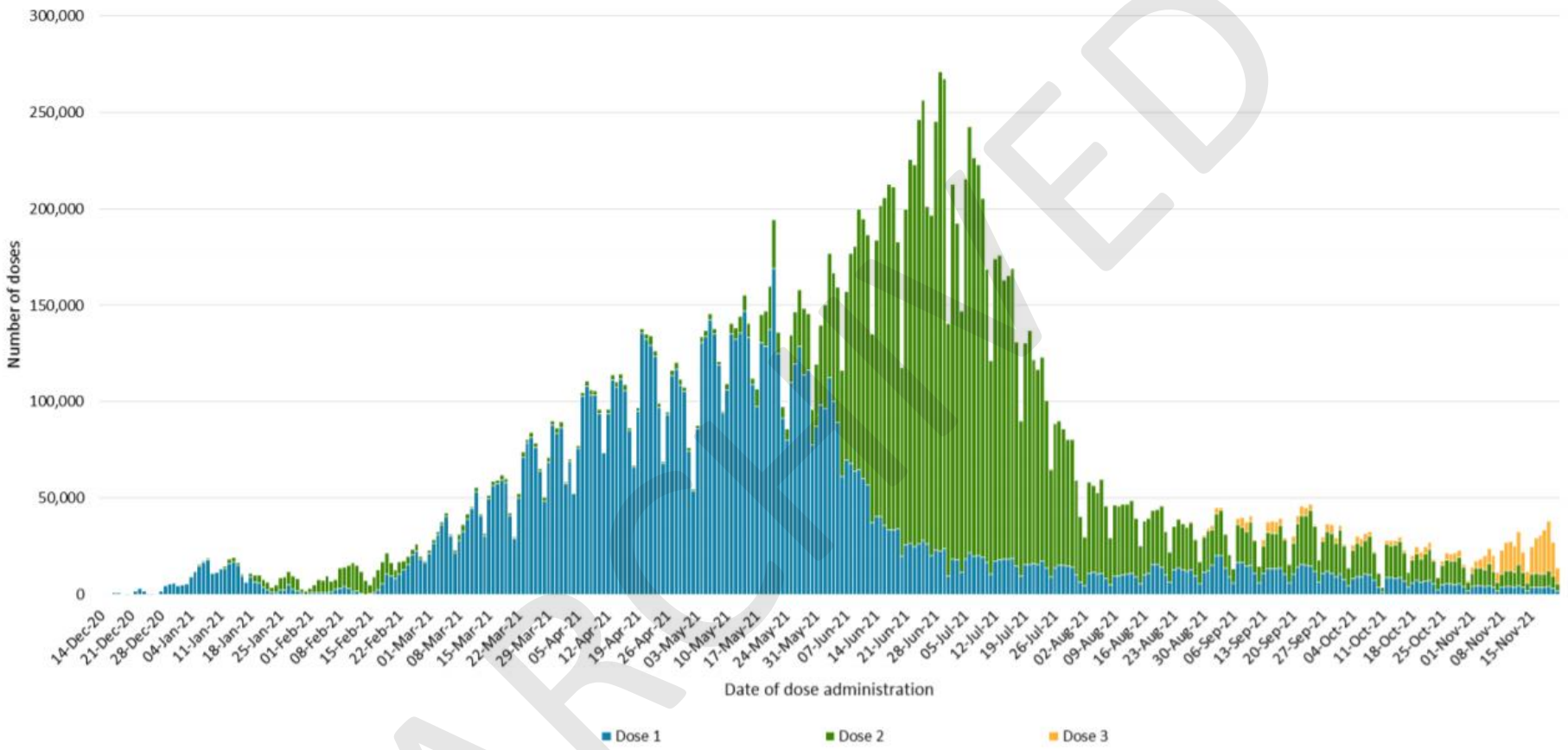
	After dose 1	After dose 2	Total
Total number of reports	125 (29.6%)	298 (70.4%)	423
Median age, years (range)	28 (12 – 80)	23 (11 – 89)	25 (11 – 89)
Age group (years)[1]			
12-17	26 (20.8%)	51 (17.1%)	77 (18.2%)
18-24	26 (20.8%)	107 (35.9%)	133 (31.4%)
25-29	19 (15.2%)	30 (10.1%)	49 (11.6%)
30-39	15 (12.0%)	48 (16.1%)	63 (14.9%)
40+	39 (31.2%)	61 (20.5%)	100 (23.6%)
Gender			
Male (%)	88 (70.4%)	236 (79.2%)	324 (76.6%)
Female (%)	37 (29.6%)	62 (20.8%)	99 (23.4%)
Median time to onset, days (range)[2]	8 (0 – 68)	2 (0 – 73)	3 (0 – 73)
Vaccine product			
Pfizer-BioNTech Comirnaty COVID-19 vaccine	100 (80.0%)	144 (48.3%)	244 (57.7%)
Moderna Spikevax COVID-19 vaccine	25 (20.0%)	154 (51.7%)	179 (42.3%)
Clinical diagnosis			
Myocarditis	39 (31.2%)	106 (35.6%)	145 (34.3%)
Pericarditis	58 (46.4%)	70 (23.5%)	128 (30.3%)
Myopericarditis[3]	28 (22.4%)	122 (40.9%)	150 (35.5%)
Healthcare Utilization/Outcome			
Emergency department visit	117 (93.6%)	288 (96.6%)	405 (95.7%)
In-patient hospitalization[4]	68 (54.4%)	213 (71.5%)	281 (66.4%)
ICU admission	5 (4.0%)	15 (5.0%)	20 (4.7%)
Fatal	0	0	0

