COVID-19 Vaccine Uptake and Program Impact in Ontario: December 14, 2020 to November 7, 2021

This report describes vaccine uptake using data extracted from the Ontario Ministry of Health’s COVaxON application. Data in this report includes the most current information extracted from COVaxON as of November 8, 2021 at approximately 7:00 a.m., and describes immunizations reported up to November 7, 2021.

Data presented may differ from other sources for various reasons, including differing extract times and methodologies for processing COVaxON data. Further details pertaining to the methodology for this report are described in the Technical Notes.

Please visit the interactive Ontario COVID-19 Data Tool to explore COVID-19 vaccination uptake data by public health unit, age group and trends over time.

Background

The COVID-19 vaccination program began in Ontario on December 14, 2020 with a three-phased distribution plan.1 Currently all individuals in the province 12 years of age and older are eligible for two doses of a Health Canada authorized COVID-19 vaccine. In August 2021, Ontario announced select vulnerable populations eligible for a third dose of a COVID-19 vaccine, including residents of long-term care homes and immunocompromised individuals.2 Further, in September 2021, guidance was released recommending one dose of an mRNA vaccine for individuals immunized outside the province with one or two doses of a vaccine that is not authorized for use by Health Canada.3

Highlights

- Overall, 75.3% (11,091,621 individuals) of the Ontario population is fully vaccinated and 78.3% (11,534,146 individuals) have received at least one dose.
- 85.5% (11,059,398 individuals) of the eligible Ontario population (12 years of age and older) are fully vaccinated and 88.9% (11,497,758 individuals) have received at least one dose of a COVID-19 vaccine.
- 186,921 individuals have received three doses of a Health Canada authorized vaccine. 4
- Over 85% of Ontarians 40 years of age and older and over 75% of those aged 12 to 39 are fully vaccinated (Table 1).
- As a result of the direct effects of the vaccination program, an estimated 158,020 cases have been prevented to date among individuals 18 years of age and older (Figures 4a and 4b).
• Further, an estimated 9,822 severe outcomes (hospitalizations or deaths) have been prevented among individuals 70 years of age and older (Figure 5).

• Since only the direct effects of vaccination are estimated in this analysis (e.g., indirect effects such as reduced transmission are not included) the reduction in cases and severe outcomes are likely to be underestimates.
Doses Administered Over Time

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

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 1b. Number of COVID-19 vaccine doses administered in Ontario by vaccine product and date

Note: Counts for the number of doses administered in Ontario exclude doses administered out of province and from non-Ontario stock.
Figure 1c. Number of COVID-19 vaccine doses administered in Ontario by vaccination setting and date

Notes:
1. The ‘mass immunization clinic’ group includes mass immunization, mobile, drive-through, and occupational clinics.
2. The ‘other/not reported’ category includes dose administration records where a vaccination setting was not specified (reported as ‘other’) or was missing (not reported).
3. Counts for the number of doses administered in Ontario exclude doses administered out of province and from non-Ontario stock.
Vaccination Coverage Over Time

Figure 2. Cumulative number of individuals who received a COVID-19 vaccine and provincial coverage estimates by date

Notes:
1. Doses administered outside of Ontario and prior to December 14, 2020, when the vaccination program began in Ontario, are excluded from trends over time figures, but are included in overall counts for coverage estimates.
2. Counts are shown using the date of dose one administration for at least one dose coverage estimates and the date of dose two administration for fully vaccinated coverage estimates.
Figure 3a. Provincial COVID-19 vaccine coverage estimates for at least one dose by age group and date

Notes:
1. Counts are shown using the date of dose one administration for at least one dose coverage estimates and the date of dose two administration for fully vaccinated coverage estimates.
2. Age-specific proportion indicates the proportion of the Ontario population within a specific age group that have received at least one dose of a COVID-19 vaccine. For example, the number of individuals that are 60-69 years of age who have received at least one dose is shown as the proportion of the Ontario population that is 60-69 years of age.
3. Doses administered outside of Ontario and prior to December 14, 2020, when the vaccination program began in Ontario, are excluded from trends over time figures, but are included in overall counts for coverage estimates.
Figure 3b. Provincial COVID-19 vaccine coverage estimates for fully vaccinated by age group and date

