Update on COVID-19 in Canada: Epidemiology and Modelling

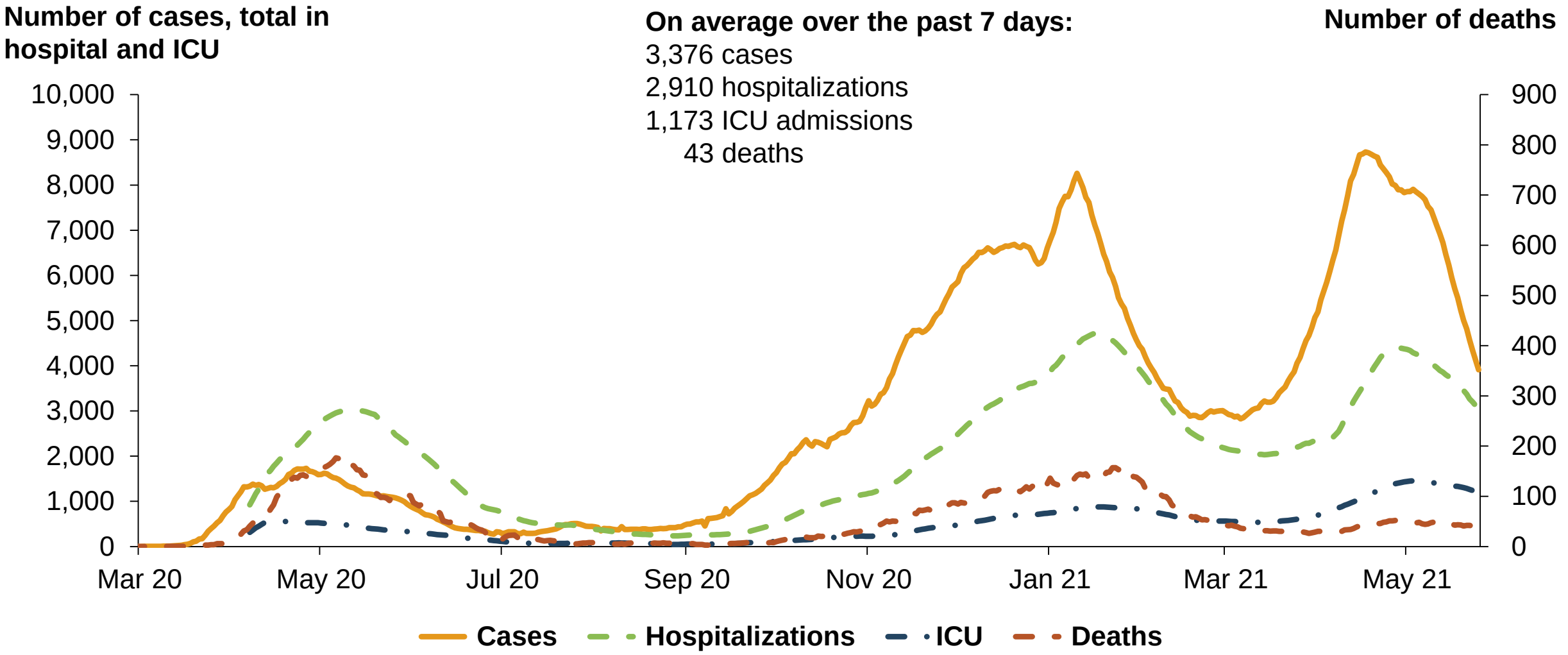
May 28th, 2021

Canada.ca/coronavirus

Public Health Agency of Canada
Agence de la santé publique du Canada

Canada

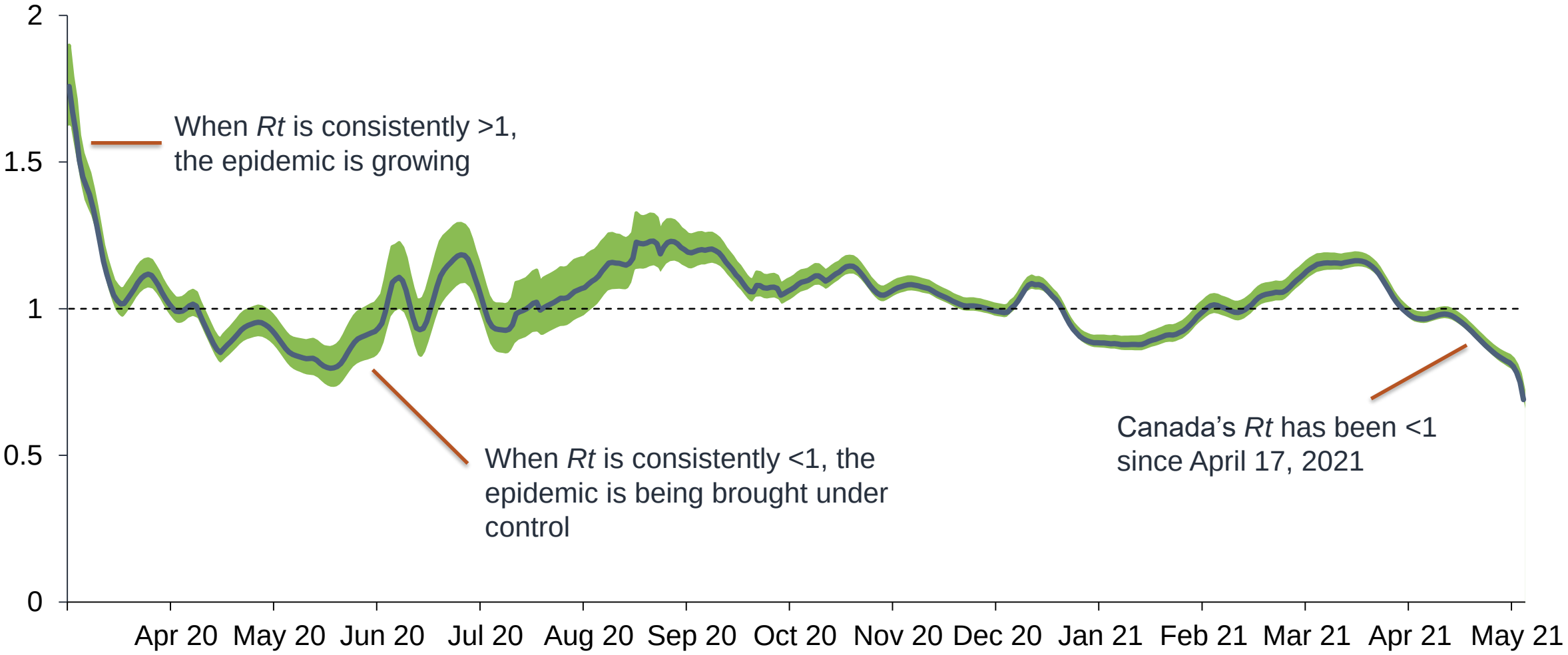
National decline across COVID-19 disease activity and severity indicators



Data in figure as of May 25, 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.*