Notes:

1. Age represents age at immunization. There was one report in an 11-year-old following dose 2. This individual was 11 years old at the time of immunization and turned 12 years of age by the end of 2021; as such, the individual was eligible and received the Pfizer-BioNTech Comirnaty COVID-19 vaccine (30 mcg product) as per the provincial program. This report is excluded from age group-specific number of reports and reporting rates.
2. Three reports with unknown time to onset were excluded from the calculation of median time to onset and range.
3. Includes "myocarditis/pericarditis" (n=3), myopericarditis (n=116) and perimyocarditis (n=31).
4. The proportion of individuals hospitalized was 78.6%, 31.3%, and 84.7% for myocarditis, pericarditis, and myopericarditis respectively.

Data source: CCM

Figure 1. Number of COVID-19 vaccine doses administered in Ontario by dose number

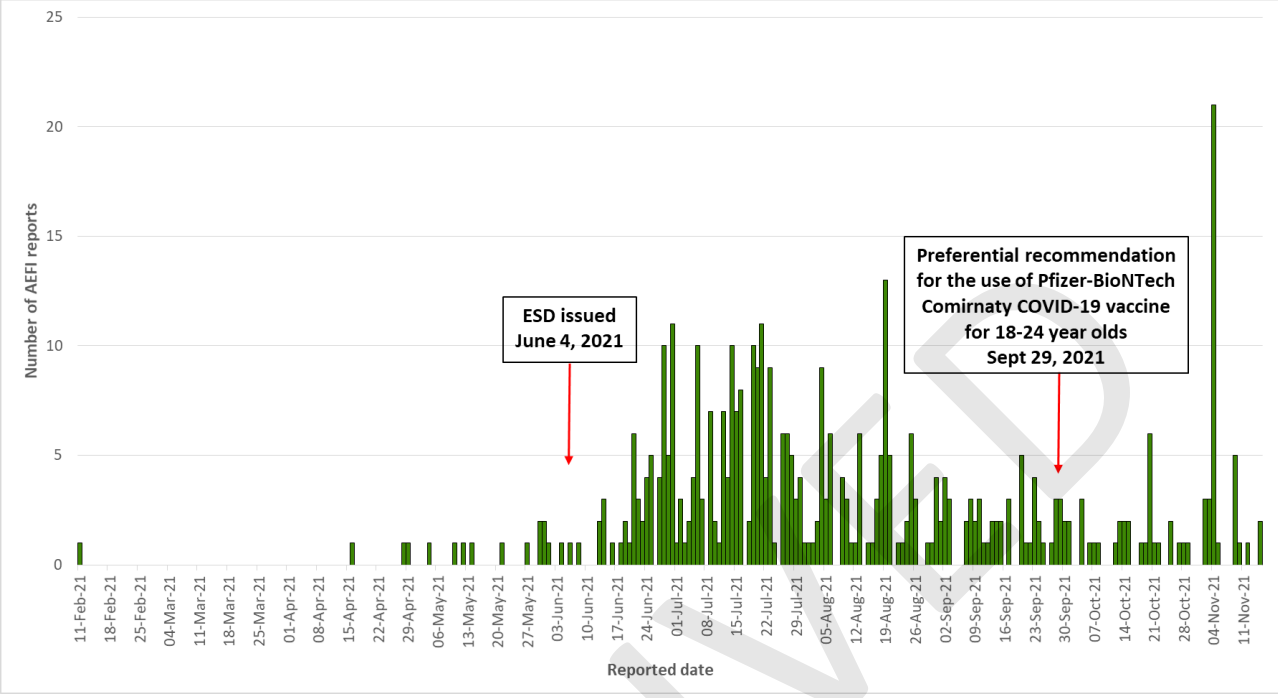


Data source: COVax$_{ON}$

Notes:

1. Counts for the number of doses administered in Ontario exclude doses administered out of province and from non-Ontario stock.
2. Doses numbers are maintained in reported counts. For example, if an individual received doses 1 and 2 out of province and a third dose in Ontario, the third doses is counted as a dose 3 administered in Ontario and the first two doses are not counted as they were administered out of province.

Figure 2. Myocarditis/pericarditis reports following any dose of COVID-19 mRNA vaccine by reported date: Ontario, December 13, 2020 to November 21, 2021

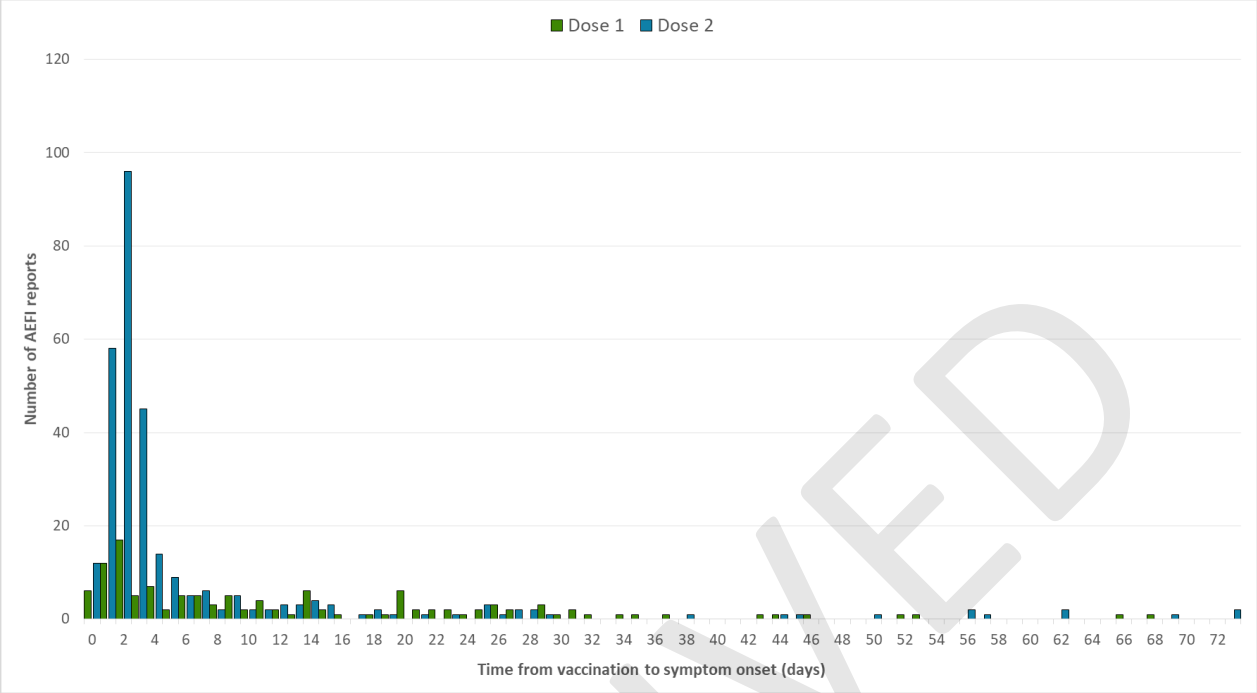


Notes:

1. Public Health Ontario (PHO) issued an Enhanced Surveillance Directive (ESD) on June 4, 2021, requesting public health units to prioritize follow-up of any reports of myocarditis/pericarditis following COVID-19 mRNA vaccine and to notify PHO on the same day of PHU notification of the report.
2. Ontario announced a preferential recommendation on September 29, 2021 for the preferential use of Pfizer-BioNTech Comirnaty COVID-19 vaccine in individuals aged 18-24 years.
3. There was a bulk submission of reports on November 4, 2021 from a single public health unit, which increased the overall number of reports that were reported on November 4, 2021.

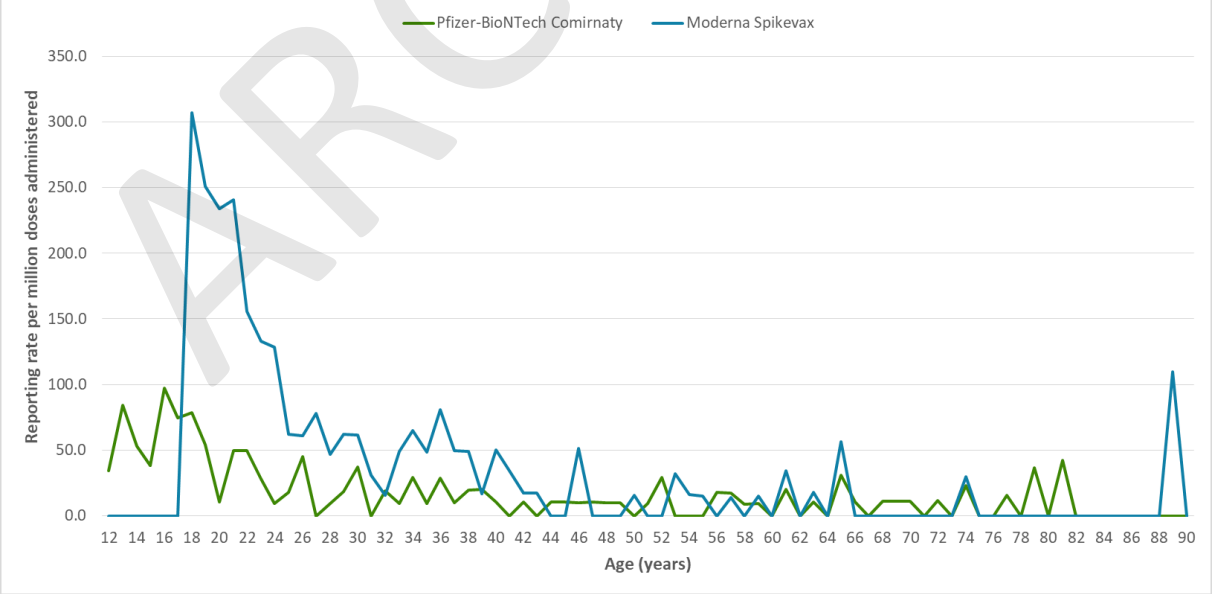
Data source: CCM

Figure 3. Myocarditis/pericarditis reports following COVID-19 mRNA vaccines by dose number and time to symptom onset: Ontario, December 13, 2020 to November 21, 2021



Notes: Excludes three reports with unknown time to onset.
Data source: CCM

Figure 4. Reporting rate of myocarditis/pericarditis per million doses administered by age and mRNA product following administration of second dose: Ontario, December 13, 2020 to November 21, 2021



Notes: No reports were received for individuals over the age of 90 years. There are no reports in individuals aged 12-17 years following receipt of Moderna Spikevax COVID-19 vaccine, as the Ontario adolescent program has exclusively used the Pfizer-BioNTech Comirnaty COVID-19 vaccine product.