Notes:
1. Counts are shown using the date of dose one administration for at least one dose coverage estimates and the date of dose two administration for fully vaccinated coverage estimates.
2. Age-specific proportion indicates the proportion of the Ontario population within a specific age group that are fully vaccinated. For example, the number of individuals that are 60-69 years of age who are fully vaccinated is shown as the proportion of the Ontario population that is 60-69 years of age.
3. Doses administered outside of Ontario and prior to December 14, 2020, when the vaccination program began in Ontario, are excluded from trends over time figures, but are included in overall counts for coverage estimates.
Vaccination Program Impact

Figure 4a. Observed number of COVID-19 cases and expected number of COVID-19 cases in the absence of vaccination among individuals 18 to 69 years of age

Notes:
1. Only direct effects of vaccination on cases were estimated. Indirect effects, including reduced transmission as a result of vaccination were not estimated. As a result, the impact of the vaccination program on the reduction in cases and is likely an underestimate.
2. Doses administered outside of Ontario and prior to December 14, 2020, when the vaccination program began in Ontario, are excluded from trends over time figures, but are included in overall counts for coverage estimates.
3. This figure includes the effects of both dose 1 and dose 2. Further details are provided in the Technical Notes.
4. Coverage estimates shows the age-specific proportion of the Ontario population that have received at least one dose of a COVID-19 vaccine. For example, the number of individuals that are 18-39 years of age who have received at least one dose is shown as the proportion of the Ontario population that is 18-39 years of age.
**Figure 4b. Observed number of COVID-19 cases and expected number of COVID-19 cases in the absence of vaccination among individuals 70 years of age and older**

### Notes:

1. Only direct effects of vaccination on cases were estimated. Indirect effects, including reduced transmission as a result of vaccination were not estimated. As a result, the impact of the vaccination program on the reduction in cases and is likely an underestimate.
2. Doses administered outside of Ontario and prior to December 14, 2020, when the vaccination program began in Ontario, are excluded from trends over time figures, but are included in overall counts for coverage estimates.
3. This figure includes the effects of both dose 1 and dose 2. Further details are provided in the Technical Notes.
4. Coverage estimates shows the age-specific proportion of the Ontario population that have received at least one dose of a COVID-19 vaccine. For example, the number of individuals that are 70+ years of age who have received at least one dose is shown as the proportion of the Ontario population that is 70+ years of age.
Figure 5. Observed number of COVID-19 severe outcomes (hospitalizations or deaths) and expected number of COVID-19 severe outcomes in the absence of vaccination among individuals 70 years of age and older

Notes:
1. Only direct effects of vaccination on severe outcomes were estimated. Indirect effects, including reduced transmission as a result of vaccination were not estimated. As a result, the impact of the vaccination program on the reduction of severe outcomes is likely an underestimate.
2. Doses administered outside of Ontario and prior to December 14, 2020, when the vaccination program began in Ontario, are excluded from trends over time figures, but are included in overall counts for coverage estimates.
3. This figure includes the effects of both dose 1 and dose 2. Further details are provided in the Technical Notes.
4. Coverage estimates shows the age-specific proportion of the Ontario population that have received at least one dose of a COVID-19 vaccine. For example, the number of individuals that are 70+ years of age who have received at least one dose is shown as the proportion of the Ontario population that is 70+ years of age.
Notes:
1. Interpret COVID-19 case counts for the most recent days with caution due to reporting lags. The light grey shading indicates the most recent period during which case counts are likely to be updated.
2. The decreases observed in cases cannot be attributed to the vaccination program alone. Public health measures have also had an impact on trends in cases.
3. Doses administered outside of Ontario and prior to December 14, 2020, when the vaccination program began in Ontario, are excluded from trends over time figures, but are included in overall counts for coverage estimates.
4. Coverage estimates show the proportion of the total Ontario population that has been vaccinated.
5. Confirmed COVID-19 cases are shown using the episode date, an estimate of disease onset. Coverage estimates are shown using the date of dose one administration for at least one dose coverage estimates and the date of dose two administration for fully vaccinated coverage estimates.
Notes:
1. Interpret COVID-19 case counts for the most recent days with caution due to reporting lags. The light grey shading indicates the most recent period during which case counts are likely to be updated.
2. The decreases observed in cases cannot be attributed to the vaccination program alone. Public health measures have also had an impact on trends in cases.
3. Doses administered outside of Ontario and prior to December 14, 2020, when the vaccination program began in Ontario, are excluded from trends over time figures, but are included in overall counts for coverage estimates.
4. Coverage estimates show the proportion of the Ontario population 80 years of age and older that have been vaccinated.
5. Confirmed COVID-19 cases are shown using the episode date, an estimate of disease onset.
6. Coverage estimates are shown using the date of dose one administration for at least one dose coverage estimates and the date of dose two administration for fully vaccinated coverage estimates.
## Vaccination Coverage by Age Group and Gender

