

COVID Model Projections

December 8, 2021

[BC COVID-19 Modelling Group](#)

[@bcCOVID19group](#)



About BC COVID-19 Modelling Group

The BC COVID-19 Modelling Group works on rapid response modelling of the COVID-19 pandemic, with a special focus on British Columbia and Canada.

The interdisciplinary group, working independently from Government, includes experts in epidemiology, mathematics, and data analysis from UBC, SFU, UVic, and the private sector, with support from the Pacific Institute for the Mathematical Sciences.



<https://bccovid-19group.ca>

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*Independent and freely offered advice,
using a diversity of modelling approaches.*

Overview

Current state of the pandemic in BC (before Omicron):

- Case rates continue to decline slowly
- 81% of all people in BC are now fully vaccinated (84% partially)
- Communities that are highly vaccinated have much lower COVID rates
 - 95% vaccinated communities have 3.4 times fewer cases than those with 75% vaccinated (12+)

The uncertain future of the pandemic in BC (with Omicron):

- Omicron, a new Variant of Concern, has spread rapidly across the globe
- Here we discuss what we know and don't know about the potential impact of Omicron
- Rapid spread would mean we have little time to respond, but we can slow the spread of Omicron in BC as we did with previous variants: **getting vaccinated, wearing tight fitting masks, improving ventilation, avoiding large indoor gatherings, and improving testing and contact tracing**
- The severity of Omicron is unknown; most experts predict that vaccinated individuals will remain partially protected from infection and strongly protected from severe disease
- An exponential rise in cases will necessarily lead to an exponential rise in hospitalization, but the proportion needing hospital care is unknown for Omicron

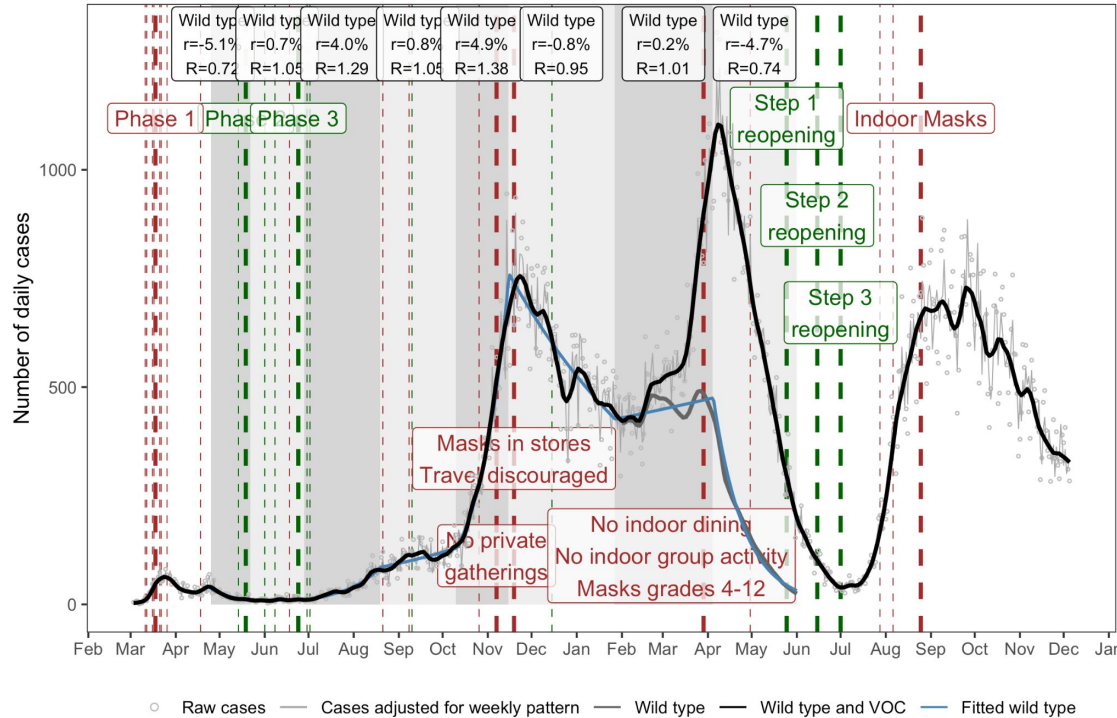
Current state of the pandemic in BC

(before Omicron)

