

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

*January 14, 2022*

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

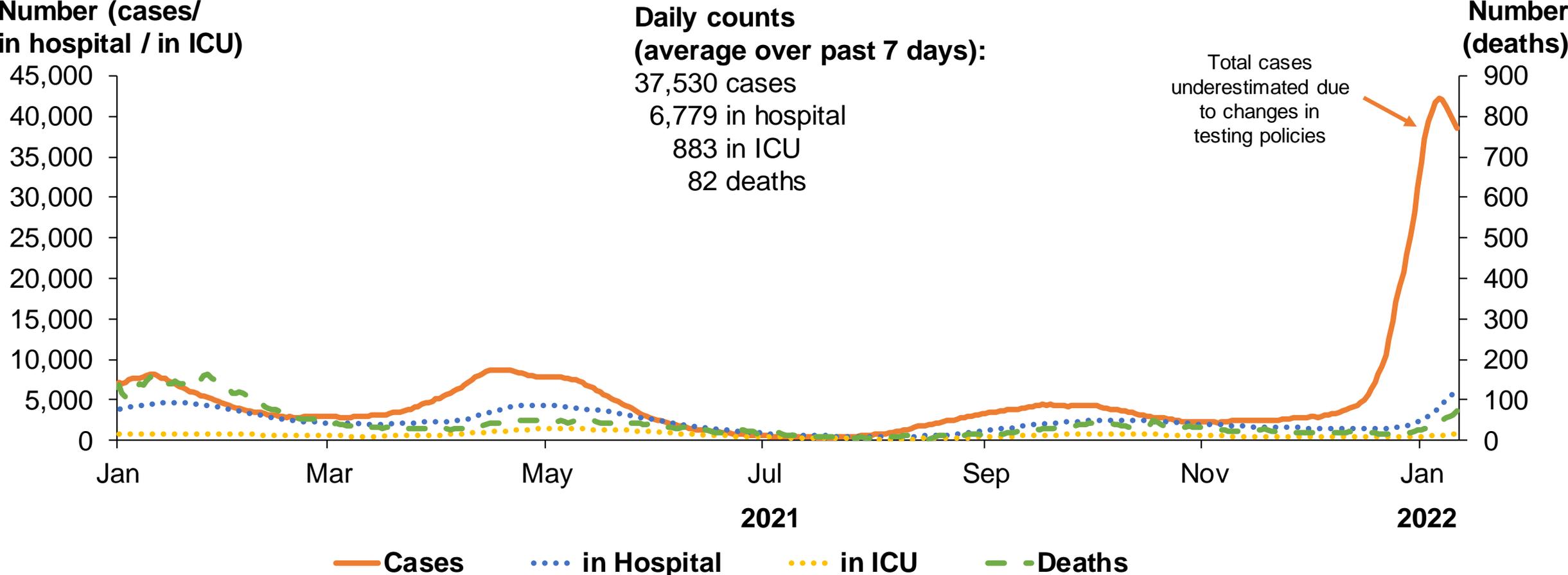


Public Health  
Agency of Canada

Agence de la santé  
publique du Canada

Canada

# Omicron disease activity has eclipsed all previous waves and is driving up severe illness trends despite being less severe than Delta



Data as of January 12, 2022

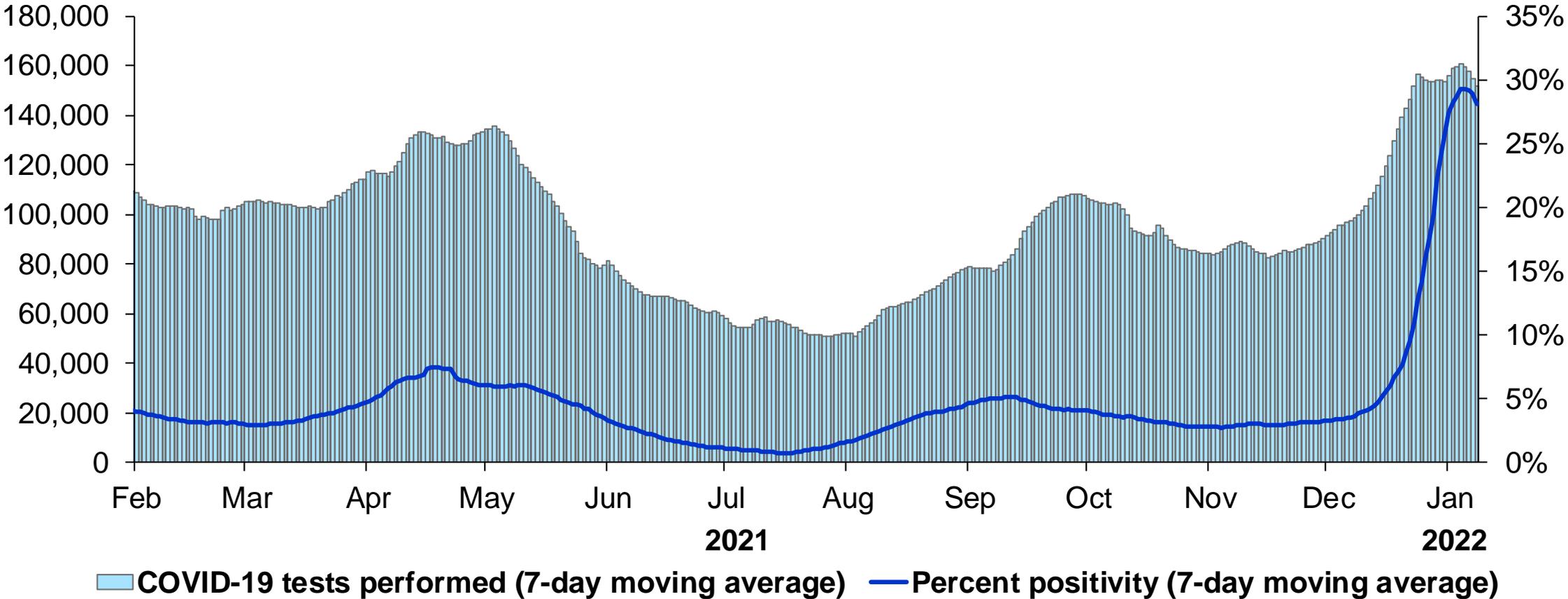
**Note:** Trend lines reflect 7-day moving averages. Total hospitalizations and ICU admissions include all people in hospital and in ICU on that day. Hospitalizations and ICU counts include data from nine of thirteen Canadian provinces and territories. Due to changes in COVID-19 testing policies in many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



