

Update on COVID-19 in Canada: Epidemiology and Modelling

October 8, 2021

Canada.ca/coronavirus



Public Health
Agency of Canada

Agence de la santé
publique du Canada

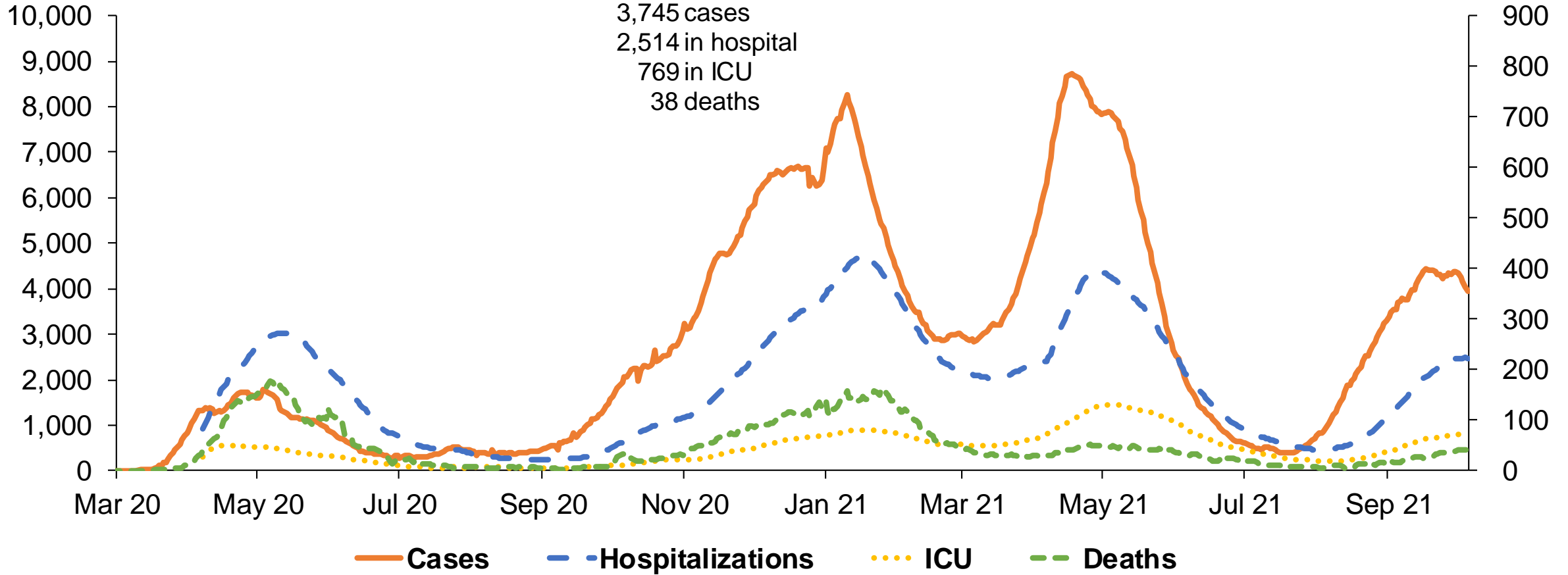
Canada

Nationally, daily COVID-19 case counts have slowed but lagging severe outcomes, occurring primarily among the unvaccinated, are still elevated

Number (cases/
in hospital/ in ICU)

Daily counts
(average over past 7 days):

Number (deaths)



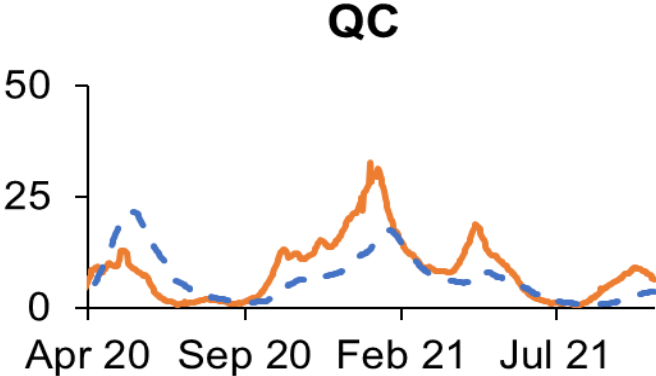
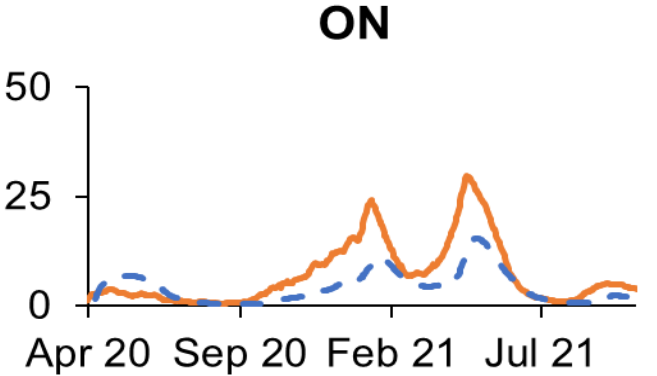
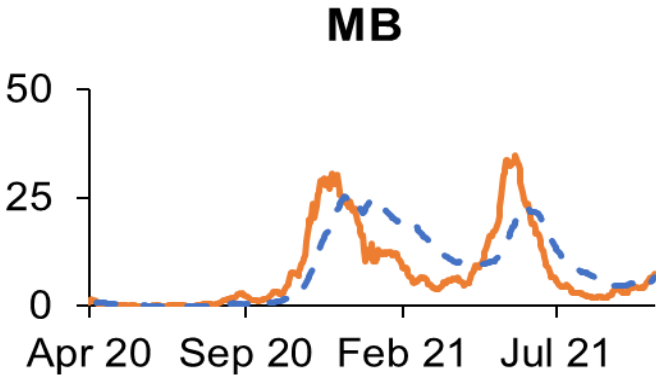
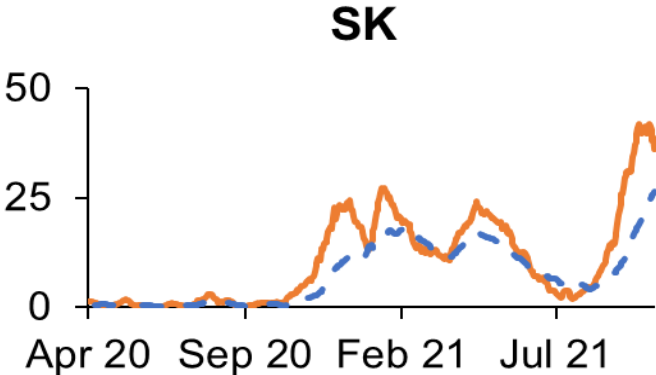
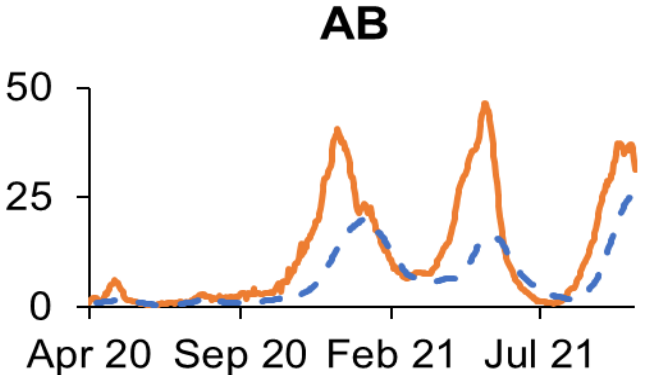
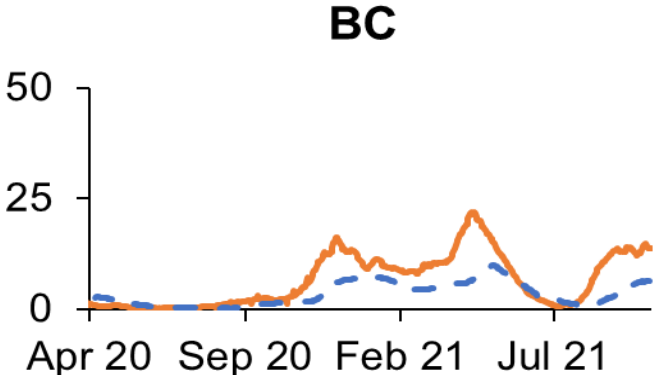
Data as of October 5, 2021

Note: Trend lines reflect 7-day moving averages. Total hospitalizations and ICU admissions include all people in hospital and in ICU on that day.