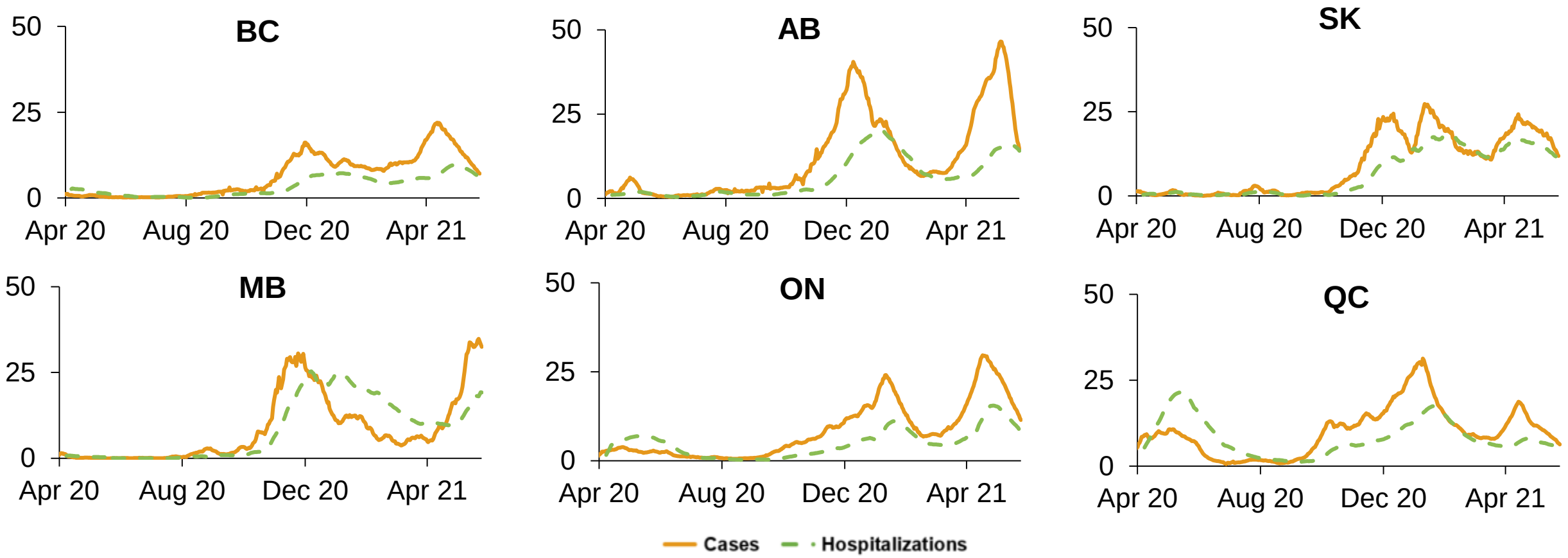
National *Rt* below 1 for over a month and continues to trend down



Data as of May 23, 2021
Note: *7-day moving average.*

Regional COVID-19 trends show case and hospitalization rates are declining but still very high in some areas

Number of cases and total in hospital per 100 000 population



Data as of May 25, 2021

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

Ongoing monitoring of Variants of Concern (VOC) impacts in the Canadian context

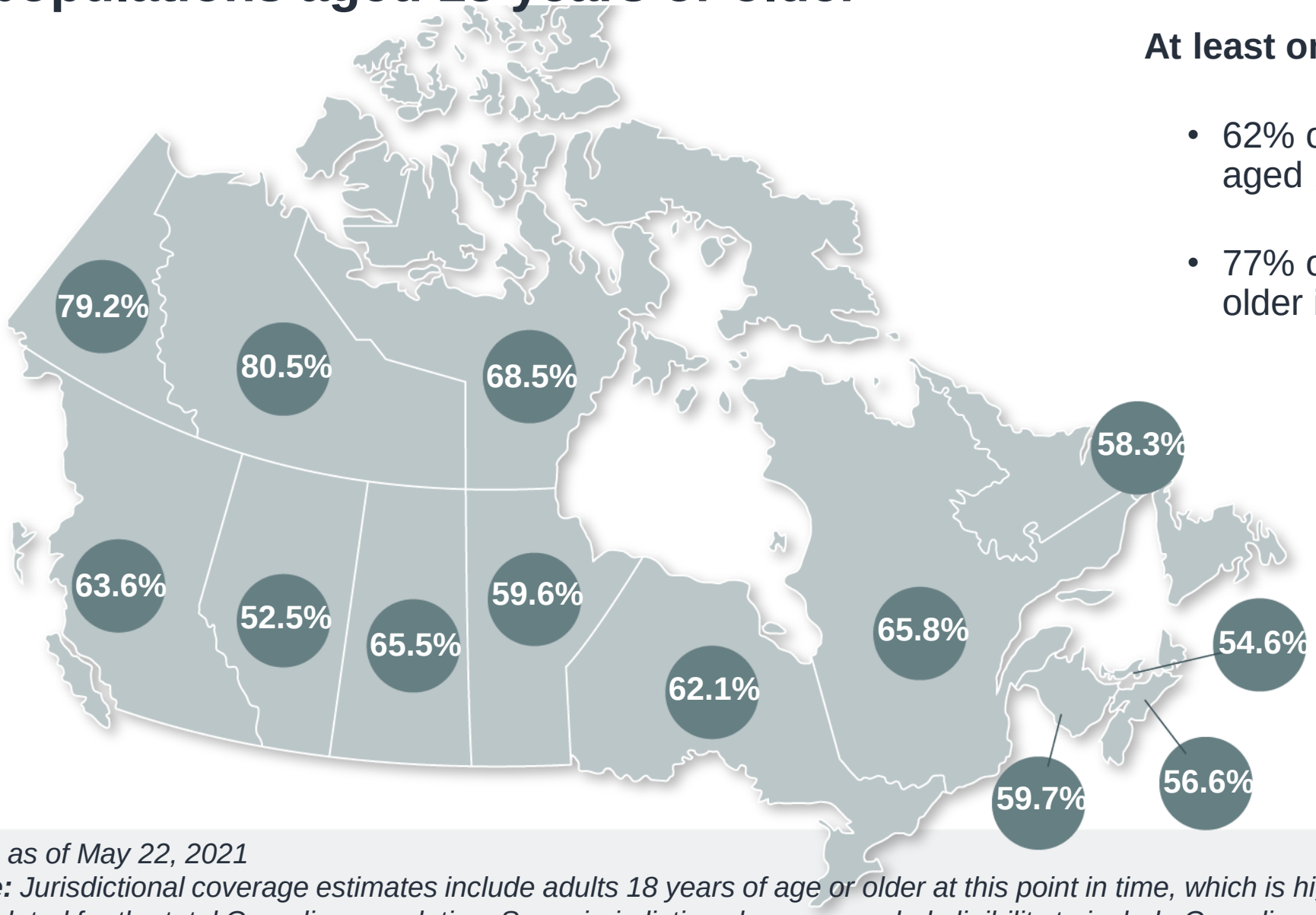
Variant of Concern (VOC)	Estimated proportion of all VOCs detected to date*	Key attributes of concern
B.1.1.7	56%	↑ transmissibility ↑ severity
B.1.617	<5%	↑ transmissibility
P.1	<5%	↑ transmissibility
B.1.351	<1%	↑ transmissibility ↓ efficacy of some vaccines

- Variants of Concern (VOCs) account for an estimated 70% of reported cases in recent weeks
- B.1.617 lineage was declared a VOC in Canada on May 12

Data as of May 18, 2021

***Note:** *Proportion of B.1.1.7, B.1.351, and P.1 from national case database. Proportion of detections of B.1.617 obtained from whole genome sequencing by NML and provincial partners. Approximately 30% of cases are identified as a VOC, but are not assigned a lineage.*

Vaccination increasing across Canada, with high coverage in adult populations aged 18 years or older