State of the COVID-19 Pandemic in BC

Covid-19 daily new cases in British Columbia (up to Sun Dec 05)

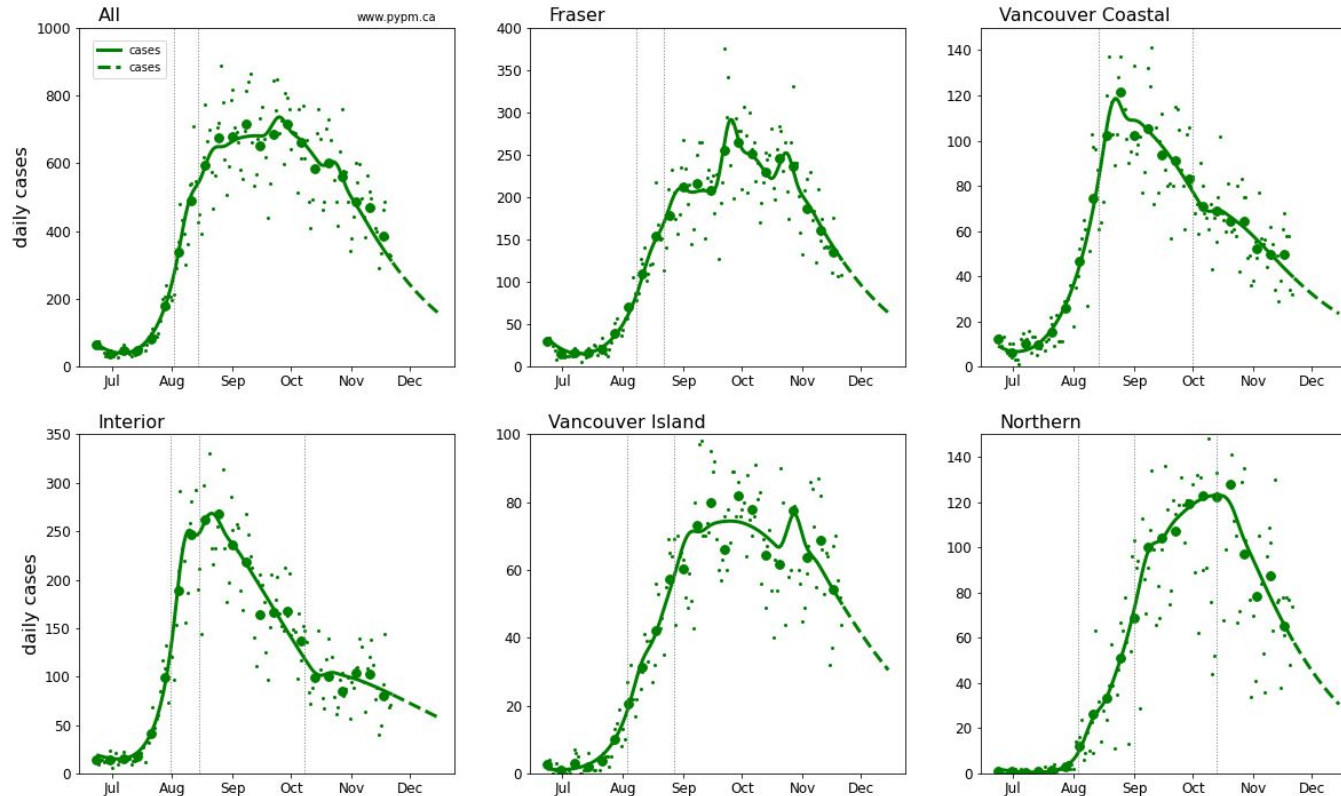
Timeline of **closure** and **reopening** events



