

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

*February 18, 2022*

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



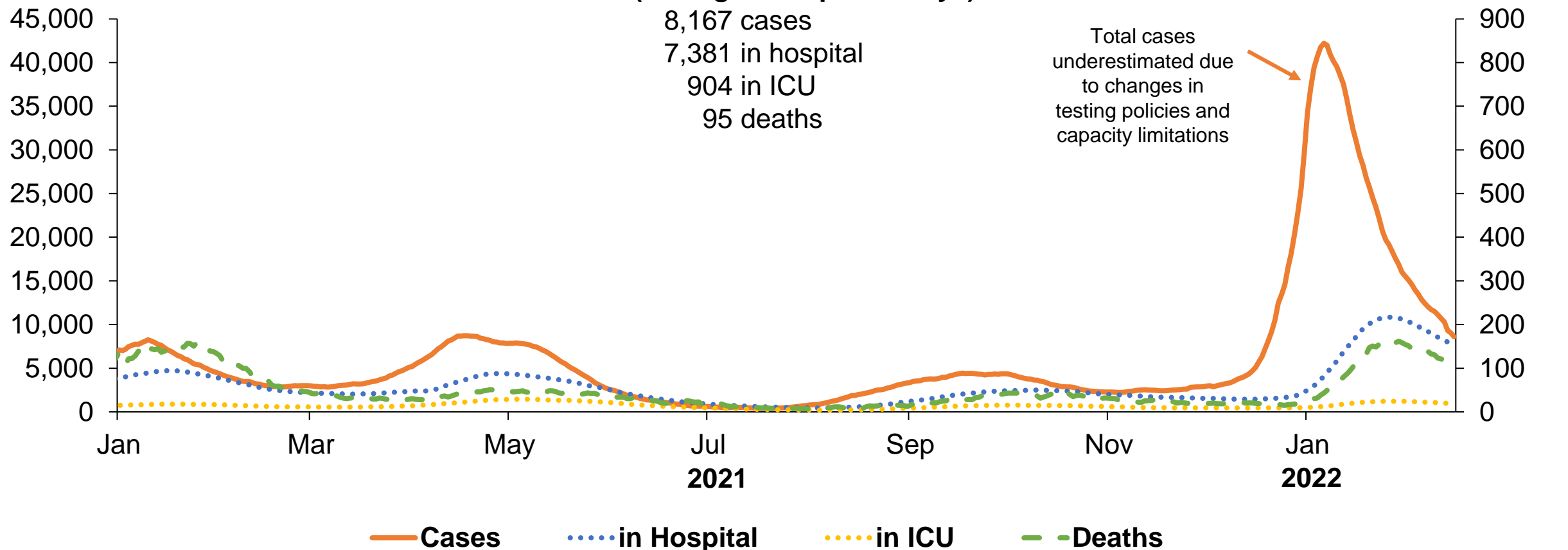
Public Health  
Agency of Canada

Agence de la santé  
publique du Canada

Canada

# Nationally, while reported Omicron cases have peaked, infection rates remain high and severe outcome trends are decreasing but still elevated

Number (cases/  
in hospital / in ICU)



Data as of February 16, 2022

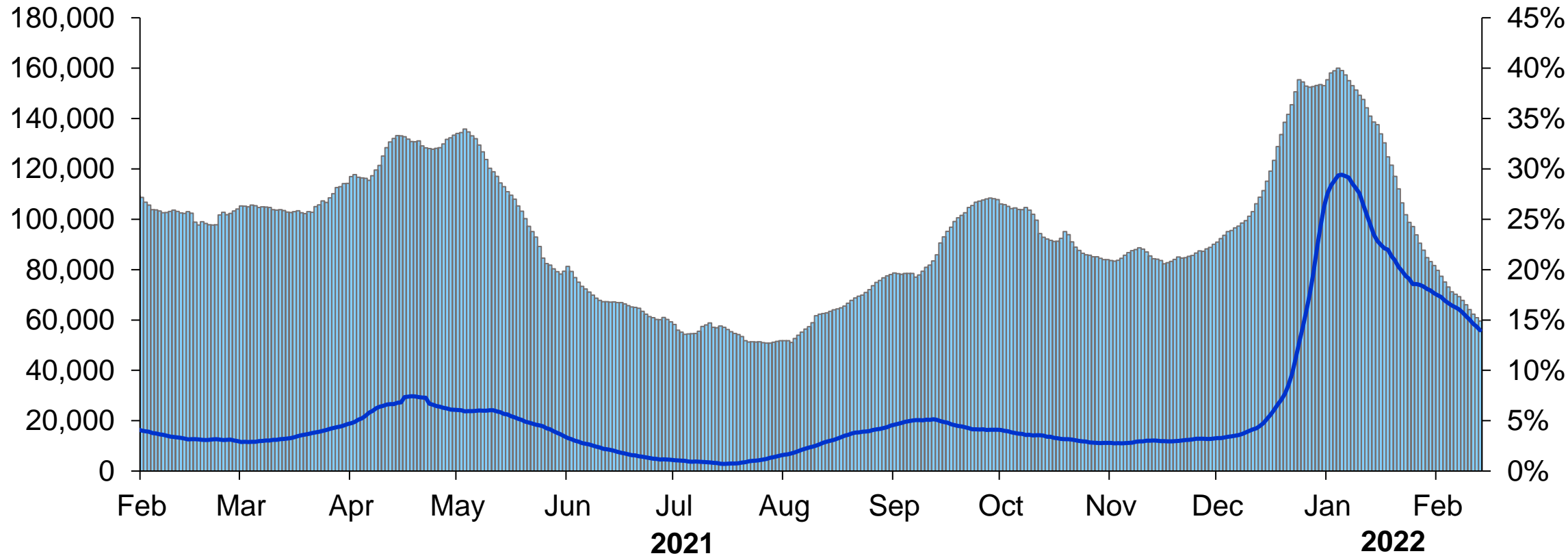
**Note:** Trend lines reflect 7-day moving averages. Total hospitalizations and ICU admissions include all people in hospital and in ICU on that day. Hospitalizations and ICU counts include data from nine of thirteen Canadian provinces and territories. Due to changes in COVID-19 testing policies and capacity limitations in many jurisdictions starting in late December 2021, case counts will underestimate the total burden of disease. Data for Saskatchewan are as of February 9, 2022.



# Still elevated laboratory test positivity indicates persistent widespread disease activity nationally

Number of COVID-19 tests performed

Percent positivity



COVID-19 tests performed (7-day moving average) Percent positivity (7-day moving average)