# Very high laboratory test positivity indicates widespread disease activity nationally

Number of COVID-19 tests performed

Percent positivity

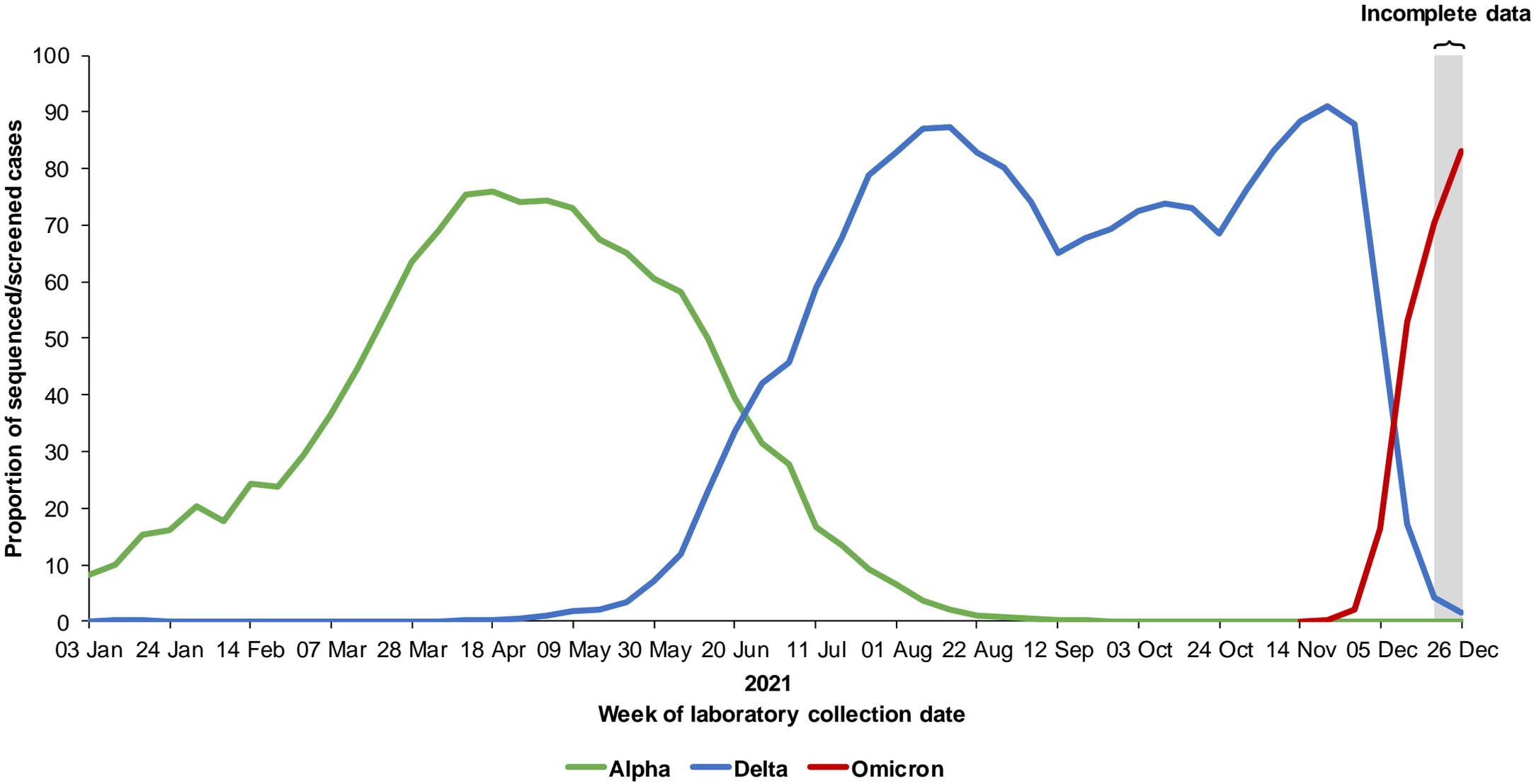


Data as of January 11, 2022

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.



# Omicron has rapidly replaced Delta to become the predominant variant in Canada



Incomplete data

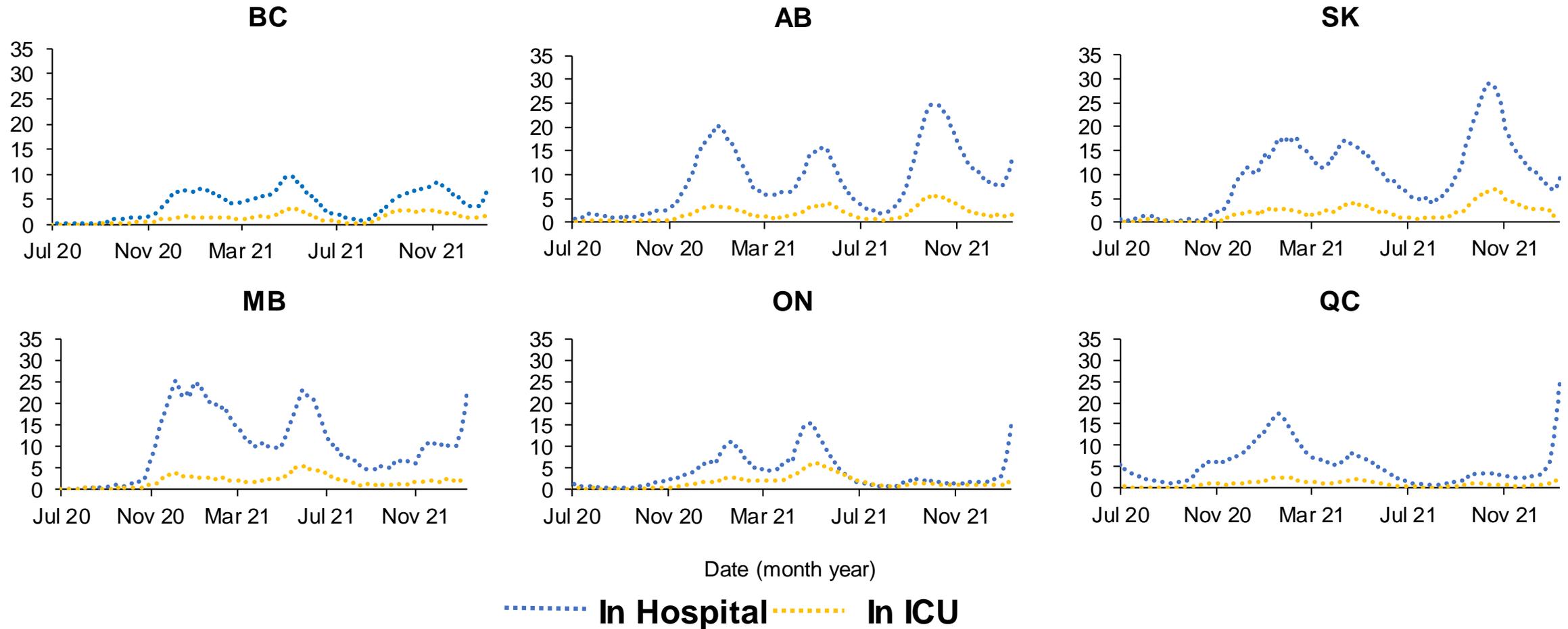
Data as of January 11, 2022, from the week of January 3, 2021 to the week of December 26, 2021.

**Note:** Variants of Concern (VOC) are identified using whole genome sequencing and screening methods which may be applied at different times depending on the epidemiological context. The proportions presented are likely an under-representation of true VOC counts as not all COVID-19 cases are screened or sequenced.



# Hospitalization trends rising or expected to rise given record high infection rates due to Omicron

Number in hospital / in ICU per 100,000 population

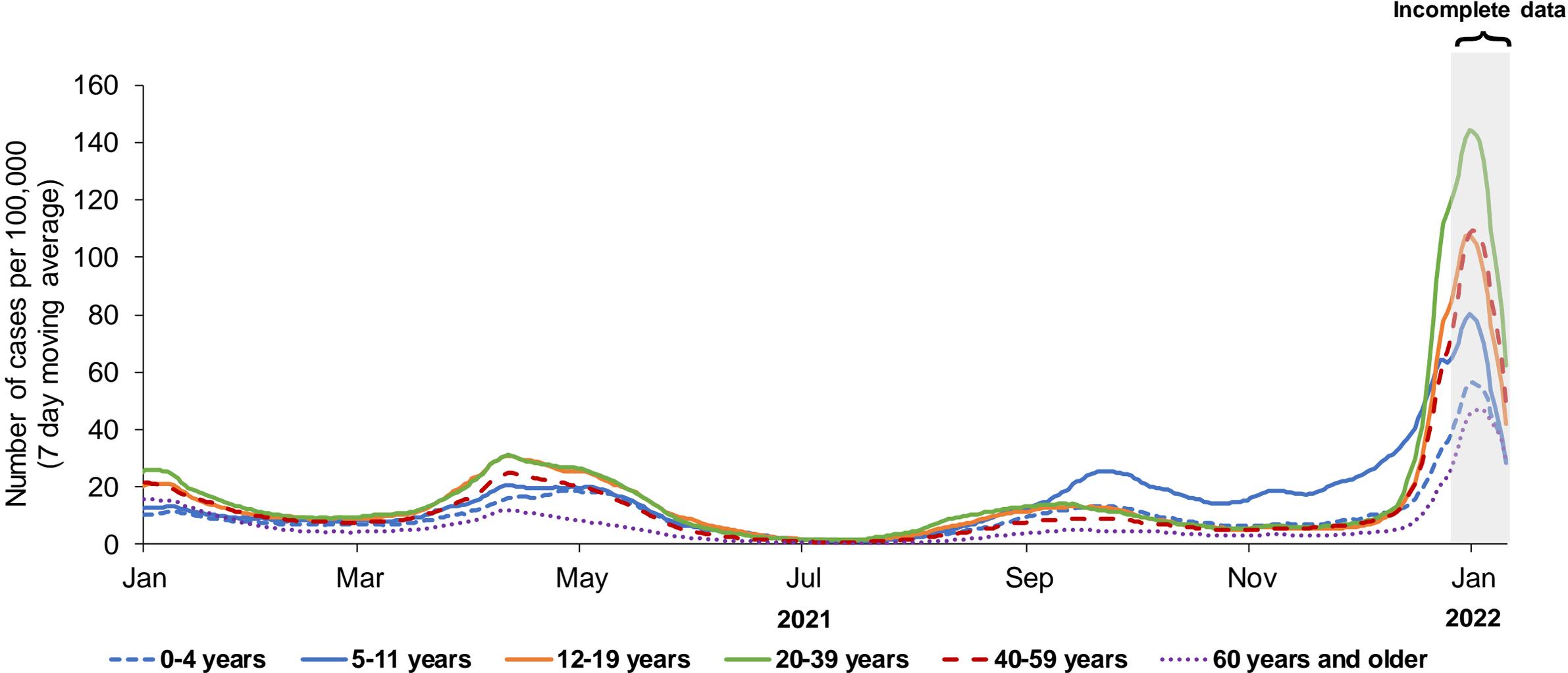


Data as of January 11, 2022

**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.



# Nationally, incidence of reported cases is higher than any time previously, with rates in adults aged 20-39 years highest of all



