

COVID-19 Vaccination During Pregnancy in Ontario Report #1: December 14, 2020 to May 31, 2021*

* Reporting interval includes all pregnant individuals with an expected date of birth on or after December 14, 2020 (when the provincial COVID-19 vaccination program began) and all COVID-19 vaccines administered and reported to COVaxON by May 31, 2021.

COVID-19 Vaccination During Pregnancy in Ontario, Report #1: December 14, 2020 to May 31, 2021

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Background

Pregnant individuals are considered a high-risk population for COVID-19 complications, based on higher rates of COVID-19 hospitalization, ICU admission, and death compared with non-pregnant individuals.¹⁻⁴ Since late April 2021, pregnant people in Ontario have been prioritized for COVID-19 vaccination as part of Phase 2 of the COVID-19 vaccine program implementation.⁵ Even prior to April, Canada and many other countries recommended not withholding COVID-19 vaccination for pregnant people in early priority groups, such as health care or other frontline workers;⁶⁻⁸ therefore, COVID-19 vaccination was already being administered during pregnancy prior to late April, but less frequently.

With support from the Public Health Agency of Canada, through the Vaccine Surveillance Reference Group and the COVID-19 Immunity Task Force, the Better Outcomes Registry & Network (BORN) Ontario is evaluating COVID-19 vaccination in pregnant individuals in Ontario. As a prescribed Registry under the Personal Health Information Protection Act (PHIPA), BORN collects extensive clinical data on all pregnancies and births in Ontario from over 250 hospitals, birth centres, midwifery practice groups, and screening labs (www.bornontario.ca).⁹ This report describes COVID-19 vaccine uptake during pregnancy using data extracted from the BORN Information System (BIS) on June 3, 2021, linked with Ontario Ministry of Health's COVaxON application, which was extracted on May 31, 2021 (additional methodological details are provided in the Appendix). **Results in this report will be updated on a regular basis as new data become available.**

Highlights

- Between December 14, 2020 and May 31, 2021, there were an estimated 129,027 pregnant individuals in Ontario. Of those, 30,892 (23.9%) received at least one dose of COVID-19 vaccine during pregnancy:
 - o 30,670 (99.3%) initiated their COVID-19 vaccine series during pregnancy and 222 (0.7%) received only dose 2 during pregnancy (i.e., received dose 1 prior to pregnancy).
 - o The mean gestational age at first COVID-19 vaccination during pregnancy was 25.5 weeks of gestation.
 - o 25,990 (84.1%) of vaccinated individuals were still currently pregnant as of the end of this reporting interval (i.e., May 31, 2021).
- Uptake of COVID-19 vaccination during pregnancy increased substantially over the reporting interval from an estimated 0.02% in December 2020 to 38.1% in May 2021.
- Cumulative incidence rates of pregnancy and birth outcomes among vaccinated individuals do not suggest any pattern of increased risk in these preliminary data.

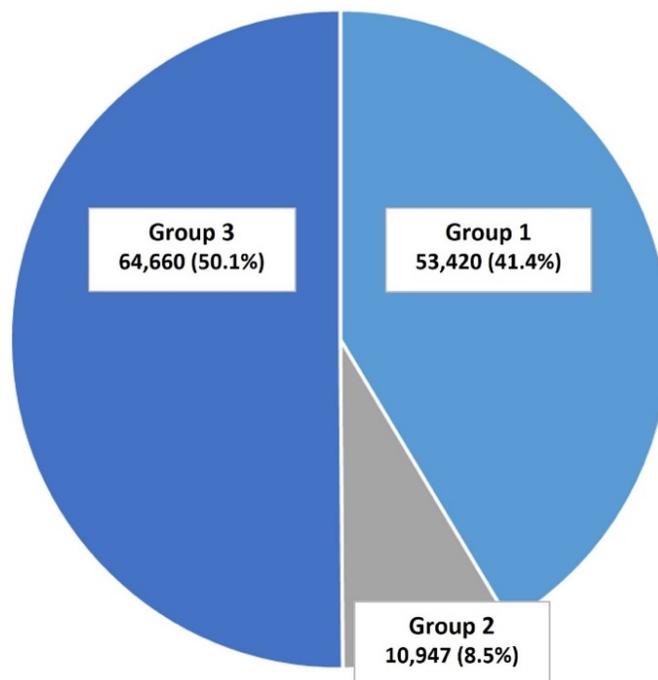
Results

1. Pregnant population in Ontario during reporting interval (December 14, 2020 to May 31, 2021)

During the interval between December 14, 2020 (when the COVID-19 vaccination program began in Ontario) and May 31, 2021, an estimated 129,027 individuals were at various stages of pregnancy (see Appendix for methodological details about how the population was identified).