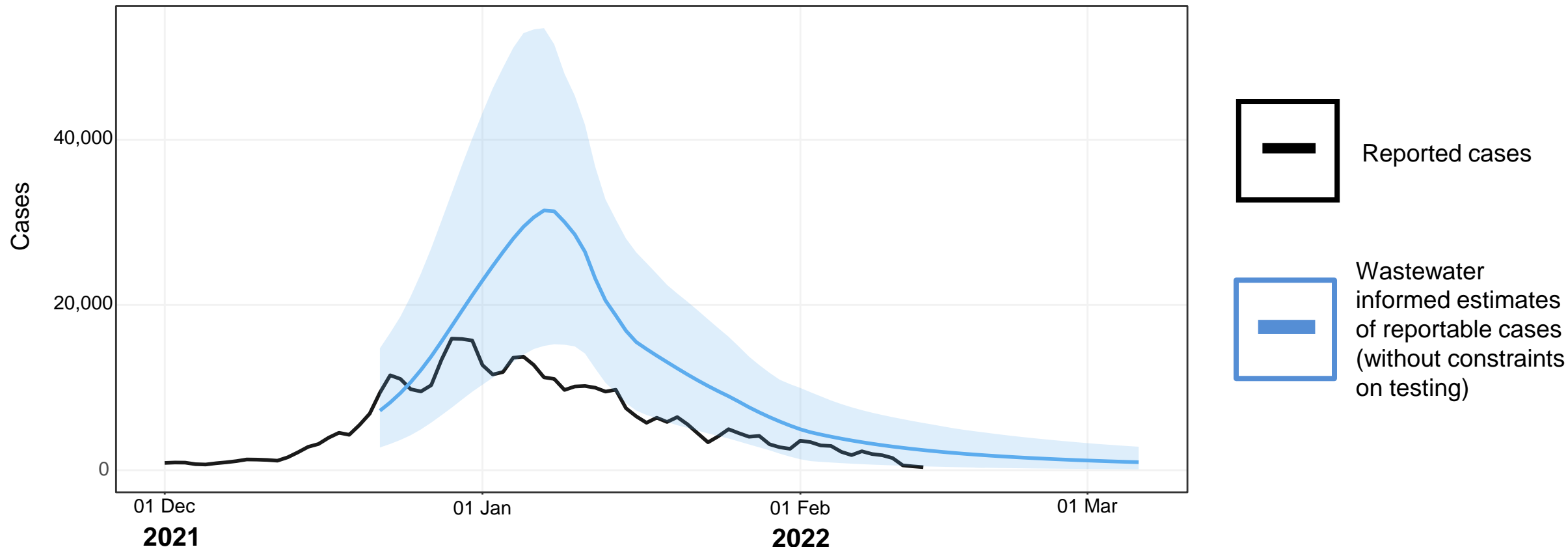
Data as of February 16, 2022

Source: Detailed testing data submitted to PHAC by the provinces and territories. COVID-19 tests includes validated laboratory-based nucleic acid amplification test (NAAT) (e.g. PCR or nucleic acid sequencing) and excludes rapid tests.



# Wastewater surveillance is helping estimate the size and trend of the Omicron wave

Reported cases and wastewater informed estimates covering Vancouver, Edmonton, Toronto, Montreal, and Halifax



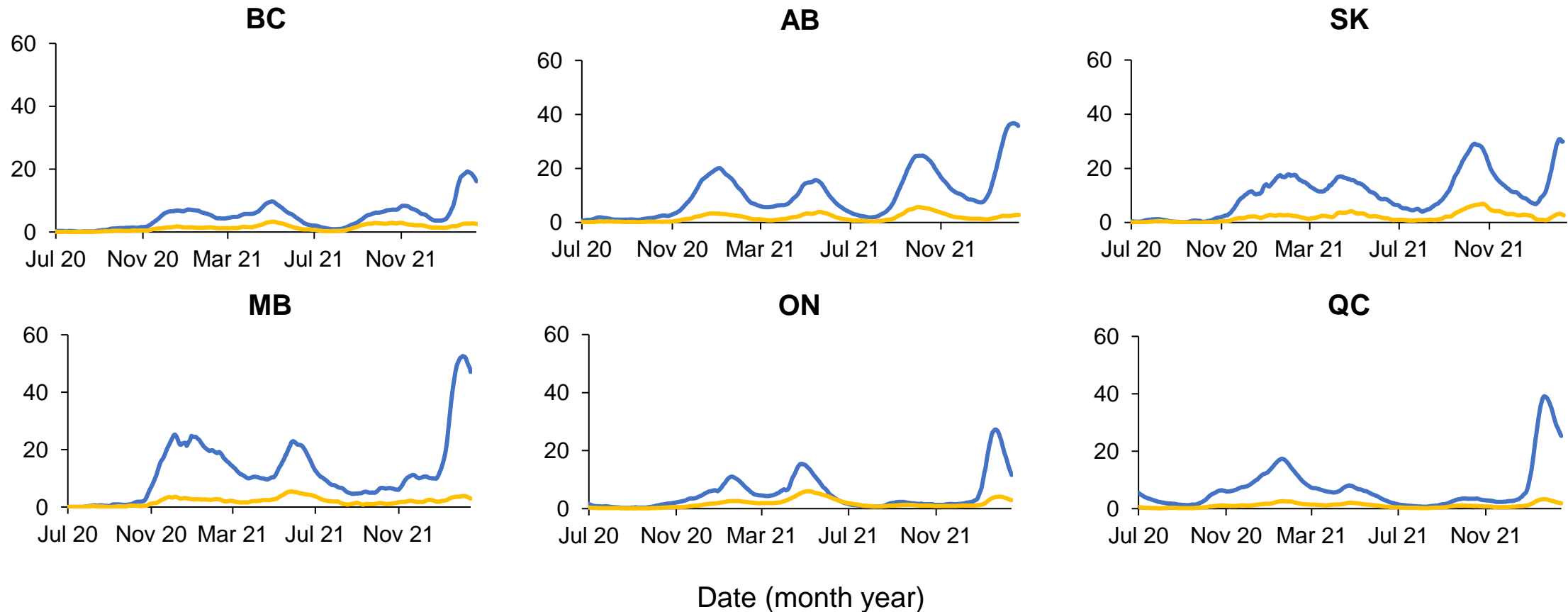
**Data sources:** Municipal website data (clinical cases) and NML/One-Health Division/Wastewater Surveillance (wastewater). Black curve: sum of all reported cases in Vancouver, Edmonton, Toronto, Montreal and Halifax. Blue curve: Mean estimate of reportable cases from an epidemic model calibrated on a composite of wastewater signals from the five cities. Light blue area represent the 95% confidence interval. Forecasts do not account for potential re-openings effects. A large proportion of cases have not been reported since late Dec 2021. Data as of February 14, 2022 for case surveillance data. Dates for wastewater-informed reportable cases: February 1 (Toronto), February 2 (Halifax), February 5 (Montreal), and February 6, 2022 (Vancouver, Edmonton).



# Hospitalization rates remain at record high levels despite showing signs of peaking in some jurisdictions, but ICU rates remain relatively low