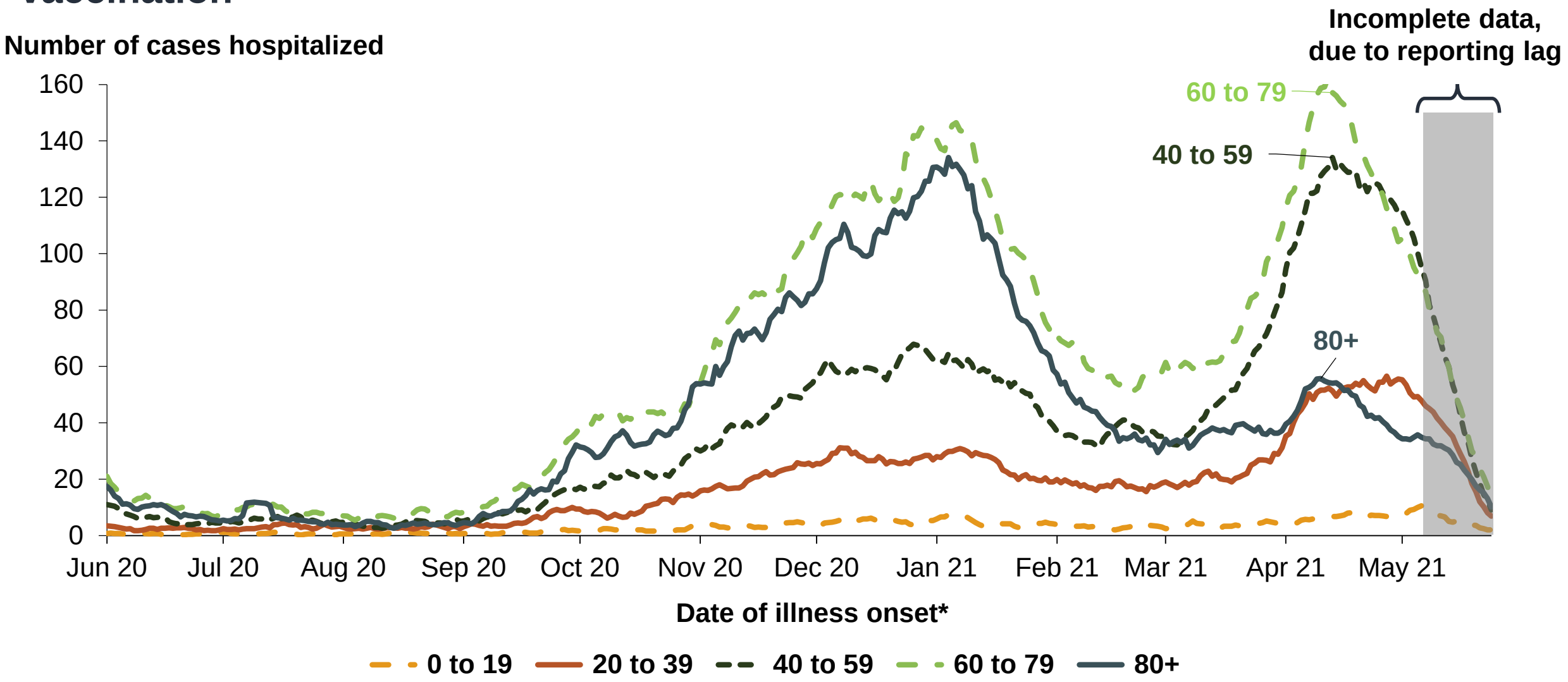
At least one dose given to:

- 62% of adults in Canada, aged 18 years or older
- 77% of adults 18 years or older in the territories

Data as of May 22, 2021

Note: *Jurisdictional coverage estimates include adults 18 years of age or older at this point in time, which is higher than the coverage rate calculated for the total Canadian population. Some jurisdictions have expanded eligibility to include Canadians 12 years of age or older.*

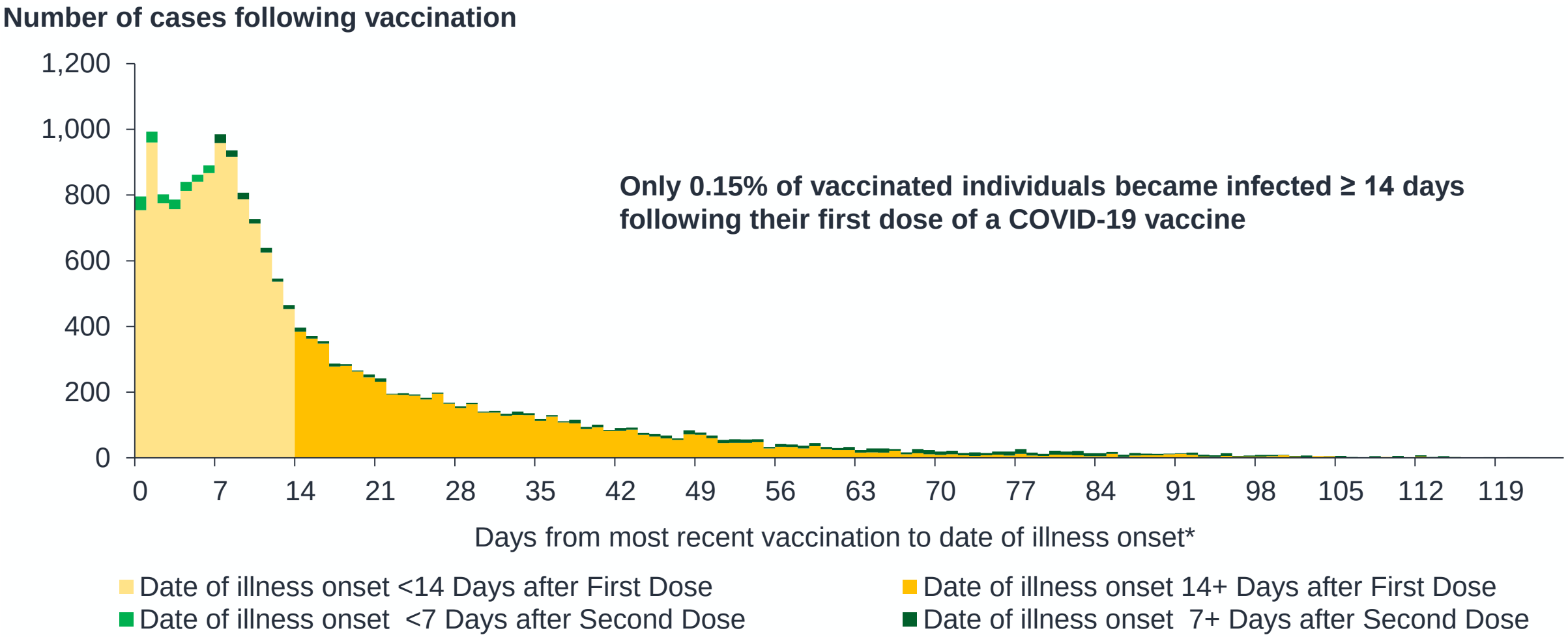
Hospitalizations declining in older adult age groups targeted for priority vaccination



Data as of May 25, 2021

Note: *Trend lines reflect 7-day moving averages. *The earliest of the following dates: Onset date, specimen collection date, laboratory testing date, date reported to province or territory, or date reported to PHAC.*

Early evidence shows COVID-19 vaccines highly protective, with low percentage of cases reported following vaccination