- 53,420 (41.4%) have given birth during the reporting interval and the birth record has already been transferred to the BORN Registry (**Group 1**)
- Another 10,947 (8.5%) have likely already given birth, based on their expected due date; however, their birth record has not yet been transferred to the BORN Registry (**Group 2**)
- 64,660 people (50.1%) were still currently pregnant as of May 31, 2021 and are expected to give birth at a later date (**Group 3**)

Figure 1. Pregnant population in Ontario during reporting interval, by type of record in the BORN Information System



^a Individuals in Group 2 are those that are expected to have given birth by this reporting interval based on the estimated due date computed from prenatal screening records. The birth records for this group have not yet been entered/transferred from the hospital of birth/midwifery practice to the BORN Information System. This is a normal lag time, but it is also possible that some of these may have ended in pregnancy loss before 20 weeks of gestation, which is not captured in the database.

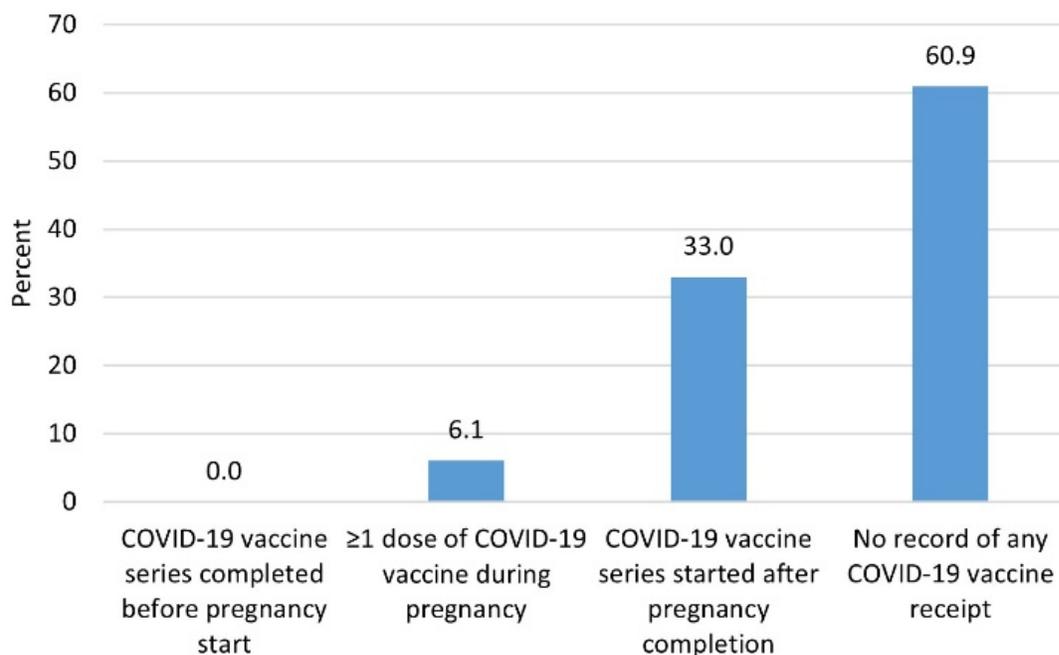
2. Number and proportion of pregnant people in Ontario who have received a COVID-19 vaccine

In this reporting interval from December 14, 2020 to May 31, 2021, **30,892** individuals had received at least one dose of COVID-19 vaccine during pregnancy.

- The figures below show the number and percentage of individuals in each group of the pregnant population by vaccination status.

GROUP 1: Birth occurred and records complete
n = 53,420

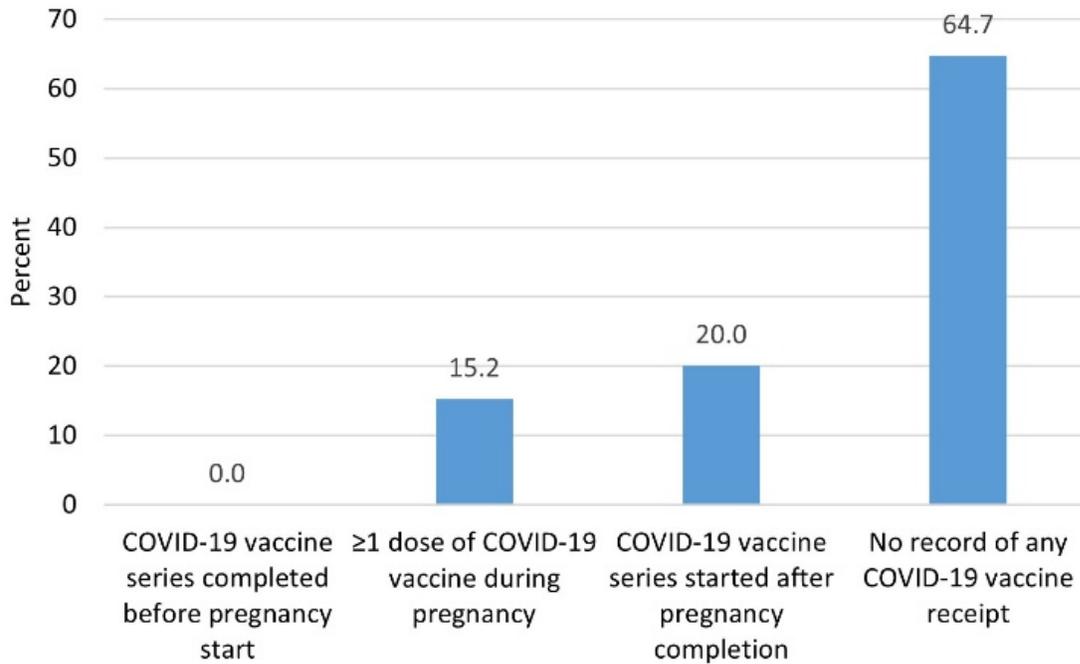
Figure 2a.



