

# Update on COVID-19 in Canada: Epidemiology and Modelling

*September 3, 2021*

[Canada.ca/coronavirus](https://Canada.ca/coronavirus)



Public Health  
Agency of Canada

Agence de la santé  
publique du Canada

Canada

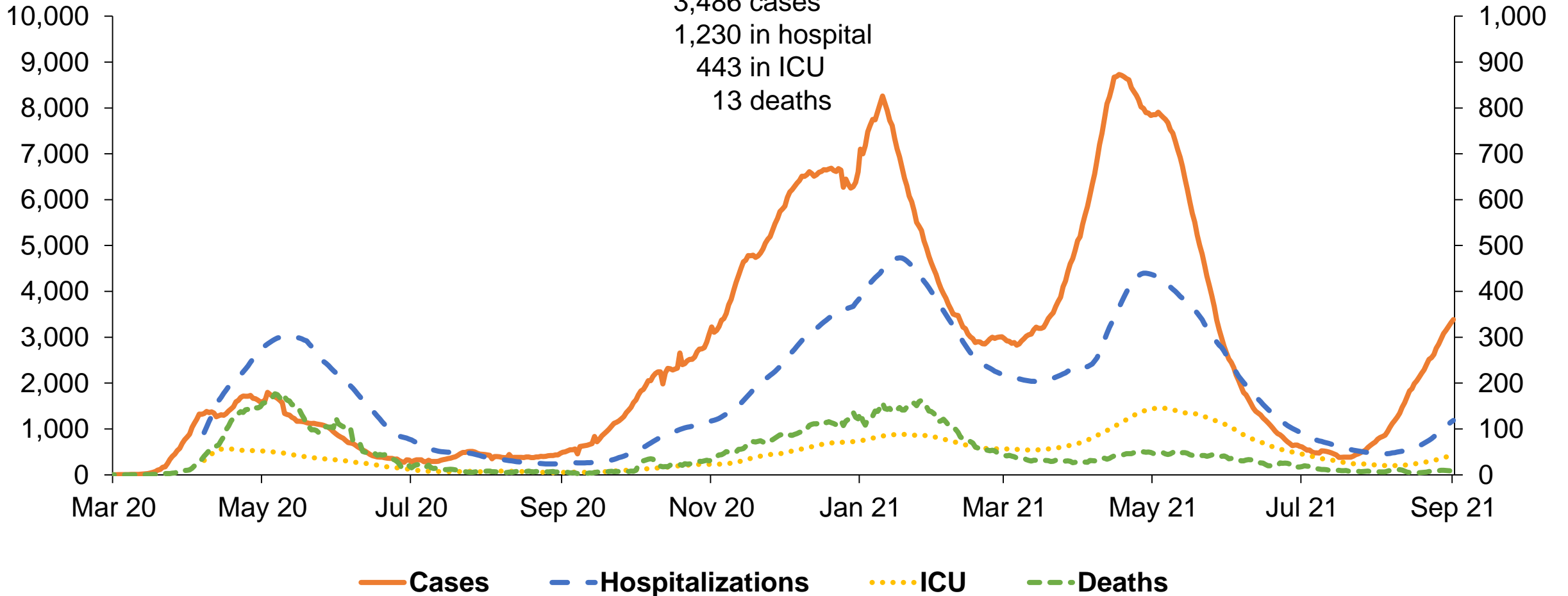
# Ongoing rapid acceleration of COVID-19 cases reflected in increasing severe illness

Number (cases / in hospital / in ICU)

On average over the past 7 days:

3,486 cases  
1,230 in hospital  
443 in ICU  
13 deaths

Number of deaths



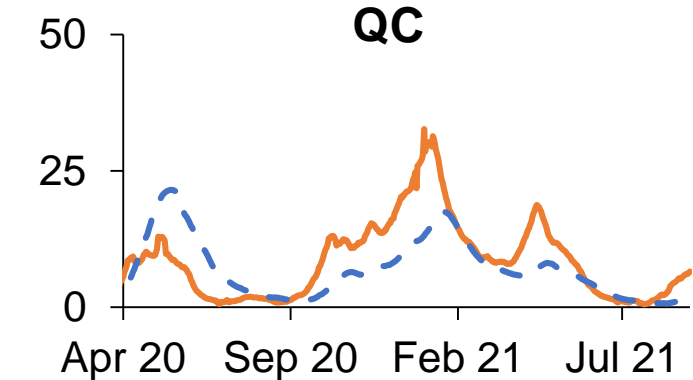
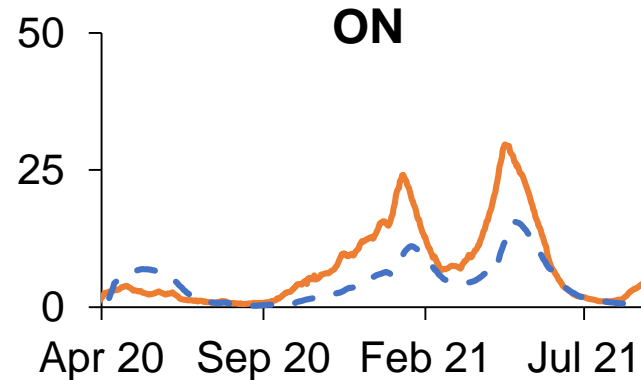
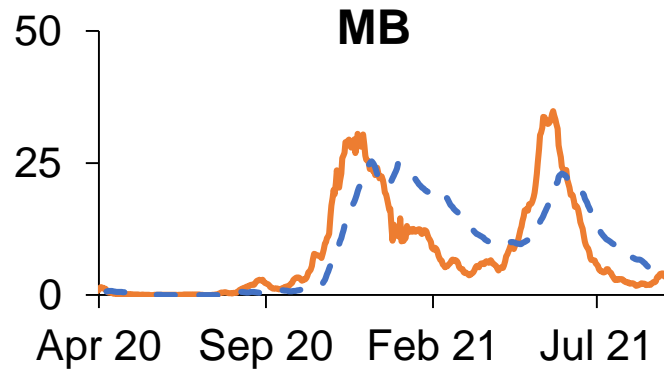
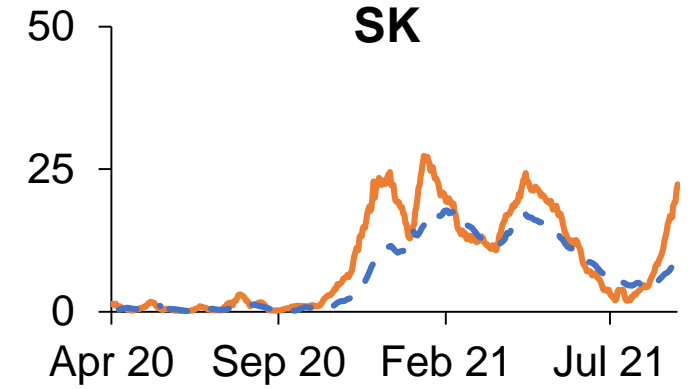
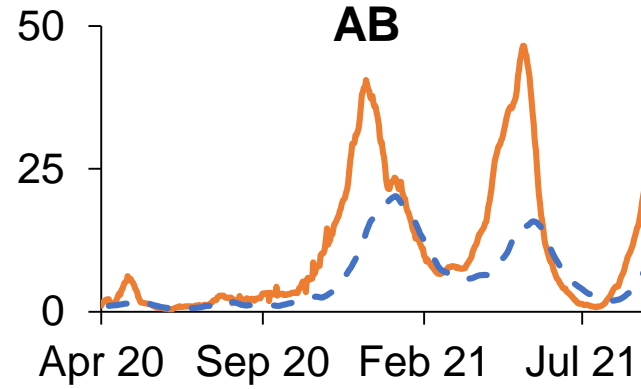
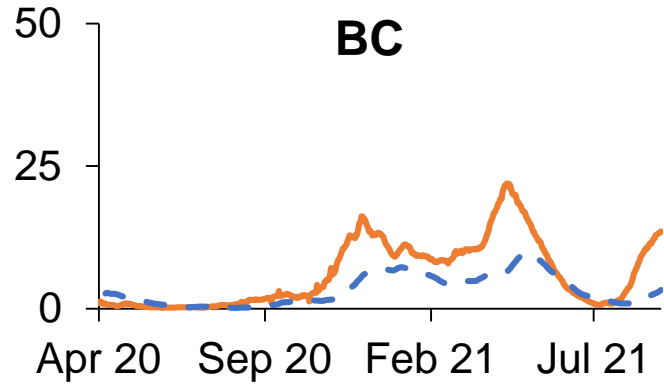
Data as of September 1, 2021