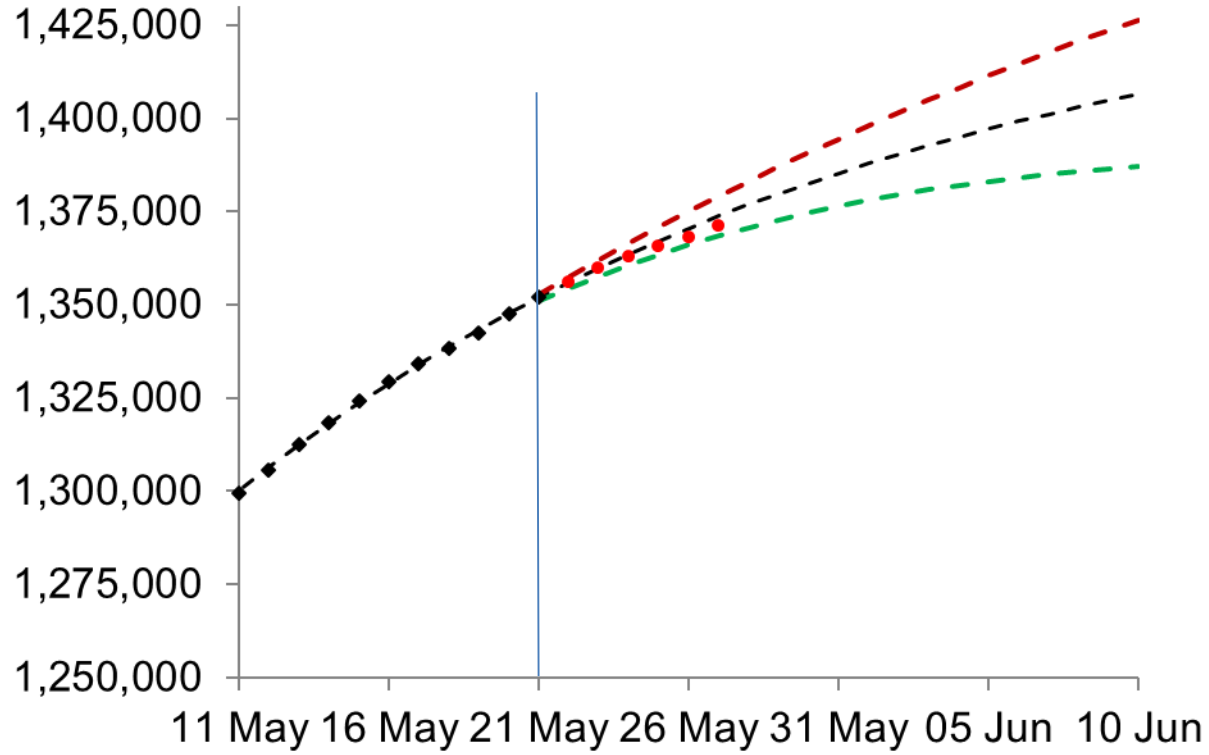


Data as of May 25, 2021

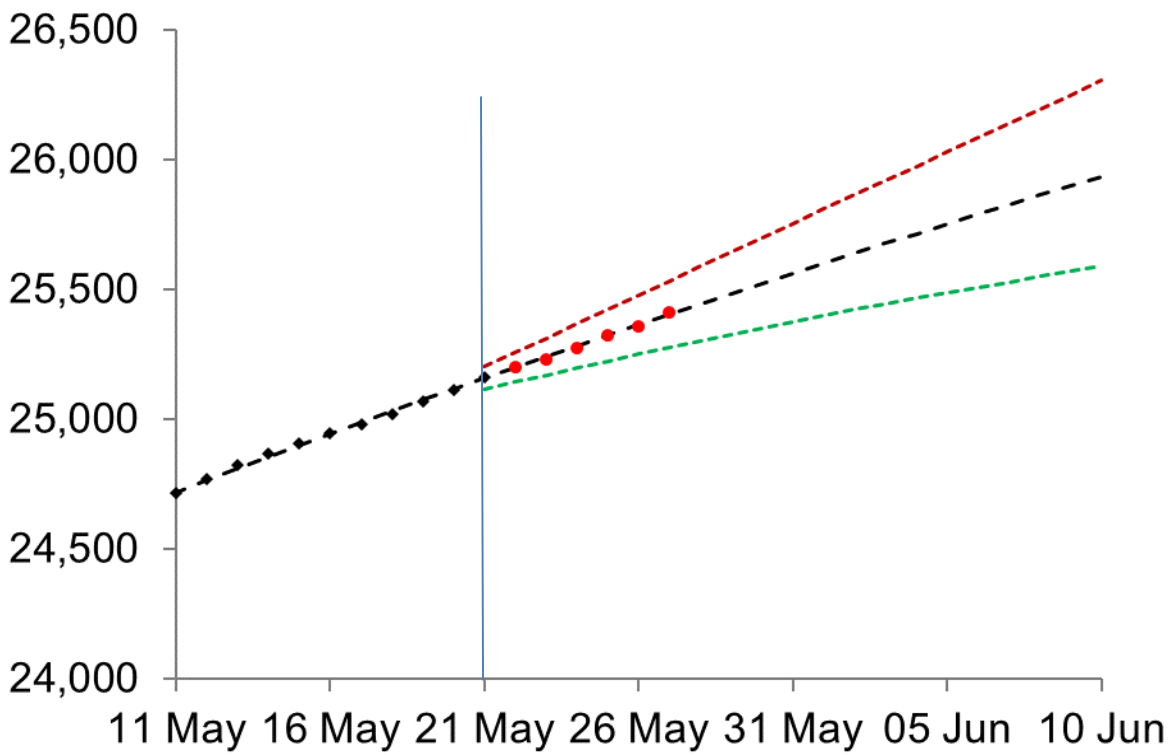
***Note:** *If the date of illness onset was not available, the earliest of lab collection date or last test result date was used. The above figure does not include data from Saskatchewan, Ontario, Quebec, or Newfoundland and Labrador.*

Short-term forecast predicts slowing rate of growth for cumulative cases and low, steady rate of growth for cumulative deaths

Cumulative cases predicted to June 10, 2021:
1,387,210 to 1,426,400



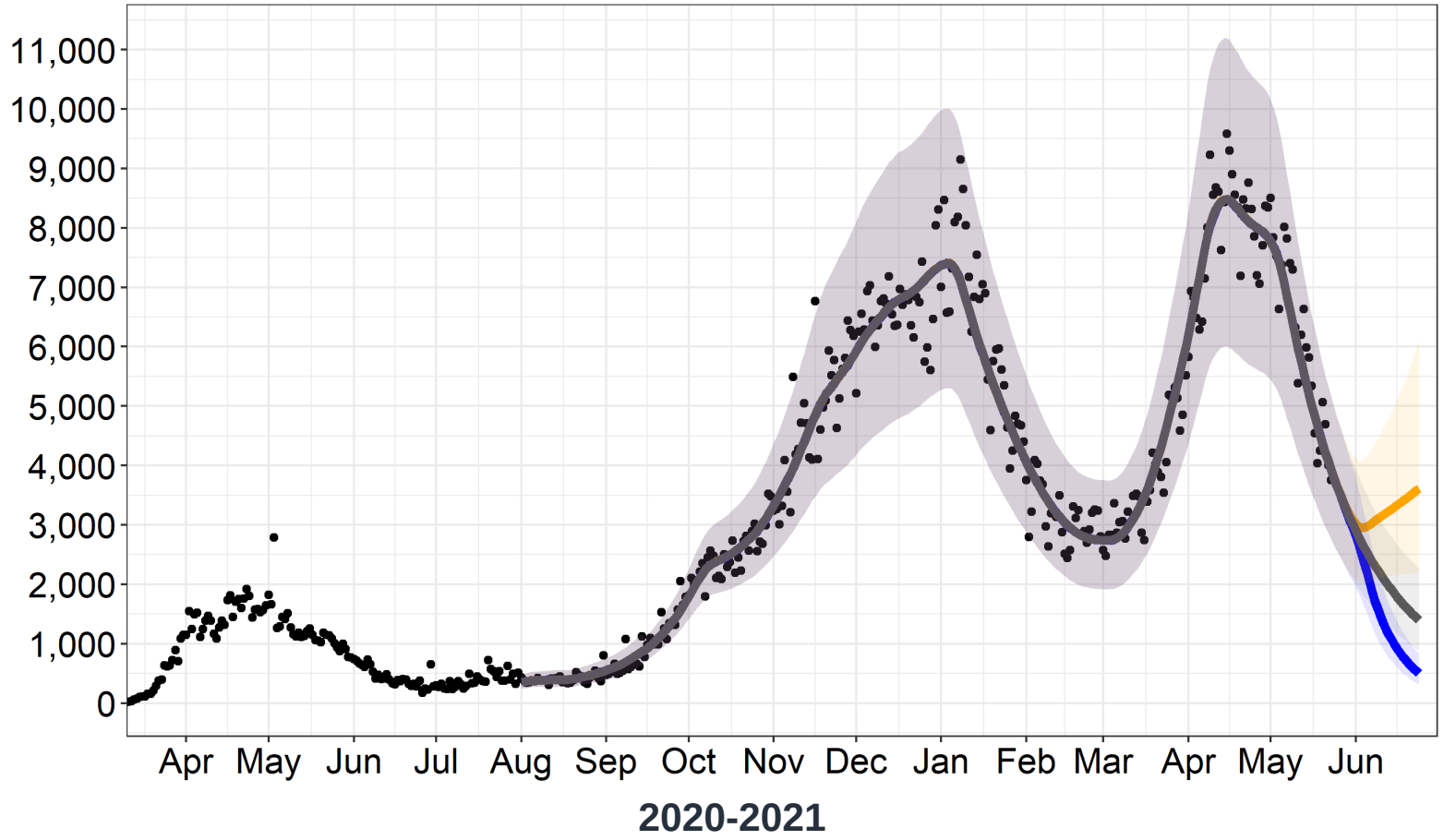
Cumulative deaths predicted to June 10, 2021:
25,590 to 26,310