- No individuals in this group had completed ^a their COVID-19 vaccine series prior to becoming pregnant
- **3,236** people (6.1%) in this group received at least one dose of COVID-19 vaccine during pregnancy (dose 1 and/or dose 2)
- **17,631** people (33.0%) started their COVID-19 vaccine series after their pregnancy was completed
- **32,553** people (60.9%) did not have any record of having received a COVID-19 vaccine at any time

GROUP 2: Birth likely occurred and records not yet complete
n = 10,947

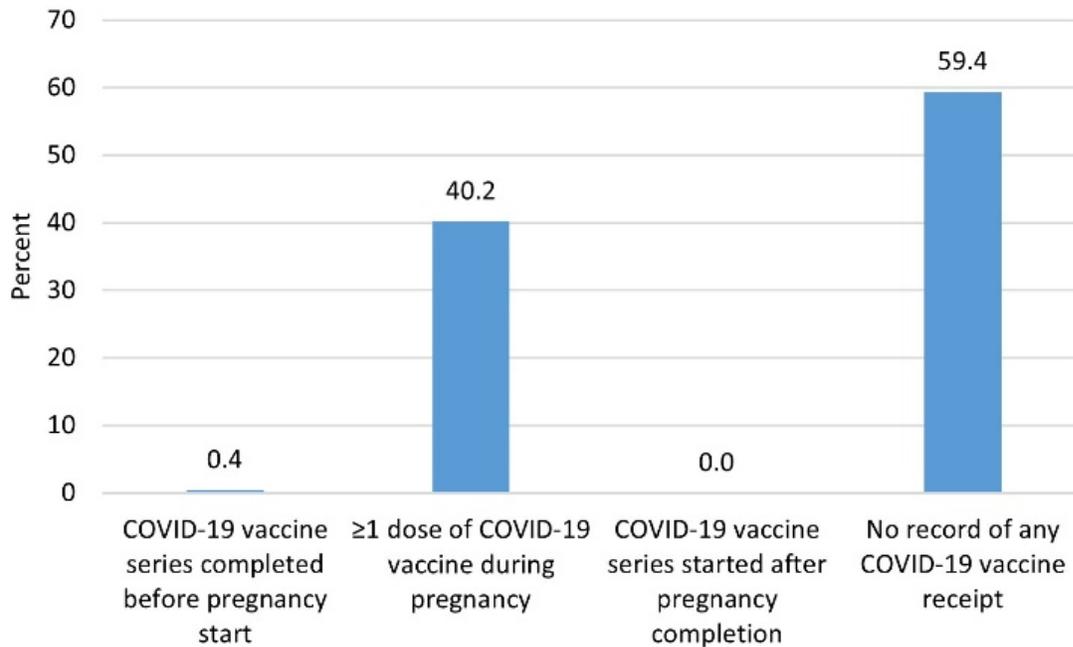
Figure 2b.



- No individuals in this group had completed ^a their COVID-19 vaccine series prior to becoming pregnant
- **1,666** people (15.2%) in this group received at least one dose of COVID-19 vaccine during pregnancy (dose 1 and/or dose 2)
- **2,194** people (20.0%) started their COVID-19 vaccine series after their pregnancy was completed
- **7,087** people (64.7%) did not have any record of having received a COVID-19 vaccine at any time

GROUP 3: Due date after May 31, 2021 (still currently pregnant)
n = 64,660

Figure 2c.



- **273** people (0.4%) had already completed ^a their COVID-19 vaccine series prior to becoming pregnant
- **25,990** people (40.2%) in this group received at least one dose of COVID-19 vaccine during pregnancy (dose 1 and/or dose 2)
- No individuals in this group started their COVID-19 vaccine series after their pregnancy was completed
- **38,397** people (59.4%) did not have any record of having received a COVID-19 vaccine at any time