Number in hospital / in ICU  
per 100,000 population

Hospitalization trend ———  
ICU trend ———



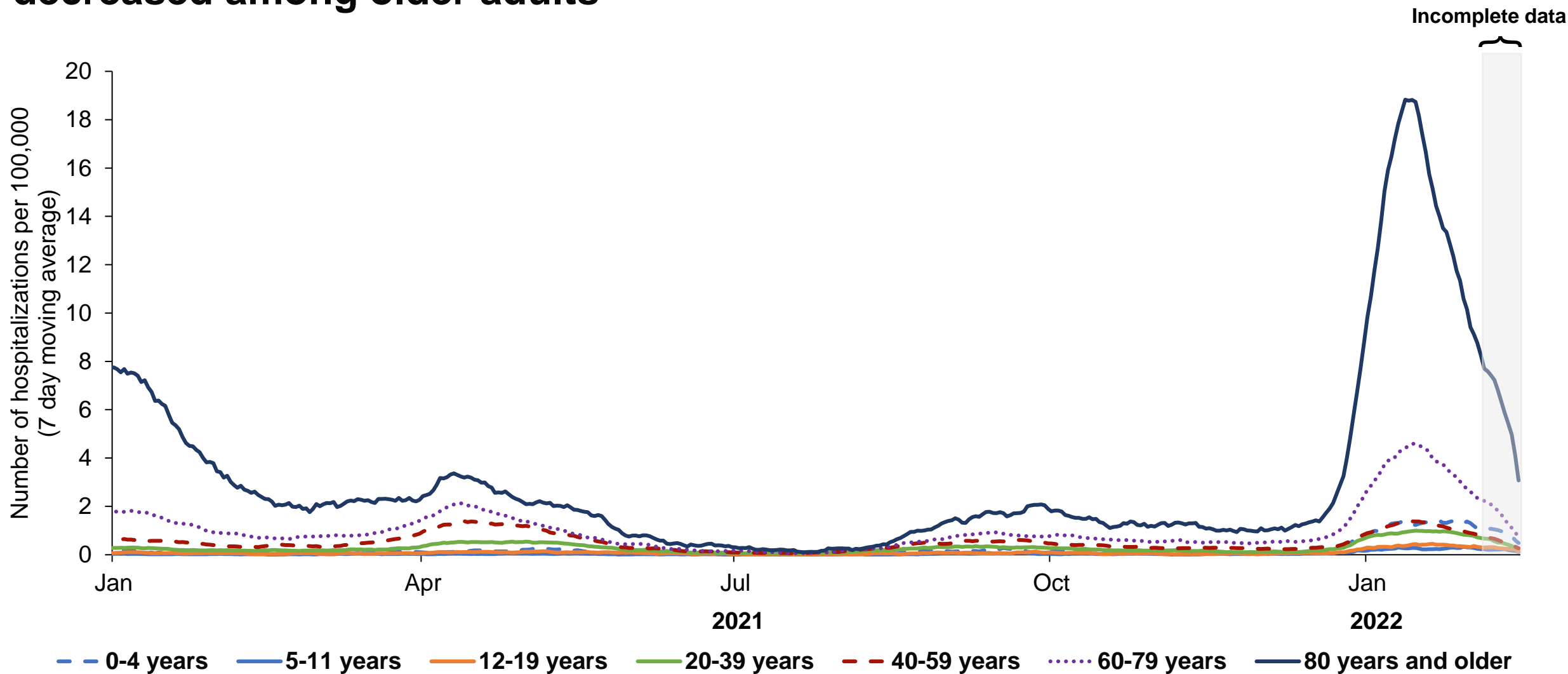
Data as of February 15, 2022.

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

Data for Saskatchewan are as of February 9, 2022.



# Hospitalization rates remain elevated across all age groups, however rates have decreased among older adults



Data as of February 16, 2022

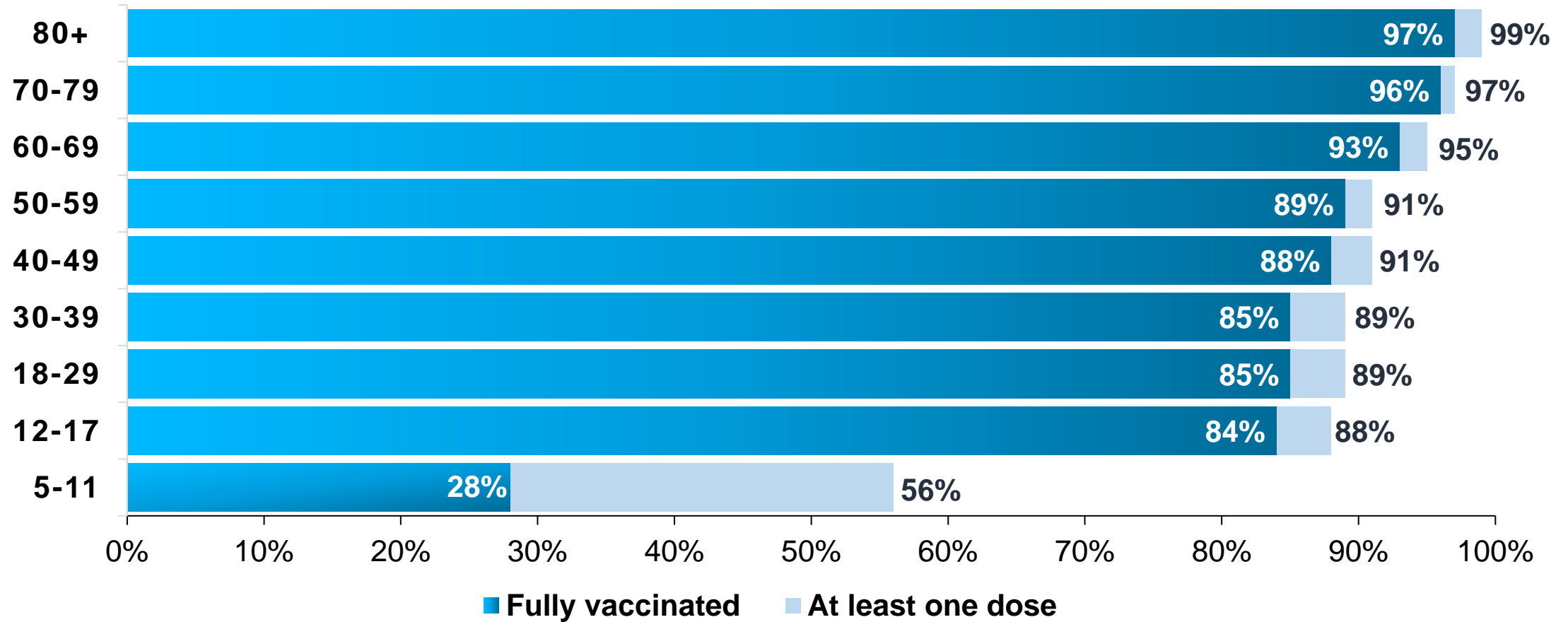
Source: Detailed case data submitted to the Public Health Agency of Canada (PHAC) by the provinces and territories. Shaded area represents period of accumulating data.

This figure includes data from the ten of Canada's thirteen provinces and territories that reported case-level information to PHAC.

Date is the earliest of symptom onset date, lab specimen collection date, lab result date, date reported to province or territory, and date reported to PHAC.

# More than 5.6 million eligible Canadians need one or more doses of COVID-19 vaccines to complete their primary series

Percentage of eligible people (≥ 5 years) with at least one dose and fully vaccinated by age group, as of February 13<sup>th</sup>, 2022