### Table 1. Number of individuals who received a COVID-19 vaccine and coverage estimates by gender or age group: Ontario, December 14, 2020 to November 7, 2021

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Number of individuals: Partially vaccinated</th>
<th>Number of individuals: Fully vaccinated</th>
<th>Number of individuals: Vaccinated with 3 doses</th>
<th>Coverage (%): At least one dose</th>
<th>Coverage (%): Fully vaccinated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>199,749</td>
<td>5,706,730</td>
<td>117,664</td>
<td>79.2</td>
<td>76.6</td>
</tr>
<tr>
<td>Male</td>
<td>241,544</td>
<td>5,360,055</td>
<td>68,172</td>
<td>77.0</td>
<td>73.6</td>
</tr>
<tr>
<td>Age in years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 to 17</td>
<td>46,532</td>
<td>802,300</td>
<td>404</td>
<td>88.3</td>
<td>83.5</td>
</tr>
<tr>
<td>18 to 29</td>
<td>129,846</td>
<td>1,955,508</td>
<td>3,966</td>
<td>83.9</td>
<td>78.7</td>
</tr>
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<td>30 to 39</td>
<td>87,582</td>
<td>1,658,643</td>
<td>6,697</td>
<td>85.8</td>
<td>81.5</td>
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<td>40 to 49</td>
<td>59,158</td>
<td>1,574,918</td>
<td>9,393</td>
<td>88.2</td>
<td>85.0</td>
</tr>
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<td>50 to 59</td>
<td>50,006</td>
<td>1,784,407</td>
<td>16,241</td>
<td>89.8</td>
<td>87.4</td>
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<td>60 to 69</td>
<td>32,591</td>
<td>1,621,025</td>
<td>27,624</td>
<td>93.7</td>
<td>91.8</td>
</tr>
<tr>
<td>70 to 79</td>
<td>16,904</td>
<td>1,064,818</td>
<td>37,378</td>
<td>95.3</td>
<td>93.9</td>
</tr>
<tr>
<td>80 and over</td>
<td>15,741</td>
<td>597,779</td>
<td>85,205</td>
<td>93.5</td>
<td>91.1</td>
</tr>
<tr>
<td>Total</td>
<td>442,525</td>
<td>11,091,621</td>
<td>186,921</td>
<td>78.3</td>
<td>75.3</td>
</tr>
</tbody>
</table>

### Notes:

1. For the purposes of this report, age was calculated on the date of dose administration. However, vaccination program eligibility may be based on birth year. For example, individuals turning 12 in 2021 are now eligible for immunization. Individuals that are 11 years of age at the time of vaccination are included in provincial totals, but not included in age specific stratum as the number of eligible 11 year olds is small.

2. The ‘vaccinated with 3 doses’ category refers to individuals that have received three doses of a HC-authorized vaccine, and includes individuals receiving a third dose based on Ontario’s edibility criteria (e.g. individuals residing in long-term care homes and immunocompromised individuals). It is a subset of individuals that are considered fully vaccinated. The fully vaccinated and vaccinated with three doses categories are not mutually exclusive.

3. Individuals that received a vaccination out of province or from non-Ontario stock are included in coverage estimates, as these individuals are residents of Ontario, but are not included in counts for the number of doses administered in Ontario. As a result, the counts reported for doses administered will not align with the number of individuals immunized.