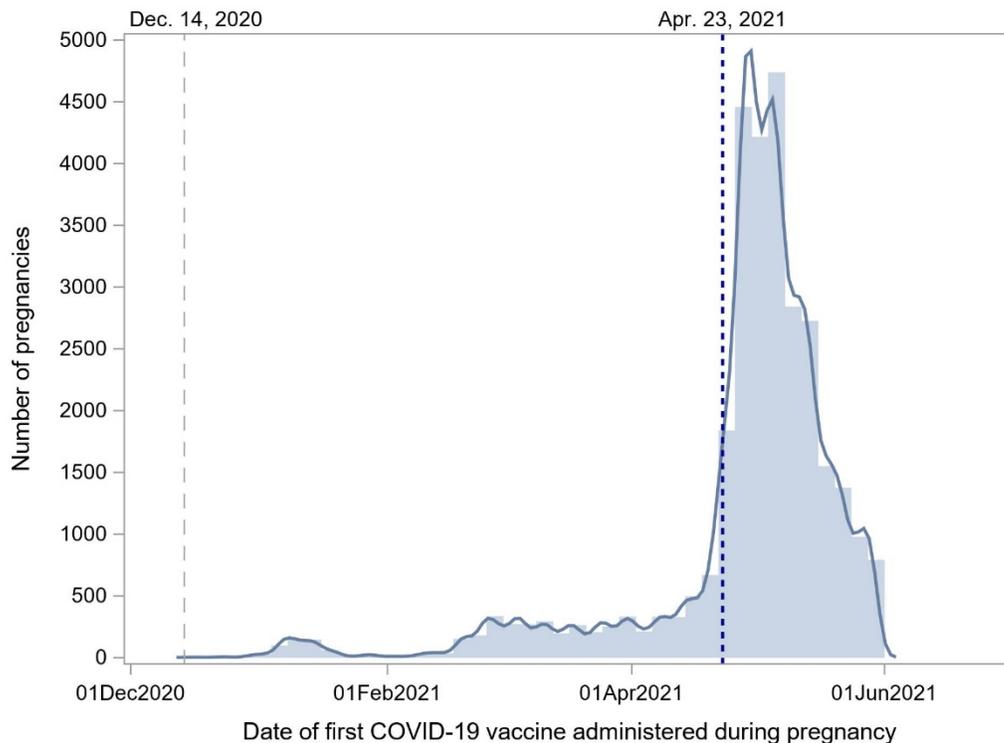
^a A complete COVID-19 vaccine series is defined as receipt of both doses of a two-dose vaccine series. All COVID-19 vaccines currently available in Ontario have a two-dose schedule.

3. Calendar timing of COVID-19 vaccination during pregnancy

Of the **30,892** pregnant individuals who received at least one dose of COVID-19 vaccine during pregnancy, 30,670 (99.3%) initiated their COVID-19 vaccine series during pregnancy (i.e., received dose 1 during pregnancy) and 222 (0.7%) received only dose 2 during pregnancy (i.e., received dose 1 prior to pregnancy).

- Figure 3 below shows the calendar timing of the first COVID-19 vaccination administered during pregnancy (i.e., dose 1 for those who initiated their COVID-19 vaccine series during pregnancy, or dose 2 for those who received dose 1 prior to pregnancy).
- The majority of vaccines were administered after April 23, 2021, when pregnant people were designated a priority population in Ontario (shown by the bold dotted line).

Figure 3. Calendar timing of the first COVID-19 vaccination administered during pregnancy



^a Vertical pale dashed line represents the date the provincial COVID-19 vaccination program began in Ontario (December 14, 2020) and vertical bold dotted line represents the date pregnant people were designated a priority population in Ontario (April 23, 2021).

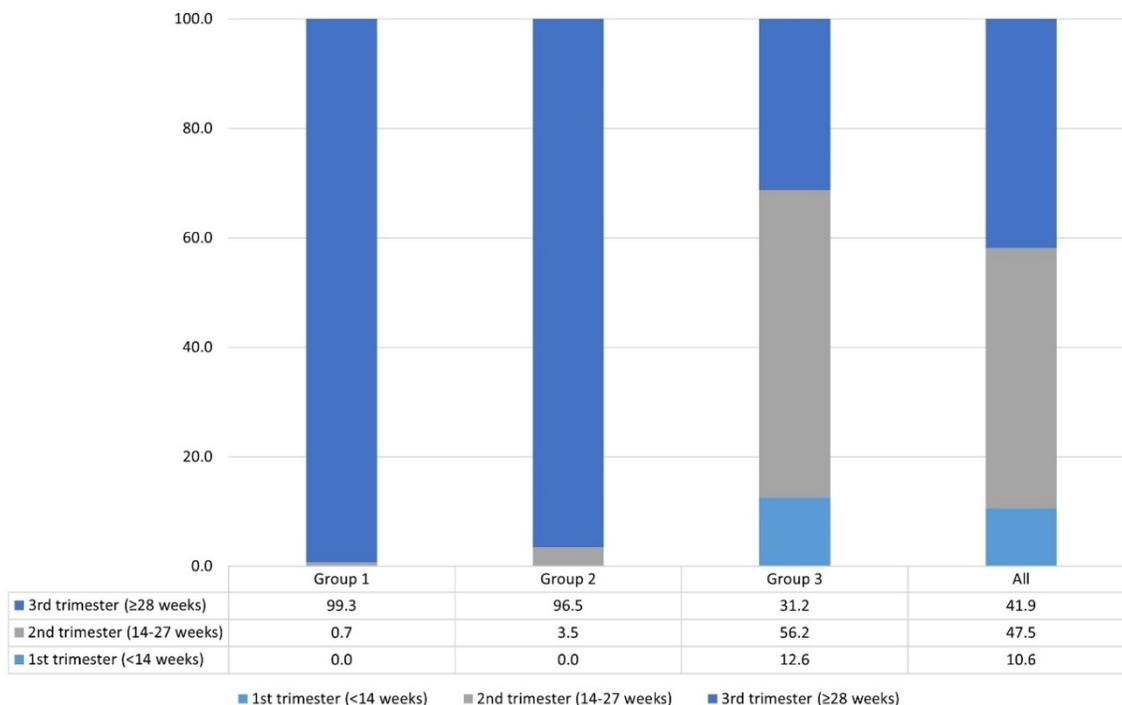
^b Timing reflects the date of the first COVID-19 vaccination administered during pregnancy (i.e., dose 1 for those who initiated their COVID-19 vaccine series during pregnancy, or dose 2 for those who received dose 1 prior to pregnancy).