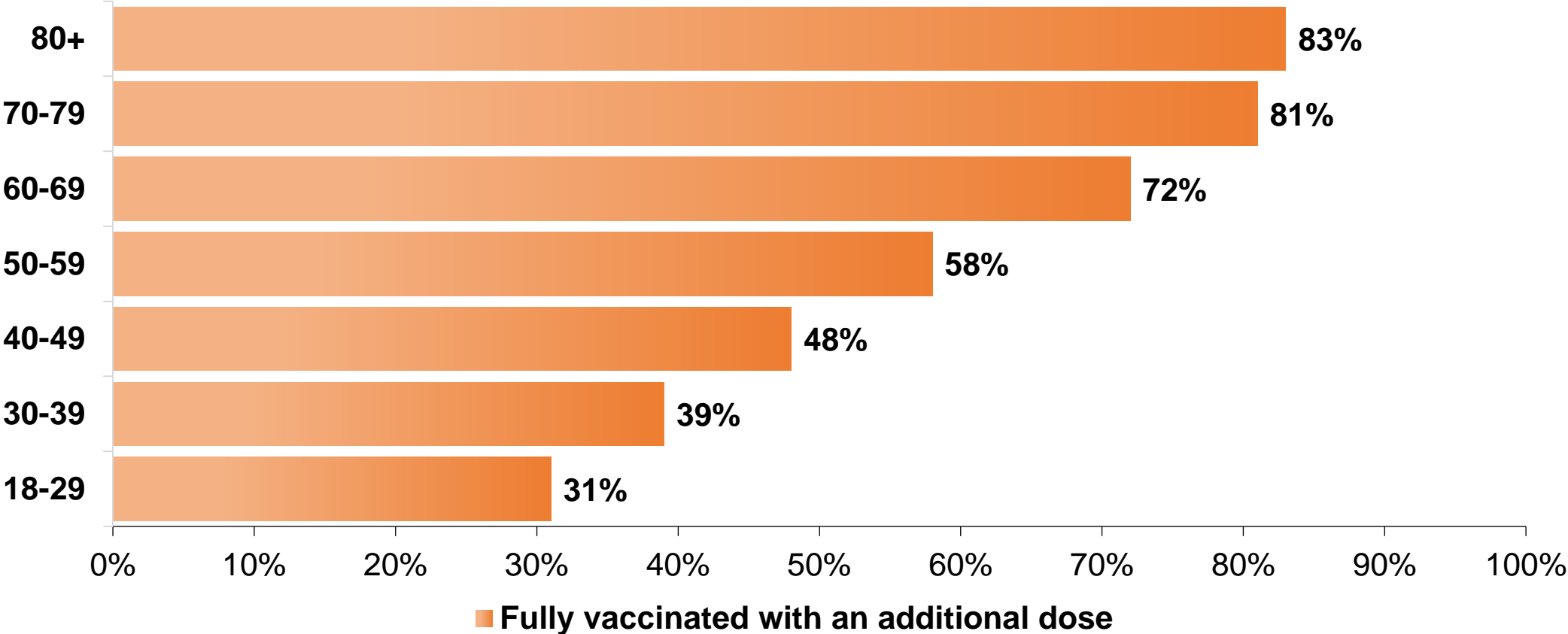
Data as of February 13, 2022

**Note:** Data obtained from the Canadian COVID-19 Vaccination Coverage Surveillance System. Fully vaccinated is defined as either: Having received the second dose of a two-dose vaccine; or having received one dose of a single-dose vaccine; or in Québec only, having received one dose of a two-dose vaccine after a laboratory-confirmed SARS-CoV-2 infection.



# There is room to improve booster dose coverage in Canada, particularly among adults aged 50+ who are at higher risk of severe outcomes

Percentage of eligible people (≥ 18 years) who are fully vaccinated with an additional dose, by age group, as of February 13<sup>th</sup>, 2022



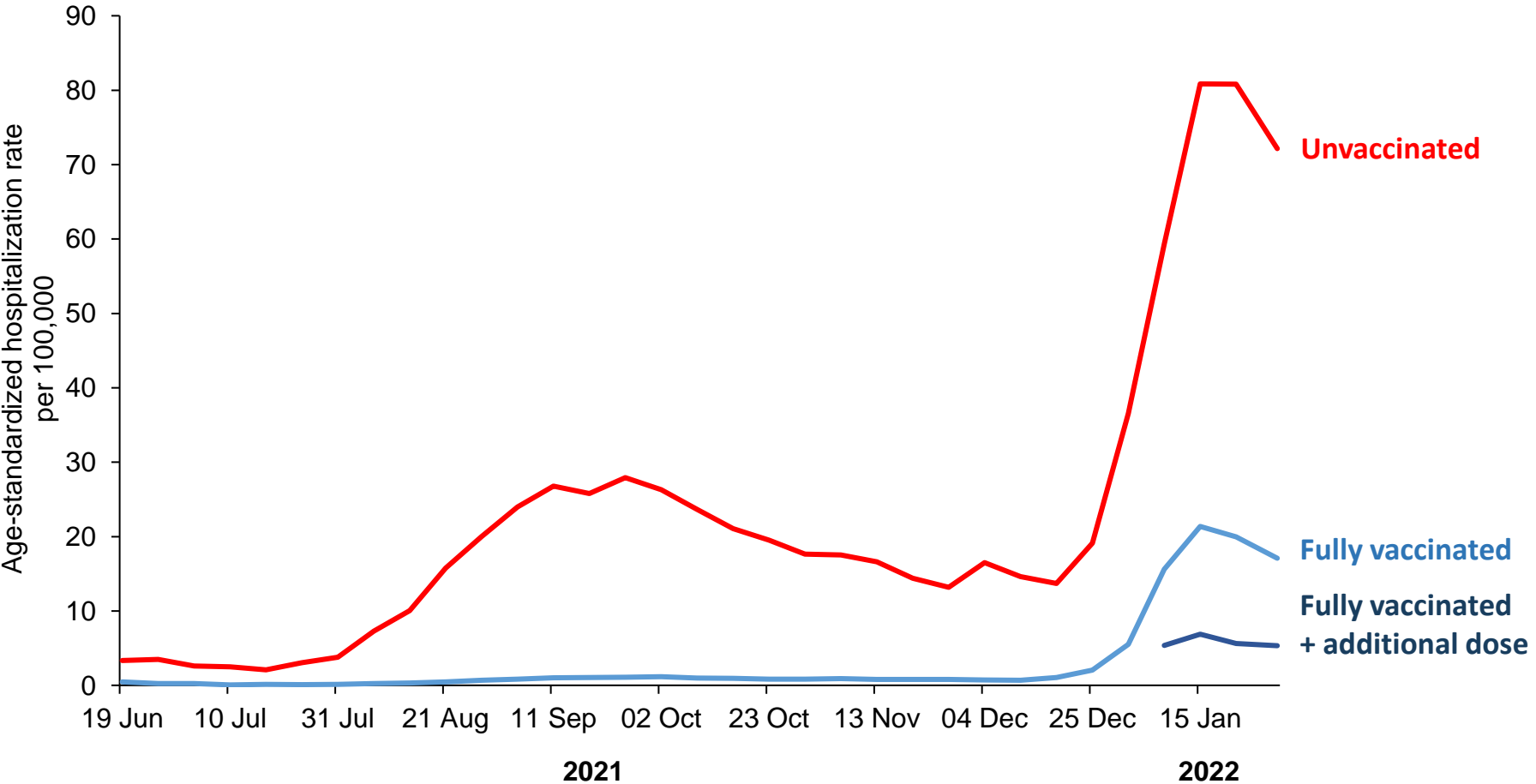
Data as of February 13, 2022

**Note:** Data obtained from the Canadian COVID-19 Vaccination Coverage Surveillance System. Fully vaccinated with an additional dose is defined as having received an additional dose of vaccine after completing the primary series. Additional doses are mostly boosters but also include additional doses given as part of primary series or for travel purposes.





# Fully vaccinated people are at significantly reduced risk of hospital admission, particularly after an additional dose to protect against severe illness due to Omicron