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



# Regional COVID-19 trends show hospital and ICU occupancy increasing, following weeks of rapidly increasing cases in some jurisdictions

Number cases / in hospital per 100,000 population



— Cases    - - - Hospitalizations

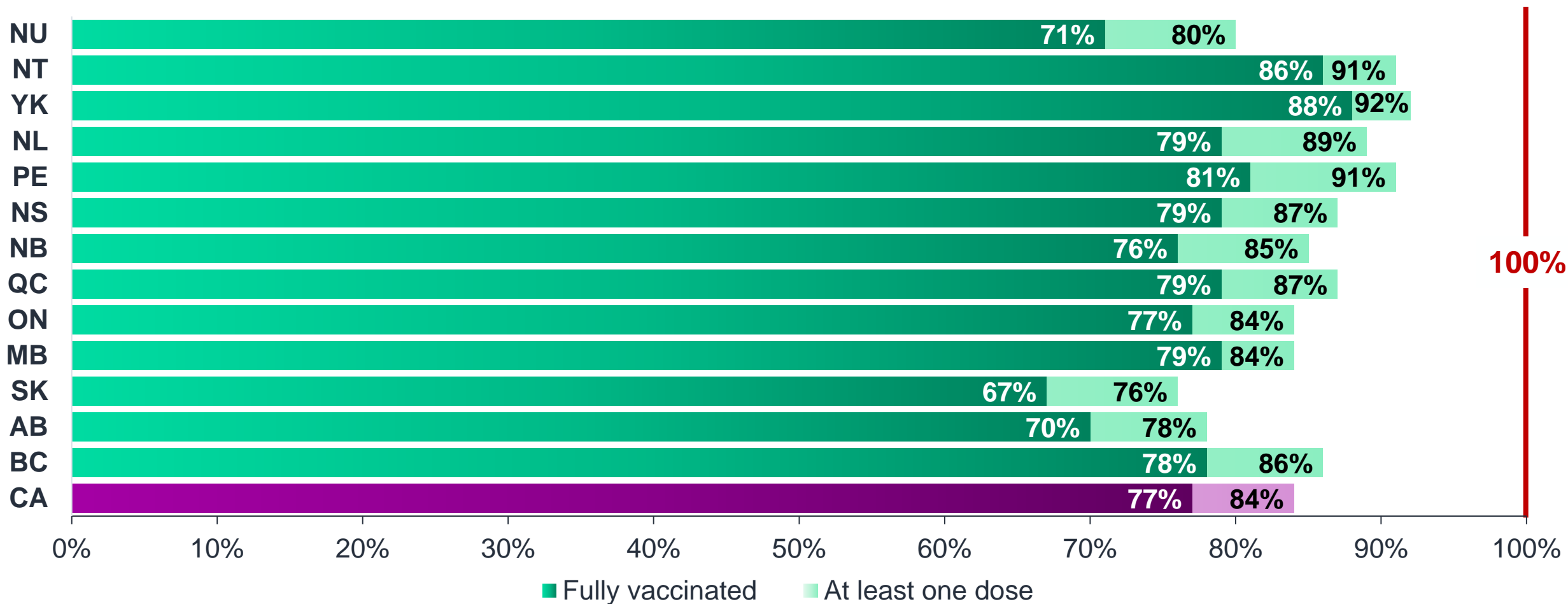
Data as of September 1, 2021

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



# Over 84% of the eligible people, aged 12 years or older, have at least one dose of COVID-19 vaccines and 77% are fully vaccinated

Percentage of eligible people (≥ 12 years) with at least one dose and fully vaccinated by jurisdiction, as of September 2<sup>nd</sup> 2021