Cumulatively reported cases in Canada by May 21
Cases added since May 21 when the prediction was made
Prediction to June 10
Lower 95% prediction limit
Upper 95% prediction limit

Data as of May 22, 2021
Note: *Extrapolation based on recent trends using a forecasting model (with ranges of uncertainty).*

Longer-range forecast shows the epidemic is projected to decline nationally provided public health measures are maintained



If we **increase** the number of people we contact each day

If we **maintain** the current number of people we contact each day

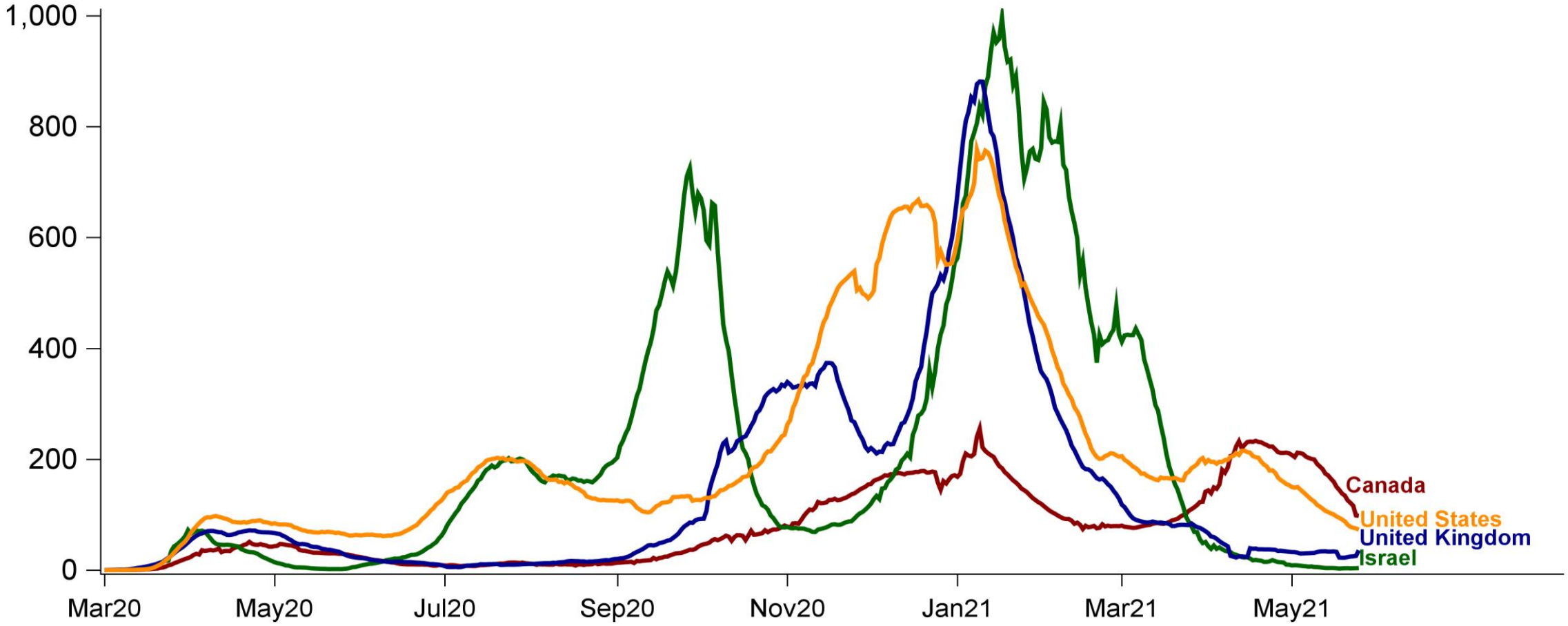
If we **reduce** the number of people we contact each day

Data as May 25, 2021

Note: *Ensemble of output from PHAC-McMaster and Simon Fraser University models. Model considers impact of vaccination and increased transmissibility of VOCs, refer to annex for detailed assumptions on modelling.*

International experience shows sustained measures are needed to prevent resurgence as vaccination coverage increases

Rate per 1,000,000 population



Data as of May 25, 2021
Note: *7-day moving average. Data for figure obtained from Our World in Data.*

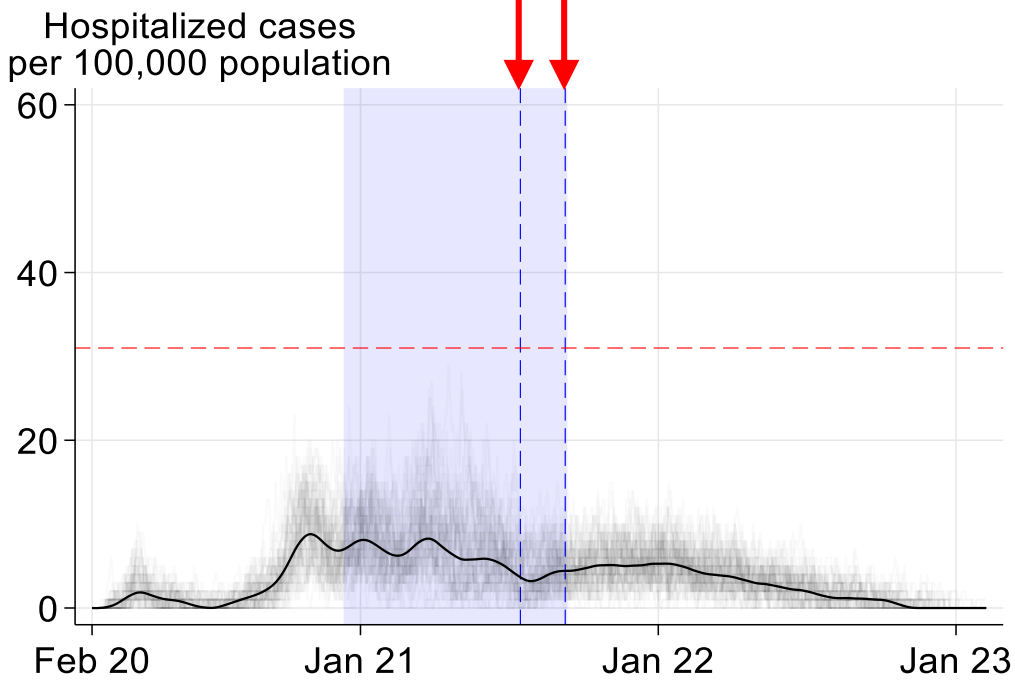
High vaccination rates and low infection rates needed to safely ease public health measures