Data source: CCM, COVax$_{ON}$

Table 2a. Crude reporting rate of myocarditis/pericarditis per million doses administered following Pfizer-BioNTech Comirnaty COVID-19 vaccines by dose number, age, and gender: Ontario, December 13, 2020 to November 21, 2021 (n=244)

Age group (years)	All gender: All doses	All gender: Dose 1	All gender: Dose 2	Females: All doses	Females: Dose 1	Females: Dose 2	Males: All doses	Males: Dose 1	Males: Dose 2
12-17	46.5	30.7	63.3	17.3	16.9	17.7	75.0	44.1	107.5
18-24	30.7	24.7	38.9	8.8	11.3	5.8	52.7	38.0	72.5
25-29	18.3	18.6	18.4	9.4	5.7	14.5	27.5	31.5	22.6
30-39	13.3	9.8	18.3	10.4	7.3	14.6	16.6	12.4	22.4
40+	6.8	5.5	8.6	4.8	3.5	6.7	9.1	7.9	11.0
Total	15.1	11.7	19.8	7.5	6.3	9.4	23.7	17.8	31.5

Notes:

1. Includes all reports, including reports with missing time to onset (i.e., no restriction on time to onset applied). Data used to calculate the reporting rates are available in Appendix A1.
2. Reporting rates for 'All doses' include the number of dose 3 administered in the denominator. Reporting rates for dose 3 are not presented as there were no events of myocarditis/pericarditis reported following dose 3.
3. Total reporting rate includes one report in the 5-11 age group following the receipt of Pfizer-BioNTech Comirnaty COVID-19 vaccine (30 mcg product) in an 11 year-old.

Data source: CCM, COVax$_{ON}$

Table 2b. Crude reporting rate of myocarditis/pericarditis per million doses administered following Moderna Spikevax COVID-19 vaccines by dose number, age, and gender: Ontario, December 13, 2020 to November 21, 2021 (n=179)

Age group (years)	All gender: All doses	All gender: Dose 1	All gender: Dose 2	Females: All doses	Females: Dose 1	Females: Dose 2	Males: All doses	Males: Dose 1	Males: Dose 2
12-17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18-24	128.5	15.5	202.8	45.3	16.8	63.3	204.7	14.5	333.9
25-29	49.0	29.0	62.0	12.3	10.7	13.3	80.7	44.3	104.9
30-39	30.6	5.1	46.7	16.6	5.4	23.7	43.4	4.9	67.9
40+	10.8	10.7	11.2	5.5	8.0	4.4	16.3	13.6	18.1
Total	31.2	12.1	43.1	12.3	8.8	14.7	50.0	15.3	71.0

Notes:

1. Includes all reports, including reports with missing time to onset (i.e., no restriction on time to onset applied). Data used to calculate the reporting rates are available in Appendix A2.
2. Reporting rates for 'All doses' include the number of dose 3 administered in the denominator. Reporting rates for dose 3 are not presented as there were no events of myocarditis/pericarditis reported following dose 3.
3. Total reporting rate includes one report in the 5-11 age group following the receipt of Pfizer-BioNTech Comirnaty COVID-19 vaccine (30 mcg product) in an 11 year-old.

Data source: CCM, COVax$_{ON}$

Table 3a. Crude reporting rate of myocarditis/pericarditis per million doses administered following Pfizer-BioNTech Comirnaty COVID-19 vaccines by dose number, age, and gender among individuals who initiated their vaccination in the enhanced surveillance period: Ontario, June 1, 2021 to November 21, 2021 (n=125)

Age group (years)	All gender: All doses	All gender: Dose 1	All gender: Dose 2	Females: All doses	Females: Dose 1	Females: Dose 2	Males: All doses	Males: Dose 1	Males: Dose 2
12-17	50.7	35.5	66.9	19.9	21.0	18.7	79.8	49.3	112.5
18-24	43.0	29.4	60.3	16.7	18.1	15.1	64.1	38.5	96.8
25-29	22.9	22.4	23.5	9.2	0.0	20.6	34.4	41.1	26.0
30-39	18.1	15.2	21.9	17.3	13.3	22.2	19.0	16.9	21.6
40+	8.8	8.8	8.9	8.2	6.0	10.9	9.4	11.5	7.0
Total	28.2	21.2	36.6	14.2	12.2	16.5	41.1	29.4	55.1

Notes:

1. Includes all reports, including reports with missing time to onset (i.e., no restriction on time to onset applied). Data used to calculate the reporting rates are available in Appendix B1.
2. Reporting rates for 'All doses' include the number of dose 3 administered in the denominator. Reporting rates for dose 3 are not presented as there were no events of myocarditis/pericarditis reported following dose 3.
3. Total reporting rate includes one report in the 5-11 age group following the receipt of Pfizer-BioNTech Comirnaty COVID-19 vaccine (30 mcg product) in an 11 year-old.