Incomplete data

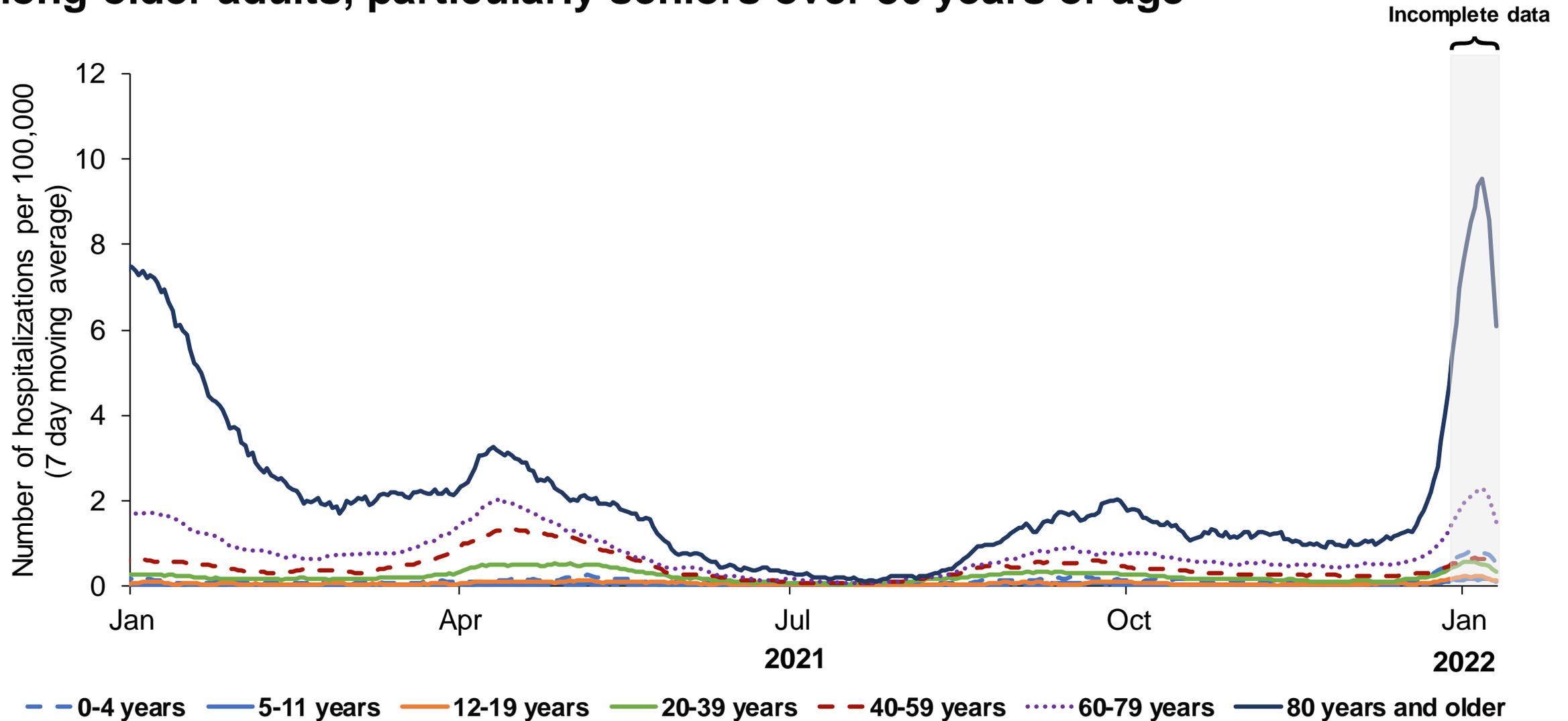
Data as of January 12, 2022.

Source: Detailed case data submitted to PHAC by the provinces and territories. Shaded area represents period of accumulating data.

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.



# Hospitalization rate increasing across all age groups, with the highest rates among older adults, particularly seniors over 80 years of age



Data as of January 12, 2022

Source: Detailed case data submitted to PHAC by the provinces and territories. Shaded area represents period of accumulating data.

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.



# Omicron associated with a smaller proportion of cases requiring hospital care, but sudden and record volume of cases results in heavy impact

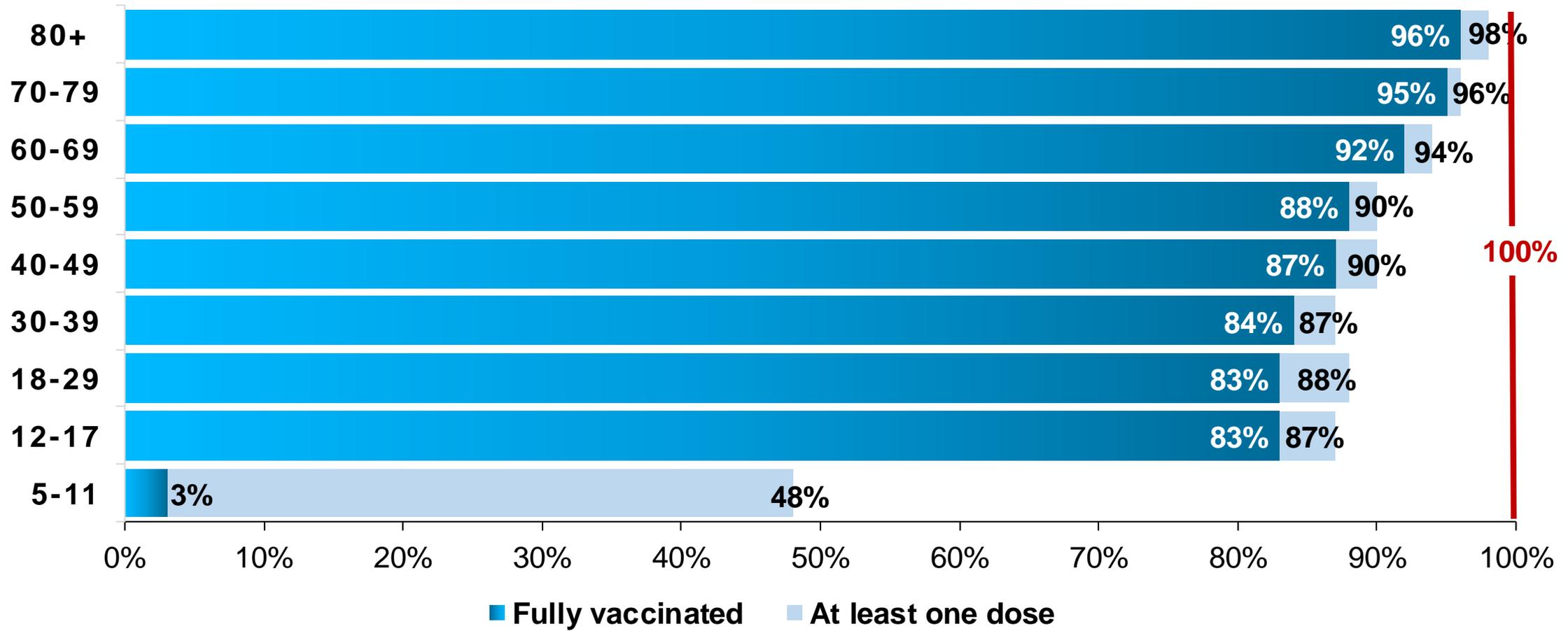
## Omicron (B.1.1.529) current evidence:

**Getting up to date with COVID-19 vaccinations + maintaining public health measures and individual protective practices continue to help control COVID-19 spread**