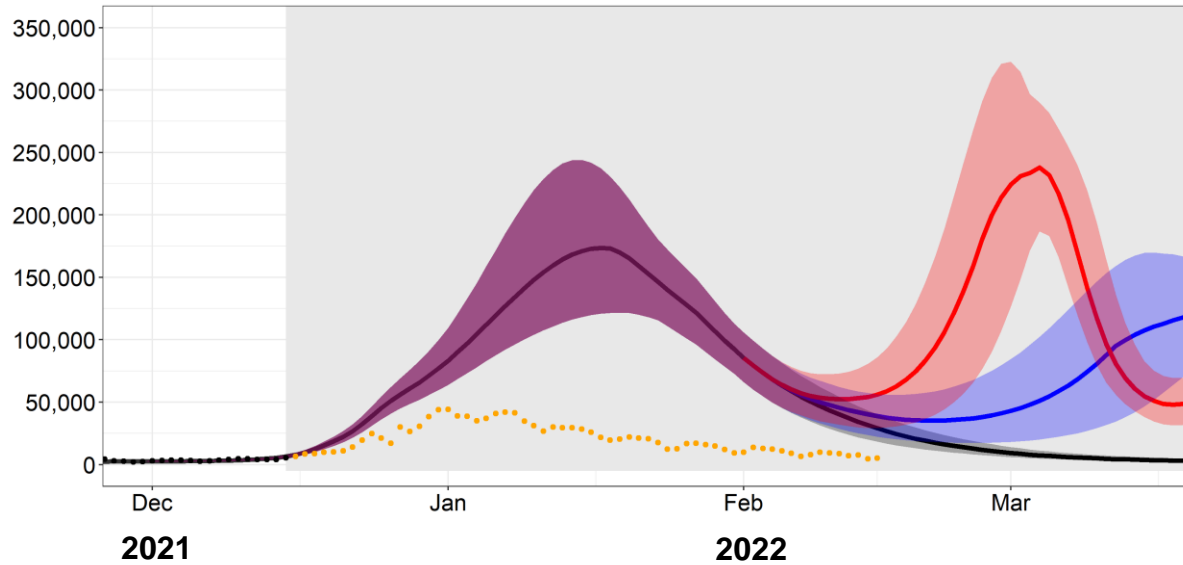


- Two doses initially resulted in substantially lower hospitalization rates in vaccinated vs. unvaccinated people
- With more time since the 2<sup>nd</sup> dose and predominance of Omicron, vaccine protection decreased
- Prior to booster dose programs, hospitalization rates increased for both groups but were still lower in vaccinated vs. unvaccinated people
- Receiving an mRNA booster dose offers superior protection vs. 2 doses, keeping more people out of hospital and preventing more deaths

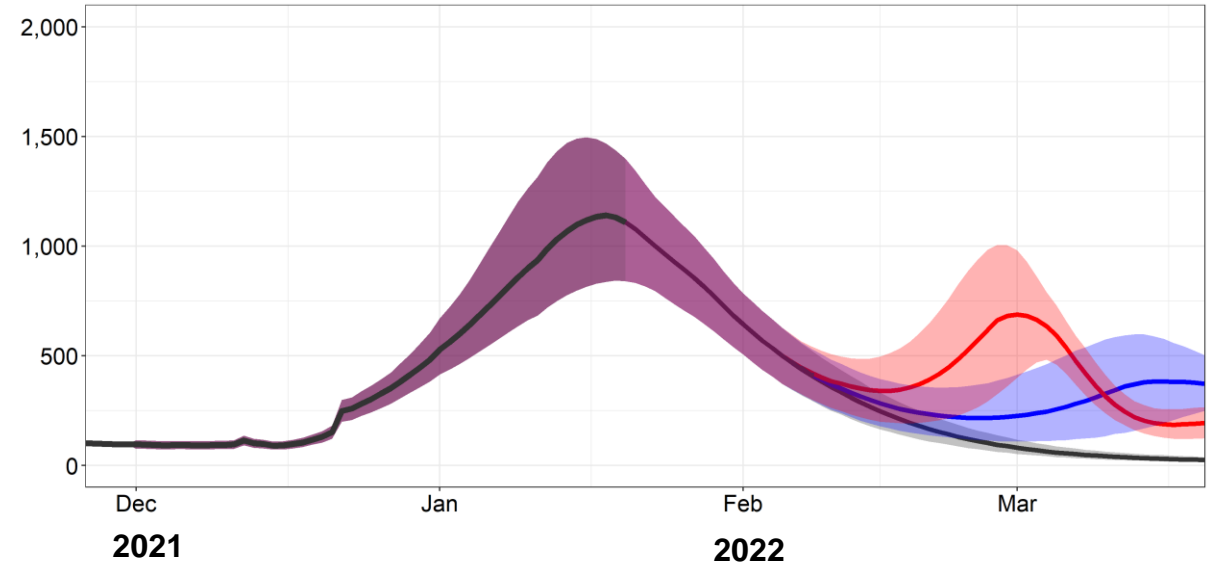
Data as of February 11, 2022 using data up to January 30, 2022 from seven provinces and territories for the eligible population 5 years or older, adjusting for age.  
**Definitions:** Unvaccinated cases include those who were unvaccinated at the time of their onset; fully vaccinated cases had onset ≥14 days from their second dose and <14 days after receiving an additional dose; cases fully vaccinated with an additional dose had onset ≥14 days after receiving an additional dose.

# While easing of public health measures could result in a resurgence of cases in Canada, the impact on hospitalizations is forecast to be lower

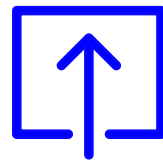
Number of daily cases\*



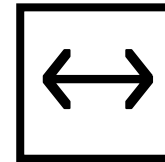
Daily hospital admissions



Easing public health measures has a substantial effect on transmission



Easing public health measures has a moderate effect on transmission



No change to transmission

**Orange points** – reported cases from recent surveillance data (which incompletely captures the number of cases)

\* The forecast number of cases will not be captured by surveillance due to limitations on testing during the period identified in grey.

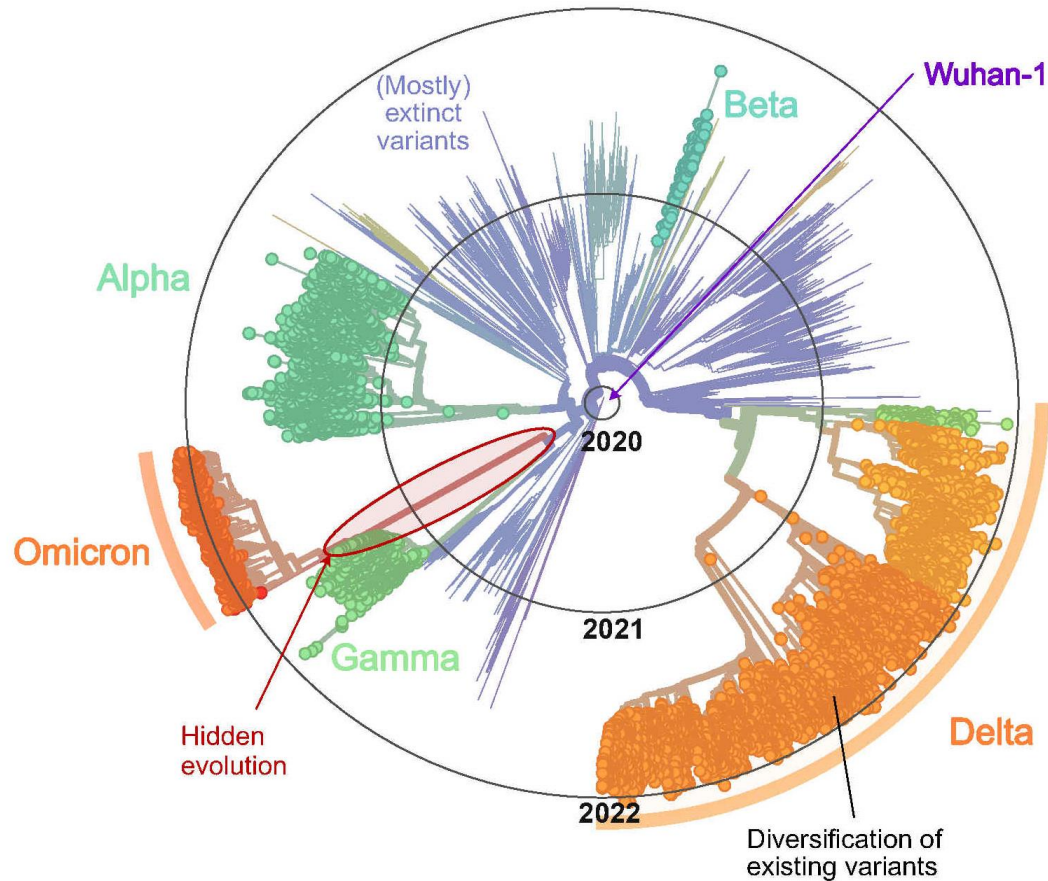
Data as of February 14, 2022; fit as of December 15, 2021 for cases and February 14, 2022 for hospitalization.