Data source: CCM, COVax$_{ON}$

Table 3b. Crude reporting rate of myocarditis/pericarditis per million doses administered following Moderna Spikevax COVID-19 vaccines by dose number, age, and gender among individuals who initiated their vaccination in the enhanced surveillance period: Ontario, June 1, 2021 to November 21, 2021 (n=65)

Age group (years)	All gender: All doses	All gender: Dose 1	All gender: Dose 2	Females: All doses	Females: Dose 1	Females: Dose 2	Males: All doses	Males: Dose 1	Males: Dose 2
12-17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18-24	127.3	19.6	215.2	51.1	0.0	90.7	185.6	33.7	314.6
25-29	83.8	49.9	111.5	13.2	0.0	23.5	136.3	85.5	178.8
30-39	40.4	7.6	66.1	22.3	0.0	39.4	55.4	13.9	88.7
40+	18.8	30.9	8.0	9.2	19.5	0.0	26.9	40.2	14.8
Total	54.8	25.9	79.3	20.8	8.4	31.0	82.4	39.6	119.2

Notes:

1. Includes all reports, including reports with missing time to onset (i.e., no restriction on time to onset applied). Data used to calculate the reporting rates are available in Appendix B2.
2. Reporting rates for 'All doses' include the number of dose 3 administered in the denominator. Reporting rates for dose 3 are not presented as there were no events of myocarditis/pericarditis reported following dose 3.
3. Total reporting rate includes one report in the 5-11 age group following the receipt of Pfizer-BioNTech Comirnaty COVID-19 vaccine (30 mcg product) in an 11 year-old.

Data source: CCM, COVax$_{ON}$

Technical Notes

Data Sources

- The data for this report were based on:
    - AEFI information from the Public Health Case and Contact Management Solution (CCM) extracted on **November 22, 2021 at approximately 9:00 a.m**.
    - Doses administered data from Ontario Ministry of Health's $COVax_{ON}$ application extracted on **November 22 at approximately 7:00 a.m**. Methodology used to calculate the number of doses administered is documented in PHO's COVID-19 Vaccine Uptake in Ontario report.[20]

Data Caveats

- Data presented in this report only represent AEFIs reported to public health units and recorded in CCM. As a result, all counts will be subject to varying degrees of underreporting or stimulated reporting due to a variety of factors.
- CCM and $COVax_{ON}$ are dynamic reporting systems which allow ongoing updates to data previously entered. As a result, data extracted from CCM and $COVax_{ON}$ represent a snapshot at the time of data extraction and may differ from previous or subsequent reports.

Methods

- AEFI reports from CCM where the Disposition was reported as ENTERED IN ERROR, DOES NOT MEET DEFINITION or DUPLICATE – DO NOT USE, or any variation on these values have been excluded. AEFI reports from CCM where the Status was reported as MERGED-OBSOLETE have also been excluded.
- Reports of myocarditis/pericarditis were identified through keyword search on all AEFI reports following receipt of COVID-19 vaccines in Ontario in CCM for 'myocarditis' or 'pericarditis'. In addition, all AEFI reports with event reported as 'COVID-19 AESI: cardiovascular injury' and 'COVID-19 AESI: myocarditis/pericarditis' have been reviewed.
- All identified reports of myocarditis or pericarditis were assessed using the Brighton Collaboration case definitions for myocarditis or pericarditis, as appropriate. This score is not a measure of severity but rather reflects the level of diagnostic certainty, with level 1 being the most highly specific for the condition.[16,17]