4. Gestational timing of COVID-19 vaccination during pregnancy

Of the **30,892** pregnant individuals who received at least one dose of COVID-19 vaccine during pregnancy, the mean gestational age when they received their first COVID-19 vaccination administered during pregnancy (i.e., dose 1 for those who initiated their COVID-19 vaccine series during pregnancy, or dose 2 for those who received dose 1 prior to pregnancy) was 25.5 weeks of gestation.

- By group, the mean gestational age at first COVID-19 vaccination during pregnancy:
 - o Group 1 (birth records complete): 39.0 weeks of gestation
 - o Group 2 (birth records not complete): 36.4 weeks of gestation
 - o Group 3 (due date after May 31, 2021): 23.1 weeks of gestation
- Almost all individuals in Groups 1 and 2 who received at least one dose of COVID-19 vaccine during pregnancy received their first vaccination in the third trimester of pregnancy (Figure 4).
- Among individuals in Group 3 (i.e., still pregnant as of May 31, 2021) and who received at least one dose of COVID-19 vaccine during pregnancy, 12.6% received their first dose in the first trimester, 56.2% in the second trimester, and 31.2% in the third trimester (Figure 4).

Figure 4. Gestational timing (trimester) of the first COVID-19 vaccination administered during pregnancy, by group

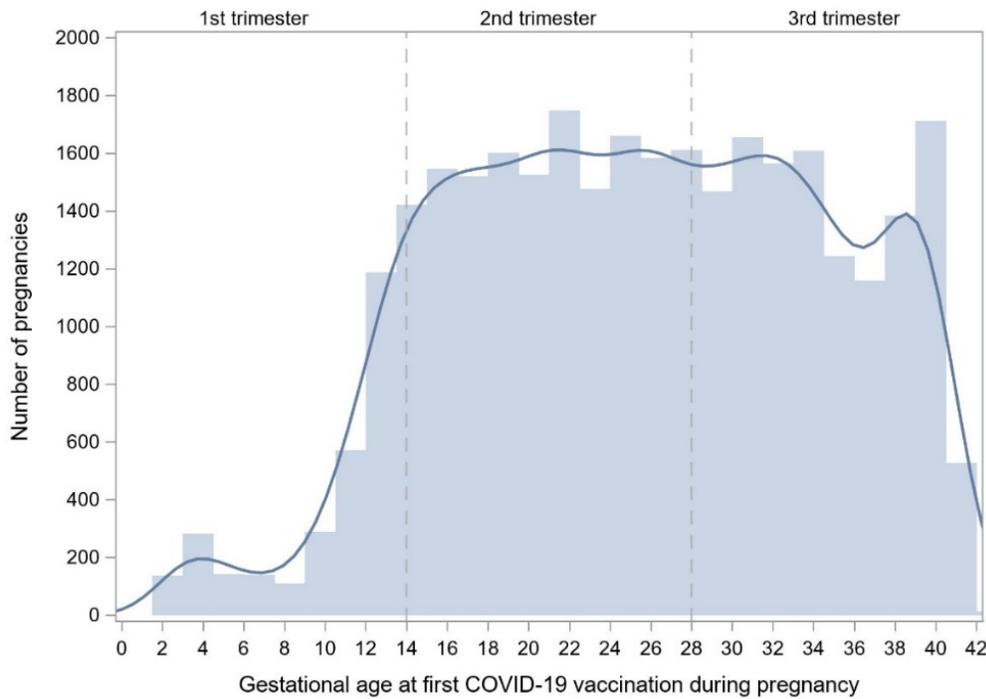


^a Only individuals who received ≥1 dose of COVID-19 vaccine during pregnancy are shown in Figure 4.

^b Group 1: Delivered and birth record received (n=3,236); Group 2: Delivered and birth record not yet received (n=1,666); Group 3: Still pregnant as of May 31, 2021 (n=25,990).

- The distribution of the gestational week of pregnancy when the first COVID-19 vaccination was administered is shown below in Figure 5.

Figure 5. Gestational timing (week) of the first COVID-19 vaccination administered during pregnancy



^a Only individuals who received ≥ 1 dose of COVID-19 vaccine during pregnancy are shown in Figure 5.