**Note:** Output from PHAC-McMaster model. Model considers impact of vaccination and increased transmissibility of VOCs (including Delta, and Omicron), refer to annex for detailed assumptions on modelling. Daily hospital admissions forecast does not include ICU.



# The SARS-CoV-2 virus that causes COVID-19 has continuously evolved, sometimes in surprising ways, and we can expect this pattern to continue

## SARS-CoV-2 Family Tree

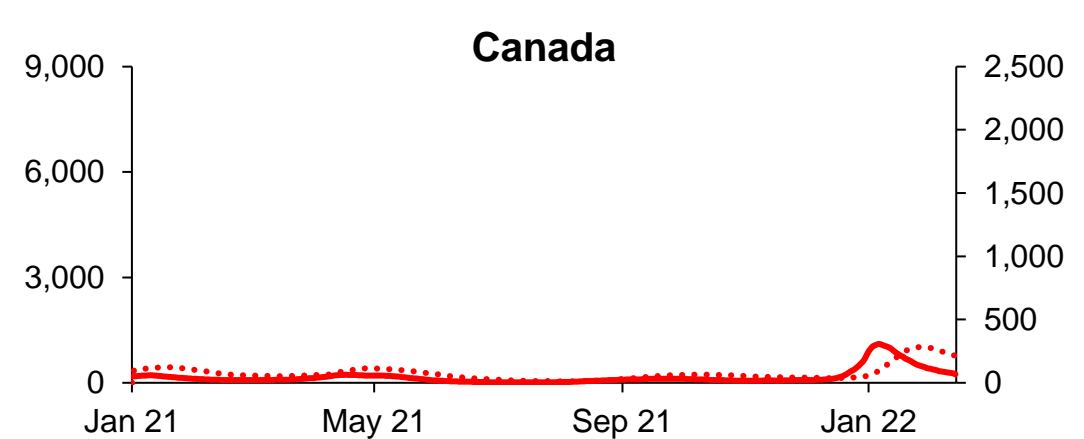
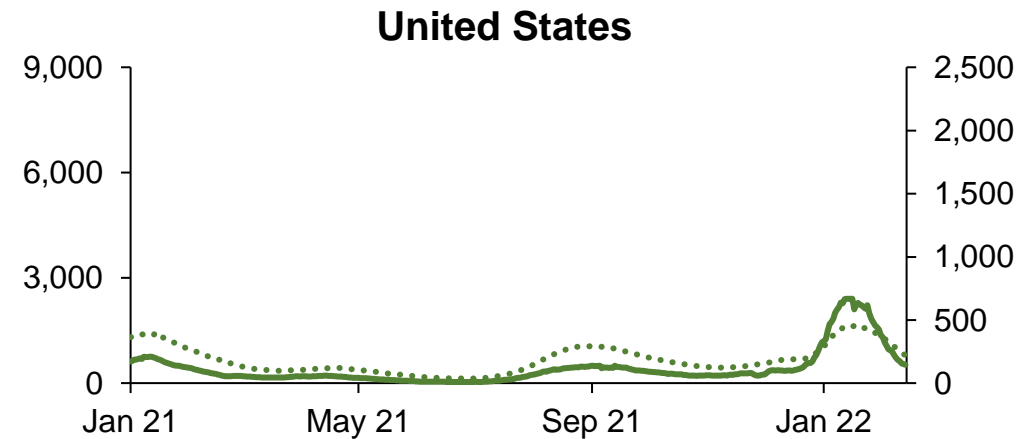
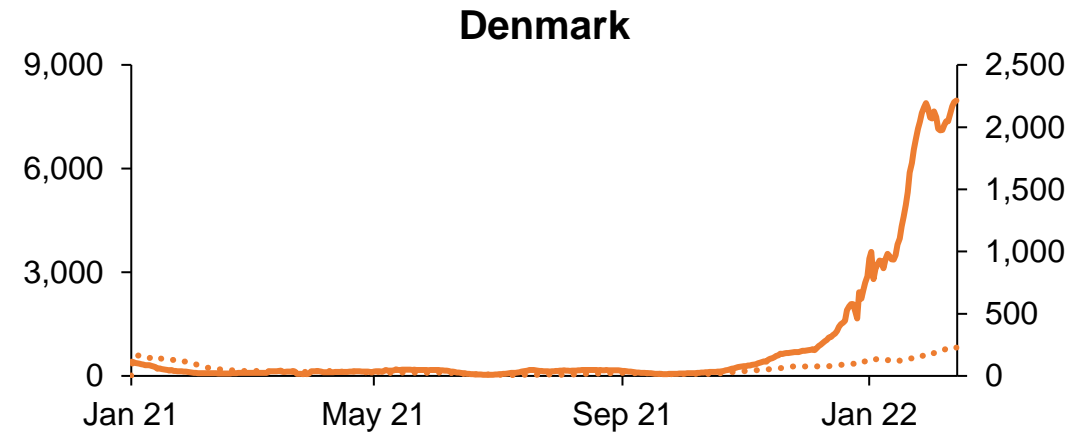
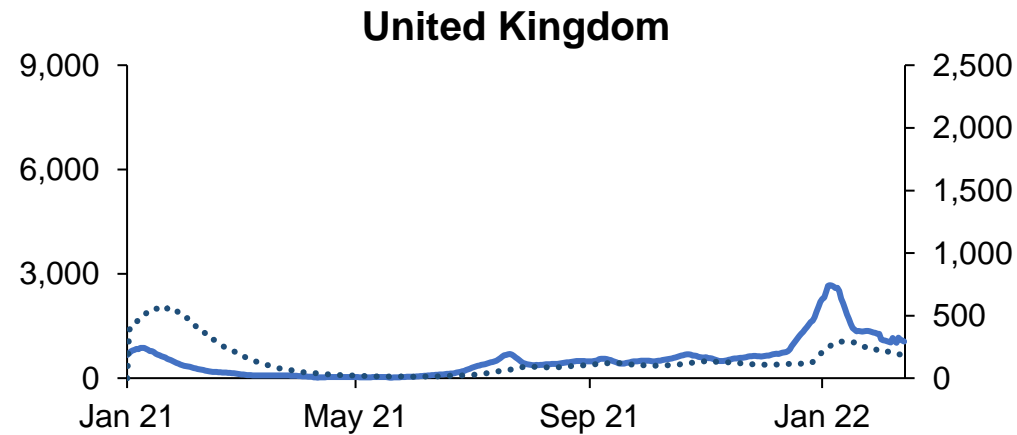


- SARS-CoV-2 virus continually evolves, randomly generating mutations that can impact characteristics of the virus, including its transmissibility and severity
- Some mutations have helped the virus spread more easily, including by evading immune protection as it passes from person to person
- In this way, accumulated mutations can result in new variants of concern, which may emerge from existing variants
- New variants can also appear more suddenly if accumulated mutations stay hidden from our surveillance (e.g. if the virus evolves in an immunocompromised person or an animal host)
- We need to closely monitor and be prepared for emergence of new variants that could appear suddenly

# Global monitoring and collaboration remain important for ongoing and longer-term management of COVID-19

Number of cases per 1,000,000 population (solid line)