4. Provincial totals include individuals with unknown age and/or gender. Further details are provided in the Technical Notes.
Figure 8. Provincial COVID-19 vaccine coverage estimates (partially and fully vaccinated) by gender and age group

Note: Individuals with unknown age and/or gender were excluded. Further details are provided in the Technical Notes.
Table 2. Number of doses administered in Ontario by product type and age group: Ontario, December 14, 2020 to November 7, 2021

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12 to 17</td>
<td>840,752</td>
<td>792,795</td>
<td>398</td>
<td>2,302</td>
<td>4,599</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>18 to 29</td>
<td>1,578,561</td>
<td>1,210,020</td>
<td>9,869</td>
<td>464,138</td>
<td>713,731</td>
<td>1,035</td>
<td>505</td>
<td>279</td>
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</tr>
<tr>
<td>30 to 39</td>
<td>1,320,341</td>
<td>1,020,791</td>
<td>6,343</td>
<td>388,974</td>
<td>617,378</td>
<td>1,145</td>
<td>14,281</td>
<td>1,653</td>
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<td>0</td>
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<tr>
<td>40 to 49</td>
<td>1,089,850</td>
<td>953,172</td>
<td>7,913</td>
<td>303,543</td>
<td>582,795</td>
<td>1,876</td>
<td>224,951</td>
<td>23,894</td>
<td>0</td>
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<tr>
<td>50 to 59</td>
<td>1,190,636</td>
<td>1,063,339</td>
<td>12,653</td>
<td>319,303</td>
<td>650,992</td>
<td>3,883</td>
<td>309,166</td>
<td>54,208</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>60 to 69</td>
<td>1,074,601</td>
<td>947,014</td>
<td>20,299</td>
<td>287,347</td>
<td>531,435</td>
<td>7,785</td>
<td>275,964</td>
<td>126,488</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>70 to 79</td>
<td>865,646</td>
<td>746,868</td>
<td>25,687</td>
<td>170,028</td>
<td>292,442</td>
<td>11,930</td>
<td>36,492</td>
<td>15,758</td>
<td>1</td>
<td>0</td>
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<tr>
<td>80 and over</td>
<td>477,858</td>
<td>424,614</td>
<td>47,210</td>
<td>130,437</td>
<td>170,031</td>
<td>38,048</td>
<td>3,412</td>
<td>1,277</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>8,473,636</td>
<td>7,190,249</td>
<td>130,703</td>
<td>2,066,276</td>
<td>3,563,485</td>
<td>65,714</td>
<td>864,800</td>
<td>223,564</td>
<td>3</td>
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</tr>
</tbody>
</table>

Notes:
1. Counts for the number of doses administered in Ontario exclude doses administered out of province and from non-Ontario stock. However, individuals that received a vaccination out of province or from non-Ontario stock are included in coverage estimates, as these individuals are residents of Ontario. As a result, the counts reported for doses administered will not align with the number of individuals immunized.
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 dose is counted as a dose 3 administered in Ontario and the first two doses are not counted as they were administered out of province.
3. For the purposes of this report, age was calculated on the date of dose administration. However, vaccination program eligibility may be based on birth year. For example, individuals turning 12 in 2021 are now eligible for immunization. Individuals that are 11 years of age at the time of vaccination are included in provincial totals, but not included in age specific stratum as the number of eligible 11 year olds is small.
4. Provincial totals include individuals with unknown age. Further detail is provided in the Technical Notes.
5. Totals for dose 1, dose 2, and dose 1 include dose records where the dose was reported as administered in Ontario but the product was unknown/missing.
Figure 9. Number of individuals by product type received for dose 1 and dose 2
Table 3. Number of doses (dose 1, dose 2, and dose 3) administered in Ontario by vaccination setting and age group: Ontario, December 14, 2020 to November 7, 2021