5. Type of COVID-19 vaccine received during pregnancy

Of the **30,892** pregnant individuals who received at least one dose of COVID-19 vaccine during pregnancy:

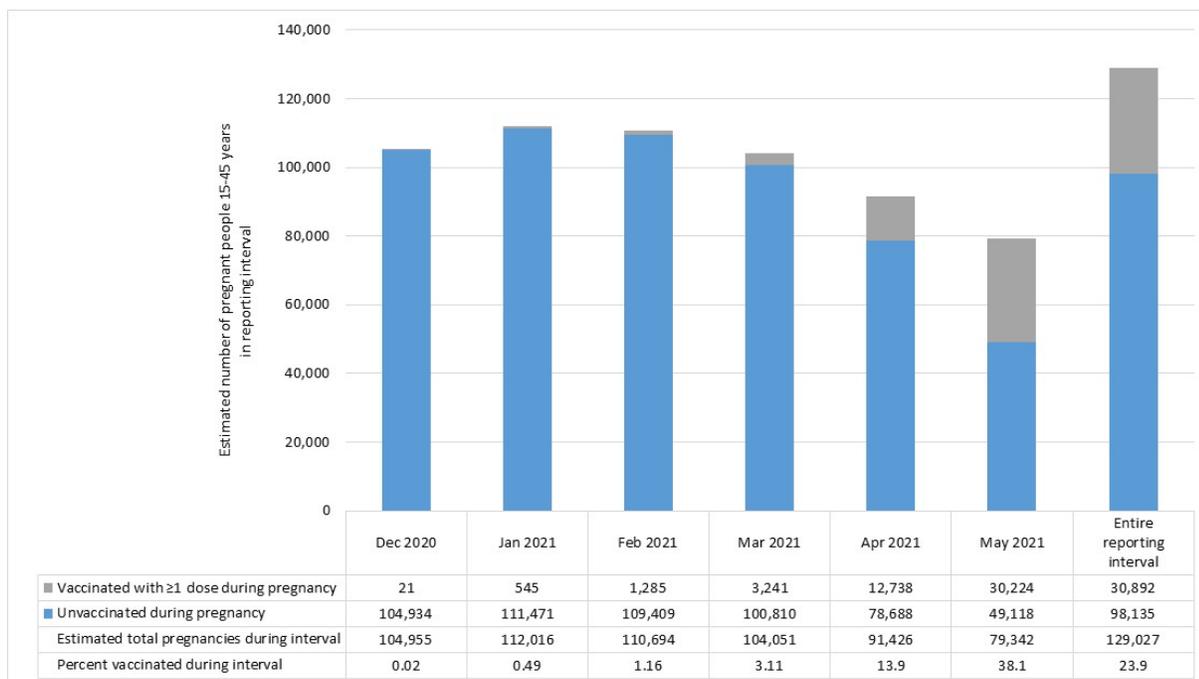
- 25,012 (81.0%) received the Pfizer-BioNTech mRNA vaccine, 5,661 (18.3%) received the Moderna mRNA vaccine, 103 (0.3%) received a viral-vector vaccine (i.e., AstraZeneca or COVISHIELD), and 116 (0.4%) had missing information on type of vaccine received.
- These results reflect the type of vaccine received for the first COVID-19 vaccination administered during pregnancy (i.e., dose 1 for those who initiated their COVID-19 vaccine series during pregnancy, or dose 2 for those who received dose 1 prior to pregnancy).
- Future reports will examine type of vaccine received for both doses.

6. Estimated COVID-19 vaccine uptake during pregnancy

Because pregnancy is a transient state and not all vaccinated individuals have given birth yet, we estimated the pregnant population during each month of the reporting interval and computed the percentage who received ≥ 1 dose of COVID-19 vaccine during pregnancy. See Appendix for details on methodology used to identify the denominator (i.e., estimated pregnant population) during each month.

- Across the entire reporting interval, 23.9% of pregnant individuals in Ontario received at least one dose of COVID-19 vaccine during pregnancy.
- Uptake of COVID-19 vaccination during pregnancy increased substantially over the reporting interval, from an estimated 0.02% among people who were pregnant at any point during the month of December 2020 to 38.1% among people who were pregnant at any point during the month of May 2021.
- Note that the estimated size of the pregnant population in each month decreases over time, particularly in the most recent months of the reporting interval. This is a reflection of normal delays in transferring birth records to the BORN Information System after the birth has taken place and, therefore, the availability of data to identify ongoing pregnancies (see Appendix for details).

Figure 6. Estimated uptake of ≥1 dose of COVID-19 vaccine during pregnancy, by month



^a Uptake was defined as the percentage of individuals who received ≥1 dose of COVID-19 vaccine during pregnancy.

^b Pregnant individuals were included during a given calendar month if they had given birth during the month, or if they were still ‘currently pregnant’ on the last day of the month (i.e., the last day of the month was between their estimated date of conception and estimated due date). As a result, the numerators and denominators across months are not mutually exclusive, and reflect the transient state of pregnancy.

^c Note that these are estimates of vaccine uptake during pregnancy only. There were an additional 273 individuals who were fully vaccinated prior to pregnancy start that are not included in these estimates. Coverage estimates, which include doses received prior to pregnancy start, will be provided in future reports.

- During this reporting interval from December 14, 2020 to May 31, 2021, uptake of COVID-19 vaccination during pregnancy showed substantial variability by maternal age and neighbourhood income quintile. Gradients were seen for both characteristics, with the lowest uptake seen among the youngest individuals and among those who lived in a neighbourhood with the lowest area-based income quintile.