Although the Delta-driven wave has levelled off nationally, there is considerable regional variation and significant strain on the health system in heavily impacted areas

Number cases / in hospital per 100,000 population



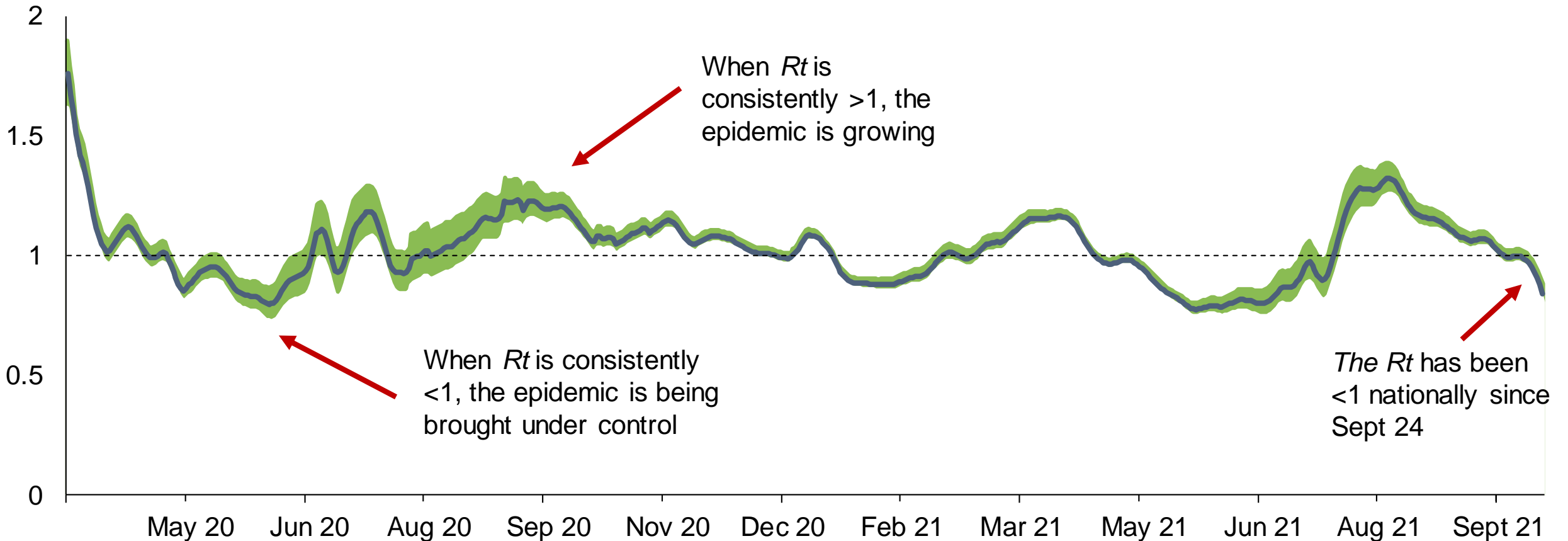
— Cases - - - Hospitalizations

Data as of October 5, 2021

Note: Daily cases trend lines reflect 7-day moving averages. Total number in hospitals include all people in hospital on that day.



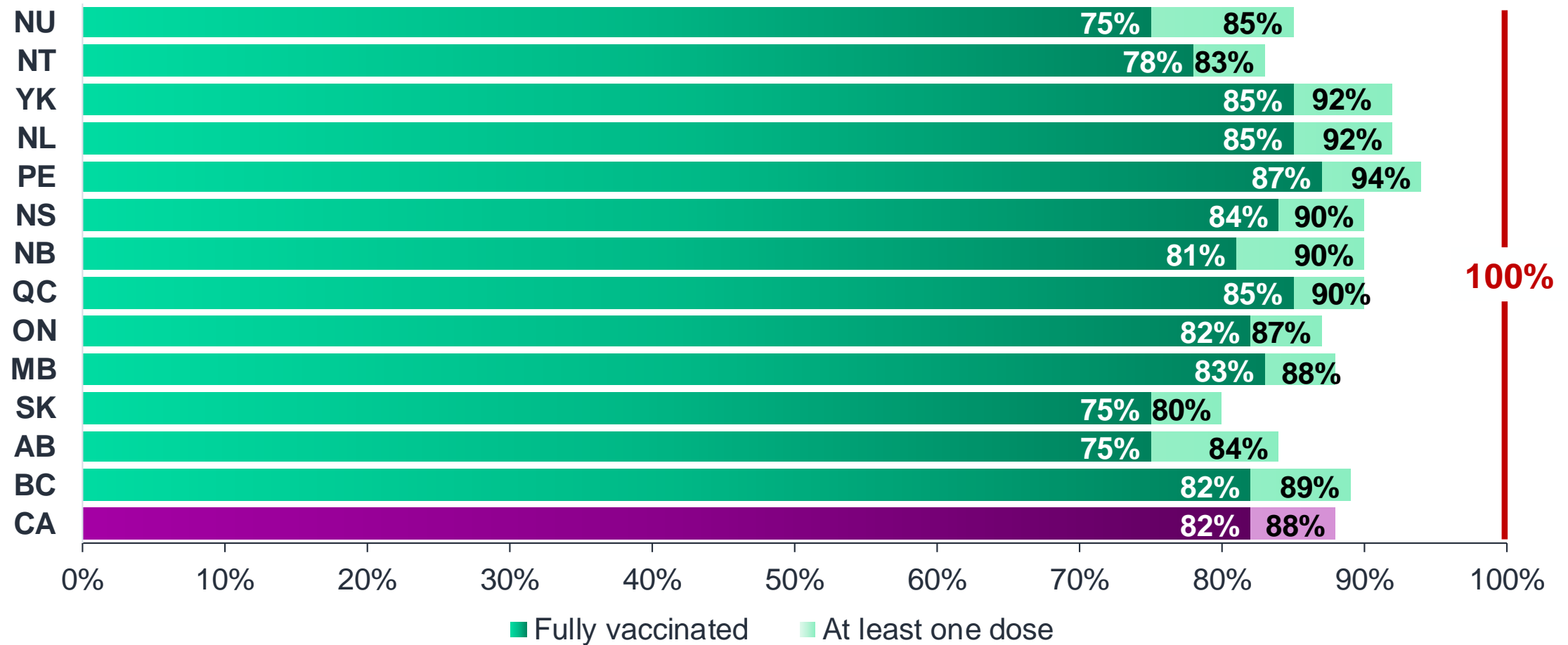
For the first time in many weeks, Canada's R_t has fallen below 1, indicating the epidemic has dropped out of a growth pattern at the national level



Data as of October 4, 2021
Note: 7-day moving average.

Over 88% of eligible people, aged 12 years or older, have at least one dose of COVID-19 vaccines and over 82% are fully vaccinated nationwide

Percentage of eligible people (≥ 12 years) with at least one dose and fully vaccinated by jurisdiction, as of October 8th, 2021