- **Rapid rate of spread likely due to a combination of inherent characteristics** of the virus and increased ability to evade prior immunity from past infection and vaccination
- **Low to very low vaccine effectiveness against infection/symptomatic disease** after second mRNA dose
  - Booster dose results in better protection against infection, but not as good as with Delta
- **Likely intrinsically less severe** with hospitalization risk lower than for Delta however serious outcomes can still occur
- **Two doses of vaccine continues to provide good protection against hospitalization**, which improves with a booster dose
- **Despite reduced severity of Omicron**, record high infection rates are expected to substantially strain healthcare capacity

# More than 6.5 million Canadians need one or more doses of COVID-19 vaccines to complete their primary series

Percentage of eligible people ( $\geq 5$  years) with at least one dose and fully vaccinated by age group, as of January 8<sup>th</sup>, 2022



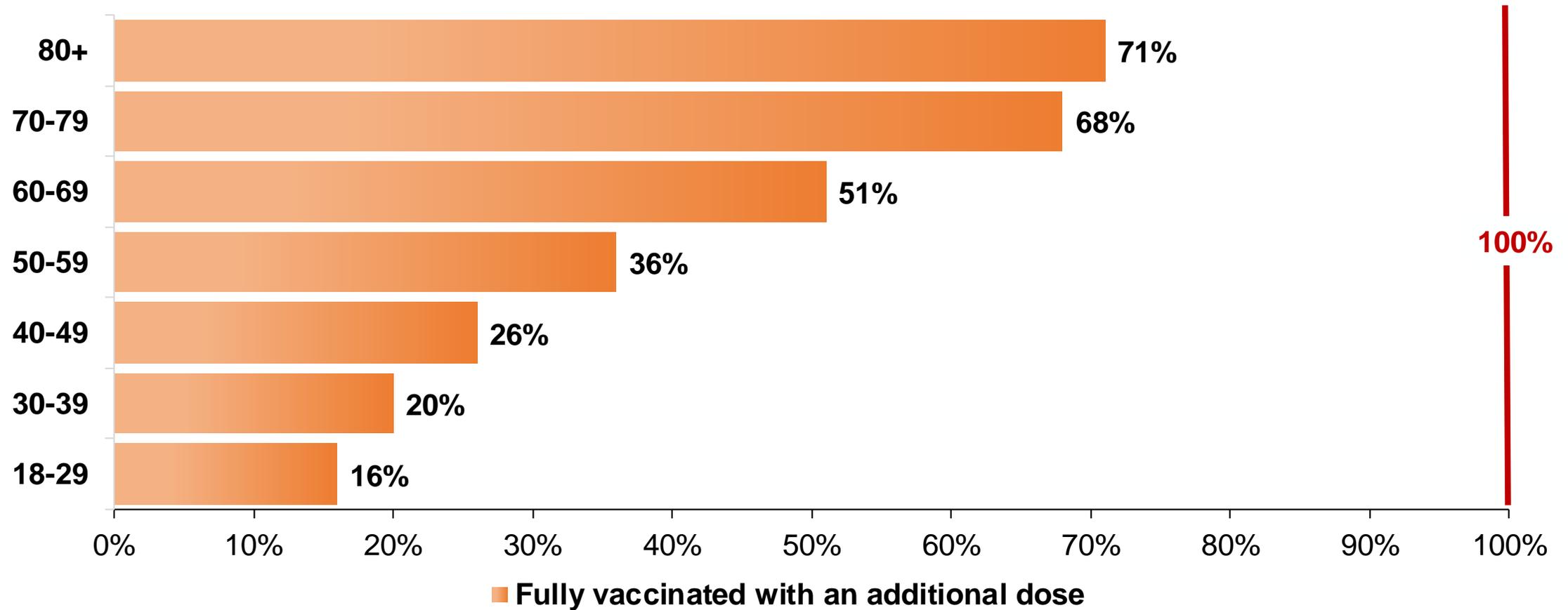
Data as of January 8, 2022

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



# Additional vaccine dose provides better protection against severe illness from Omicron

Percentage of eligible people ( $\geq 18$  years) who are fully vaccinated with an additional dose by age group, as of January 8<sup>th</sup>, 2022

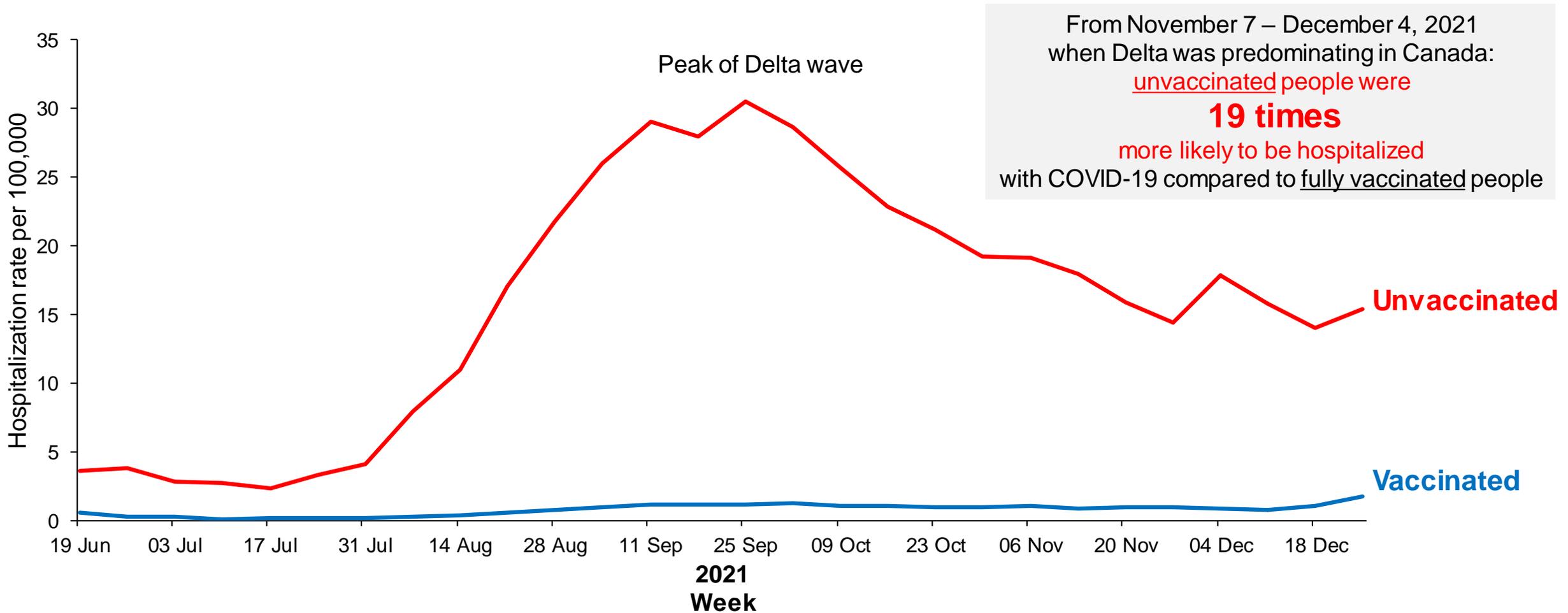


Data as of January 8, 2022

**Note:** Data obtained from the Canadian COVID-19 Vaccination Coverage Surveillance System. Cumulative percent excludes data for Quebec, Nova Scotia and Newfoundland and Labrador. Additional doses are mostly boosters but also include third doses given as part of primary series or for travel purposes.