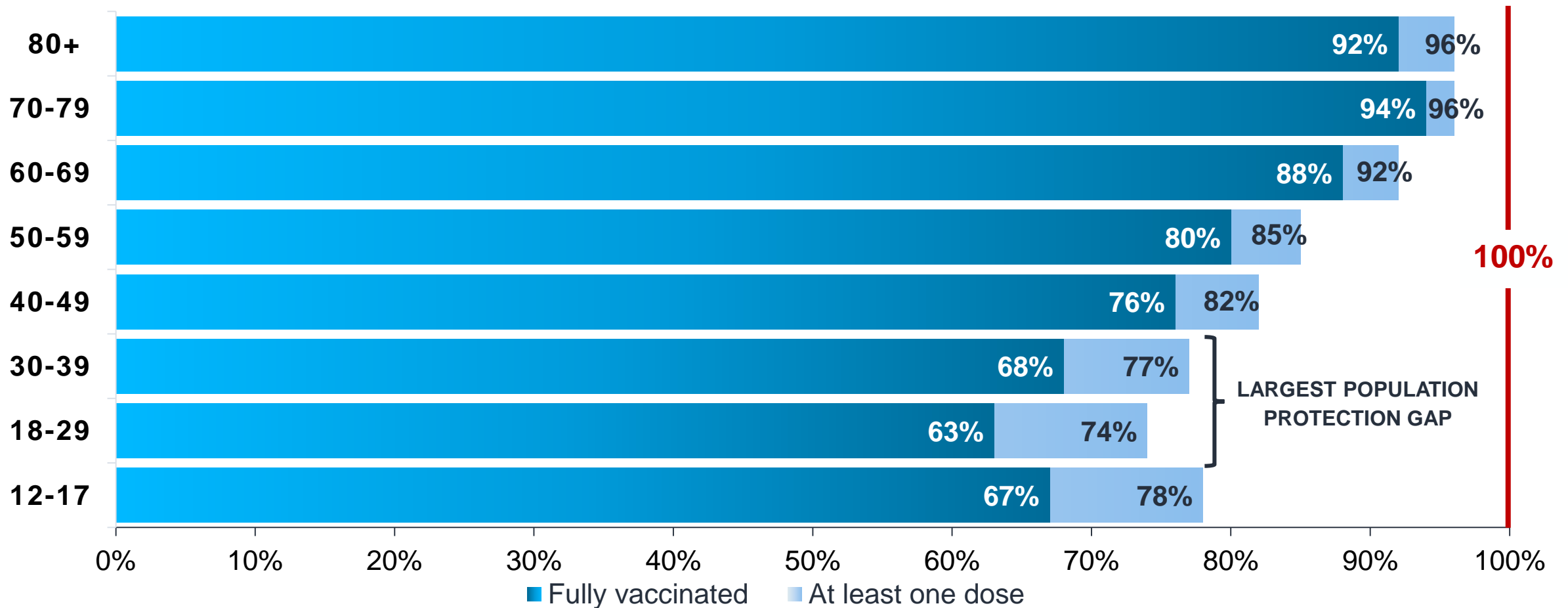
Data as of September 2, 2021

Note: Data obtained from <https://covid19tracker.ca/vaccinationtracker.html>. Accessed on 2 September, 2021 (12:30PM EDT)



# Vaccine coverage has increased stepwise as vaccination programs expanded to younger age groups, but uptake has slowed more recently

Percentage of eligible people ( $\geq 12$  years) with at least one dose and fully vaccinated by age group, as of Aug. 28<sup>th</sup>, 2021

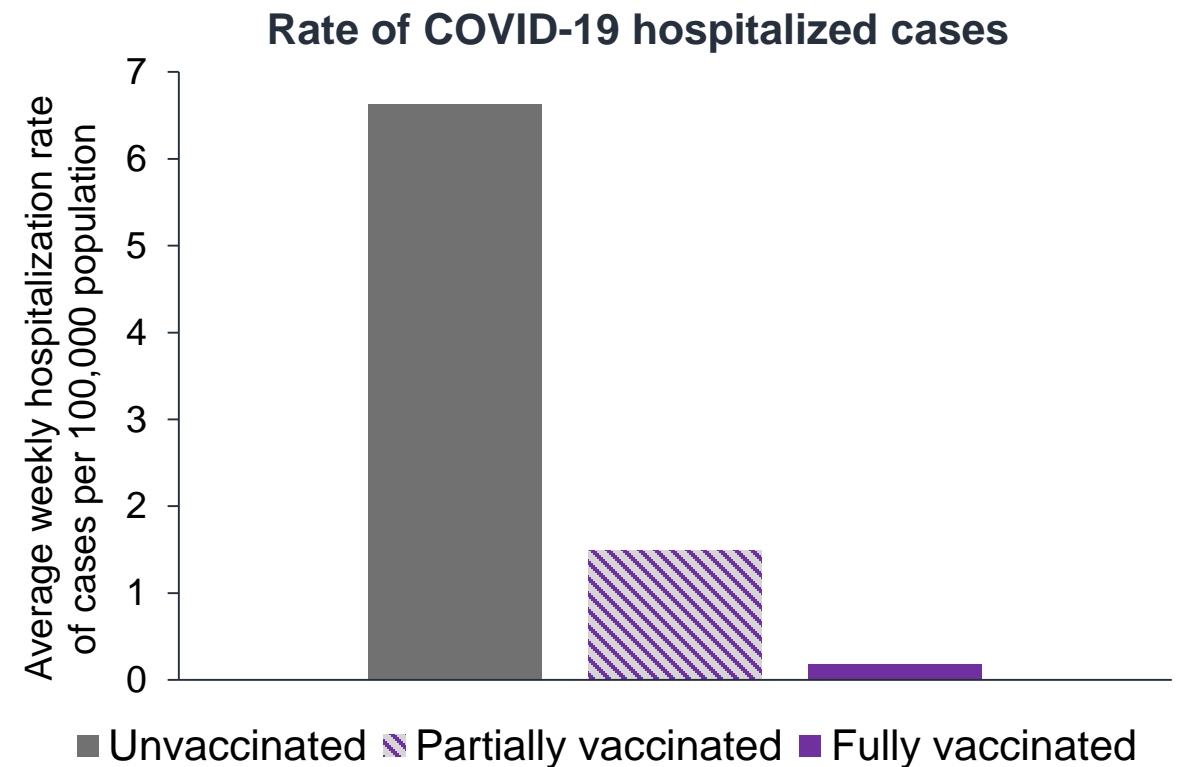
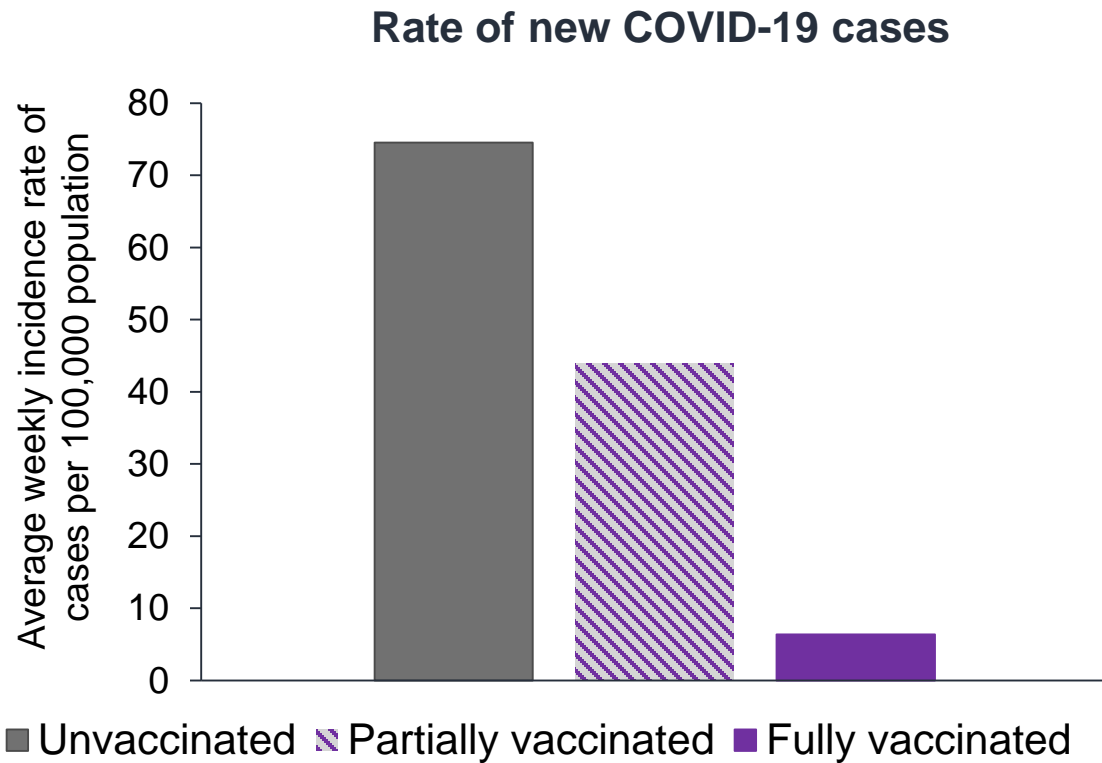