SUMMER: Safe to begin easing restrictive measures

1st dose	At least 75% among those 12+
2nd dose	At least 20% among those 12+

FALL (OR EARLIER): Safe to begin easing personal protective measures

Fully vaccinated	At least 75% among those 12+



OUTCOME: hospital capacity not exceeded

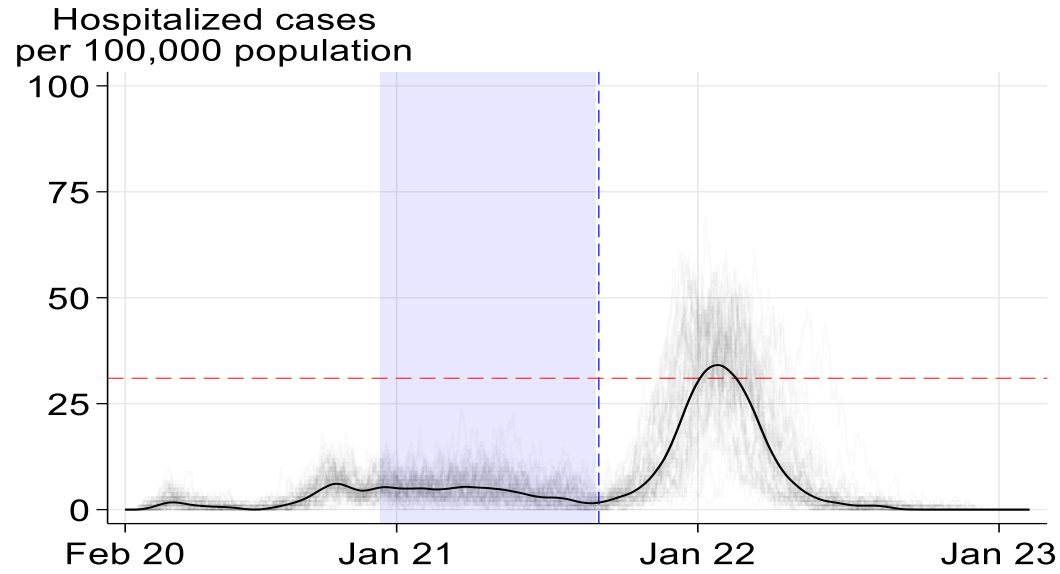
Hospital capacity | Measures lifted | Median hospitalized cases | Vaccination period

Note: *Physical distancing, mask wearing, and other personal protective measures would be maintained throughout the summer when restrictive public health measures are lifted and current levels of testing and tracing would be maintained throughout. The 75% 1st dose and 20% 2nd dose refers to the eligible population; for the total Canadian population, the coverage rates are 66% and 18%, respectively. Refer to annex for detailed assumptions on modelling.*

High vaccine uptake needed across all age groups to prevent a strong resurgence

FALL: Plausible alternative scenario with low vaccine uptake and restrictive and personal protective measures lifted

Vaccine uptake for the first and second dose is **50% among adults aged 20-44**



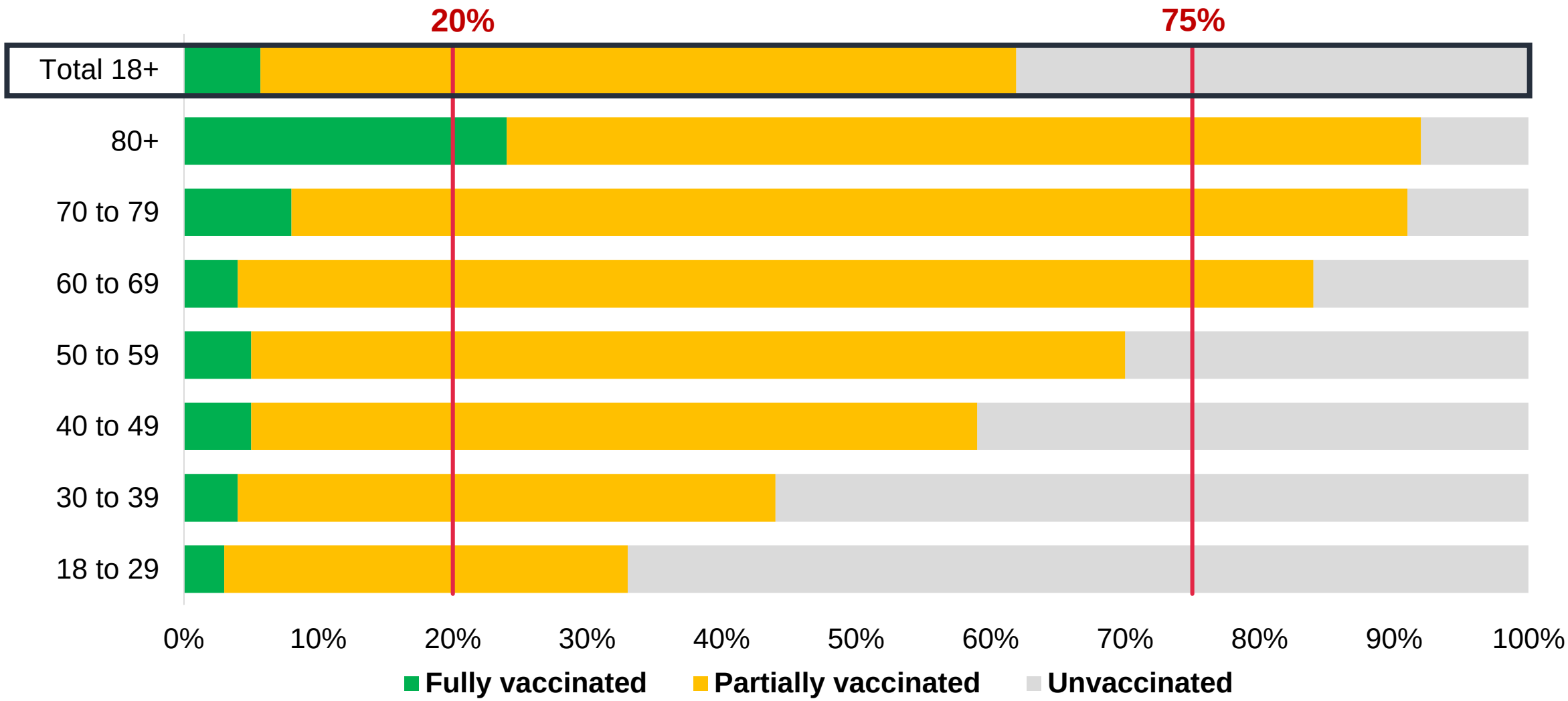
OUTCOME: hospital capacity <u>exceeded</u> in fall/winter 2021/22

- **Younger people** have higher contact rates **and play an important role in transmission and control** of COVID-19
- The **more younger people get vaccinated**, the **better our control** of the epidemic will be
- **Your shot counts!**

Hospital capacity Measures lifted Median hospitalized cases Vaccination period

Note: *Refer to annex for detailed assumptions on modelling.*

Good progress in Canada's vaccine roll-out with high first dose coverage among older age groups



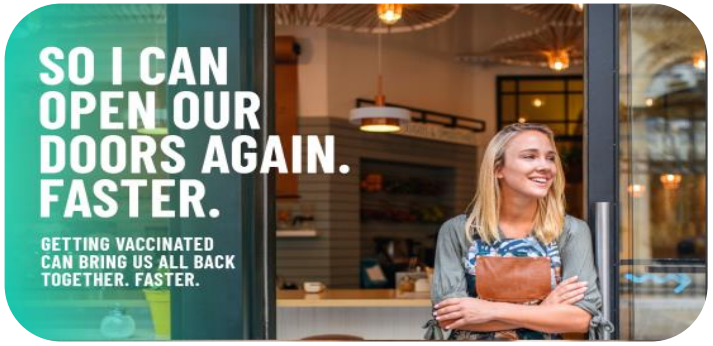
Data as of May 22, 2021

Getting vaccinated will help us get there *FASTER*, TOGETHER!