MountainMath, Data: BCCDC

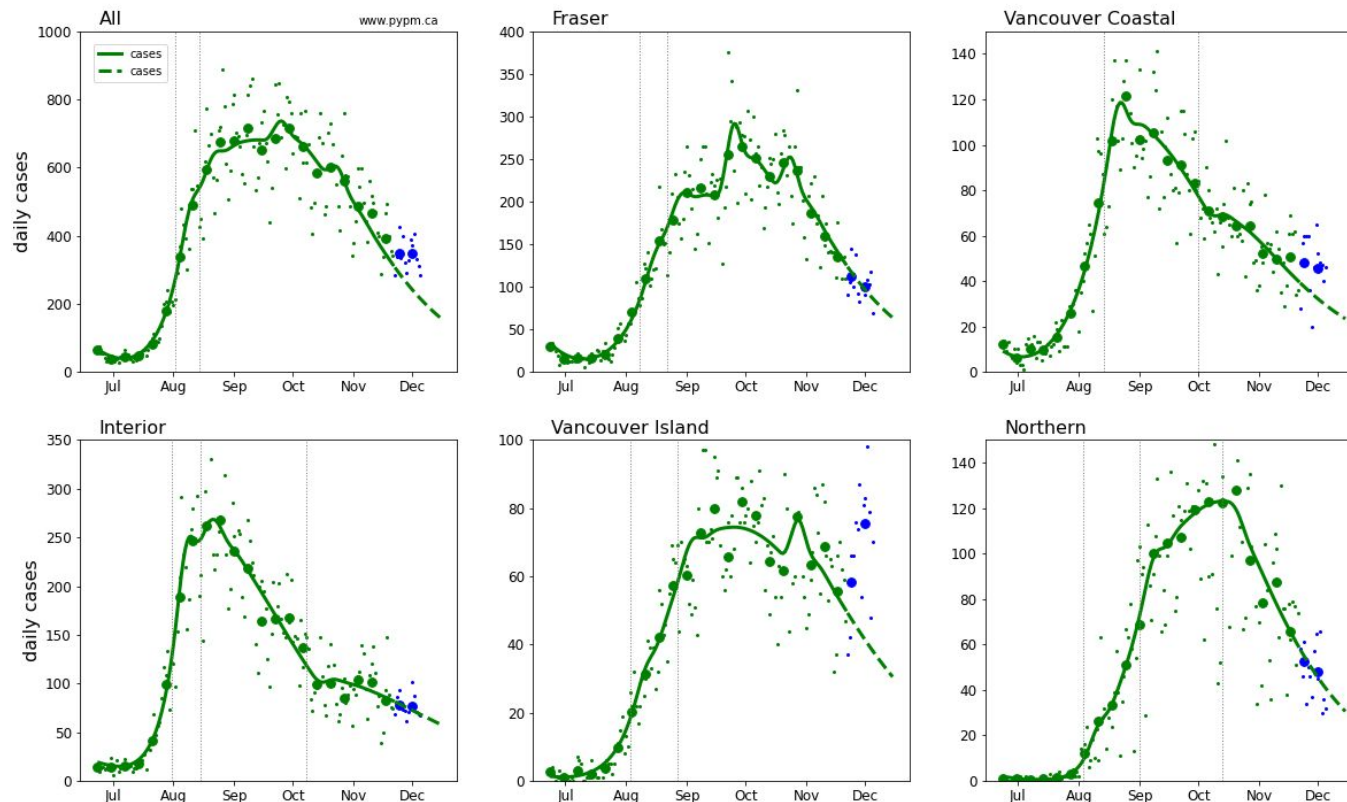
Source (J. von Bergmann) Case data from BC COVID-19 Database (<http://www.bccdc.ca/health-info/diseases-conditions/covid-19/data>). Vertical lines give dates of public health measures (major as thick lines, minor as thin lines). Grey dots are raw case counts, grey lines is cases abused for weekly pattern, black STL trend line and blue fitted periods of constant exponential growth. *Central Okanagan – July 29: masks, August 6: restrictions on group gatherings; [Interior](#) – August 21: masks; August 23: some restrictions on group gatherings. BC – August 25 mask mandate; BC's Vaccine Card to come into effect on September 13 (first dose) and October 24 (second dose)

Previous fits to BC data (November 24 report)



Source (D. Karlen). See www.pypm.ca. These models include vaccination but have no age structure. Vertical lines show fitted dates for transmission rate changes. The larger dots show weekly averages.