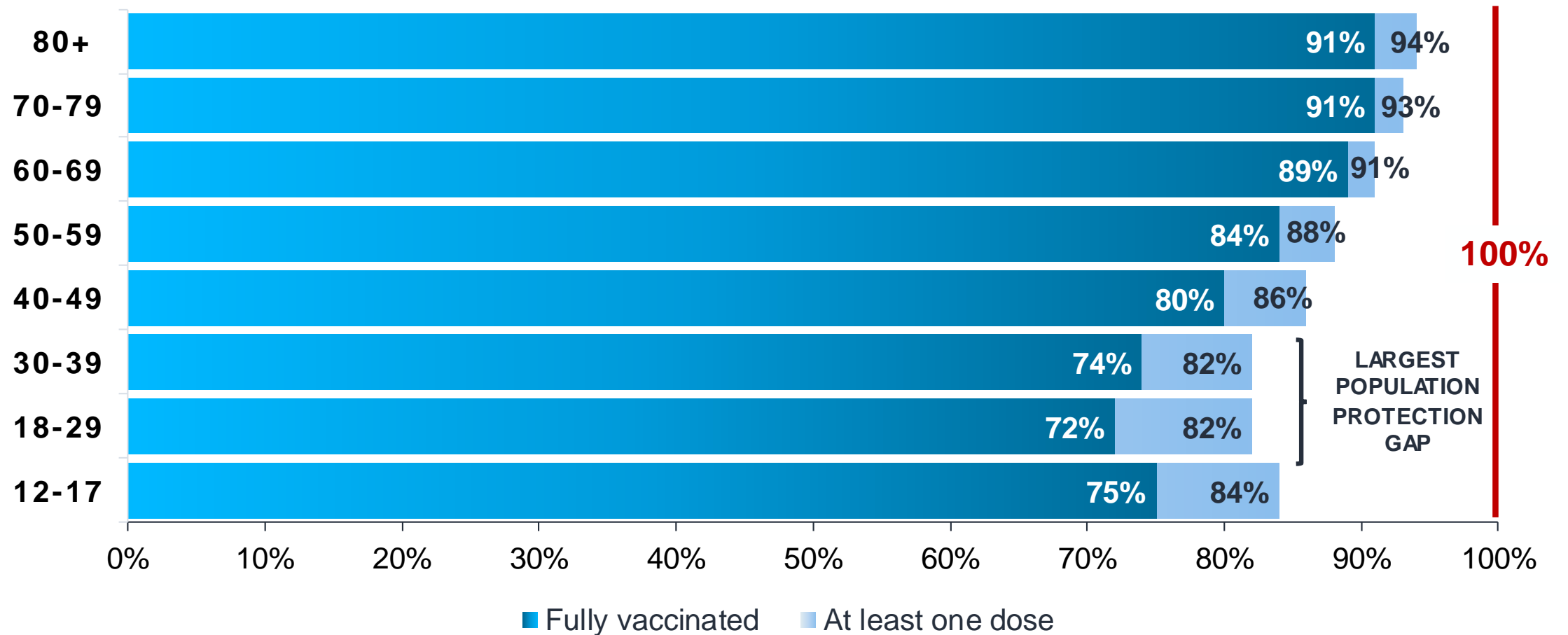


Note: National and provincial/territorial coverage, with the exception of the Northwest Territories as of October 8, 2021 was obtained from <https://covid19tracker.ca/vaccinationtracker.html>. Accessed on October 8, 2021 (8:00 AM EDT). Northwest Territories coverage as of October 2, 2021 was obtained from <https://nwt-covid.shinyapps.io/Testing-and-Cases>. Many provinces and territories have started to report data for third doses administered. This has resulted in decreases to the “% At least one dose” metric for some jurisdictions. Further changes to these metrics may be expected.



Vaccine coverage continues to increase, though a significant protection gap remains among the younger age groups with persistently high infection rates

Percentage of eligible people (≥ 12 years) with at least one dose and fully vaccinated by age group, as of October 2nd, 2021

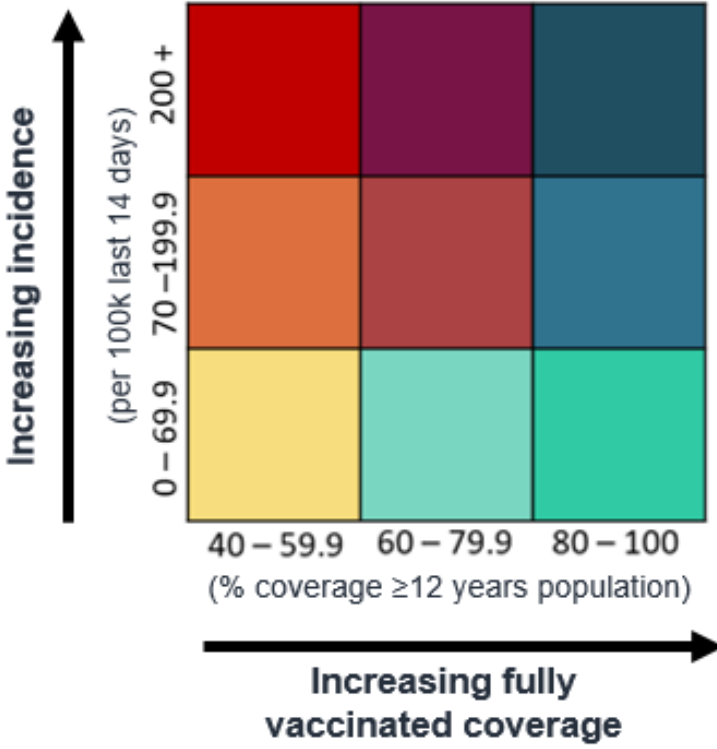
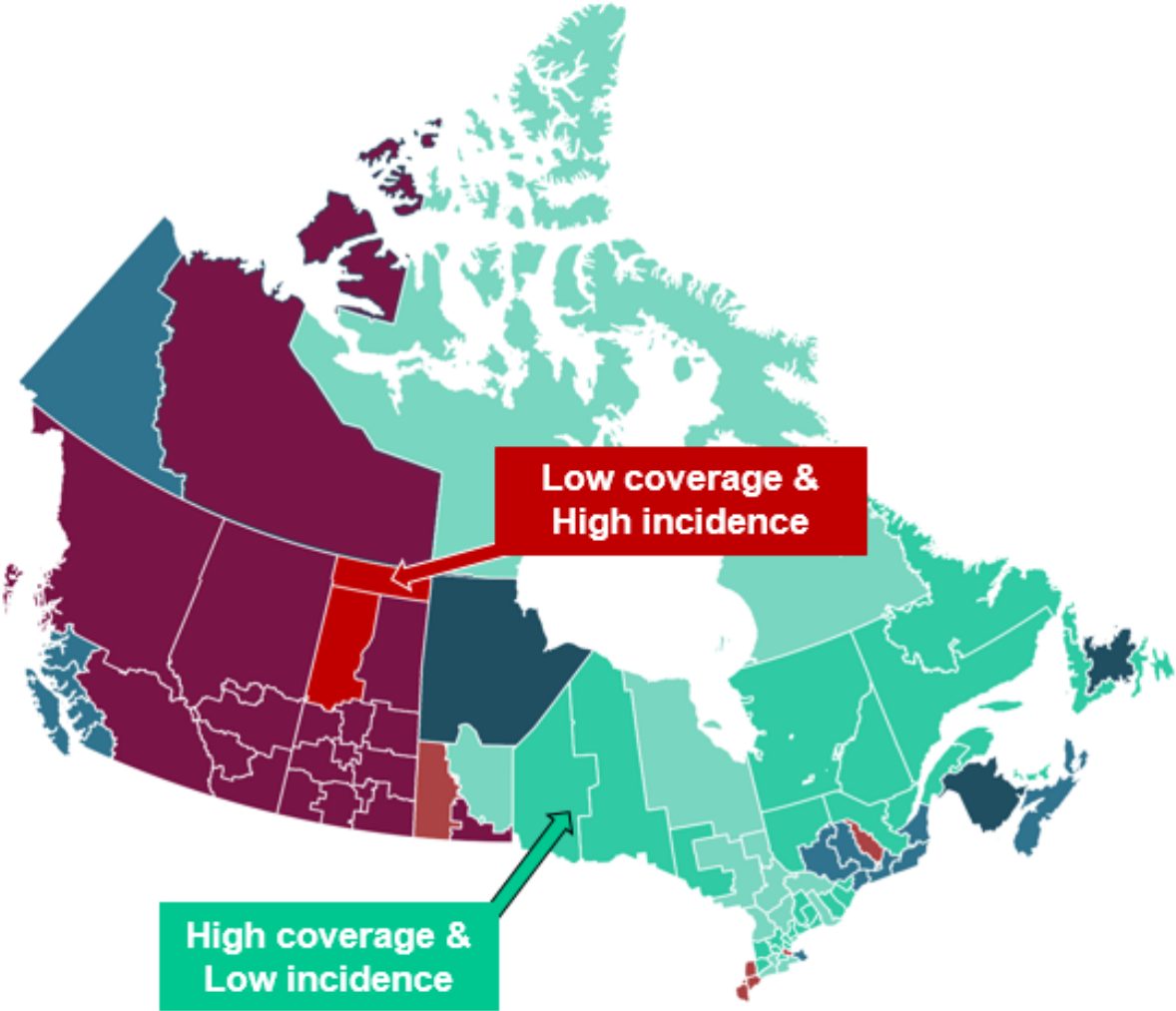


Data as of October 2, 2021

Note: Data obtained from the Canadian COVID-19 Vaccination Coverage Surveillance System