# Unvaccinated people are significantly more likely to be hospitalized with COVID-19 compared to fully vaccinated people

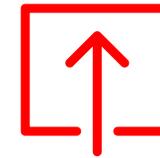
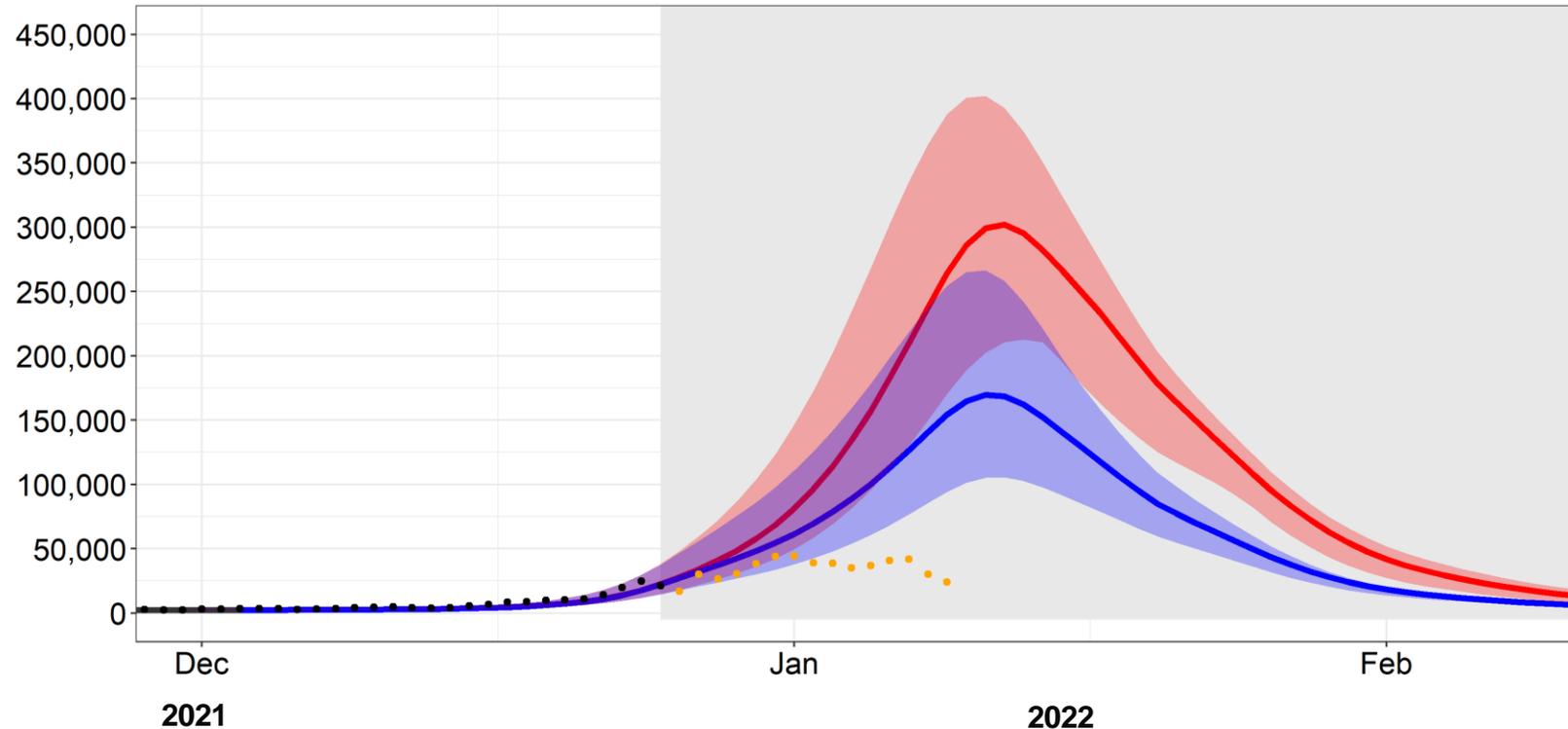


Data as of January 7, 2022 using data up to December 25, 2021 from ten provinces and territories for the eligible population 12 years or older, adjusting for age.  
**Definitions:** Unvaccinated cases include those who were unvaccinated at the time of their onset; fully vaccinated cases had onset  $\geq 14$  days from their second dose.

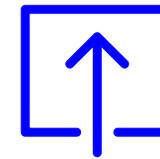


# A large surge of rapidly accelerating Omicron cases is forecast for Canada

## Daily cases\*



Without the recent strengthening of public health measures



If current public health measures strongly reduce transmission

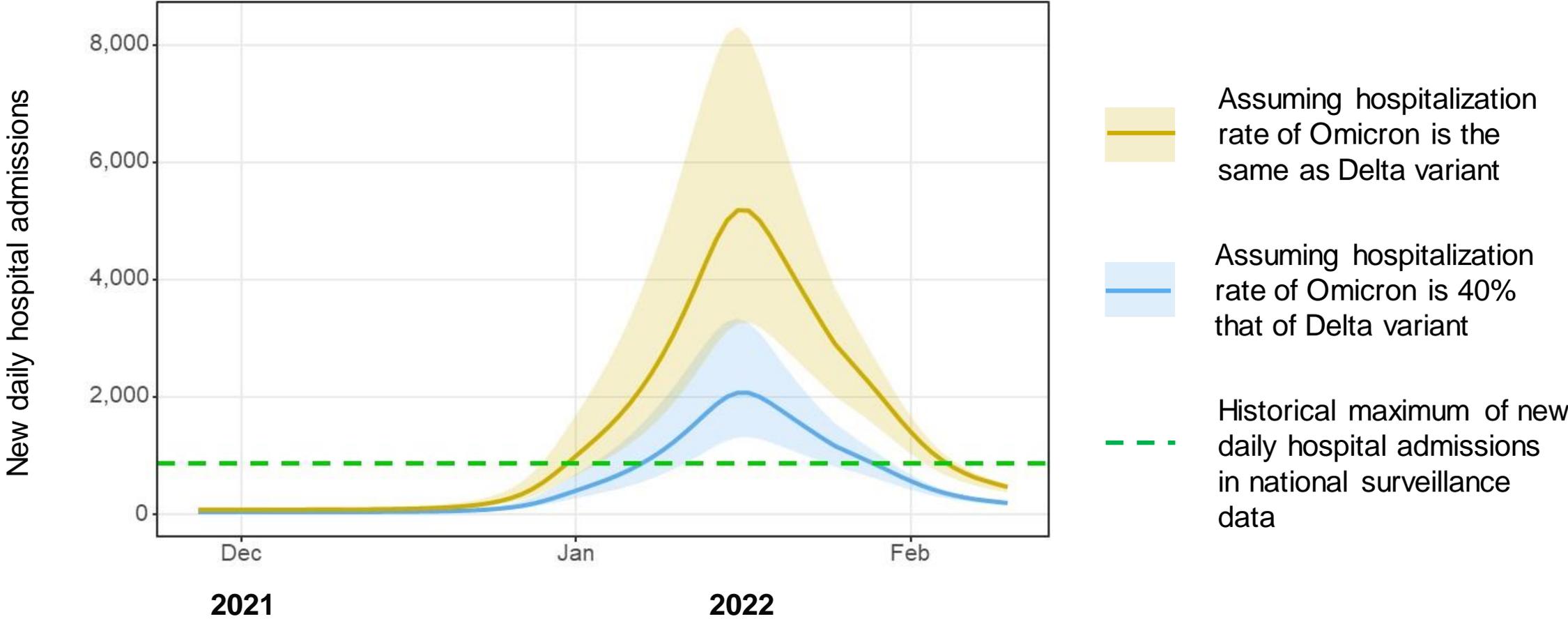
**Orange points** – recent surveillance data

\* 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 Jan 7, 2022; fit as of Dec 25th, 2021

**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.

# New daily hospital admissions are also forecast to surge in the coming weeks given extremely high levels of Omicron transmission



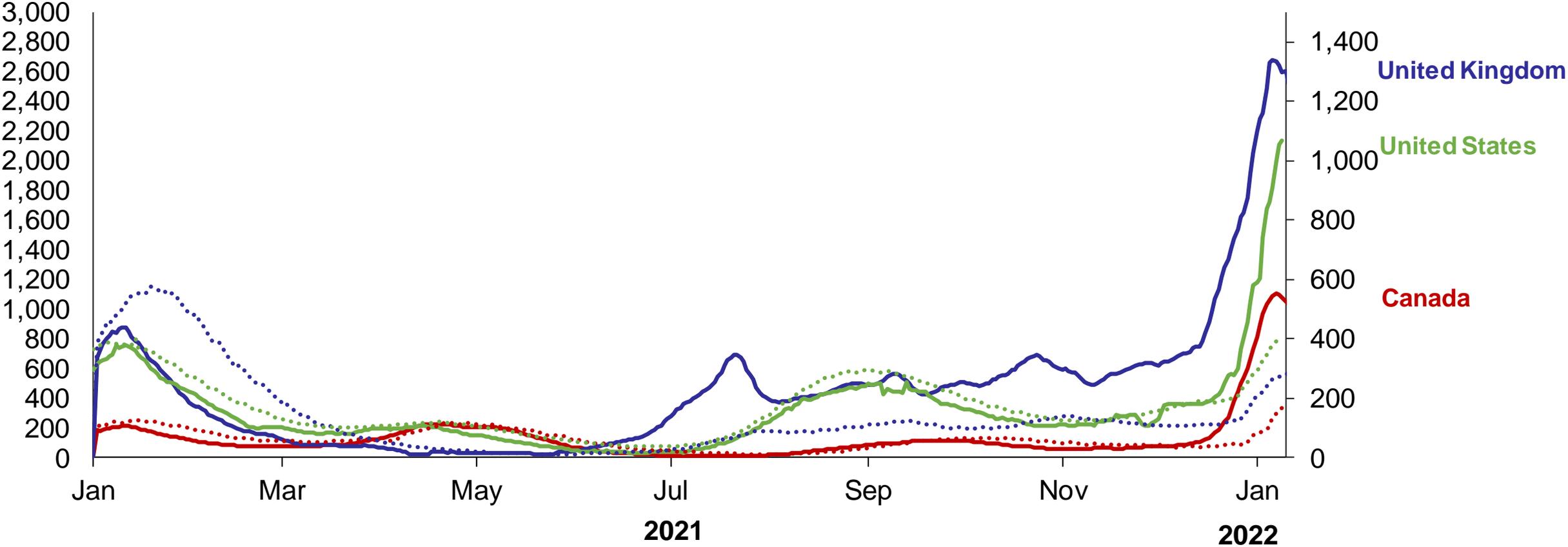
**Note:** Forecast of hospitalizations is obtained from cases forecast by the PHAC-McMaster model. Ratio of hospitalized to all reported cases, and historic maximum number of daily admissions is obtained from surveillance data and may differ slightly from data from hospitals. Refer to annex for detailed assumptions on modelling.