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Number of doses: Congregate living/care</th>
<th>Number of doses: Hospital</th>
<th>Number of doses: Mass immunization clinic</th>
<th>Number of doses: Pharmacy</th>
<th>Number of doses: Physician’s office</th>
<th>Number of doses: Other/Not reported</th>
<th>Total doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 to 17</td>
<td>5,217</td>
<td>179,717</td>
<td>1,178,983</td>
<td>245,125</td>
<td>25,449</td>
<td>6,359</td>
<td>1,640,850</td>
</tr>
<tr>
<td>18 to 29</td>
<td>38,247</td>
<td>616,637</td>
<td>2,413,840</td>
<td>788,588</td>
<td>106,945</td>
<td>13,881</td>
<td>3,978,138</td>
</tr>
<tr>
<td>30 to 39</td>
<td>38,154</td>
<td>558,889</td>
<td>2,026,966</td>
<td>640,026</td>
<td>97,265</td>
<td>9,606</td>
<td>3,370,906</td>
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<tr>
<td>40 to 49</td>
<td>39,750</td>
<td>523,351</td>
<td>1,743,712</td>
<td>747,829</td>
<td>125,565</td>
<td>7,787</td>
<td>3,187,994</td>
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<td>50 to 59</td>
<td>52,845</td>
<td>611,814</td>
<td>1,934,217</td>
<td>863,034</td>
<td>135,264</td>
<td>7,006</td>
<td>3,604,180</td>
</tr>
<tr>
<td>60 to 69</td>
<td>57,567</td>
<td>497,687</td>
<td>1,825,591</td>
<td>757,688</td>
<td>127,720</td>
<td>4,682</td>
<td>3,270,935</td>
</tr>
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<td>70 to 79</td>
<td>69,347</td>
<td>384,993</td>
<td>1,363,584</td>
<td>290,780</td>
<td>54,102</td>
<td>2,046</td>
<td>2,164,852</td>
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<td>80 and over</td>
<td>236,657</td>
<td>263,954</td>
<td>679,762</td>
<td>78,750</td>
<td>32,799</td>
<td>965</td>
<td>1,292,887</td>
</tr>
<tr>
<td>Total</td>
<td>537,909</td>
<td>3,640,665</td>
<td>13,213,033</td>
<td>4,427,162</td>
<td>706,675</td>
<td>52,986</td>
<td>22,578,430</td>
</tr>
</tbody>
</table>

Notes:
1. Counts for the number of doses administered in Ontario exclude doses administered out of province and from non-Ontario stock. However, individuals that received a vaccination out of province or from non-Ontario stock are included in coverage estimates, as these individuals are residents of Ontario. As a result, the counts reported for doses administered will not align with the number of individuals immunized.
2. For the purposes of this report, age was calculated on the date of dose administration. However, vaccination program eligibility may be based on birth year. For example, individuals turning 12 in 2021 are now eligible for immunization. Individuals that are 11 years of age at the time of vaccination are included in provincial totals, but not included in age specific stratum as the number of eligible 11 year olds is small. The ‘mass immunization clinic’ group includes mass immunization, mobile, drive-through, and occupational clinics.
3. The ‘other/not reported’ category includes dose administration records where a vaccination setting was not specified (reported as ‘other’) or was missing (not reported).
4. Provincial totals include individuals with unknown age. Further detail is provided in the Technical Notes.
Technical Notes

Definition of Terms

Vaccine series refers to the number of vaccine doses within a schedule that has been approved by Health Canada. COVID-19 vaccine products currently available in Ontario have a two-dose (i.e. Moderna Spikevax, Pfizer-BioNTech Comirnaty, AstraZeneca Vaxzevria or COVISHIELD COVID-19 vaccines) schedule.

Interval refers to the period of time (e.g. number of days) between doses. For all available COVID-19 vaccines, there is a recommended minimum number of days that an individual must wait after receiving their first dose and before receiving their second dose.

Partially vaccinated refers to individuals that have received only the first dose of a two-dose Health Canada (HC) authorized vaccine, and individuals that have received one or two doses of a non-HC authorized vaccine.

Fully vaccinated refers to individuals that have received one dose of a one-dose HC-authorized vaccine product (i.e. dose one of one), both doses of a two-dose HC-authorized vaccine series (i.e. dose two of two), or three doses of any vaccine product whether it is HC-authorized or not. This includes individuals that have received two doses of a non-HC authorized vaccine, followed by an mRNA vaccine.