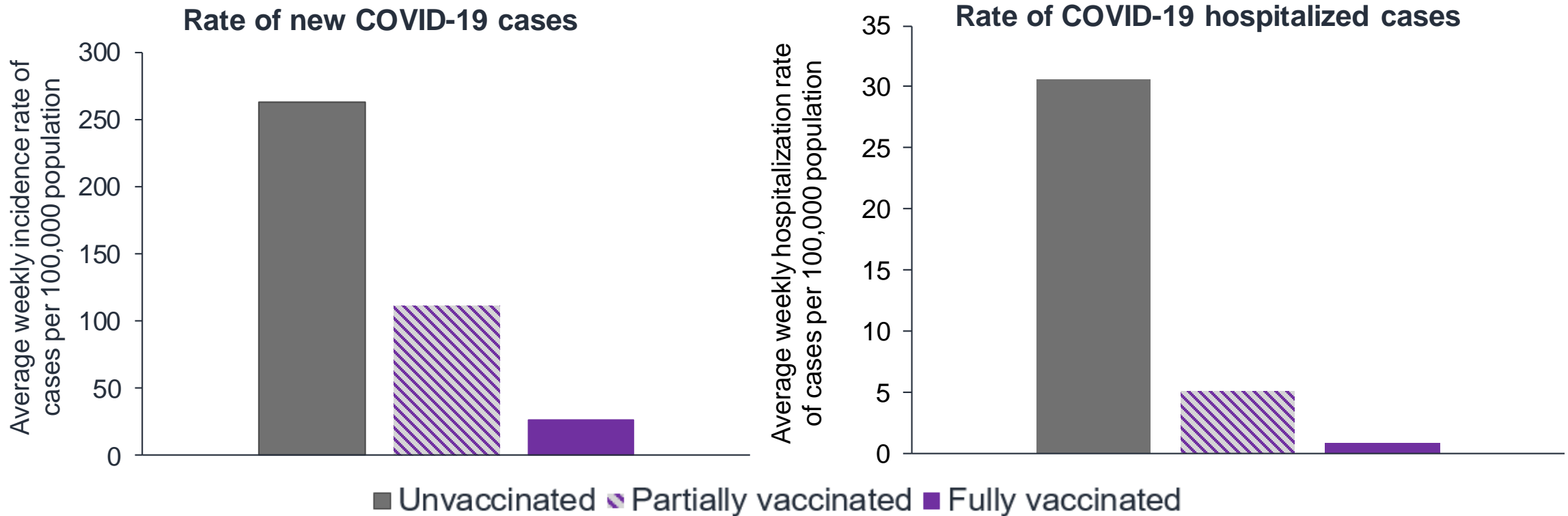
Health regions with lower vaccination coverage are experiencing, or at risk of, high infection rates and hospitalizations, leading to strain across the health system



Data as of October 6, 2021
Note: Map only shows COVID-19 cases where health region had been attributed in source data.
Data source: COVID-19 Vaccination Tracker <https://covid19tracker.ca/vaccinationtracker.html>.

Evidence shows COVID-19 vaccines continue to be highly protective, even with the Delta variant predominating in Canada

- New cases among unvaccinated people were **10** times higher than in the fully vaccinated
- Hospitalized cases among unvaccinated people were **36** times higher than in the fully vaccinated

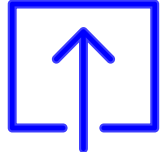
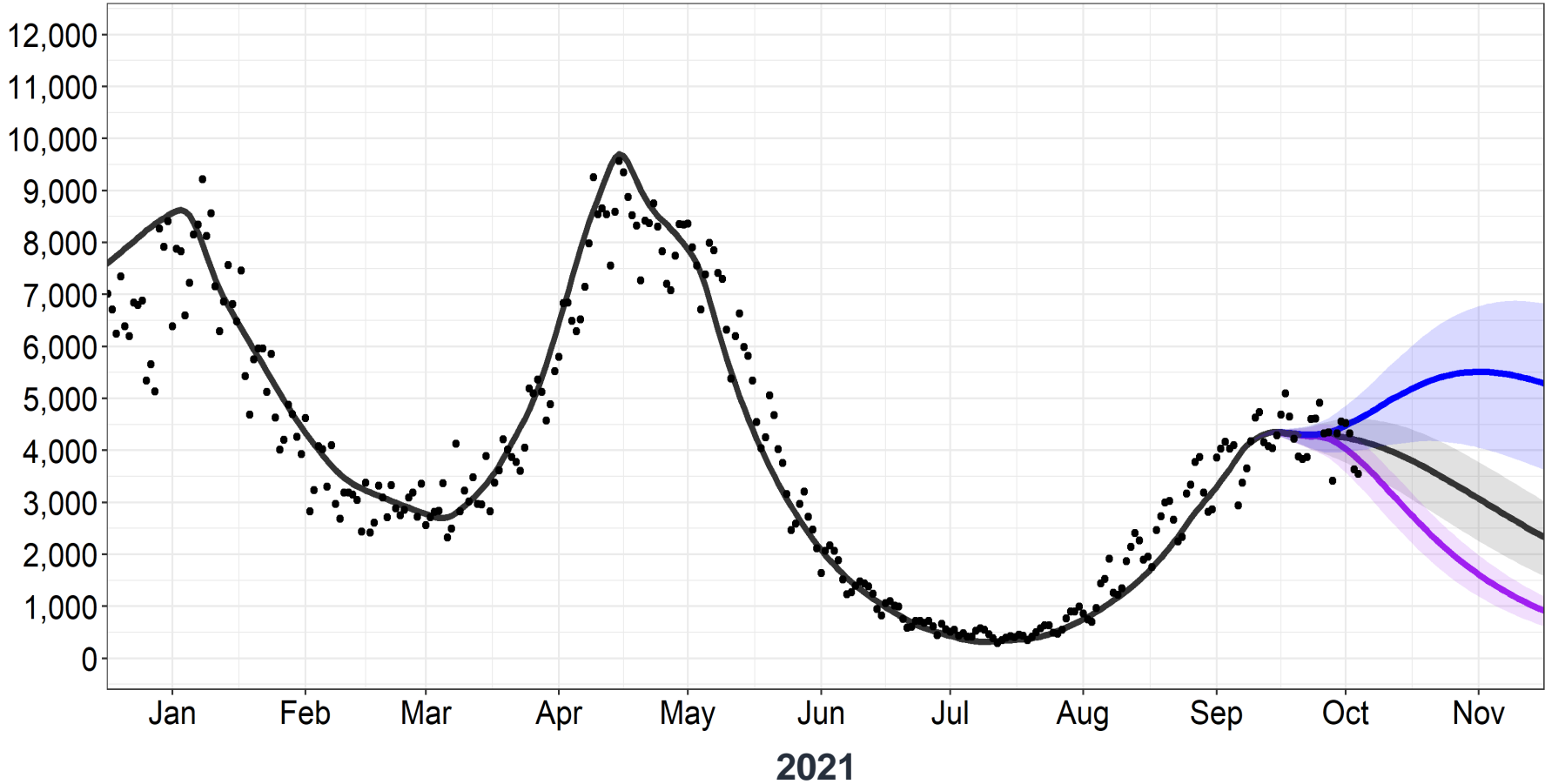


Data as of October 1, 2021 using data from **August 22-September 18, 2021** from 12 provinces and territories (not including Quebec) for the eligible population 12 years or older, adjusting for age. **Definitions:** unvaccinated cases include those who were unvaccinated at the time of their onset; partially vaccinated cases had onset between ≥ 14 days from their first dose and < 14 days after their second dose; fully vaccinated cases had onset ≥ 14 days from their second dose

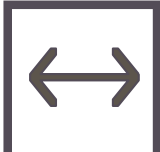


Longer-range forecast suggests that, at current levels of transmission, the fourth wave could decline in the coming weeks