Data as of August 28, 2021

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

# Evidence shows COVID-19 vaccines are highly protective, even with the emergence and spread of the Delta variant in Canada

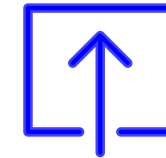
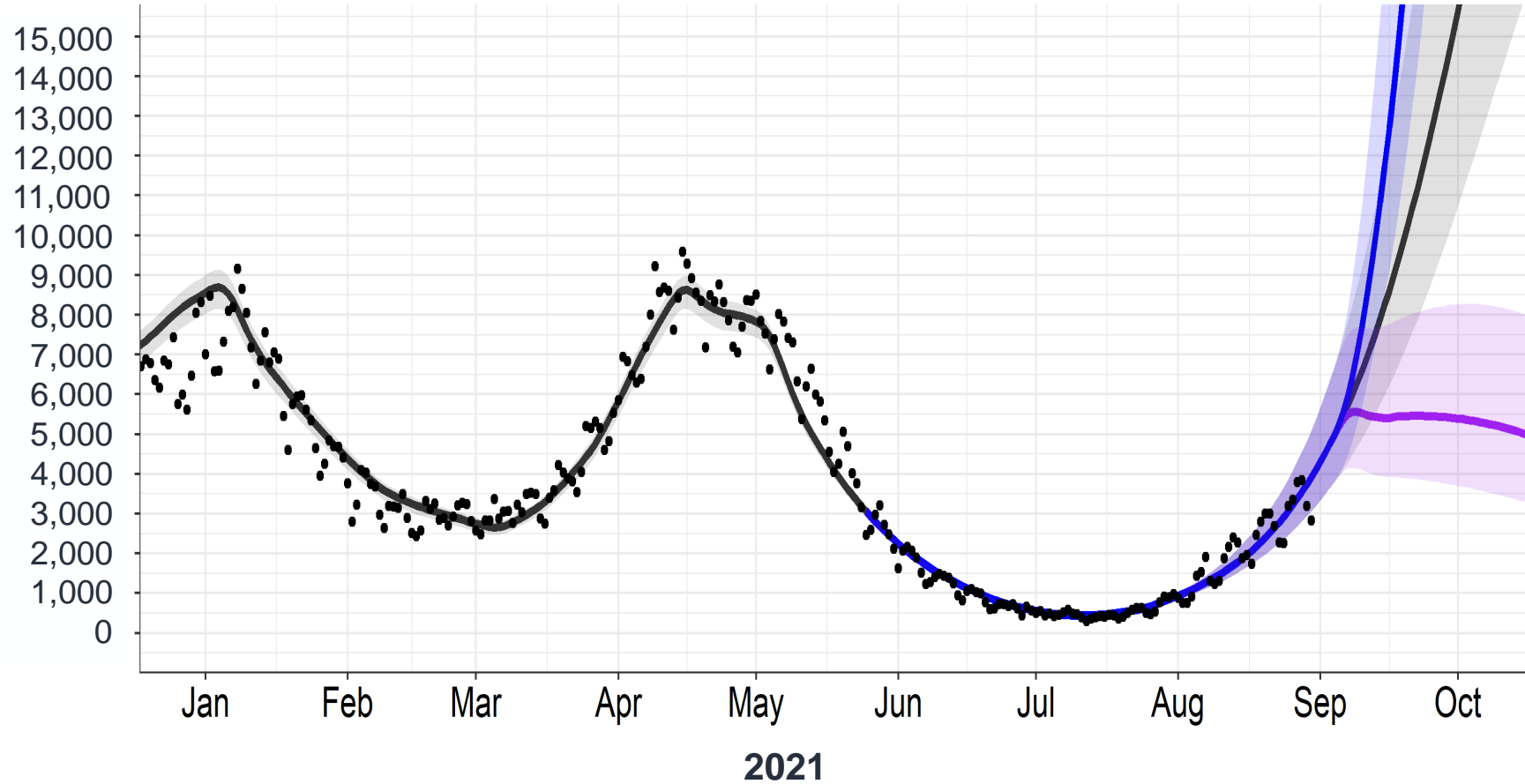
- New cases among unvaccinated people were **12** times higher than in the fully vaccinated
- Hospitalized cases among unvaccinated people were **36** times higher than in the fully vaccinated



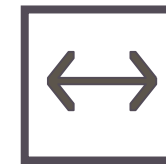
Data as of August 30, 2021 using data from **July 18, 2021 to August 14, 2021** from 11 provinces and territories (not including Saskatchewan, Quebec) for the eligible population 12 years or older, adjusting for age. **Definitions:** unvaccinated cases include those who were unvaccinated at the time of their onset; partially vaccinated cases had onset between  $\geq 14$  days from their first dose and  $< 14$  days after their second dose; fully vaccinated cases had  $\geq 14$  days from their second dose

# Longer-range forecast still showing strong resurgence trajectory, but strengthening measures to reduce spread could slow acceleration