# International experience shows hospitalisations rise steeply during an Omicron surge but not at the same explosive rate as cases

Cases per 1 million population (solid line)

Hospitalizations per 1 million population (dotted line)



Data as of January 12, 2022  
Source: Our World in Data

# Caution and consistency needed in the coming weeks to reduce size of the Omicron surge and help maintain health system and critical functions of society

- **While Canada could see a sharp peak and decline in cases in the coming weeks**, given disease activity far exceeding previous peaks, even the downside of this curve will be considerable.
- **With several weeks of very intense activity expected to come**, we need to do our best now to limit the size and impact of the Omicron surge in order to maintain health system and critical functions of society.
- **Practically speaking, we need to continue to:**
  - **get up-to-date with our COVID-19 vaccines**, including getting a booster dose when eligible
  - **limit in-person contacts**, to immediate household members as much as possible, and
  - **consistently use layers of personal protections** to reduce the risks of exposure and spreading the virus by:
    - following local public health advice,
    - wearing a good quality and snug-fitting face mask,
    - maintaining good ventilation



- 1 **Sleeves up** – Get fully vaccinated + booster dose as recommended
- 2 **Keep up** – Wash-Mask-Space layers of protection + #GoodVentilation
- 3 **Listen up** – Follow local public health advice

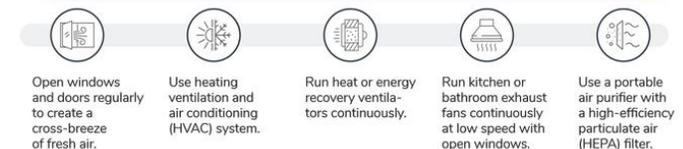
## Lowering the risk with layers

Choose and wear a well-fitted and well constructed mask



## Lowering the risk with layers

Improve ventilation and air filtration in your home

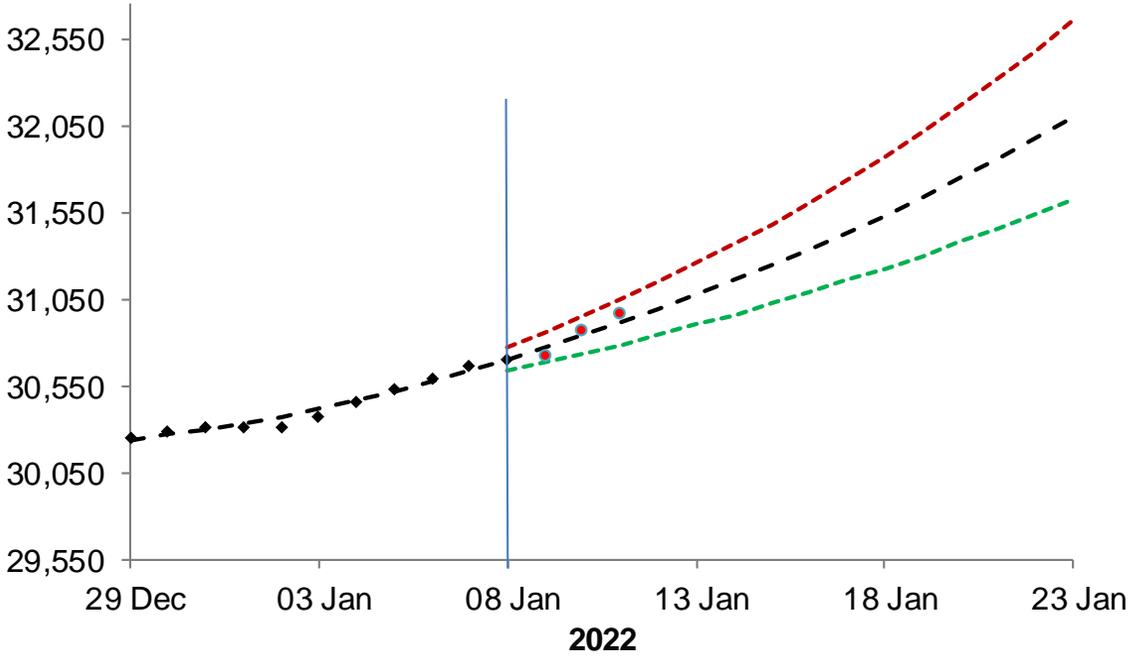
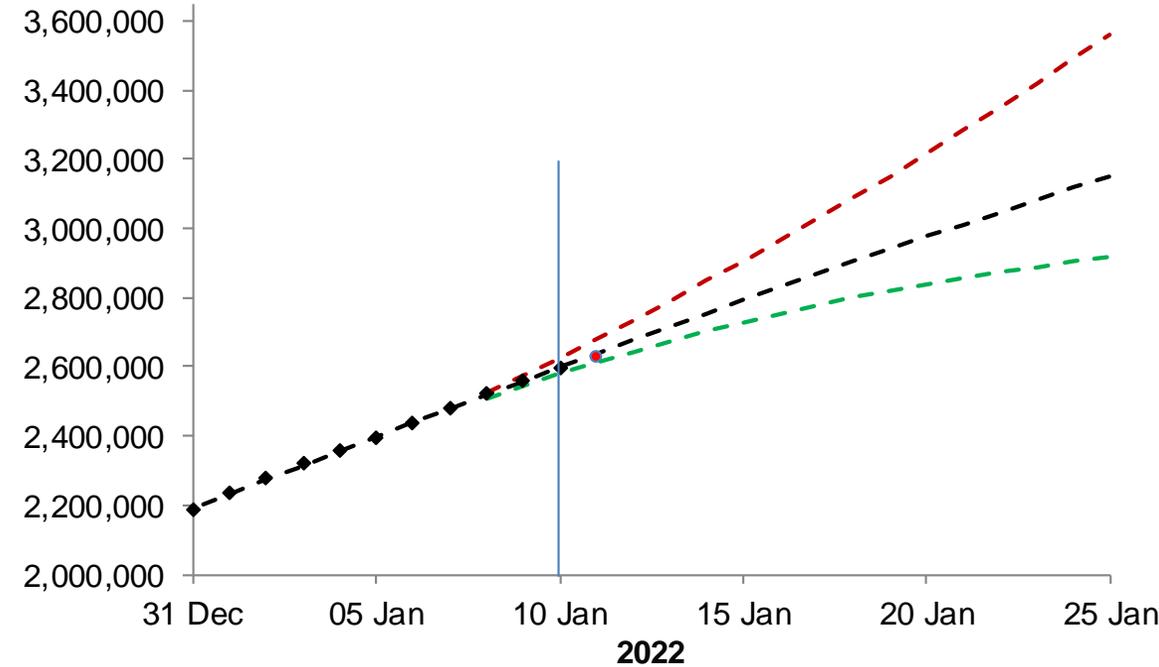


# ANNEX

# Short-term forecast predicts slowing increase in cumulative cases (with large uncertainty due to testing and reporting) and an accelerated increase in cumulative deaths