- **We're on track for a better summer and a safer fall**
  - with more of us getting vaccinated we'll get there, *faster* together!

- **Half way is not okay** – when recommended, we need two doses of COVID-19 vaccine
  - to achieve optimal protection for ourselves
  - to build strong immunity across the population, *faster* together!

- **Continued caution on the way down the curve** (wash, mask, space) is the way to bring back our connections, routines and activities safely

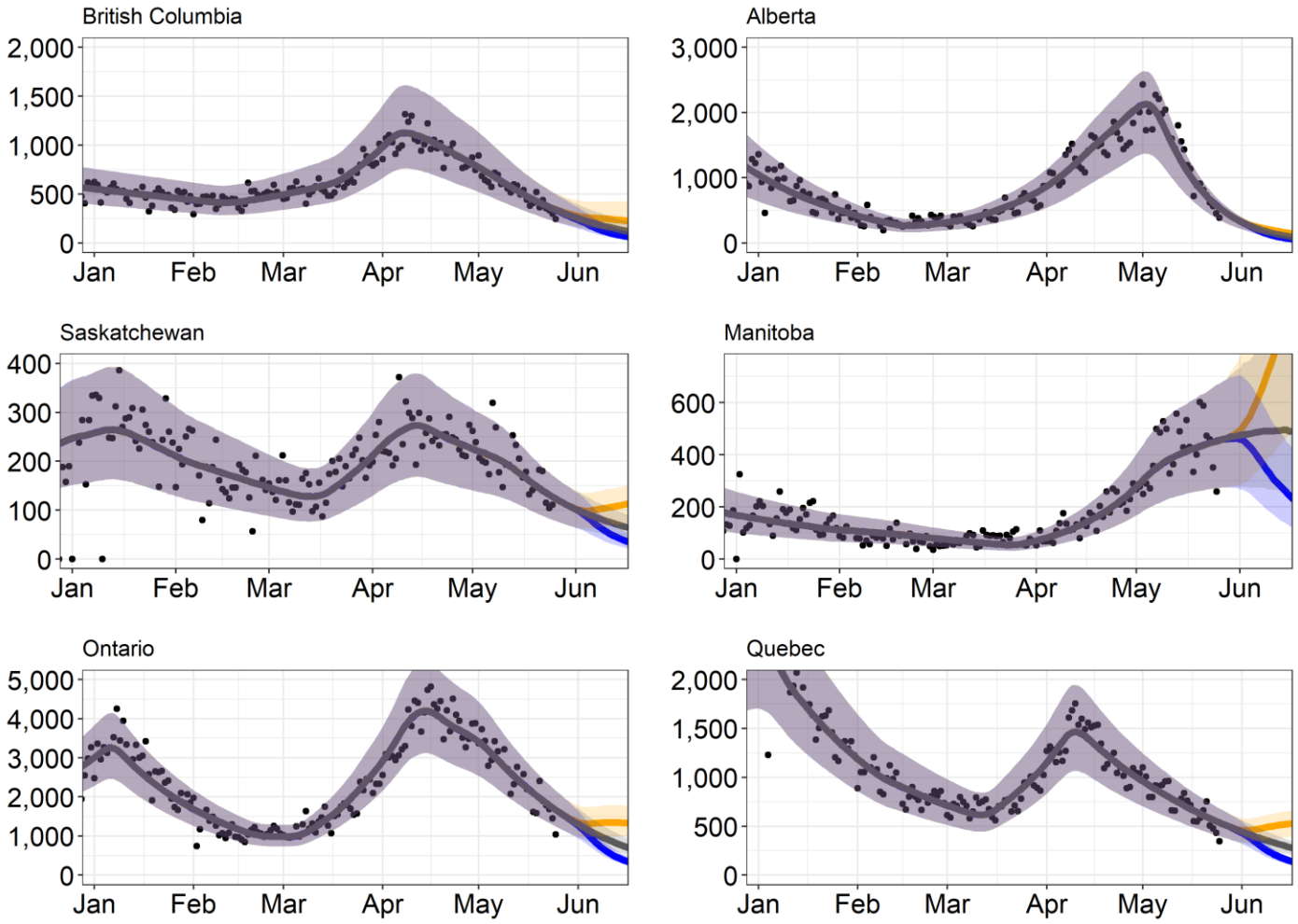


Source: *FasterTogether.ca is a voluntary effort by a wide variety of people working together to promote Covid-19 vaccine acceptance and help speed a recovery from this pandemic. Access free resources and share the message!* https://resources.fastertogether.ca/

ANNEX

Longer-range forecasts are for downward trend in many areas of the country with current levels, but continued increase in Manitoba if measures remain the same

Reported cases



If we **increase** the number of people we contact each day

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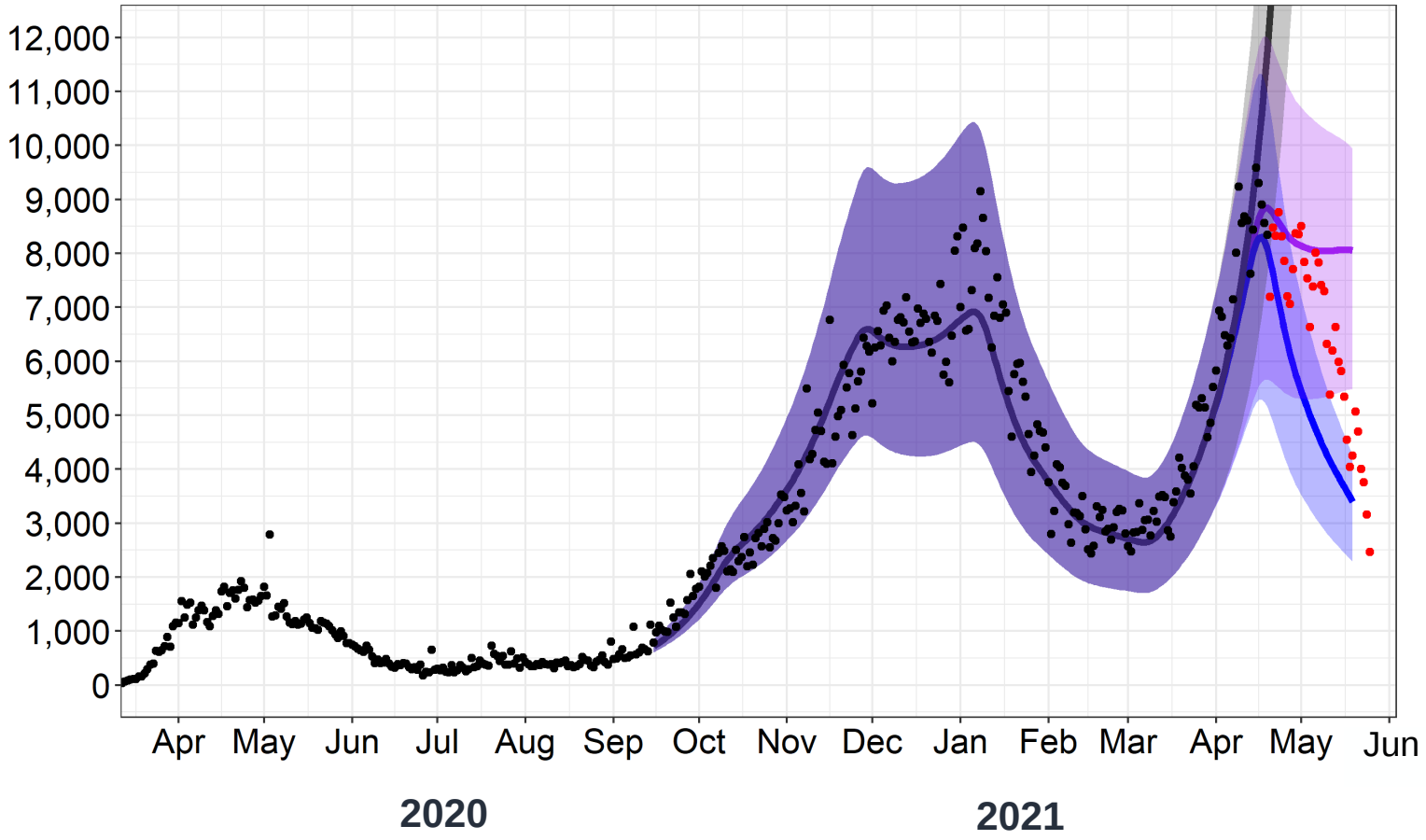
Data as May 25, 2021