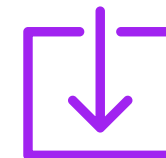
Reported cases



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



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



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

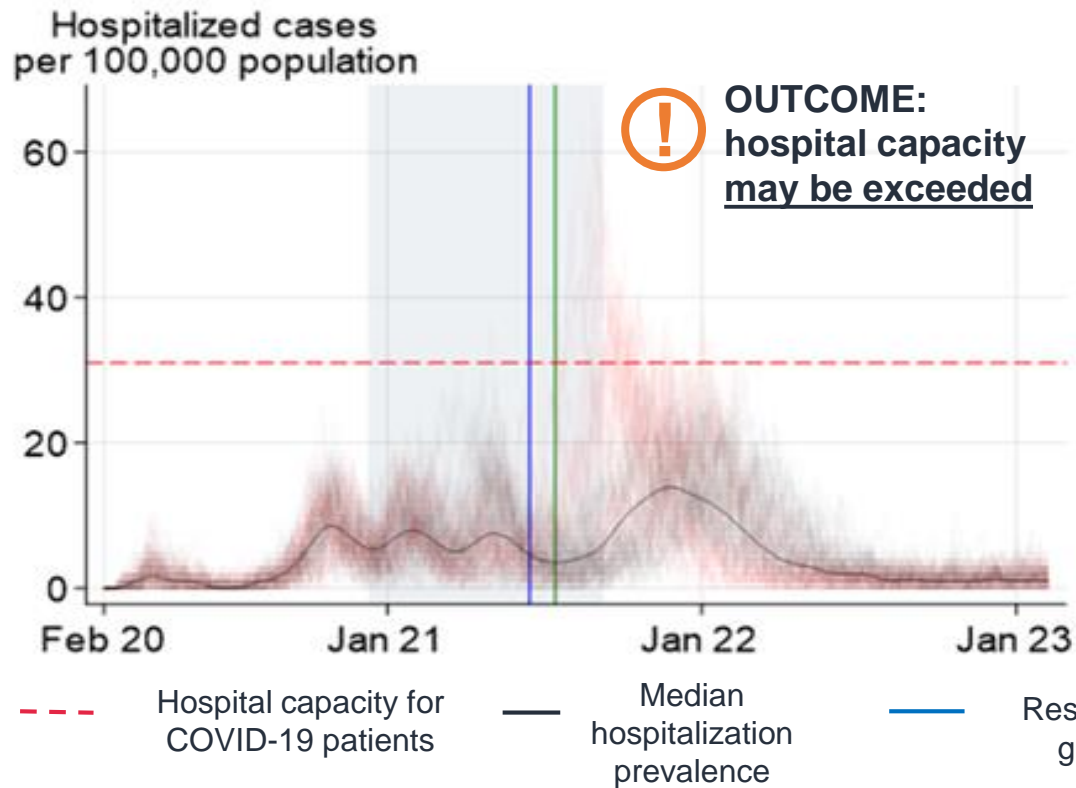
Data as of August 30, 2021

**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.

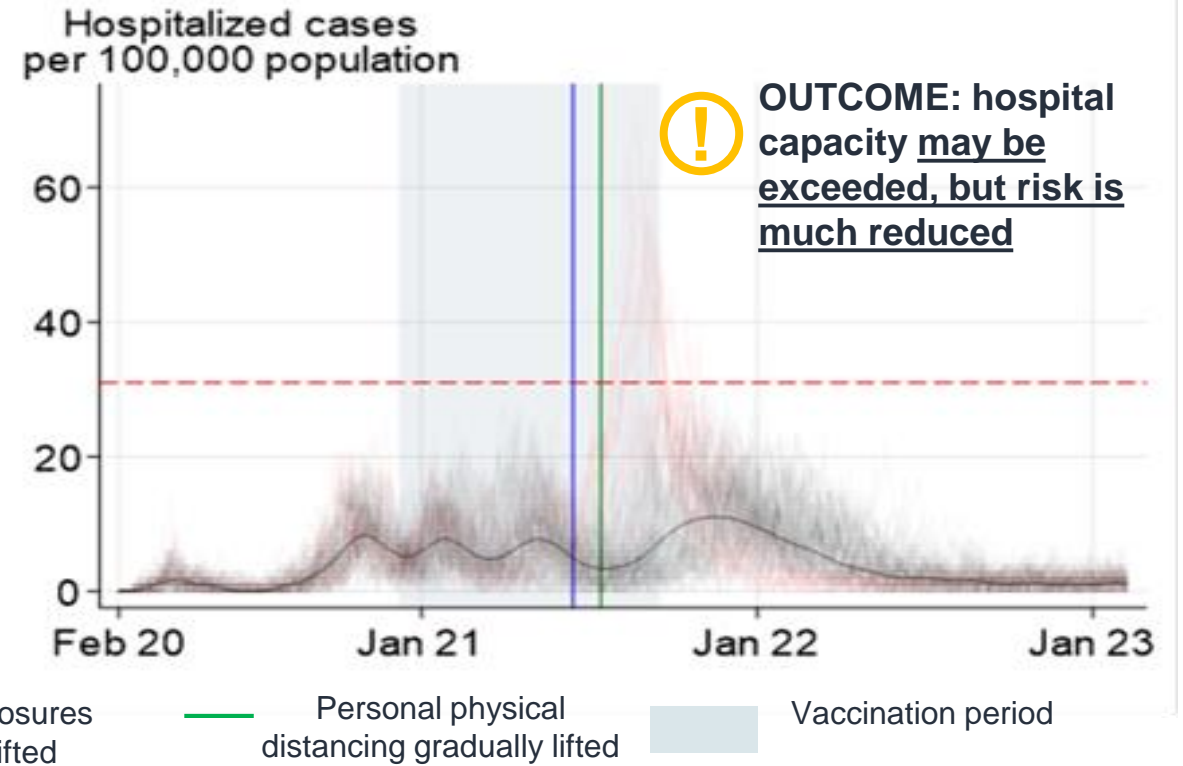


# Immediate acceleration of vaccine uptake, with increased uptake among adults, aged 18-39 years, could dampen the impact on hospitalization

## UPDATED SCENARIO WITH CURRENT RATE OF VACCINATION



## UPDATED SCENARIO WITH INCREASED UPTAKE AMONG AGES 18-39 AND EXPEDITED VACCINATION RATE



**Note:** For all scenarios, a two-step approach to lifting public health measures is modelled. Vaccine acceptance varies by age group and is informed by actual rates of vaccine uptake by age groups (as of August 14, 2021) with an additional 1% increase in coverage projected for age groups up to 59 years of age because these groups are currently actively receiving the vaccine. The current rate of vaccination is defined as vaccination rollout rates for the week of Aug. 13-19. Expedited vaccination is defined as the rate during the peak rollout period of the first half of July. In the scenario on the right, vaccine uptake among ages 18-39 is increased from 74.5% to 80%. Vaccine coverage in the eligible population (12+) is 82.8% on the left and 84.5% on the right.



# Now is our window of opportunity to rapidly increase vaccine coverage for maximum effect in slowing growth to protect health system capacity

- Updated modelling shows the urgent need to get more 18-39 year olds vaccinated and **speed up the overall rate of vaccination** to reduce the impact of the Delta-driven resurgence
- **12.5 million Canadians need better protection**, including those **not yet vaccinated**, those **still needing a second dose** and **children too young to be vaccinated**
- **Regardless of our vaccination status, an indoor fall and winter also means maintaining layers of protection**, including masking and spacing, and **taking precautions** like staying home if you develop any symptoms.