Previous fits to BC data (with recent data - blue)



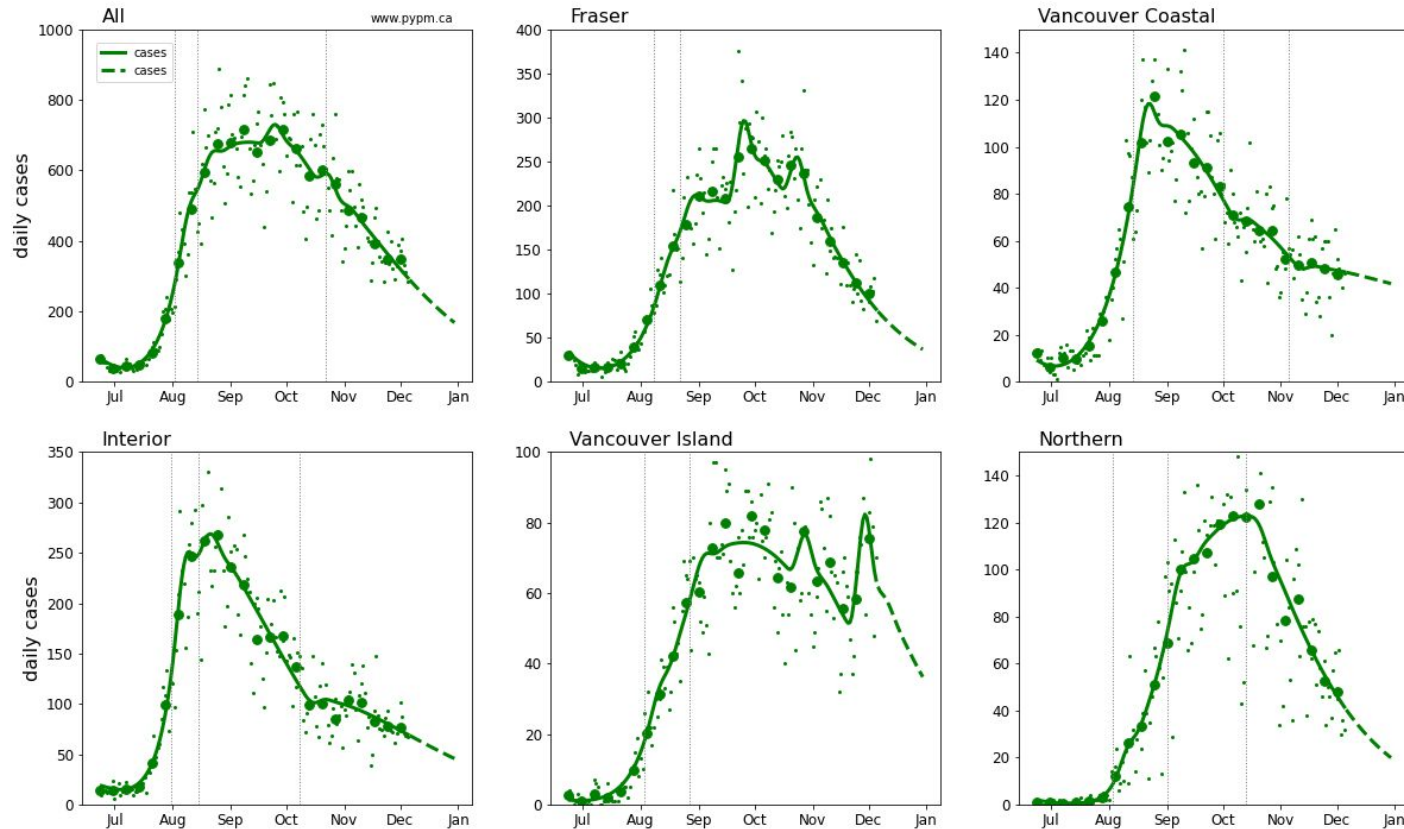
Fraser, Interior,
Northern: continuing
previous trends.

Vancouver Coastal:
recent increase in
transmission rate.

Vancouver Island:
recent outbreaks.

Source (D. Karlen). See www.pymp.ca. These models include vaccination but have no age structure. Vertical lines show fitted dates for transmission rate changes. The larger dots show weekly averages.