- Reports of myocarditis or pericarditis included in this report are those that have a:
    - Diagnosis of myocarditis and meeting Brighton Collaboration level of diagnostic certainty 1 to 3 for myocarditis[16] OR
    - Diagnosis of pericarditis and meeting the Brighton Collaboration level of diagnostic certainty 1 to 3 for pericarditis[17] OR
    - Diagnosis of myopericarditis or perimyocarditis and meeting either the Brighton Collaboration levels 1 to 3 for myocarditis or pericarditis[16,17]
- Reporting rates of myocarditis or pericarditis were calculated per million doses of COVID-19 mRNA vaccine doses administered by age group, gender, dose number, and product type. All reports, including reports with missing time to onset (i.e., no restriction on time to onset applied), were included in the calculation of reporting rates.
- The calculation of reporting rates were repeated by restricting both the numerator and denominator to individuals who initiated their vaccination series on or after June 1, 2021, in order to account for any increase in AEFI reporting following the increased awareness resulting from media reports and the provincial ESD for myocarditis/pericarditis that began in June 2021.
- Data presented in Appendix C only include those reports that have a diagnosis of myocarditis, myopericarditis or perimyocarditis and meet the Brighton Collaboration levels 1 to 3 for myocarditis.

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Appendix A

Table A1. Number of myocarditis/pericarditis reports and doses administered following the Pfizer-BioNTech Comirnaty COVID-19 vaccine by dose number, age, and gender: Ontario, December 13, 2020 to November 21, 2021

Gender	Age group	Dose Number	Number of myocarditis/pericarditis reports	Doses administered
Female	12-17	1	7	415,041
Female	12-17	2	7	395,409
Female	18-24	1	5	440,749
Female	18-24	2	2	346,199
Female	25-29	1	2	349,804
Female	25-29	2	4	275,611
Female	30-39	1	5	684,839
Female	30-39	2	8	547,227
Female	40+	1	9	2,542,427
Female	40+	2	15	2,252,109
Male	12-17	1	19	430,972
Male	12-17	2	44	409,216
Male	18-24	1	17	446,907
Male	18-24	2	25	344,961
Male	25-29	1	11	348,795
Male	25-29	2	6	265,363
Male	30-39	1	8	642,824
Male	30-39	2	11	491,137
Male	40+	1	17	2,164,216
Male	40+	2	21	1,906,861

Data source: CCM, COVax$_{ON}$

Table A2. Number of myocarditis/pericarditis reports and doses administered following the Moderna Spikevax COVID-19 vaccine by dose number, age and gender: Ontario, December 13, 2020 to November 21, 2021

Gender	Age group	Dose Number	Number of myocarditis/pericarditis reports	Doses administered
Female	12-17	1	0	1,216
Female	12-17	2	0	2,364
Female	18-24	1	2	119,027
Female	18-24	2	12	189,536
Female	25-29	1	1	93,603
Female	25-29	2	2	149,926
Female	30-39	1	1	184,364
Female	30-39	2	7	295,021
Female	40+	1	5	622,887
Female	40+	2	5	1,127,269
Male	12-17	1	0	1,102
Male	12-17	2	0	2,263
Male	18-24	1	2	137,900
Male	18-24	2	68	203,625
Male	25-29	1	5	112,837
Male	25-29	2	18	171,545
Male	30-39	1	1	204,816
Male	30-39	2	22	324,154
Male	40+	1	8	586,832
Male	40+	2	20	1,102,262

Data source: CCM, COVax$_{ON}$

Appendix B

Table B1. Number of myocarditis/pericarditis reports and doses administered following the Pfizer-BioNTech Comirnaty COVID-19 vaccine by dose number, age and gender among individuals who initiated their vaccination in the enhanced surveillance period: Ontario, June 1, 2021 to November 21, 2021

Gender	Age group	Dose Number	Number of myocarditis/pericarditis reports	Doses administered
Female	12-17	1	6	285,512
Female	12-17	2	5	267,540
Female	18-24	1	3	165,307
Female	18-24	2	2	132,720
Female	25-29	1	0	120,996
Female	25-29	2	2	97,169
Female	30-39	1	3	224,765
Female	30-39	2	4	180,300
Female	40+	1	2	333,897
Female	40+	2	3	275,788
Male	12-17	1	15	304,395
Male	12-17	2	32	284,459
Male	18-24	1	8	207,719
Male	18-24	2	16	165,285
Male	25-29	1	6	145,967
Male	25-29	2	3	115,587
Male	30-39	1	4	236,241
Male	30-39	2	4	185,102
Male	40+	1	4	348,451
Male	40+	2	2	285,755