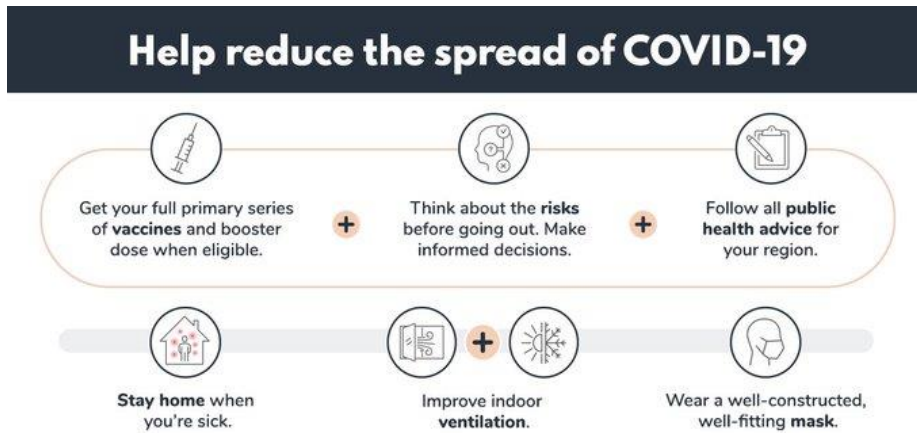
Number in hospital per 1,000,000 population (dotted line)



Date (month year)

# Caution and a state of readiness is our strongest advantage for achieving a balanced and sustainable approach to managing COVID-19 over the long term

- **Although resurgence is still possible**, there is room for optimism. We now have a greater range and availability of tools to minimize serious illness and overall deaths while minimizing societal disruption.
- **As we go forward, prevention, early detection and response tools will remain crucial during this next phase**, including vaccines, testing, robust surveillance, treatments, and public health and healthcare infrastructure.
- **For public health and individuals alike, maintaining a state of readiness will be our strongest advantage**, as we recover and enhance surge capacity for future response.

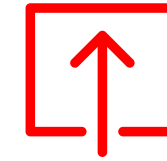
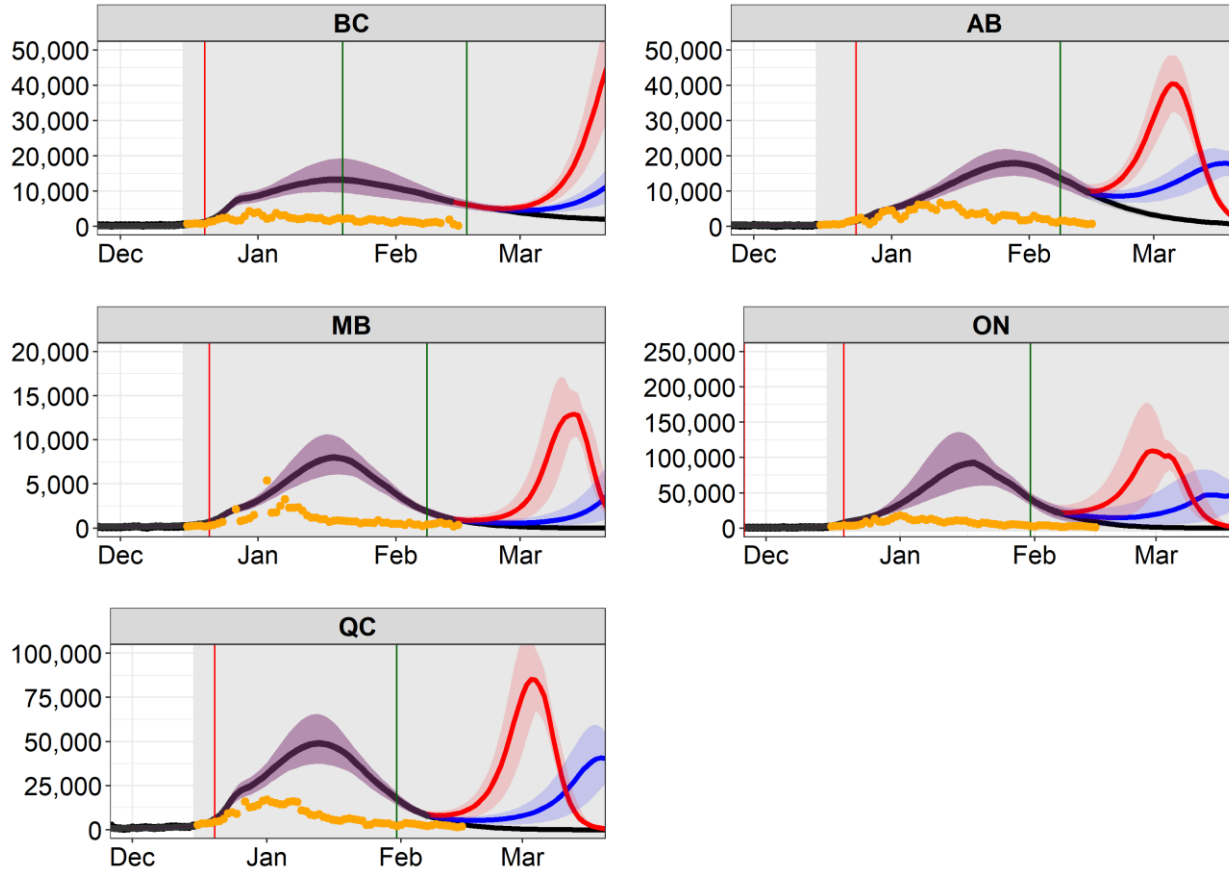


← Continuing to follow local public health advice on evolving risks and prevention practices can help keep the virus in check, as we get back to greater sense of normalcy.

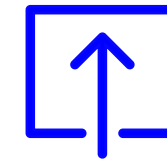
# ANNEX

# A resurgence in incidence is forecast for all provinces with easing of public health measures

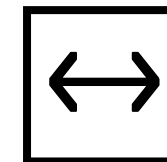
Number of daily cases\*



Easing public health measures has a substantial effect on transmission



Easing public health measures has a moderate effect on transmission



No change to transmission

**Orange points** – reported cases from recent surveillance data (which incompletely captures the number of cases)

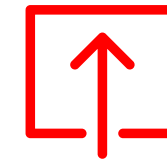
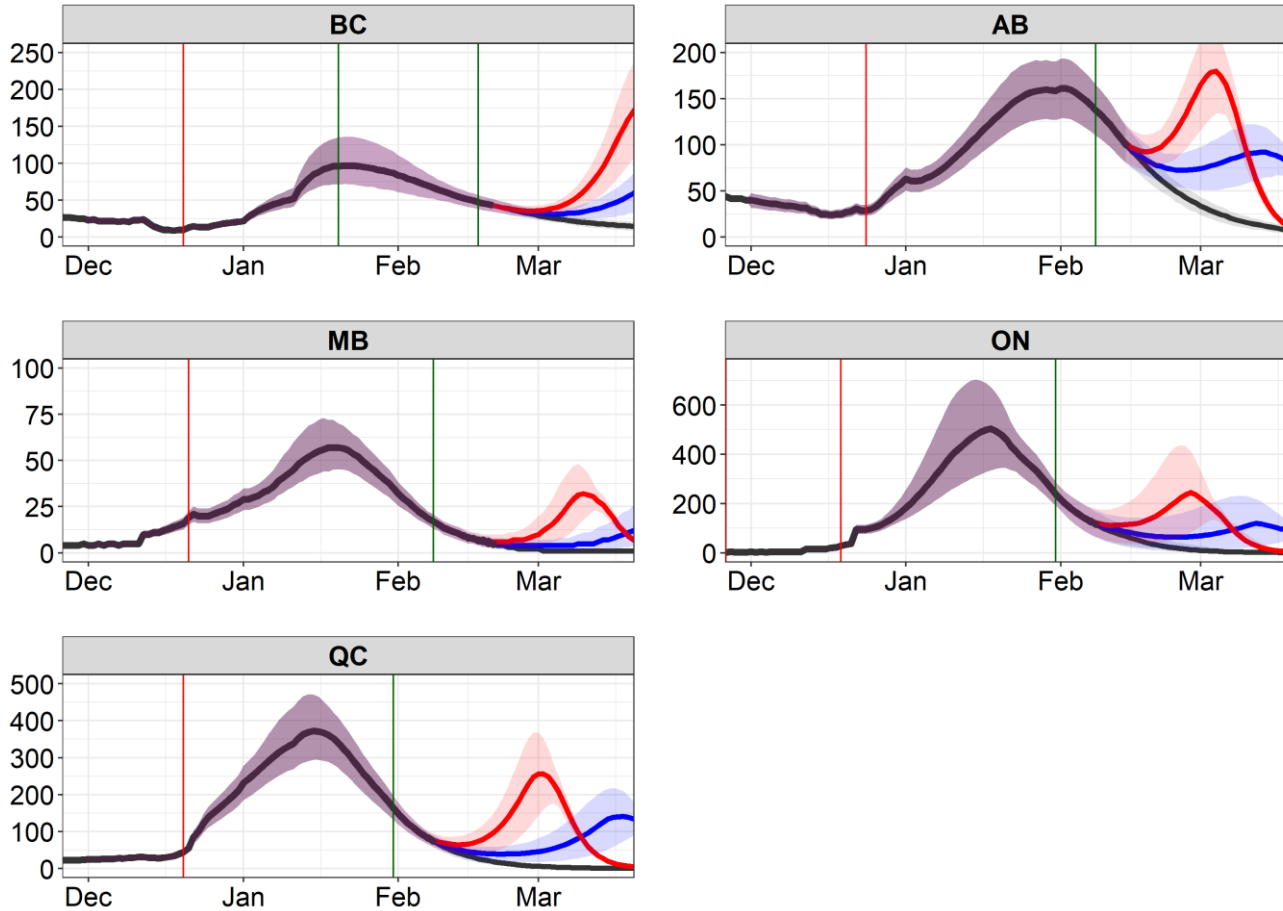
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Data as of February 14, 2022; fit as of December 15, 2021 for cases and February 14, 2022 for hospitalization.