53 MILLION+ vaccines given in Canada  
25 MILLION+ Canadians fully vaccinated!



## WE NEED MORE CANADIANS VACCINATED TO:

### Close the protection gap:

~12.5 Million Canadians are not yet fully protected through vaccination

~5.2 M not yet vaccinated

~2.5 M need a second dose

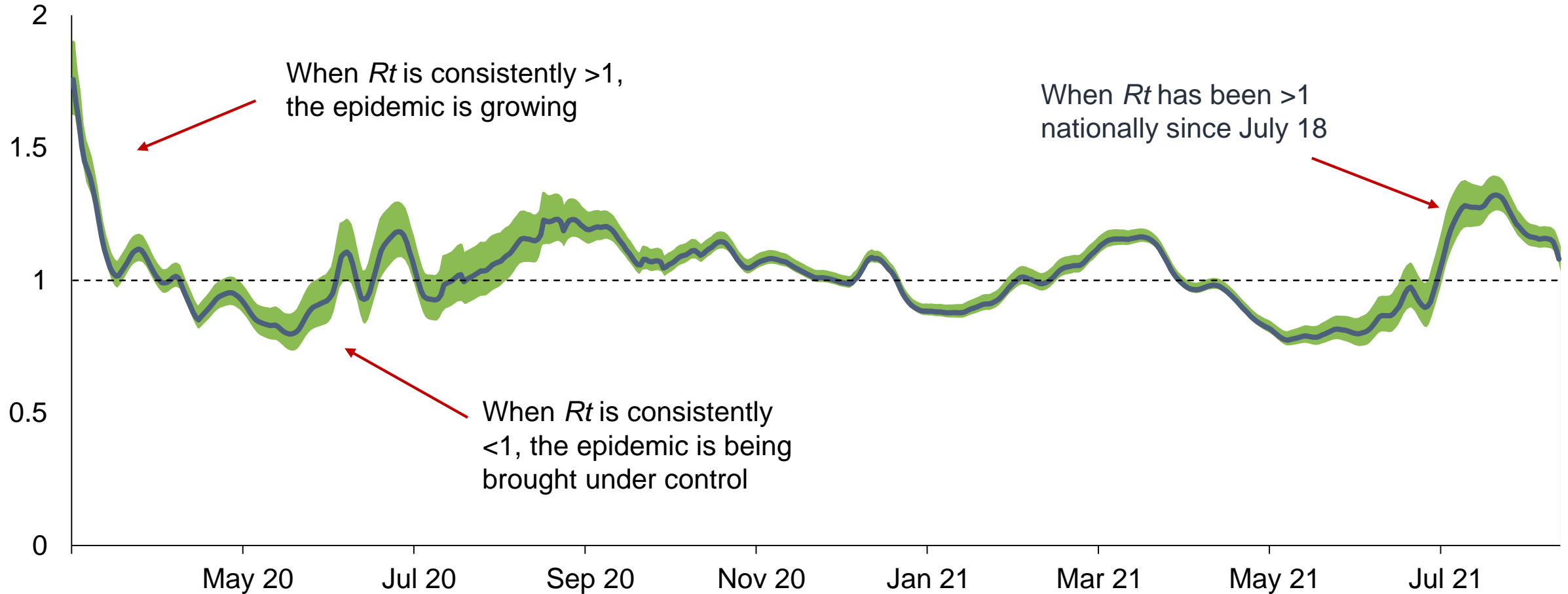
~4.8 M children under 12 not yet eligible

### Build up the vaccination firewall to:

- **Provide indirect protection for 4.8 M children under 12 years of age** & immunocompromised and others less protected by or not eligible for vaccines
- **Protect healthcare system capacity & workforce**
- **Get back to in-person activities and social connections:** keeping schools/higher learning, work, fitness, recreation & social settings open!

# ANNEX

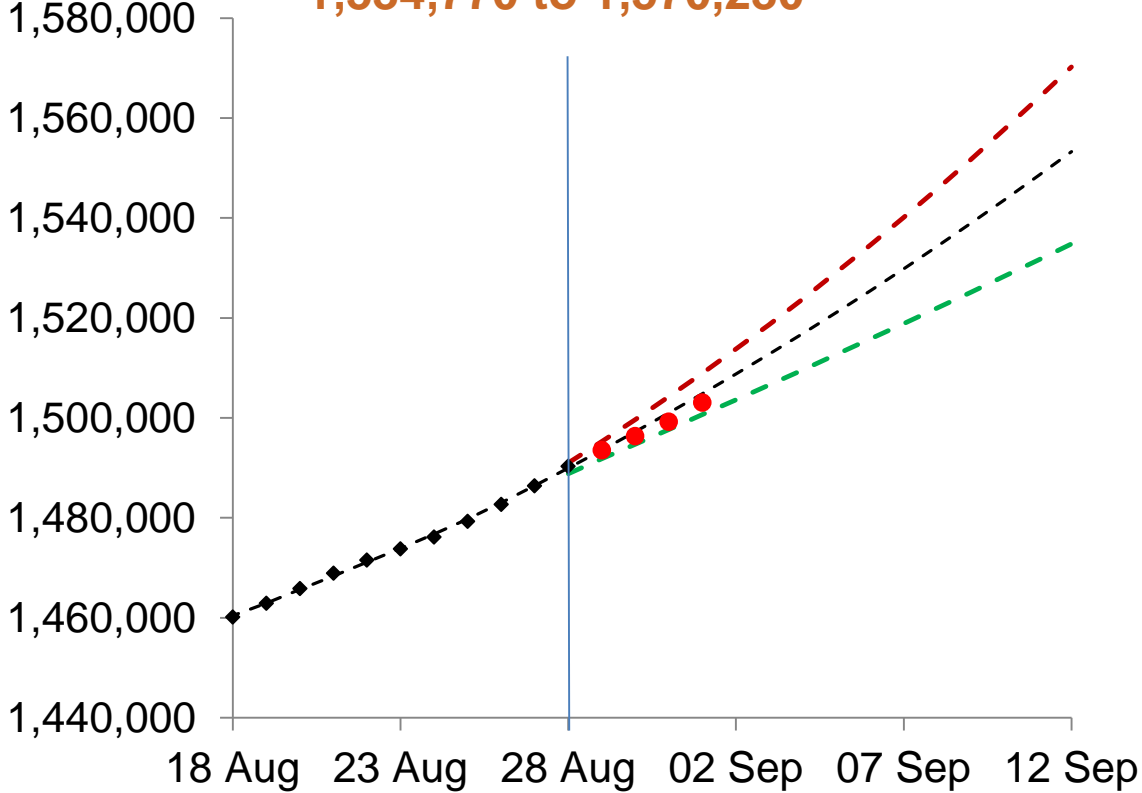
# National $R_t$ remains above 1, maintaining a national epidemic growth pattern



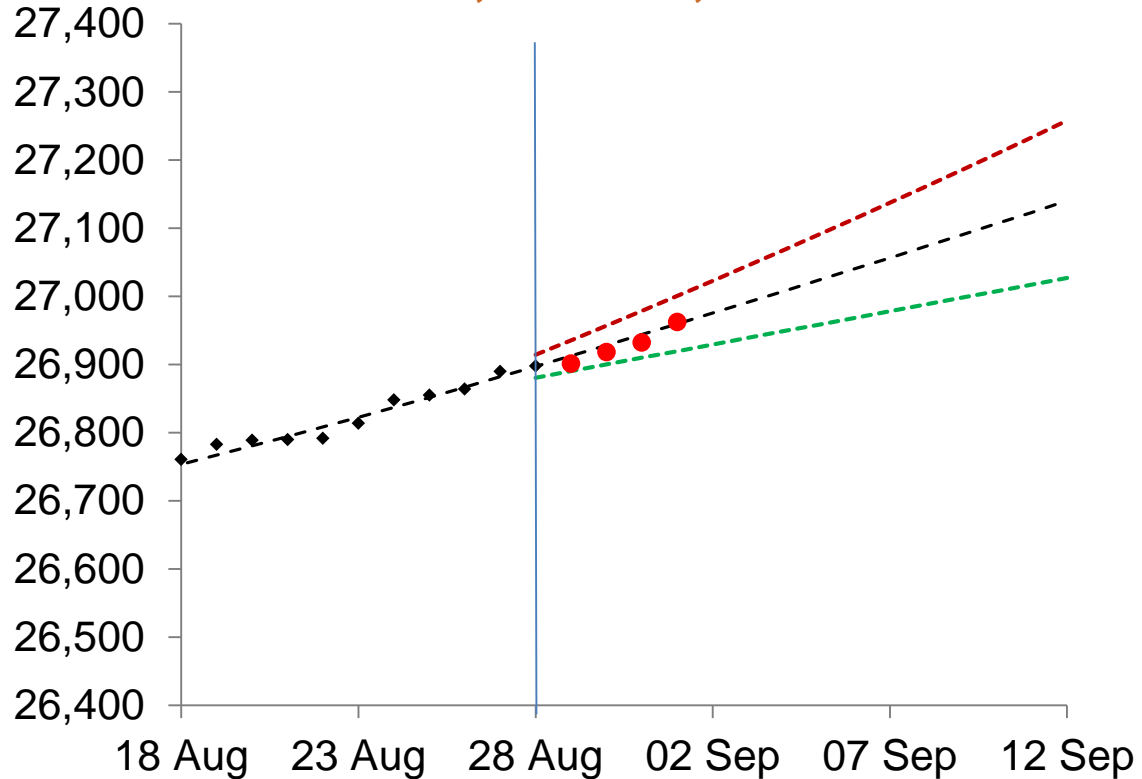
Data as of August 29, 2021  
Note: 7-day moving average.