**Cumulative cases predicted to January 25, 2022:**  
**2,917,370 to 3,562,450**

**Cumulative deaths predicted to January 23, 2022:**  
**31,620 to 32,660**



- ◆ Cumulatively reported cases in Canada by Jan. 10
- Prediction to Jan. 25 with plausible range
- Cases added since Jan. 10 when the predictions were made

- ◆ Cumulatively reported deaths in Canada by Jan. 8
- Prediction to Jan. 23 with plausible range
- Deaths added since Jan. 8 when the predictions were made

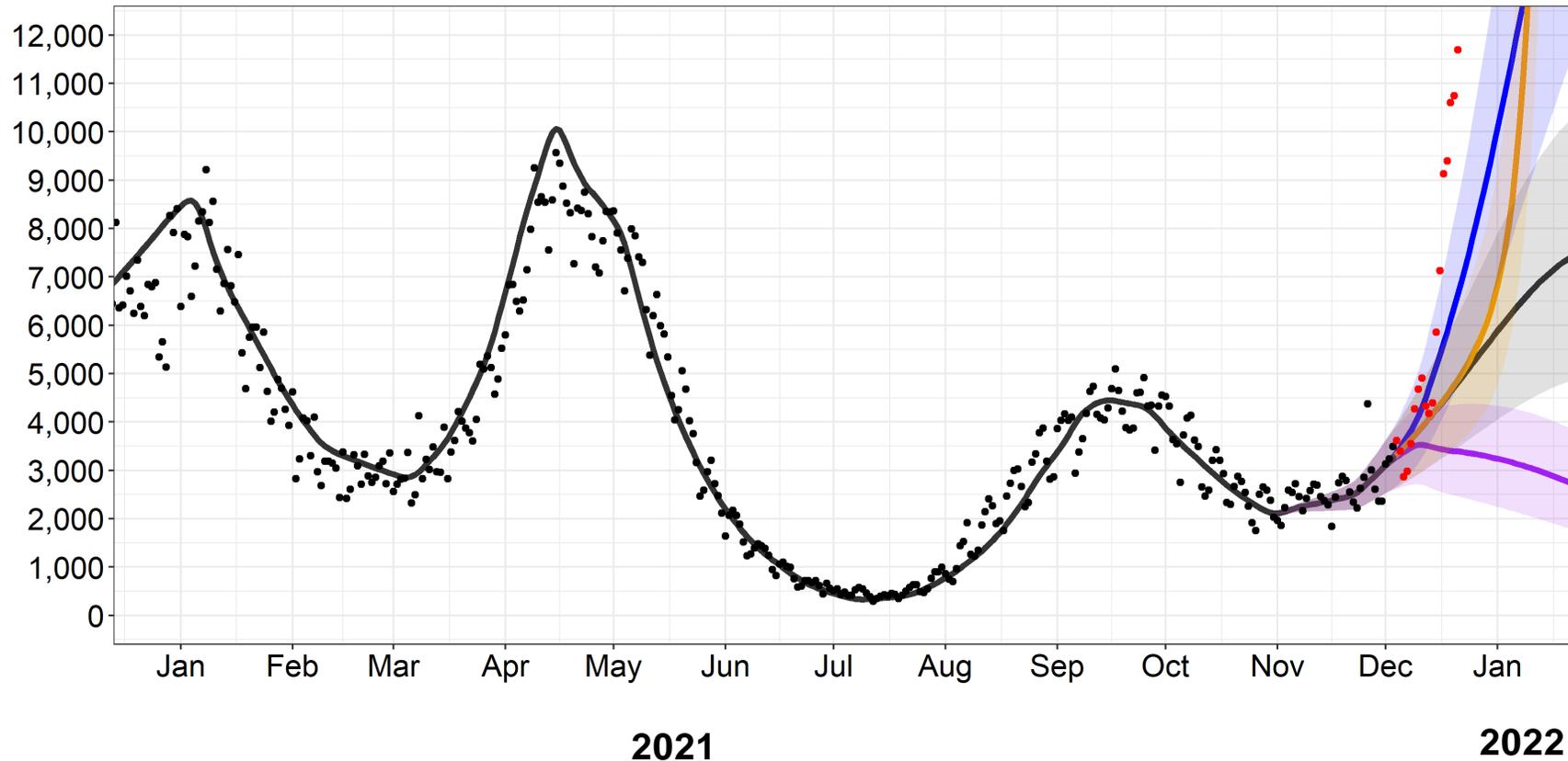
Data as of January 10, 2022

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

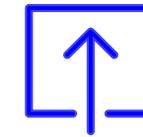


# Since December 10<sup>th</sup> forecast, cases have exceeded the increased transmission trajectory (blue)

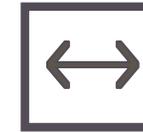
## Reported cases



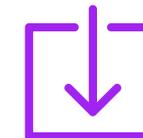
## DELTA Predominant



If transmission increases by 15%



If we maintain the current levels of transmission



If public health measures reduce transmission by 15% today

## OMICRON Replacement



If we maintain the current levels of transmission and Omicron successfully establishes\*

\*Underestimate - accounts for only increased transmissibility but not immune evasion

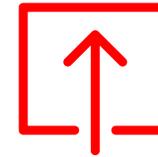
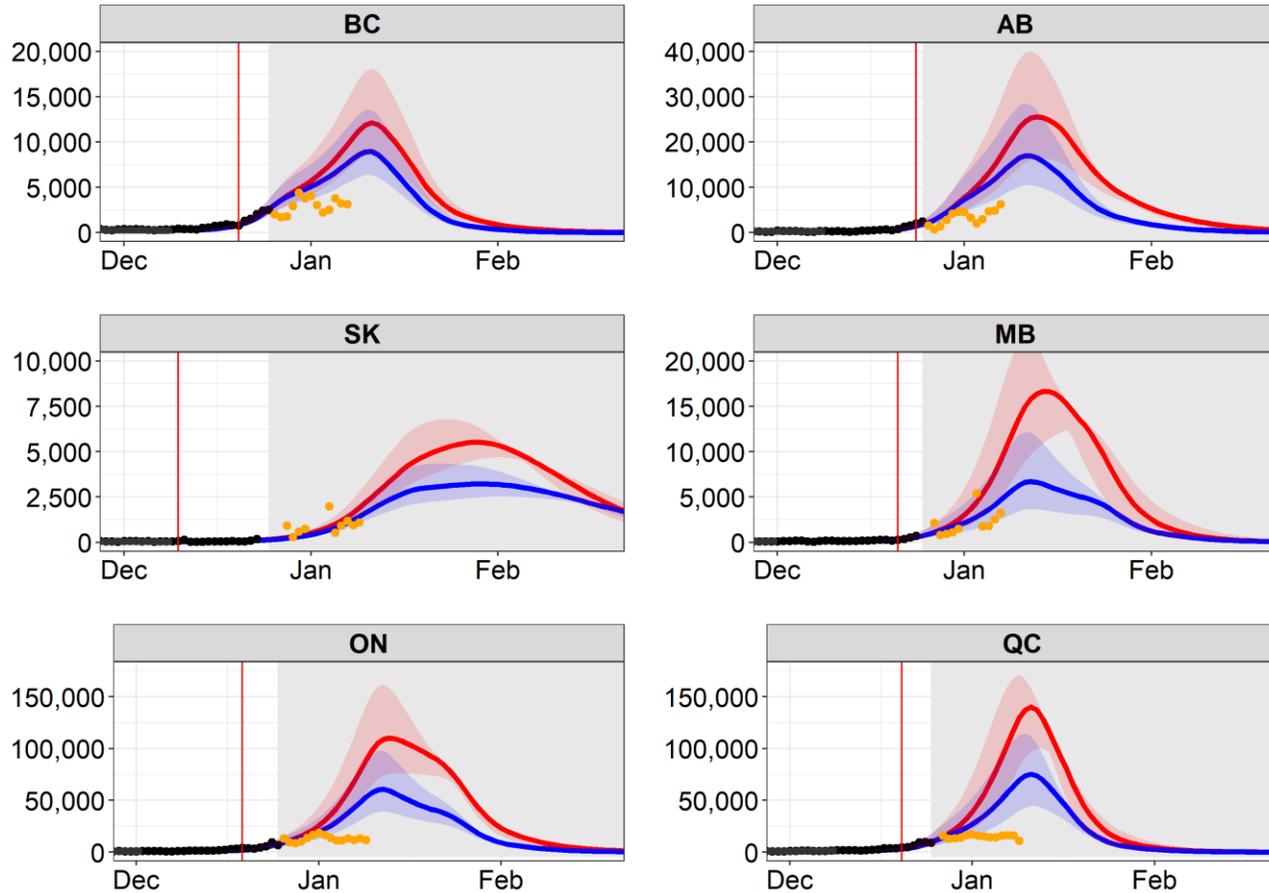
**Red points** – Surveillance data after the forecast

Data as of December 20, 2021; fit as of December 3, 2021

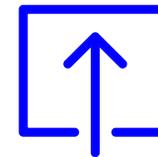
**Note:** Output from PHAC-McMaster model. Model considers impact of vaccination and increased transmissibility of VOCs (including Omicron), refer to annex for detailed assumptions on modelling. At the time, the speed and introduction of Omicron were uncertain.