Table 1. Estimated uptake of ≥ 1 dose of COVID-19 vaccine during pregnancy, by maternal age

Maternal age (years) at birth or estimated date of birth	Number vaccinated (≥ 1 dose) during pregnancy	Estimated number of pregnant individuals	Percent vaccinated during pregnancy (95% confidence interval)
<25	826	9,604	8.6% (8.1-9.2)
25-29	5,667	30,622	18.5% (18.1-18.9)
30-34	14,217	52,509	27.1% (26.7-27.5)
35-39	8,423	29,618	28.4% (27.9-29.0)
≥ 40	1,759	6,674	26.4% (25.3-27.4)
Total	30,892	129,027	23.9% (23.7-24.2)

^a Uptake was defined as the percentage of individuals who received ≥ 1 dose of COVID-19 vaccine during pregnancy.

^b Note that these are estimates of vaccine uptake during pregnancy only. There were an additional 273 individuals who were fully vaccinated prior to pregnancy start that are not included in these estimates. Coverage estimates, which include doses received prior to pregnancy start, will be provided in future reports.

Table 2. Estimated uptake of ≥ 1 dose of COVID-19 vaccine during pregnancy, by neighbourhood income quintile

Neighbourhood income quintile	Number vaccinated (≥ 1 dose) during pregnancy	Estimated number of pregnant individuals	Percent vaccinated during pregnancy (95% confidence interval)
1 (lowest)	4,761	21,353	22.3% (21.7-22.9)
2	5,889	22,050	26.7% (26.1-27.3)
3	6,625	23,489	28.2% (27.6-28.8)
4	7,189	22,865	31.4% (30.8-32.0)
5 (highest)	6,107	17,796	34.3% (33.6-35.0)
Missing	321	21,474	1.5% (1.3-1.7)
Total	30,892	129,027	23.9% (23.7-24.2)

^a Uptake was defined as the percentage of individuals who received ≥ 1 dose of COVID-19 vaccine during pregnancy.

^b Note that these are estimates of vaccine uptake during pregnancy only. There were an additional 273 individuals who were fully vaccinated prior to pregnancy start that are not included in these estimates. Coverage estimates, which include doses received prior to pregnancy start, will be provided in future reports.

7. Pregnancy and birth outcomes

The cumulative incidence rates of pregnancy and birth outcomes among vaccinated pregnant individuals who had given birth by the end of the reporting interval and had a birth record available (i.e., Group 1) are provided in Table 3-Table 6 below. These estimates were calculated among the subgroup of pregnancies that could have reached the potential gestational length of 42 weeks by the end of the reporting interval (i.e., those with a last menstrual period date prior to August 7, 2020) in order to prevent cohort truncation bias. For context, a range of background rates of the same outcomes are also provided for the Ontario pregnant population prior to the COVID-19 pandemic (i.e., for the same calendar interval of time, two years earlier).

- Although these two groups are not directly comparable due to differences in prevalence of demographic and clinical risk factors in the vaccinated group, the results do not suggest any pattern of increased risk for these outcomes among vaccinated pregnant individuals. Future epidemiological analyses are planned and will account for baseline differences in prevalence of demographic and clinical risk factors in vaccinated and unvaccinated pregnant individuals to formally assess these, and other, outcomes.

Table 3. Cumulative incidence rates of pregnancy and birth outcomes (among pregnant individuals) in vaccinated individuals and corresponding background rates in the Ontario pregnant population

Pregnancy and birth outcomes among pregnant individuals	Cumulative incidence rates among vaccinated pregnant individuals ^a	Range of background rates in Ontario ^b
Post-partum hemorrhage Cumulative incidence per 1,000 (95% CI)	5.1 (1.3-8.9)	11.7-13.6

^a Includes any pregnant individual in Group 1 who received ≥ 1 dose of COVID-19 vaccine during pregnancy, limited to those with a last menstrual period date prior to August 7, 2020 to prevent cohort truncation bias.

^b Background rates computed among all births in the BORN Information System from December 14, 2018 to May 31, 2019, limited to those with a last menstrual period date prior to August 7, 2018 to prevent cohort truncation bias. Range determined from 95% confidence interval bounds around point estimate of the computed incidence rates.

Table 4. Cumulative incidence rates of pregnancy and birth outcomes (among all births) in vaccinated individuals and corresponding background rates in the Ontario pregnant population

Pregnancy and birth outcomes among all births (live births and stillbirths)	Cumulative incidence rates among vaccinated pregnant individuals ^a	Range of background rates in Ontario ^b
Stillbirth Cumulative incidence per 1,000 (95% CI)	0	2.5-3.5

^a Includes any pregnant individual in Group 1 who received ≥ 1 dose of COVID-19 vaccine during pregnancy, limited to those with a last menstrual period date prior to August 7, 2020 to prevent cohort truncation bias.

^b Background rates computed among all births in the BORN Information System from December 14, 2018 to May 31, 2019, limited to those with a last menstrual period date prior to August 7, 2018 to prevent cohort truncation bias. Range determined from 95% confidence interval bounds around point estimate of the computed incidence rates.