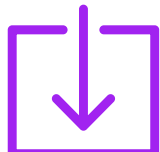
Reported cases



If transmission **increases** by 15%



If we **maintain** the current levels of transmission



If public health measures **reduce** transmission by 15%

Data as of October 4, 2021

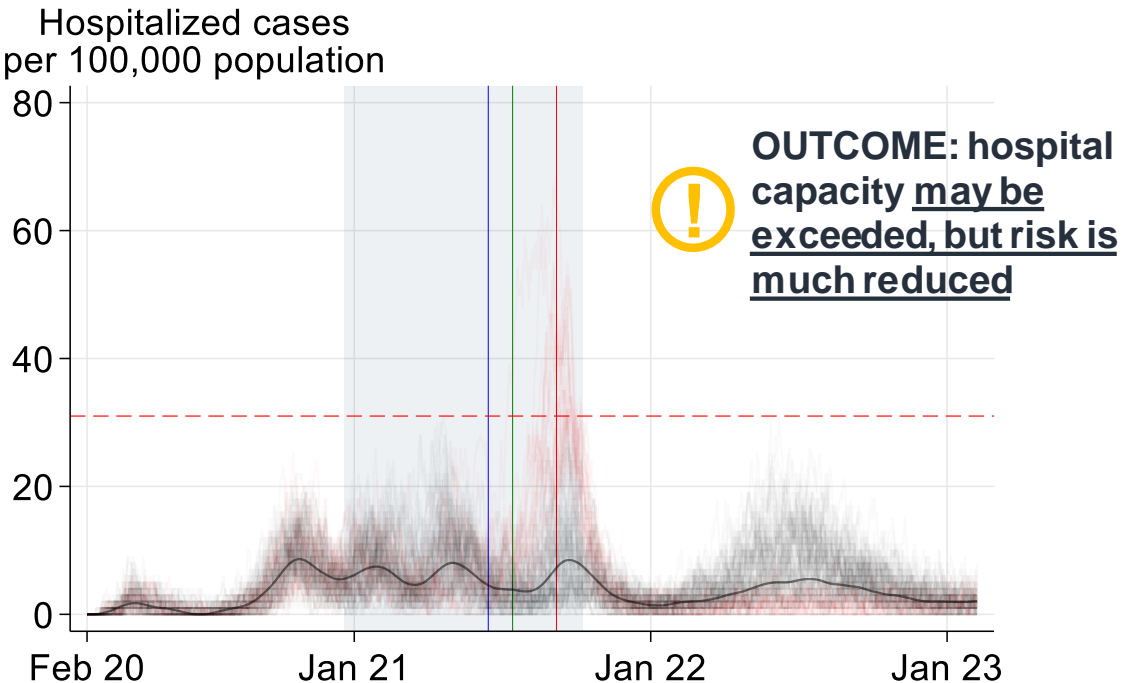
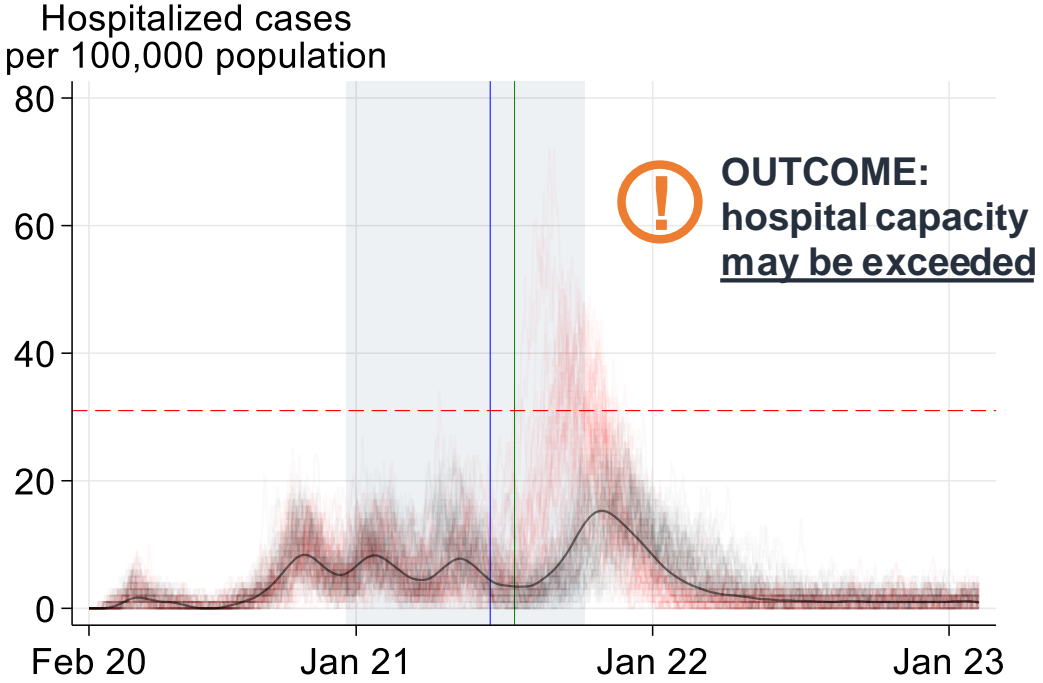
Note: Output from PHAC-McMaster model. Model considers impact of vaccination and increased transmissibility of VOCs (including Delta), refer to annex for detailed assumptions on modelling.



Maintaining key public health measures such as masking and spacing through the fall and winter could reduce the likelihood of overwhelming healthcare capacity

WITHOUT public health measures this fall/winter

WITH public health measures this fall/winter



- - - Hospital capacity for COVID-19 patients
- Median hospitalization prevalence
- Restrictive closures gradually lifted
- Personal physical distancing gradually lifted
- Reintroduction of PH measures in fall 2021
- Vaccination period

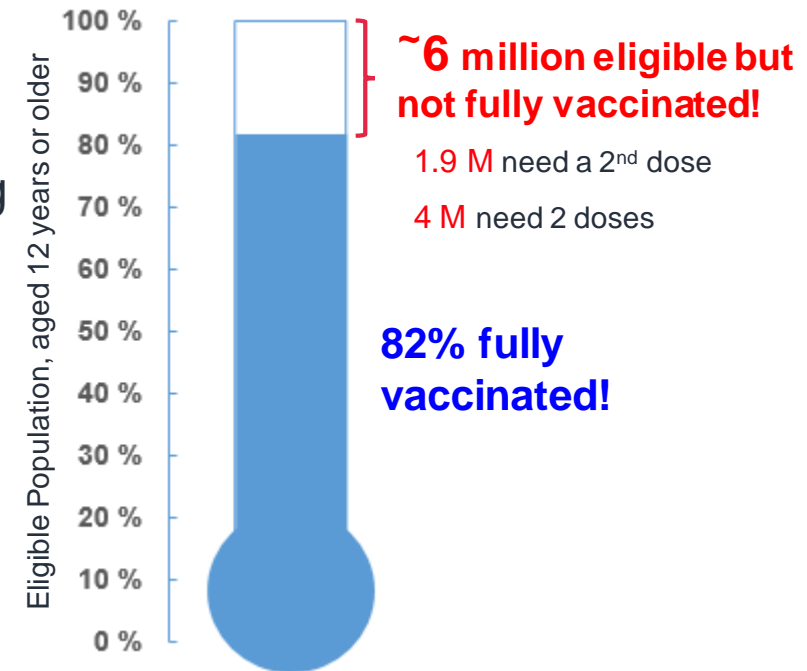
Note: Each grey line represents one model realization out of 100; the black line represents the median value. The shaded blue area represents the vaccination rollout period from December 14, 2020 to mid-October 2021 – the overall vaccine coverage is estimated as 86.0% in the eligible population (ages 12 and up) and 75.1% in the total population. The three vertical lines in chronological order are: gradual lifting of restrictive PH measures (solid blue line, commencing June 15, 2021), gradual lifting of personal physical distancing (solid green line, commencing July 15, 2021) and the reintroduction of PHMs in the fall (red solid line, September 7, 2021) The red dashed horizontal line represents the Canadian hospital bed limit (31 beds per 100,000, updated January 25, 2021 from Health Canada data), this limit assumes 40% of all beds available for COVID-19 patients but will vary across provinces and territories.



Efforts we've made to date and those we can sustain over the coming months will see us through a safer winter and set us on the best path forward

56.8 MILLION+ vaccines given in Canada
27 MILLION+ Canadians fully vaccinated!
🧡 THANK YOU!! 🧡

- **Although several jurisdictions are still facing considerable challenges**, this update reaffirms that by achieving a strong foundation of protection, with over 82% of eligible Canadians fully vaccinated, and applying public health measures, epidemic growth can be managed.
- **Nationally, case counts have levelled off but are still high overall** and infection rates are *exceedingly high in several areas of the country*.
- **With the increased severity of the Delta variant**, more people are becoming very sick, resulting in a heavy strain on the health system where the virus is surging.
- **As we head into Thanksgiving weekend**, Canadians are being urged to **keep gatherings small** and **follow local public health advice** based on the local epidemiological situation.
 - **We can all make indoor gatherings safer** by getting fully vaccinated, taking steps to improve ventilation, and continuing to use personal precautions.
 - **In the case of people who are not yet fully vaccinated**, limiting indoor gatherings to household members only or choosing outdoor gatherings, are safer options.