Vaccinated with three doses refers to individuals that have received three doses of a HC-authorized vaccine, and includes individuals receiving a third dose based on Ontario’s eligibility criteria (e.g. individuals residing in long-term care and high risk retirement homes and immunocompromised individuals). This category is a subset of individuals that are considered fully vaccinated. The fully vaccinated and vaccinated with three doses categories are not mutually exclusive. For example, individuals residing in long-term care that have received three doses of a HC-authorized vaccine are reported as fully vaccinated as well as vaccinated with three doses.

Coverage estimate (at least one dose) refers to the proportion of the population that has received at least one dose of a COVID-19 vaccine. Reflects individuals that are partially or fully vaccinated.

Coverage estimate (fully vaccinated) refers to the proportion of the population that is fully vaccinated.

Note: Coverage for individuals that have received three doses, as per Ontario’s eligibility criteria, are not included in the report at this time.

Data Sources

- COVID-19 vaccination data were based on information successfully extracted from the Ontario Ministry of Health’s COVaxON application as of November 8, 2021 at approximately 7:00 a.m. for vaccination records created on or after June 1, 2021 and November 4, 2021 at approximately 7:00 a.m. for vaccination records created up to May 31, 2021.

- COVID-19 case data were based on information successfully extracted from the Ontario Ministry of Health’s CCM application as of November 8, 2021 at approximately 1:00 p.m. for cases reported from Feb 1, 2021 on and as of November 4, 2021 at approximately 9:00 a.m. for cases reported up to Jan 31, 2021.
Ontario population estimate data were sourced from Statistics Canada. Population estimates 2001-2020: Table 1 annual population estimates by age and sex for July 1, 2001 to 2020, health regions, Ontario [unpublished data table]. Ottawa, ON: Government of Canada; 2021 [received April 22, 2021].

Data Caveats

- COVaxON and CCM are dynamic reporting systems, which allow ongoing updates to data previously entered. As a result, data extracted from COVaxON and CCM represent a snapshot at the time of extraction and may differ from previous or subsequent reports.

- The data represent immunization and case information reported and recorded in COVaxON or CCM. As a result, all counts may be subject to varying degrees of underreporting due to a variety of factors.

- Counts for the number of doses administered in Ontario exclude doses administered out of province and from non-Ontario stock. However, individuals that received a vaccination out of province or from non-Ontario stock are included in coverage estimates, as these individuals are residents of Ontario. As a result, the counts reported for doses administered will not align with the number of individuals immunized.

- Only cases meeting the confirmed case classification as listed in the MOH COVID-19 case definition are included.5 This includes persons with a positive detection of serum/plasma immunoglobulin G (IgG) antibodies to SARS-CoV-2, which was added to the confirmed case definition on August 6, 2020.

- Ontario-specific vaccine effectiveness (VE) estimates (for both symptomatic infection and severe outcomes) used in this analysis reflect VE of 14 or more days following dose 1 and dose 2 administration. VE increases with time, particularly for those aged 70 years or older. As such, VE may be an under-estimate and the number of cases and severe outcomes averted is likely a conservative estimate.

- VE also varies with age, with lower VE among older age groups. As a result the estimated impact on severe outcomes (calculated using VE for individuals 70+ years of age) for individuals 70-79 years of age is likely an underestimate, while the estimated impact for individuals 80+ years of age may be an overestimate.

- Only direct effects of vaccination on cases and severe outcomes were estimated in this analysis. Indirect effects including, reduced transmission, as a result of vaccination were not estimated. Further, only first doses were considered in these analyses. As a result, the impact the vaccination program on the reduction in cases and severe outcomes is likely an underestimate.

Methods: Vaccination Data

- Data presented may differ from other sources for various reasons, including differing extract times and methodologies for processing COVaxON data. Further details pertaining to the methodology for this report are described below.