# Short-term forecast predicts increased rate of growth for cumulative cases but not for cumulative deaths

Cumulative cases predicted to September 12, 2021:  
**1,534,770 to 1,570,230**



Cumulative deaths predicted to September 12, 2021:  
**27,025 to 27,260**

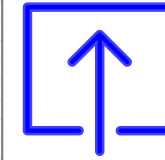
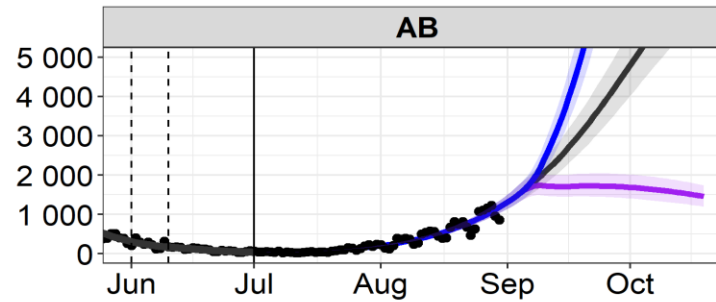
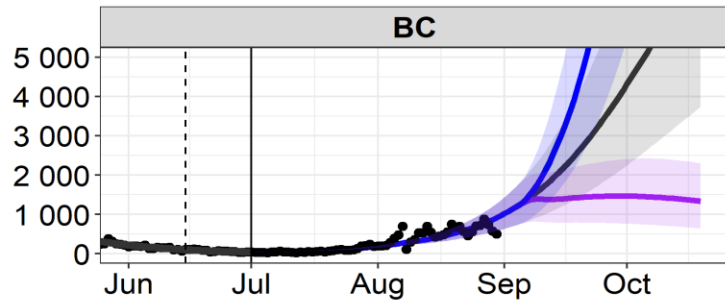


- ◆ Cumulatively reported cases in Canada by Aug 28
- Cases added since Aug 28 when the prediction was made
- Prediction to September 12
- - - Lower 95% prediction limit
- - - Upper 95% prediction limit

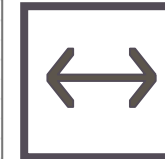
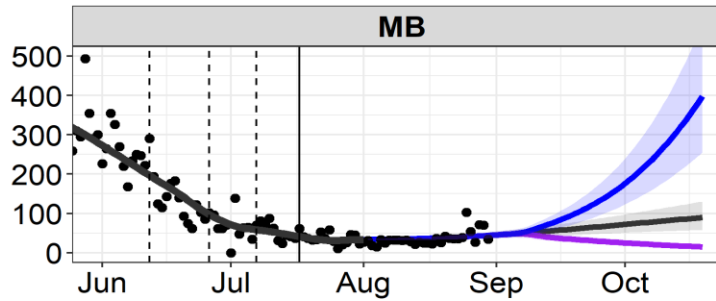
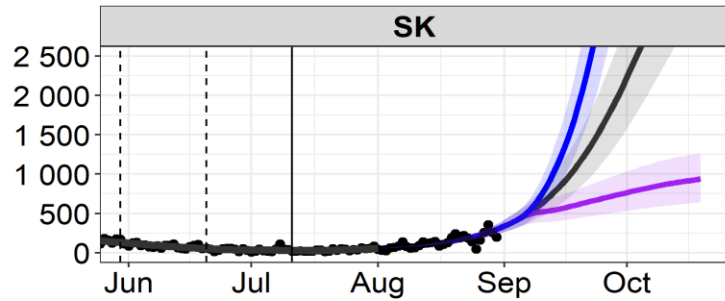
Data as of August 28, 2021  
 Note: Extrapolation based on recent trends using a forecasting model (with ranges of uncertainty).