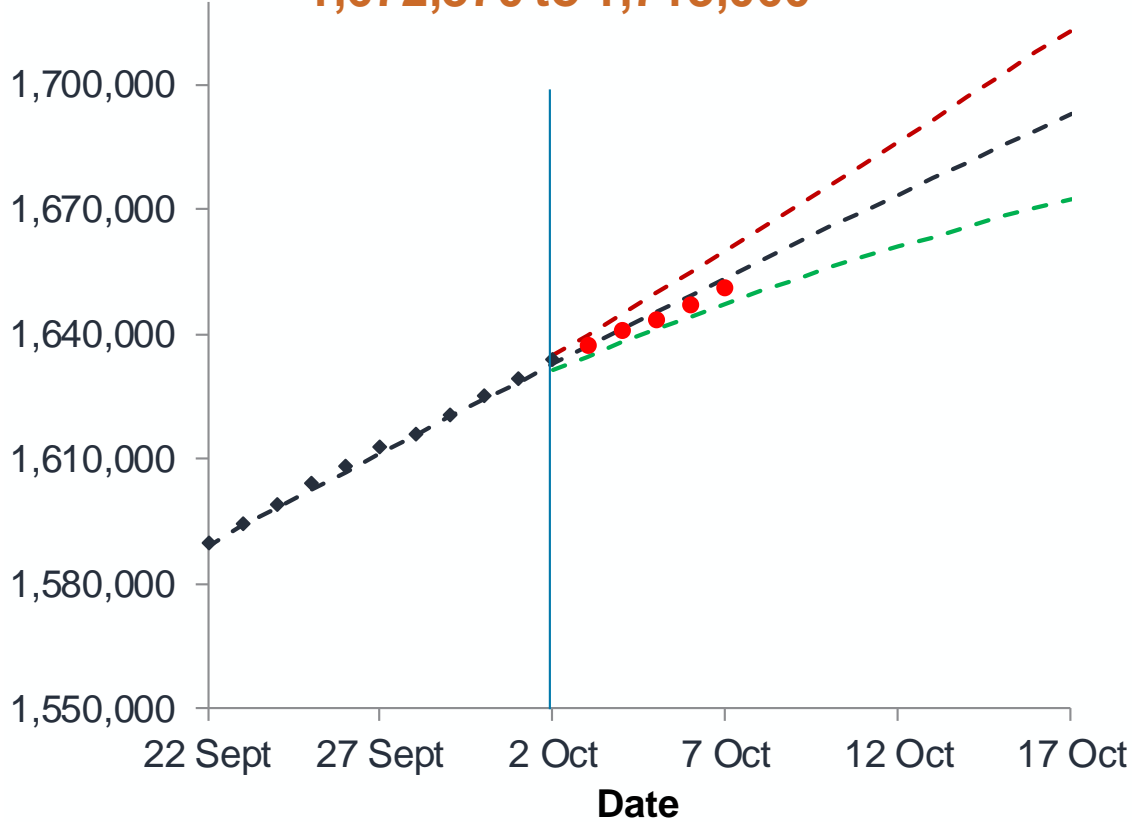
ASSESSING YOUR PERSONAL RISKS: For more information and resources to help you assess your personal risks and family risks as well as choose and organize safer, less risky activities when going out or engaging with others, visit:

<https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/vaccines/life-after-vaccination.html>

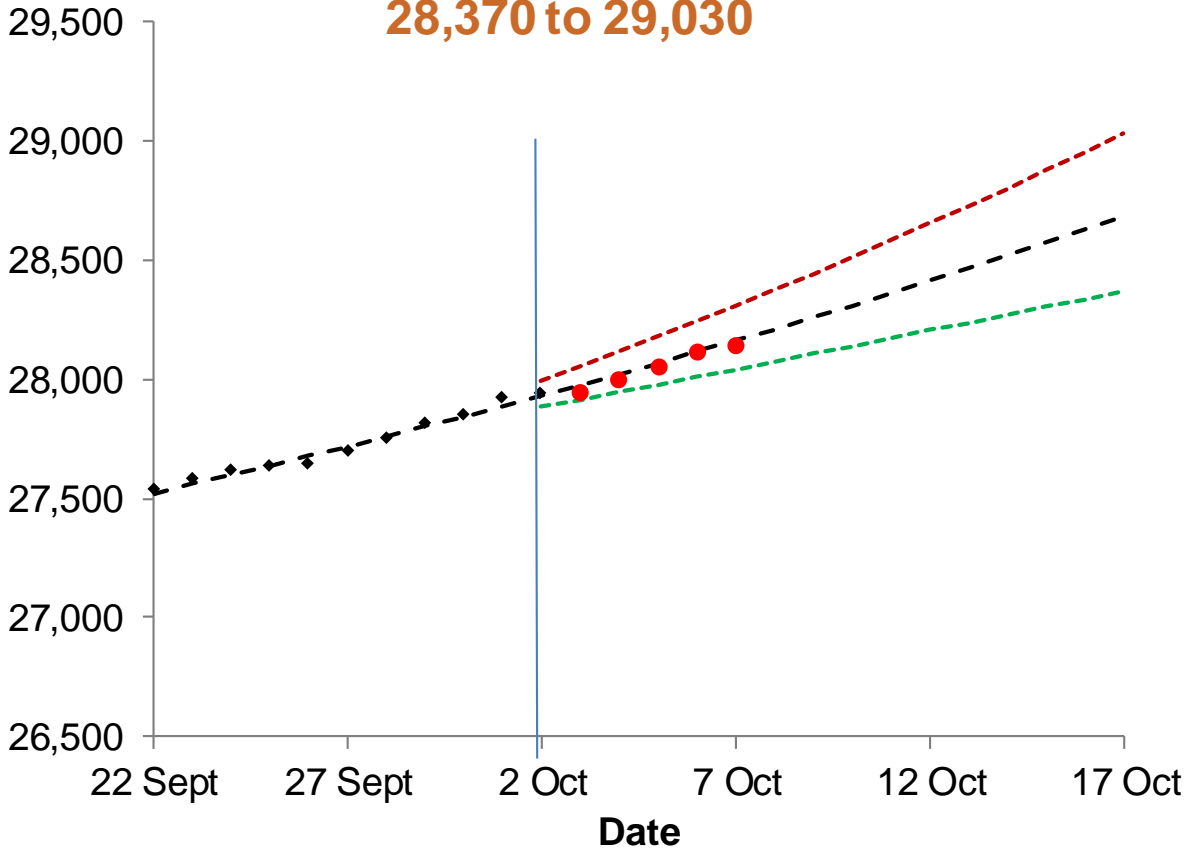
ANNEX

Short-term forecast predicts steady increases in cumulative cases and cumulative deaths

Cumulative cases predicted to October 17, 2021:
1,672,370 to 1,713,060



Cumulative deaths predicted to October 17, 2021:
28,370 to 29,030



- ◆ Cumulatively reported cases in Canada by Oct 2
- Cases added since Oct 2 when the prediction was made
- Prediction to October 17
- - - Lower 95% prediction limit
- - - Upper 95% prediction limit