- Data includes clients with a dose administration record recorded in COVaxON which includes a small number of client records with a residential postal code outside of Ontario who may be eligible for immunization on the basis of working in a high-risk setting (i.e. LTCH) in Ontario.
• The following definitions were used to assign vaccination status to individuals:
  
  **Partially vaccinated** refers to individuals that have received:
  
  • Only the first dose of a Health Canada (HC) authorized or non-HC authorized vaccine series; two doses of a non-HC authorized vaccine; and a first dose of an HC-authorized vaccine followed by a second dose of a non-HC authorized vaccine

  **Fully vaccinated** refers to individuals that have received:
  
  • One dose of a one-dose HC-authorized vaccine product (i.e. dose one of one); both doses of a two-dose HC-authorized vaccine series (i.e. dose two of two); and three doses of any vaccine product whether it is HC-authorized or not.

  **Vaccinated with three doses** refers to individuals:
  
  • That have received three doses of a HC-authorized vaccine, and includes individuals eligible for a third dose based on Ontario’s eligibility criteria (e.g. individuals residing in long-term care homes and immunocompromised individuals).
  
  • This category is a subset of individuals that are considered fully vaccinated. The fully vaccinated and vaccinated with three doses categories are not mutually exclusive.

• Out of province dose administration records well as doses administered from non-Ontario stock (e.g. doses from federal stock for populations such as the Armed Forces) are included in coverage estimates. However, out of province and non-Ontario stock dose administration records are not included in dose counts.

• 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 dose is counted as a dose 3 administered in Ontario and the first two doses are not counted as they were administered out of province.

• For missing dose administration dates and dose administration dates prior to December 14, 2020, the date the administration record was created was used as a proxy. It is possible that dose administration records could be created in advance of dose administration, and thus this may not reflect the true dose administration date.

• Dose administration date was used to determine the dose number (e.g. the first chronological dose was considered dose 1) as well as the dose interval (e.g. number of days from first to second dose).

• Non-valid dose records were excluded. Non-valid records included doses where the status was reported as ‘entered in error’, ‘invalid’, or other similar variations, as well as doses where the status was valid (e.g. ‘administered’) but that were identified as non-valid client records (e.g. client first and last name were reported as ‘test’, ‘do not use’, ‘error’, ‘ignore’, or other similar variations).

• Duplicate dose administration records were excluded (i.e. clients with multiple dose administration records with the same date). Duplicate dose records were identified and excluded using personal identifiers, such as health card number, name, date of birth, and postal code, where available, as well as dose administration date.
• After removing duplicate dose administration records, dose 1, dose 2, and dose 3 were assigned based on the dose administration dates reported.

• For clients with multiple doses reported with different administration dates, the first chronological dose was considered the first dose.

• To determine a date for the second dose, the first subsequent date on or after the product-specific recommended minimum interval of the first dose product, with a 4-day grace period, was used. Doses administered prior to the product-specific recommended minimum interval, with a 4-day grace period, were not considered valid. For example, if there were two subsequent doses that were 7 days and 21 days from a Moderna Spikevax COVID-19 vaccine first dose, respectively, then the dose that was 21 days from the first dose was used as the second dose. Similarly, if there were two subsequent doses that were 10 days and 12 days from the first dose, respectively, then neither dose was used and the individual was not assigned a second dose. The recommended product specific minimum intervals, with a 4-day grace period, as outlined by the National Advisory Committee on Immunization (NACI) are as follows:
  - Pfizer-BioNTech Comirnaty COVID-19 vaccine: 15 days (19 days with a 4-day grace period).\(^6\) There is currently no maximum interval for second doses (i.e. no recommendation to restart a vaccine series regardless of the length of delay of the second dose).
  - Moderna Spikevax COVID-19 vaccine: 17 days (21 days with a 4-day grace period).\(^6\) There is currently no maximum interval for second doses (i.e. no recommendation to restart a vaccine series regardless of delay of second dose).
  - AstraZeneca Vaxzevria/COVISHIELD COVID-19 vaccine: 24 days (28 days with a 4-day grace period).\(^6\) There is currently no maximum interval for second doses (i.e. no recommendation to restart a vaccine series regardless of delay of second dose).
  - Non-Health Canada authorized products or unspecified products: 17 days (21 days with a 4-day grace period).