# Significant increases forecast for six largest provinces, though trajectories vary

Daily cases\*



Without the recent strengthening of public health measures



If current public health measures strongly reduce transmission

**Orange points** – recent surveillance data

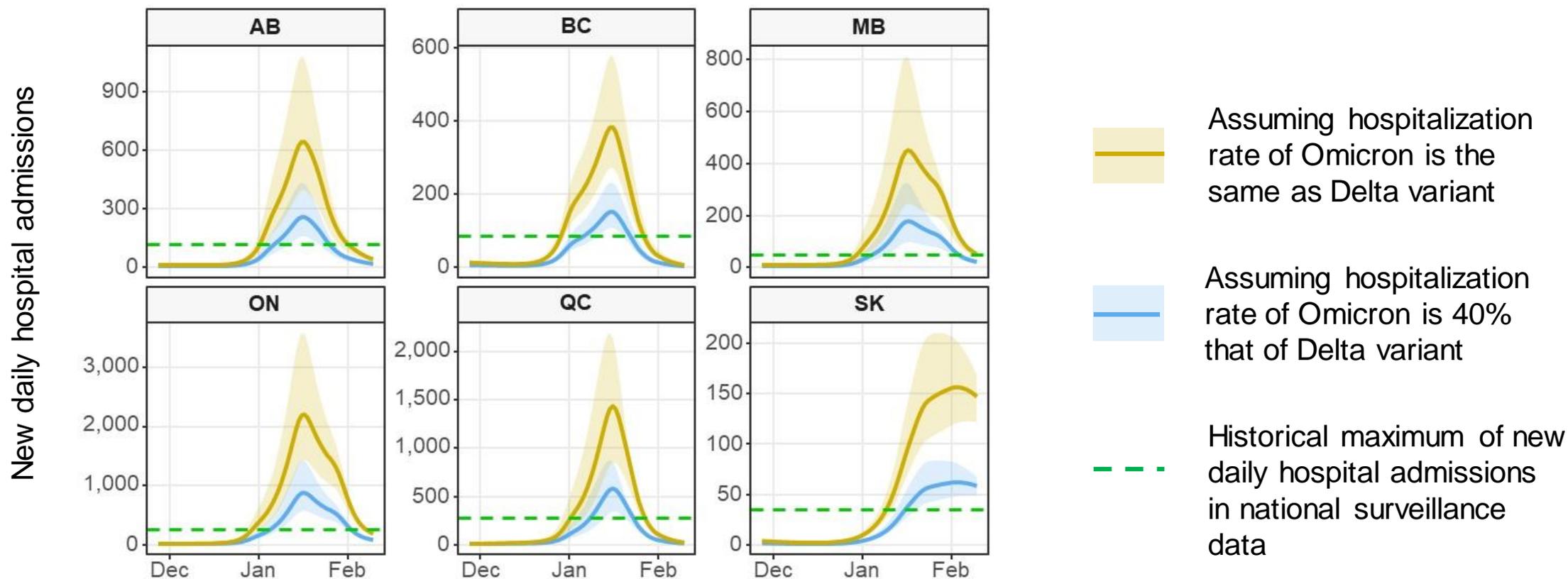
\* The forecast number of cases will not be captured by surveillance due to limitations on testing during the period identified in grey.

Data as of Jan 7, 2022; fit as of Dec 25th, 2021

**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.



# A large increase in new daily hospital admissions is forecast for each province due to the spread of Omicron



**Note:** Forecast of hospitalizations is obtained from cases forecast by the PHAC-McMaster model. Ratio of hospitalized to all reported cases, and historic maximum number of daily admissions is obtained from surveillance data and may differ slightly from data from hospitals. Refer to annex for detailed assumptions on modelling.

# Types of models used to inform decision making

## Statistical forecast models:

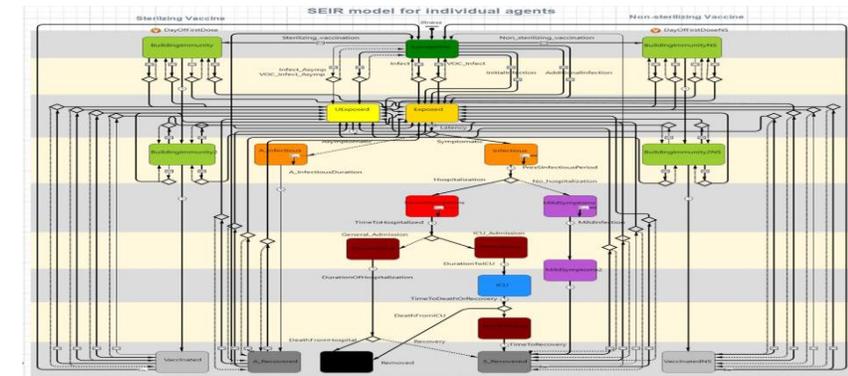
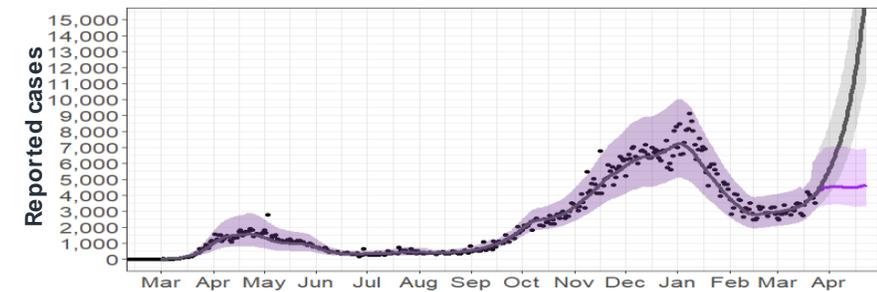
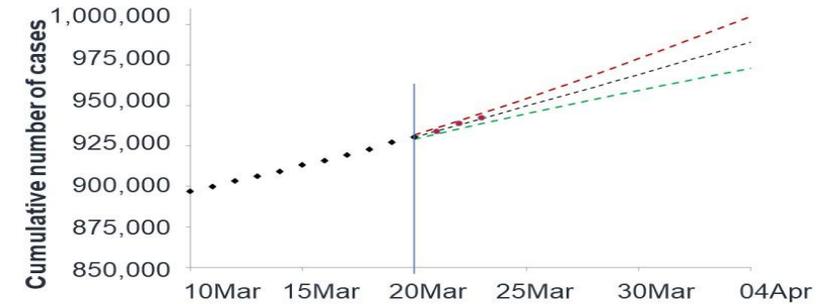
- Short-range forecast of expected cases given recent incidence

## 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.
- A simplified approach to modelling the Omicron variant is used 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 for Omicron. It is assumed that booster doses increase VE against infection to 70%.
- The national forecast includes two scenarios for changes in the effective transmission rate. These include a scenario for expected change in cases if reduction of effective transmission rates by public health measures is weak (red – public health measures in place in December 2021) and strong (blue – public health measures introduced in January 2022). There are uncertainties with the amount of transmission which propagates forward in the forecasting scenarios.
- The forecast includes projected vaccine roll-out at current rates, 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 vaccine hesitancy in eligible populations of 8% for first dose, 10% for second dose and 15% for the booster dose. Waning of immunity is not accounted for.
- Hospital admissions forecasts are obtained assuming the forecast of cases follows the strong reduction in effective transmission (blue) scenario. The forecast includes two scenarios, including one where the ratio of reported hospitalisations to cases for Omicron is the same as Delta (orange), with the ratio of reported hospitalisation to cases in surveillance data from 1st July to 1st November 2021 representing the ratio for the Delta, and another where those infected with Omicron have a chance of being hospitalised that is approximately 40% the chance of hospitalisation for a Delta case (blue).