Data source: CCM, COVax$_{ON}$

Table B2. Number of myocarditis/pericarditis reports and doses administered following the Moderna Spikevax COVID-19 vaccine by dose number, age and gender among individuals who initiated their vaccination in the enhanced surveillance period: Ontario, June 1, 2021 to November 21, 2021

Gender	Age group	Dose Number	Number of myocarditis/pericarditis reports	Doses administered
Female	12-17	1	0	391
Female	12-17	2	0	642
Female	18-24	1	0	42,637
Female	18-24	2	5	55,157
Female	25-29	1	0	33,294
Female	25-29	2	1	42,532
Female	30-39	1	0	58,457
Female	30-39	2	3	76,103
Female	40+	1	2	102,431
Female	40+	2	0	115,722
Male	12-17	1	0	407
Male	12-17	2	0	671
Male	18-24	1	2	59,298
Male	18-24	2	22	69,939
Male	25-29	1	4	46,786
Male	25-29	2	10	55,935
Male	30-39	1	1	72,130
Male	30-39	2	8	90,153
Male	40+	1	5	124,309
Male	40+	2	2	135,566

Data source: CCM, COVax$_{ON}$

Appendix C

Table C1. Number of myocarditis reports and doses administered following the Pfizer-BioNTech Comirnaty COVID-19 vaccine by dose number, age, and gender: Ontario, December 13, 2020 to November 21, 2021

Gender	Age group	Dose Number	Number of myocarditis reports	Doses administered
Female	12-17	1	4	415,041
Female	12-17	2	6	395,409
Female	18-24	1	5	440,749
Female	18-24	2	1	346,199
Female	25-29	1	2	349,804
Female	25-29	2	3	275,611
Female	30-39	1	2	684,839
Female	30-39	2	5	547,227
Female	40+	1	3	2,542,427
Female	40+	2	5	2,252,109
Male	12-17	1	15	430,972
Male	12-17	2	36	409,216
Male	18-24	1	8	446,907
Male	18-24	2	21	344,961
Male	25-29	1	5	348,795
Male	25-29	2	5	265,363
Male	30-39	1	4	642,824
Male	30-39	2	11	491,137
Male	40+	1	5	2,164,216
Male	40+	2	4	1,906,861

Data notes: Only includes those reports that have a diagnosis of myocarditis, myopericarditis or perimyocarditis and meet the Brighton Collaboration levels 1 to 3 for myocarditis**.**
Data source: CCM, $COVax_{ON}$

Table C2. Number of myocarditis reports and doses administered following the Moderna Spikevax COVID-19 vaccine by dose number, age and gender: Ontario, December 13, 2020 to November 21, 2021

Gender	Age group	Dose Number	Number of myocarditis reports	Doses administered
Female	12-17	1	0	1,216
Female	12-17	2	0	2,364
Female	18-24	1	1	119,027
Female	18-24	2	12	189,536
Female	25-29	1	1	93,603
Female	25-29	2	1	149,926
Female	30-39	1	0	184,364
Female	30-39	2	5	295,021
Female	40+	1	3	622,887
Female	40+	2	1	1,127,269
Male	12-17	1	0	1,102
Male	12-17	2	0	2,263
Male	18-24	1	0	137,900
Male	18-24	2	64	203,625
Male	25-29	1	5	112,837
Male	25-29	2	15	171,545
Male	30-39	1	0	204,816
Male	30-39	2	19	324,154
Male	40+	1	4	586,832
Male	40+	2	13	1,102,262

Data notes: Only includes those reports that have a diagnosis of myocarditis, myopericarditis or perimyocarditis and meet the Brighton Collaboration levels 1 to 3 for myocarditis**.**
Data source: CCM, COVax$_{ON}$

Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Myocarditis and pericarditis following vaccination with COVID-19 mRNA vaccines in Ontario: December 13, 2020 to November 21, 2021. Toronto, ON: Queen's Printer for Ontario; 2022.

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