• To determine a date for the third dose, the first subsequent date 28 days or more after the second dose was used, regardless of the vaccine product of the second dose (i.e. the dose 3 interval was not product-specific). For example, if there were two subsequent doses that were 10 days and 28 days from a Pfizer Comirnaty COVID-19 vaccine second dose, respectively, then the dose that was 28 days from the second dose was used as the third dose. Similarly, if there were two subsequent doses that were 11 days and 13 days from the second dose, respectively, then neither dose was used and the individual was not assigned a third dose.

• A maximum of three doses were assigned for an individual. If multiple doses 28 days or more after the second dose were reported, then the first chronological dose after the second dose was used. For example, if there were two subsequent doses that were 30 days and 33 days from a Pfizer Comirnaty COVID-19 vaccine second dose, respectively, then the dose that was 30 days from the second dose was used as the third dose.

• Age at the time of dose 1 administration was calculated using the client date of birth and the date of dose 1 administration. Ages reported as \(>=120\) years, <0 years, or where date of birth was missing were considered unknown. In Canada, the Pfizer-BioNTech Comirnaty and Moderna Spikevax COVID-19 vaccines are authorized for use in individuals aged 12 years and
older. The AstraZeneca Vaxzevria/COVISHIELD COVID-19 vaccines are authorized for use in individuals aged 18 years and older.\textsuperscript{7,8} Based on expected vaccine product use as per NACI and product monographs, clients under 12 years of age that received the Pfizer-BioNTech Comirnaty or Moderna Spikevax COVID-19 vaccine, and clients under 18 years of age that received the AstraZeneca Vaxzevria/COVISHIELD COVID-19 vaccines, were also considered to have unknown age.

- Clients reporting a gender of ‘Non-binary/third gender’ and ‘Other’ were combined into an ‘Other’ category. ‘Unknown’ gender included clients where gender was reported as ‘Prefer not to say’, ‘Unknown’, or where gender was missing.

- Organization postal code and public health unit were assigned using institution-specific IDs.

- Postal code of residence was extracted from the client residential address. For clients where the public health unit of residence was not reported and the postal code of residence was available, the postal code of residence was used to assign clients to a public health unit of residence.

- Priority population categories were informed by the MOH’s COVID-19: Guidance for Prioritization Health Care Workers for COVID-19 Vaccination.\textsuperscript{9}
  - The ‘reason for immunization’ field was used to assign individuals as LTCH/RH residents

### Methods: Case Data

- Methods for processing the CCM case data are described in the Technical Notes of the COVID-19 Daily Epidemiological Summary.\textsuperscript{10}

### Methods: Vaccination Program Impact

- The estimated number of cases and severe outcomes (i.e., hospitalizations or deaths) averted by COVID-19 vaccination was estimated using a methodology outlined by Public Health England.\textsuperscript{11}

- For cases with multiple severe outcomes (i.e., hospitalization and death) only the hospitalization was used.

- Cases where the date of hospital admission and/or fatal outcome was not reported were excluded.

- The impact of COVID-19 vaccines against cases and severe outcomes was estimated by multiplying vaccination coverage by vaccine effectiveness (VE) against cases and severe outcomes, respectively. The following Ontario-specific VE estimates for dose 1 and dose 2 were used:\textsuperscript{12}
  - A VE of 71% against symptomatic infection 14 or more days after dose 1 was applied for cases 18-39 years of age, a VE of 66% was applied for cases 40-69 years of age, and a VE of 40% was applied for cases 70+ years of age.
  - A VE of 93% against symptomatic infection 14 or more days after dose 2 was applied for cases 18-39 years of age, a VE of 89% was applied for cases 40-69 years of age, and a VE of 94% was applied for cases 70+ years of age.
  - A VE of 67% against severe outcomes 14 or more days after dose 1 was applied for severe outcomes among cases 70-79 and 80+ years of age.
- A VE of 97% against severe outcomes 14 or more days after dose 2 was applied for severe outcomes among cases 70-79 and 80+ years of age.

- Given the time required from vaccination to protection for vaccination (i.e., to mount an immune response), the following lags were applied when estimating impacts:
  - A lag of 14 days (corresponding to VE estimates) was applied to estimate the impact on cases.
  - A lag of 20 days for hospitalizations and 27 days for death (corresponding to VE estimates plus median number of days from onset to hospitalization or death) were applied to estimate the impact on severe outcomes.
References