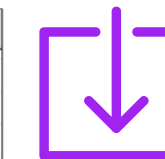
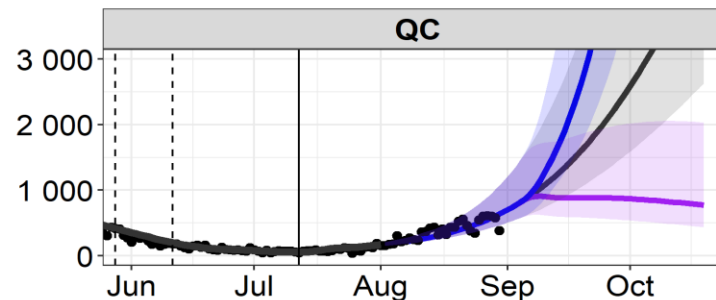
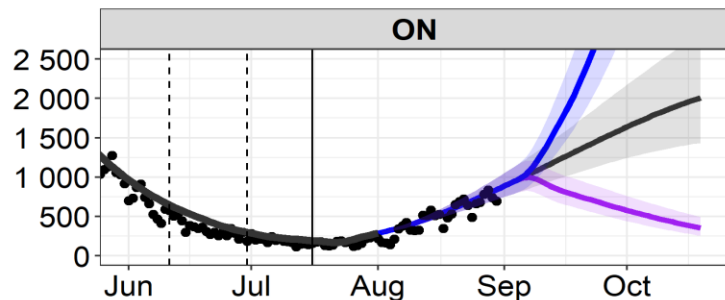
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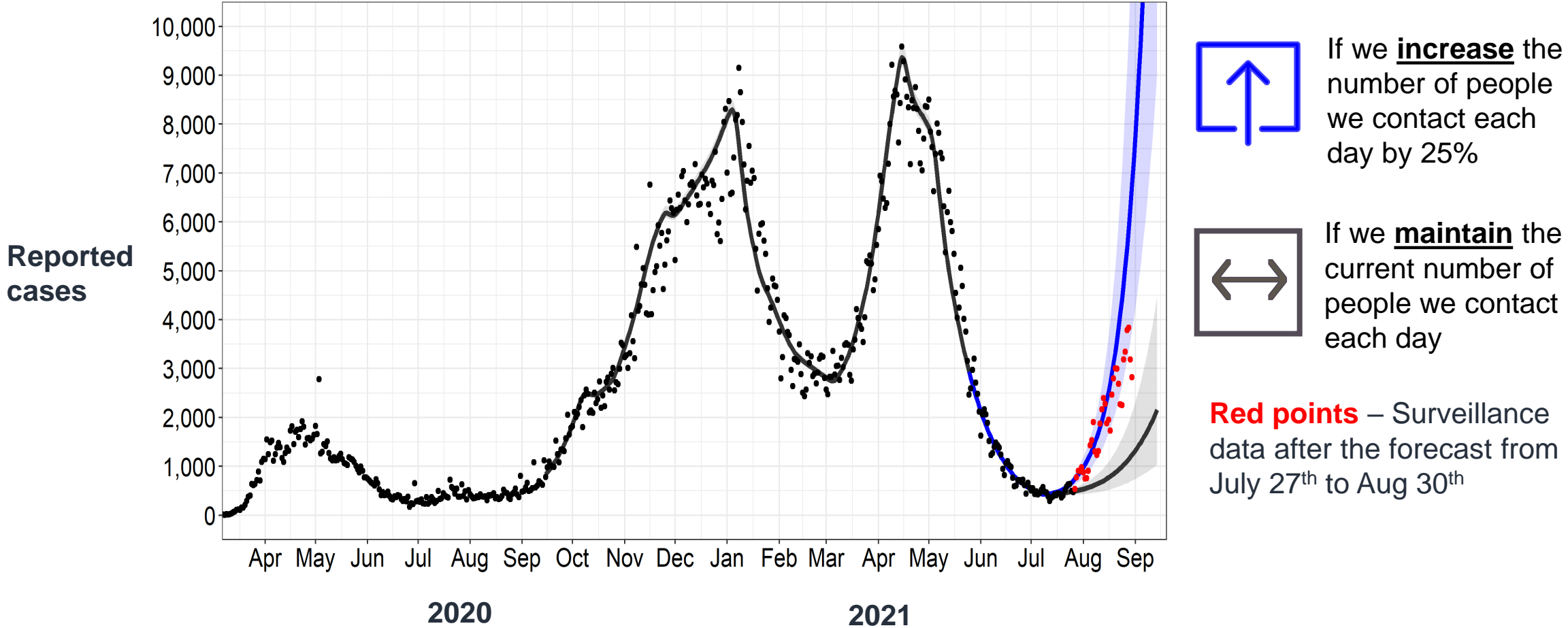
Reported cases

Data as of August 30, 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. In provincial plots, vertical dashed lines represent previous stages of reopening, solid vertical lines represent current/upcoming reopening.



# Previous longer term modelling forecast from July 30 shows that daily cases have increased along the strong resurgence trajectory



Model data as of July 26, 2021. Surveillance data as of August 30<sup>th</sup>.

**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:

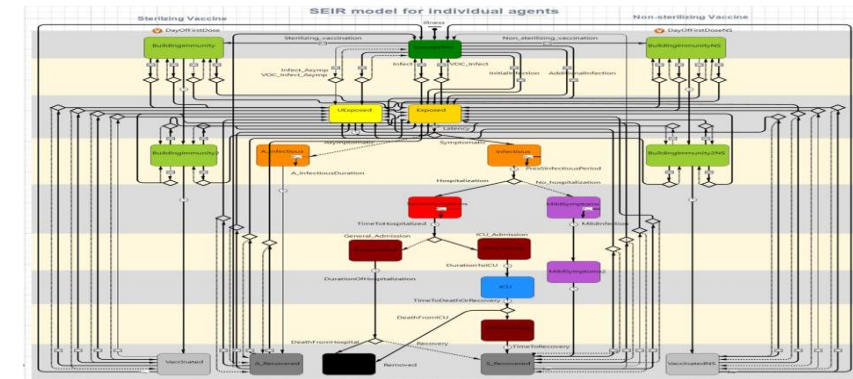
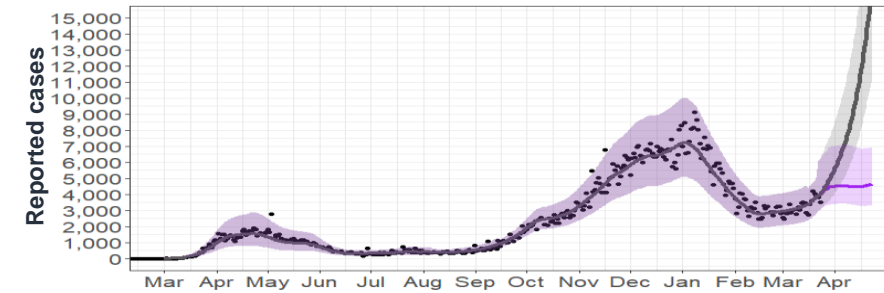
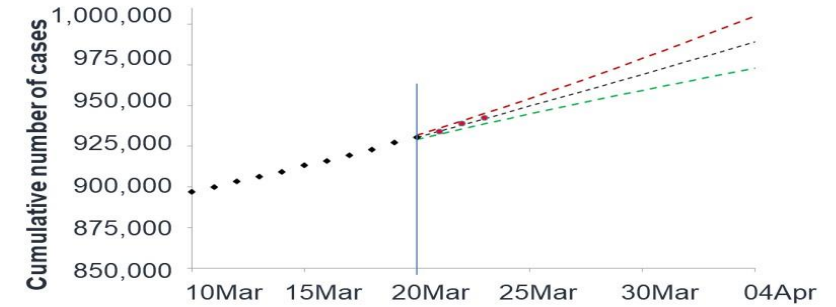
- Short-range forecast of expected cases given recent incidence

## 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.
- Vertical dashed lines represent previous stages of re-opening. Solid vertical lines represent last/latest re-opening and result in increases in overall transmission.
- The national forecast includes three scenarios for changes in the effective transmission rate as of Aug 31<sup>st</sup>. 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 25% (blue line); and decreases by 25% (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 50% more transmissible and 100% more virulent than Alpha 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 at various times according to the eligible population in each scenario and the vaccination rate (current or expedited). The website COVID-19 Tracker Canada - Vaccination Tracker ([covid19tracker.ca](https://covid19tracker.ca)) is used to calculate current and expedited vaccination rates +/- 1% of the real time rates. Vaccine acceptance is from the August 19, 2021 Canadian Immunization Centre report which contains data for vaccination including, and up to, August 14, an additional 1% of vaccine coverage is projected for age groups up to 59 years of age because these groups are currently actively receiving the vaccine.
- In the scenario with the current rate of vaccination, vaccine coverage is an estimated 82.8% in the eligible population and 72% in the total population. In the scenario with increased uptake in those aged 18-39 and expedited vaccination, vaccine coverage is an estimated 84.5% in the eligible population and 73.5% 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). Full reopening is assumed by September 1, 2021
- 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
- The phased reopening of the Canadian border to travellers is incorporated in the model. Prior to Phase 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.