Table 5. Cumulative incidence rates of pregnancy and birth outcomes (among live births) in vaccinated individuals and corresponding background rates in the Ontario pregnant population

Pregnancy and birth outcomes among live births	Cumulative incidence rates among vaccinated pregnant individuals ^a	Range of background rates in Ontario ^b
Preterm birth <37 weeks' gestation Cumulative incidence per 100 (95% CI)	2.6 (1.7-3.4)	5.6-6.0
5-minute Apgar score <7 Cumulative incidence per 100 (95% CI)	1.7 (1.0-2.3)	1.7-1.9

^a Includes any pregnant individual in Group 1 who received ≥ 1 dose of COVID-19 vaccine during pregnancy, limited to those with a last menstrual period date prior to August 7, 2020 to prevent cohort truncation bias.

^b Background rates computed among all births in the BORN Information System from December 14, 2018 to May 31, 2019, limited to those with a last menstrual period date prior to August 7, 2018 to prevent cohort truncation bias. Range determined from 95% confidence interval bounds around point estimate of the computed incidence rates.

Table 6. Cumulative incidence rates of pregnancy and birth outcomes (among singleton live births) in vaccinated individuals and corresponding background rates in the Ontario pregnant population

Pregnancy and birth outcomes among singleton live births	Cumulative incidence rates among vaccinated pregnant individuals ^a	Range of background rates in Ontario ^b
Small for gestational age ^c Cumulative incidence per 100 (95% CI)	6.6 (5.2-7.9)	9.3-9.8

^a Includes any pregnant individual in Group 1 who received ≥ 1 dose of COVID-19 vaccine during pregnancy, limited to those with a last menstrual period date prior to August 7, 2020 to prevent cohort truncation bias.

^b Background rates computed among all births in the BORN Information System from December 14, 2018 to May 31, 2019, limited to those with a last menstrual period date prior to August 7, 2018 to prevent cohort truncation bias. Range determined from 95% confidence interval bounds around point estimate of the computed incidence rates.

^c Defined as $<10^{\text{th}}$ percentile of sex- and gestational age-specific birth weight distribution using a Canadian reference standard.

Appendix

Methods

- Data were extracted from COVaxON on May 31, 2021 and from the BORN Information System (BIS) on June 3, 2021. Since both data sources are dynamic reporting systems, allowing ongoing updates to data previously entered, this report represents a snapshot at the time of data extraction. The results in this report may, therefore, differ from previous or subsequent reports. It is also important to note that the estimated denominator of all pregnancies and the uptake estimates may differ from other sources (e.g., such as those reported by ICES) because of different definitions, data sources, or reporting delays.
- We identified the population of all individuals who were pregnant at any point since the COVID-19 vaccination program began in Ontario on December 14, 2020 using prenatal screening records (transferred weekly to the BIS from provincial screening labs) and available birth records to identify ongoing and new pregnancies and births in near real-time. Pregnancies of screened individuals can be identified as early as 12 weeks of gestation and about 70% of pregnant individuals in Ontario undergo prenatal screening.^{10,11} Pregnancies of non-screened individuals cannot be identified until the birth has occurred and the record has been transferred to BORN Ontario. Extensive details about BIS data can be found elsewhere.⁹
- We linked the pregnant population in the reporting interval with vaccination records from COVaxON, which is the single data source used to capture COVID-19 immunization events in Ontario.
- Estimated date of conception was calculated by adding 14 days to the date of the last menstrual period recorded in the BIS. If the date of the last menstrual period was missing, it was estimated by subtracting 280 days from the estimated date of birth (i.e., due date) recorded in the BIS.

Limitations

- The data in this report may differ from other Ontario reported data due to different data sources used to define the pregnant population. In particular, BORN uses prenatal screening records to estimate the pregnant population in Ontario. The uptake of prenatal screening in Ontario is approximately 70%^{10,11} so this report will underestimate the total number of currently pregnant people, especially in the more recent months of the reporting interval due to delays in transferring birth records from some hospitals.
- The COVaxON database was deterministically linked to the BORN Information System primarily using health card number. Some vaccination records may not have linked to a pregnancy record due to missing or inaccurate health card number in either the BORN Information System and/or COVaxON.
- BORN Ontario does not collect outcome data on pregnancy losses or terminations prior to 20 weeks of gestation.

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Project Steering Committee

Deshayne Fell, Gillian Alton, Jon Barrett, Lise Bisnaire, Sarah Buchan, Darine El-Chaar, Shelly Dougan, Sandy Dunn, Christopher Gravel, Jeff Kwong, Shannon MacDonald, Nannette Okun, Annette Regan, Prakeshkumar Shah, Ann Sprague, Eszter Török, Mark Walker, Kumanan Wilson, Sarah Wilson

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For Further Information

Please contact BORN Ontario at: covid@bornontario.ca

BORN Ontario

The Better Outcomes Registry & Network (BORN) Ontario is the province's pregnancy, birth and childhood registry and network. By collecting, interpreting, sharing and rigorously protecting critical data about every birth in the province, BORN Ontario makes a positive and lasting contribution to the health of mothers, newborns, children and the citizens of Ontario. BORN Ontario is a provincial program of CHEO, a pediatric health and research centre based in Ottawa. www.bornontario.ca