Note: *Ensemble of output from PHAC-McMaster and Simon Fraser University models. Model considers impact of vaccination and increased transmissibility of VOCs, refer to annex for detailed assumptions on modelling.*

Previous longer-range modelling forecast from April 23rd showed strong measures were required to counter more transmissible VOCs as vaccines continued to roll out



Without recent changes to public health measures. ***Many jurisdictions have recently implemented measures to prevent this trajectory***

Implementation of recent public health measures and adherence to them **reduces** contact between people by **30%**

Implementation of recent public health measures and adherence to them **reduces** contact between people by **40%**

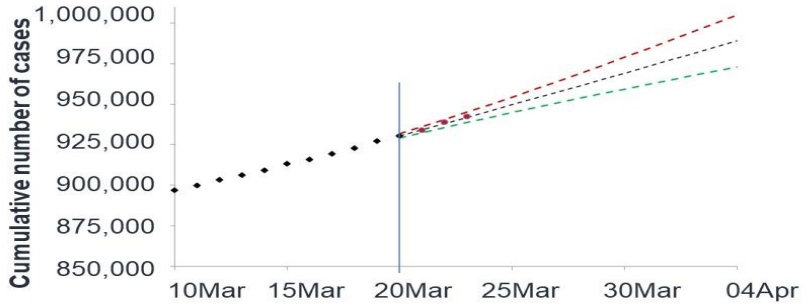
Red points - surveillance data after the forecast from April 20th to May 22nd

Model data as of April 19, 2021. Surveillance data of May 22, 2021.
Note: *Model developed by PHAC and McMaster University. Model considers impact of vaccination and increased transmissibility of VOCs, refer to annex for detailed assumptions on modelling.*

Types of models used to inform decision making

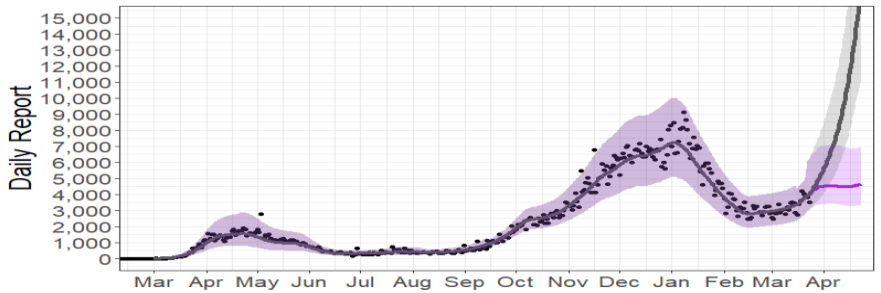
Statistical forecast models:

- Short-range forecast of expected cases given recent incidence



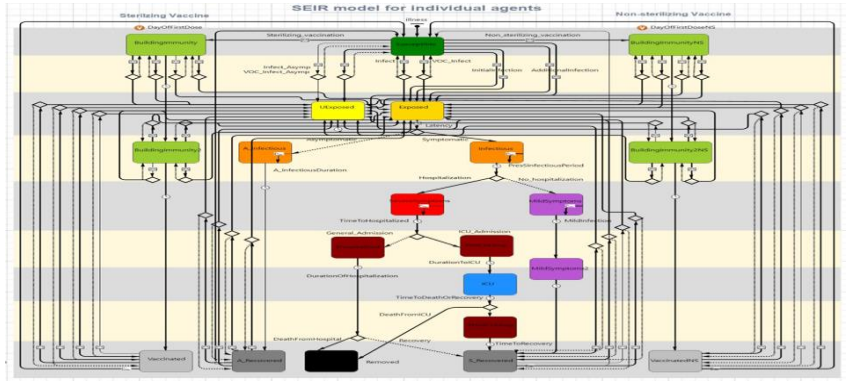
Long-range forecast models:

- 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



Details on modelling and assumptions: https://www.sciencedirect.com/science/article/pii/S1755436521000177; https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2020-46/issue-6-june-4-2020/predictive-modelling-covid-19-canada.html; https://nccid.ca/news/phac-modelling/; https://www.canada.ca/content/dam/phac-aspc/documents/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2020-46/issue-11-12-nov-5-2020/ccdrv46i1112a08-eng.pdf; https://www.cmaj.ca/content/192/37/E1053.long

Longer-range forecasting model assumptions

- The ensemble forecast uses compartmental models reflecting the biology of COVID-19 and public health response developed by PHAC in collaboration with McMaster University, and Simon Fraser 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 VOCs are 40-50% more transmissible compared to previous strains. This value is used to estimate the rate at which VOCs replace existing strains.
- VOCs are considered to have been introduced in mid-December (~1 week prior to first detected case in Canada) at very low prevalence. The proportion of cases due to VOCs is indirectly fitted when calibrating to data.
- Changes to public health measures impact the speed with VOCs replace previous strains; stronger public health measures result in slower growth and replacement rates.
- The forecast includes a graph showing the expected decrease in cases if public health measures remains constant (grey line), one that assumes recent changes to public health measures will decrease transmission by 30% (blue line), and one that assumes recent changes to public health measures will increase transmission by 30% (orange line).
- The PHAC-McMaster model forecast includes simplified assumptions on vaccine roll-out, including an assumption that vaccinations are 60% effective against infection after one dose, a simplified roll-out using the daily administered numbers and doses not prioritise by age, and a static vaccination rate. Because only simplified assumptions on vaccine roll-out are included, the forecast is limited to 30 days.
- The SFU model assumes 65% effectiveness against infection after one dose, and roll-out according to anticipated vaccine supply schedule.

Assumptions for the modelling of restrictive public health measures

- An age-stratified agent-based model was used for exploring the impact of vaccination rates on lifting of public health measures (slides 11 and 12).
- Key model assumptions include:
  - VOC were introduced in December 2020 and are 50% more transmissible and 40% more virulent than previous strains, but do not have immune breakthrough from vaccines.
  - 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.
  - Hospital bed capacity in Canada is estimated at 31 per 100,000.
  - The vaccination period is Dec 14, 2020 to Sep 5, 2021. 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.
  - Vaccine acceptance by age group is estimated from two Canadian surveys (2020 Canadian Community Health Survey – September 2020) and EKOS probability based research panel (January 6-11, 2021).
  - In the scenario shown on slide 11, a two-step lifting approach is shown. Restrictive measures are lifted in summer when at least 75% of those 12 and over have received their first dose and at least 20% have received their second dose. The easing of personal protective measures occurs when at least 75% of those 12 and over have received their second dose. Until these time points, the epidemic is controlled by a combination of restrictive closures, case detection and isolation, contact tracing and quarantine, and physical distancing. The average vaccine acceptance is 75%, ranging from 72% (18-44) to 84.7% (65+).
  - In the scenario shown on slide 12, restrictive measures are lifted and personal protective measures are eased in the fall, but because only 50% of adults aged 20 to 44 have been vaccinated, the overall vaccine acceptance is 67.9%.
  - The model assumes on the day restrictive measures are lifted, the border reopens and the number of imported cases increases from 2 per 100,000 per week to 12 per 100,000 based on current reduction in travel volume due to border restrictions, imported cases are estimated from the PHAC importation model.