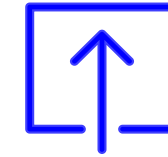
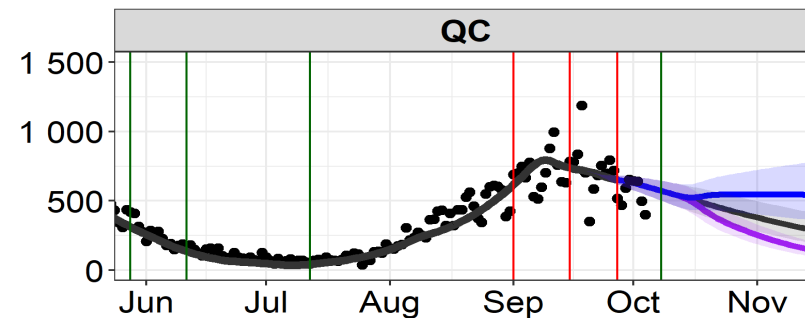
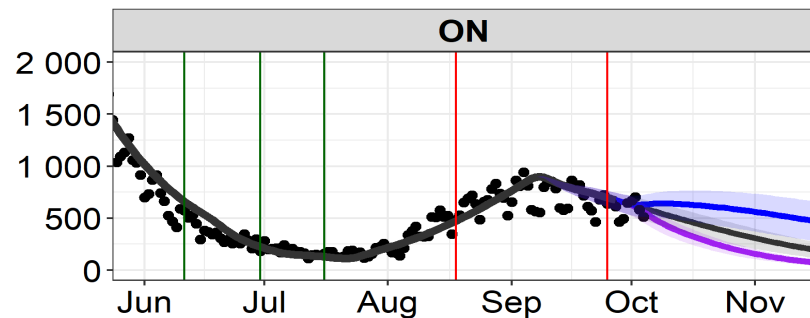
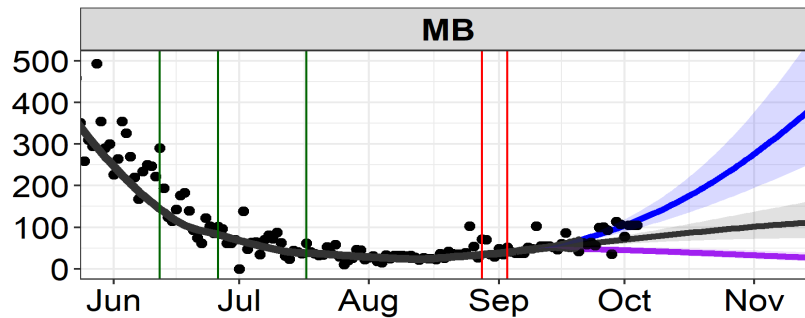
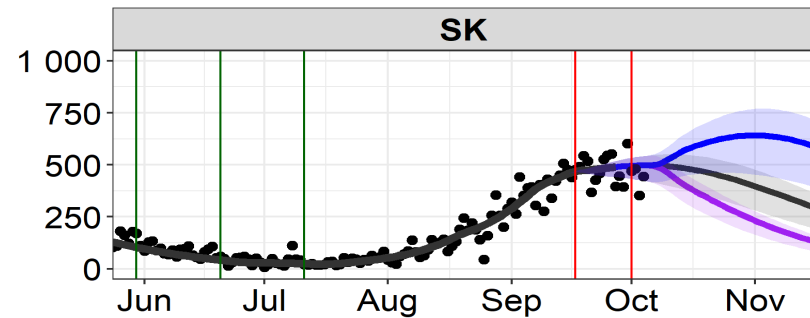
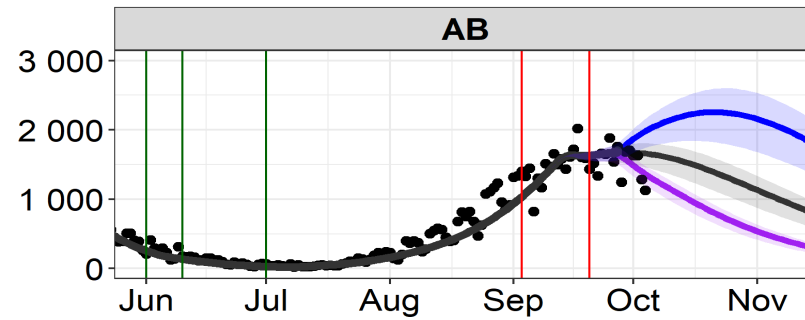
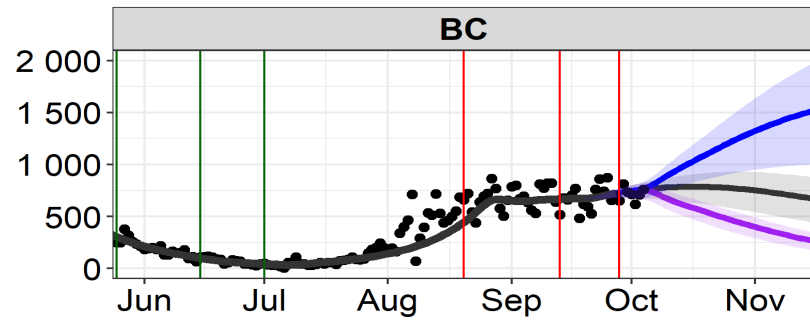
Data as of October 2, 2021

Note: Extrapolation based on recent trends using a forecasting model (with ranges of uncertainty).

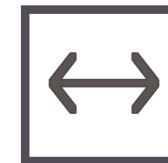


Provincial longer range forecasts show there is significant regional variation

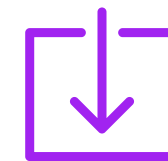
Reported cases



If transmission **increases** by 15%



If we **maintain** the current levels of transmission



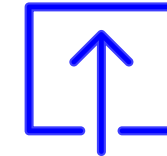
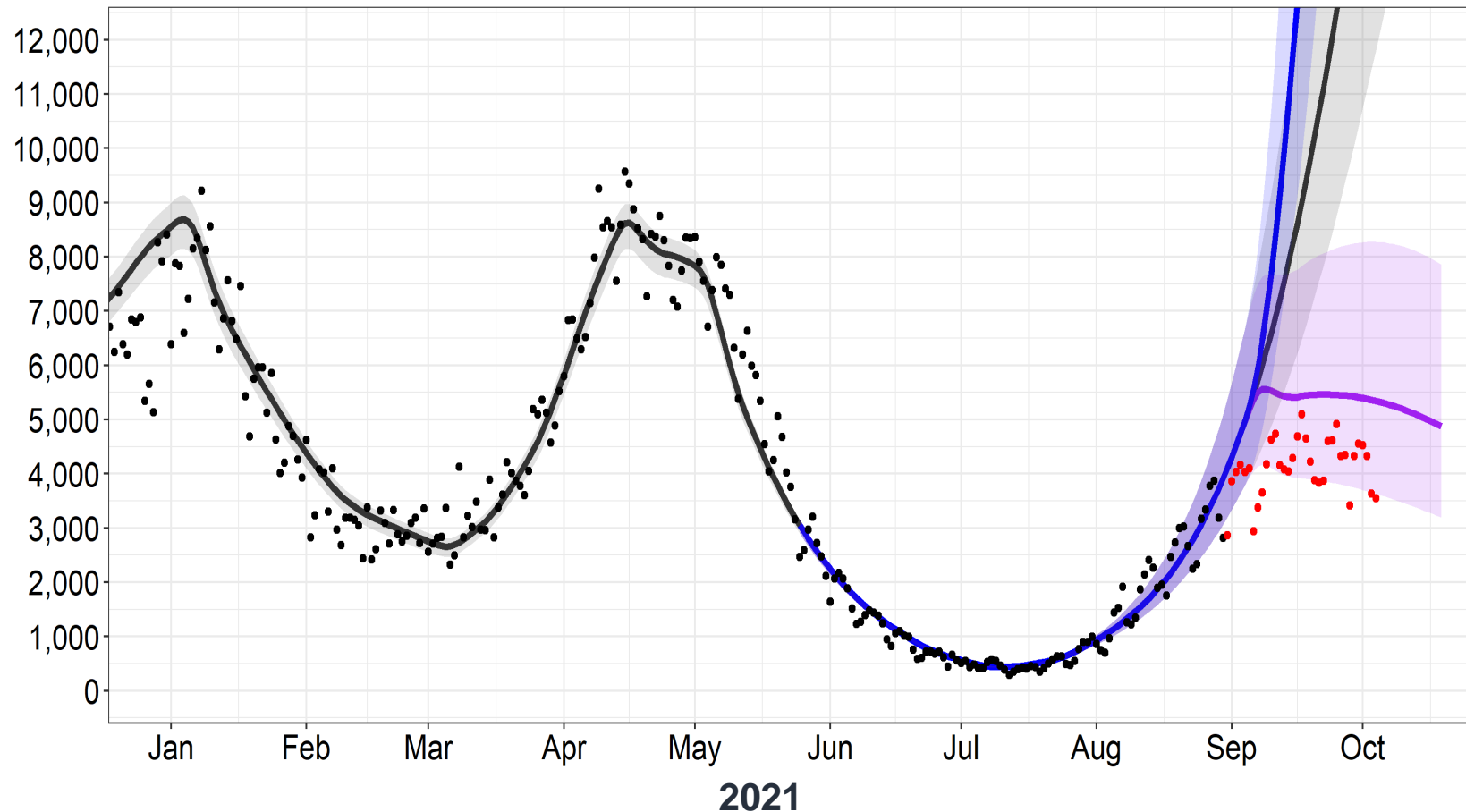
If public health measures **reduce** transmission by 15%

Data as of October 4, 2021

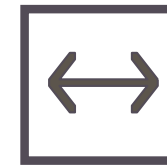
Note: Output from PHAC-McMaster model. Model considers impact of vaccination and increased transmissibility of VOCs (including Delta), refer to annex for detailed assumptions on modelling. Dark green vertical lines represent relaxed public health measures (i.e., reopening, increasing capacities, etc.). Red solid vertical lines represent reimplementing of public health measures (i.e., vaccine proof, mandate masking, etc.).