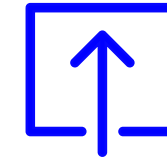
**Note:** Output from PHAC-McMaster model. Model considers impact of booster vaccinations and increased transmissibility of VOCs (including Delta, and Omicron), refer to annex for detailed assumptions on modelling. Red vertical lines represent the timing of reimplement/reinforcement of measures in each province and green vertical lines represent easing of public health measures. There is no forecast for SK as daily data (including hospitalizations from which cases are estimated) are no longer available.

# A possible increase in daily hospital admissions is forecast for all provinces with easing of public health measures

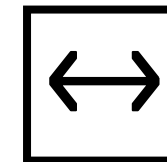
## Daily hospital admissions



Easing public health measures has a substantial effect on transmission



Easing public health measures has a moderate effect on transmission



No change to transmission

Data as of February 14, 2022; fit as of December 15, 2021 for cases and February 14, 2022 for hospitalization.

**Note:** Output from PHAC-McMaster model. Model considers impact of vaccination and increased transmissibility of VOCs (including Delta, and Omicron), refer to annex for detailed assumptions on modelling. Red vertical lines represent the timing of reimplementing/reinforcement of measures in each province and green vertical lines represent easing of public health measures. There is no forecast for SK as daily data (including hospitalizations from which cases are estimated) are no longer available.



# Types of models used to inform decision making

## Statistical forecast models:

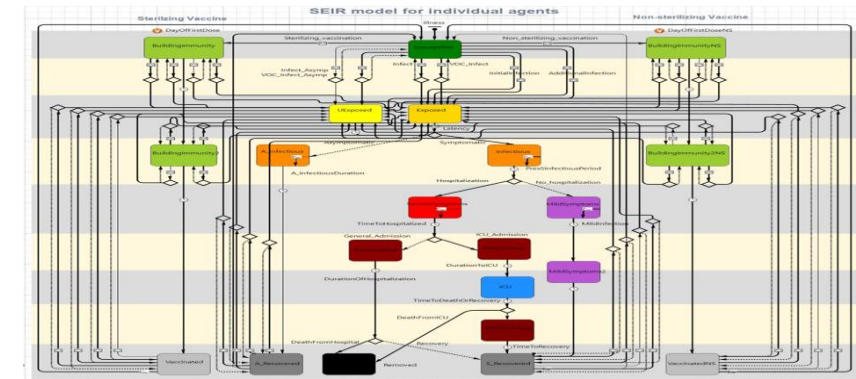
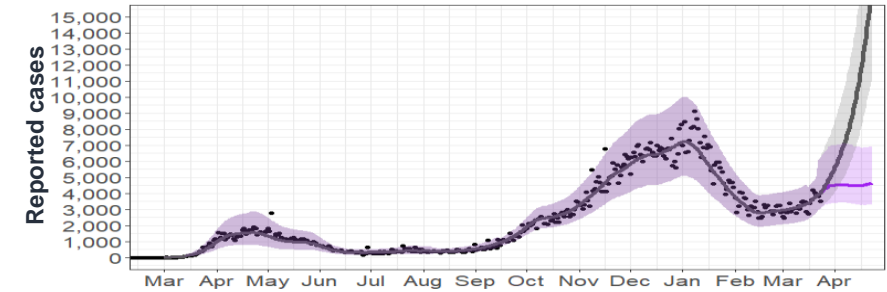
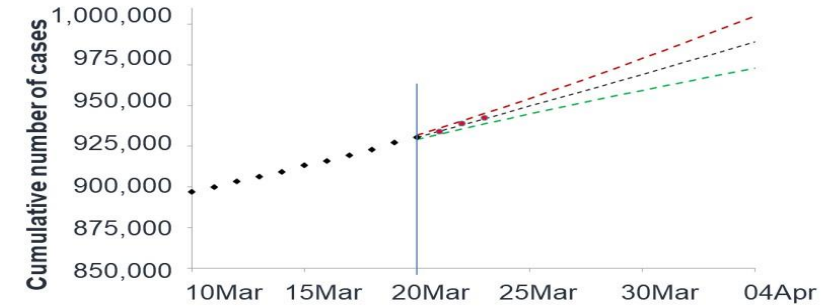
- Short-range forecast of expected cases given recent incidence

## 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, with provincial variations. The proportion of cases due to VOCs are indirectly fitted when calibrating to data.
- A simplified approach to modelling the Omicron variant in which it is assumed that i) combined transmissibility and immune escape effects result in transmissibility 3x that of Delta; ii) Omicron replaces Delta at the rate seen in Gauteng, Republic of South Africa, Ontario, and the UK (0.3/day); and iii) 1% of Omicron introduced in the last week of Nov for all PTs. Vaccine effectiveness (VE) is assumed to decrease 50% with respect to Delta implying 15% and 40% for first and second dose respectively. It is assumed that booster doses increase VE against infection to 70%. Possible impacts of other emerging variants, such as BA.2, are not included.
- The national forecast includes three scenarios for changes in the effective transmission rate. These include a scenario for expected change in cases if public health measures remains the same (black), easing public health measures has a substantial effect on transmission (red), and easing public health measures has a moderate effect on transmission (blue). There are uncertainties with the amount of transmission which propagates forward in the forecasting scenarios and reopening dates are different for different PTs.
- The forecast includes projected vaccine roll-out at current rates and assumes that vaccinations are 60% effective against infection after one dose and 90% after the second dose for wild-type and Alpha, 30% after one dose and 80% after the second dose for Delta, and as described above for Omicron. The vaccine projections assume 5% for first dose and 10% for second dose and 15% for boosters hesitancy of the eligible population (Ages 5+). Waning of immunity is not accounted for.
- Hospital admissions forecasts are obtained using the dynamic PHAC-McMaster model to estimate hospitalisations, accounting for the temporal change in the proportions of cases in non-immune people versus those in people with vaccinal or post-infection immunity.