Daily case reports have followed the slower resurgence trajectory presented in the September 3rd longer range forecast

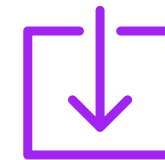
Reported cases



If further reopening **increases** transmission by 25%



If we **maintain** the current levels of transmission



If public health measures **reduce** transmission by 25%

Red points – Surveillance data after the forecast from Aug 31st to Oct 4th

Model data as of August 30, 2021. Surveillance data as of October 4, 2021.

Note: Output from PHAC-McMaster model. Model considers impact of vaccination and increased transmissibility of VOCs (including Delta), refer to annex for detailed assumptions on modelling.

Types of models used to inform decision making

Statistical forecast models:

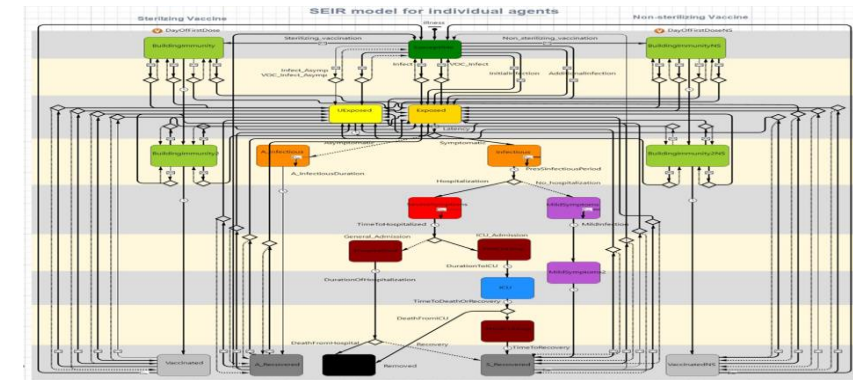
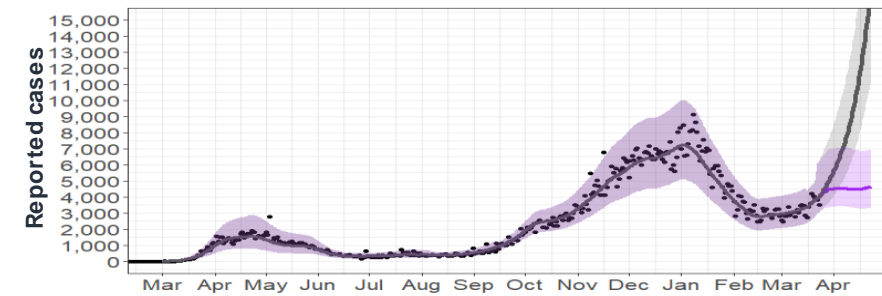
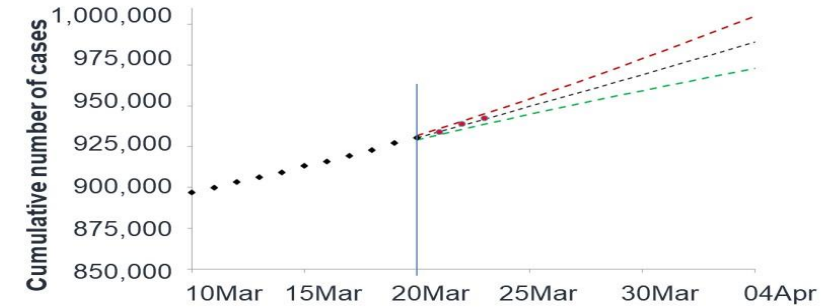
- Short-range forecast of expected cases given recent incidence

Long-range forecast models:

- Dynamic compartment model adapted to project near-future given recent incidence and scenarios for control/release/variants of concern

Models to explore scenarios of opening up:

- More complex models
 - Deterministic, age structured compartment model
 - Agent-based model
- Initially developed to model control measures needed
- Recently adapted to model effects of vaccination and transmission of VOC



Longer-range forecasting model assumptions

- The forecast uses compartmental models reflecting the biology of COVID-19 and public health response developed by PHAC in collaboration with McMaster University. It projects the near future given recent incidence of COVID-19 and scenarios for public health measures, variants of concern and vaccination.
- The model assumes that the B.1.617.2 (Delta) VOC is 50% more transmissible compared to B.1.1.7 (Alpha). This value is used to estimate the rate at which VOCs replace existing strains.
- Delta is considered to have been introduced in mid-March at very low prevalence. Proportions vary across provinces. The proportion of cases due to VOCs are indirectly fitted when calibrating to data.
- Dark green vertical lines represent relaxed public health measures (i.e., reopening, increasing capacities, etc.). Red solid vertical lines represent reimplementations of public health measures (i.e., vaccine proof, mandate masking, etc.).
- The national forecast includes three scenarios for changes in the effective transmission rate as of the latest public health measures in place for each province. This includes a line showing the expected change in cases if effective transmission rates do not increase (grey line); a line that assumes effective transmission increases by 15% (blue line); and decreases by 15% (purple line). There is uncertainty with the amount of transmission which propagates forward in the forecasting scenarios.
- The PHAC-McMaster model forecast includes current vaccine roll-out, including an assumption that vaccinations are 60% effective against infection after one dose and 90% after second dose for all variants except for Delta (30% after one dose and 80% after second dose). The vaccine projections assume 10% for first dose and 15% for second dose hesitancy of the eligible population.

Assumptions for the PHAC agent-based model

- The vaccine is 60% effective at preventing infection and 80% effective at preventing hospitalization after one dose, and 92% effective at preventing infection and 96% effective at preventing hospitalization after two doses;
- A VOC modelled on B.1.1.7 (Alpha) was introduced in December 2020 and is 50% more transmissible and 40% more virulent than the wild-type strain, but does not have immune breakthrough from vaccines;
- A second VOC modelled on B.1.617.2 (Delta) was introduced in March 2021 and is 100% more transmissible and 80% more virulent than the wild-type strain with immune escape from vaccines causing a 33% reduction in protection against infection after the first dose and a 6% reduction in protection against infection after the second dose;
- Hospital bed capacity available for COVID-19 patients in Canada is estimated at 31 per 100,000;
- The vaccination period begins Dec 14, 2020 and is estimated to end in mid-October. The website COVID-19 Tracker Canada - Vaccination Tracker (covid19tracker.ca) is used to calculate current and expedited vaccination rates +/- 1% of the real time rates. Vaccine acceptance is from the September 2, 2021 Canadian Immunization Centre report which contains data for vaccination including, and up to, August 28, an additional 1% to 6% of vaccine coverage is projected for age groups up to 59 years of age because these groups are currently actively receiving the vaccine.
- Vaccine coverage is an estimated 86.0% in the eligible population (12 years and over) and 75.1% in the total population.
- Vaccination roll-out proceeds in order of priority groups as recommended by NACI with a 4-month interval between doses starting from March 4, 2021. The 4-month delay progressively decreases to a 28-day interval by June;
- For all scenarios, a two-step gradual approach to lifting public health measures was modelled. Restrictive measures are lifted gradually in early summer (when at least 75% of those 12 and over have received their first dose and approximately 15% have received their second dose).
- The easing of personal protective measures occurs in mid-summer (when at least 80% of those 12 and over have received their first dose and approximately 50% have received their second dose), with return to approximately 80% of pre-pandemic contact rates by September 1, 2021. In the scenario with PHMs this fall, the reintroduction of PH measures occurs on September 7, 2021 and is released again on January 1, 2022.
- Reopening of the Canadian border to travellers commences on July 5, 2021 (Stage 1), August 2 (Stage 2) and September 7 (Stage 3), these stages correspond with varying estimates of imported cases as estimated from the PHAC importation risk model. Prior to Stage 1 reopening, the number of imported cases was estimated to be 2 per 100,000 per week (one transient and one permanent case).
- Prior to lifting of public health measures, the epidemic is controlled by a combination of restrictive closures, case detection and isolation, contact tracing and quarantine, and physical distancing.