Updated fits to BC data



Fraser, Interior,
Northern: no changes

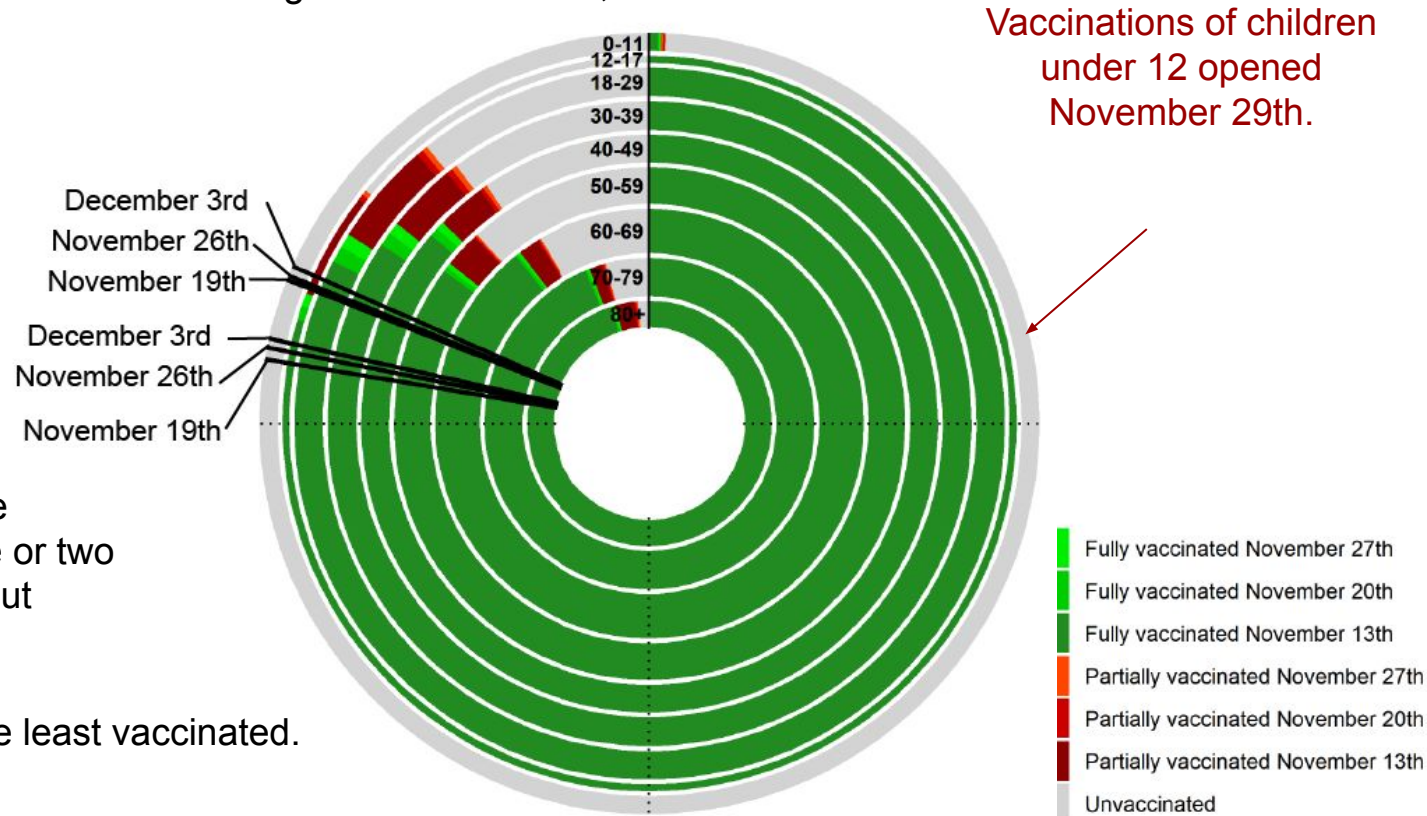
Vancouver Coastal:
included recent change
in transmission rate

Vancouver Island:
included recent
outbreak
(fit suggests that more
than 400 infections
were involved)

Source (D. Karlen). See www.pymp.ca. These models include vaccination but have no age structure. Vertical lines show fitted dates for transmission rate changes. The larger dots show weekly averages.

Closing the circle: Vaccination status by age

December 3rd update includes data through November 27th, 2021



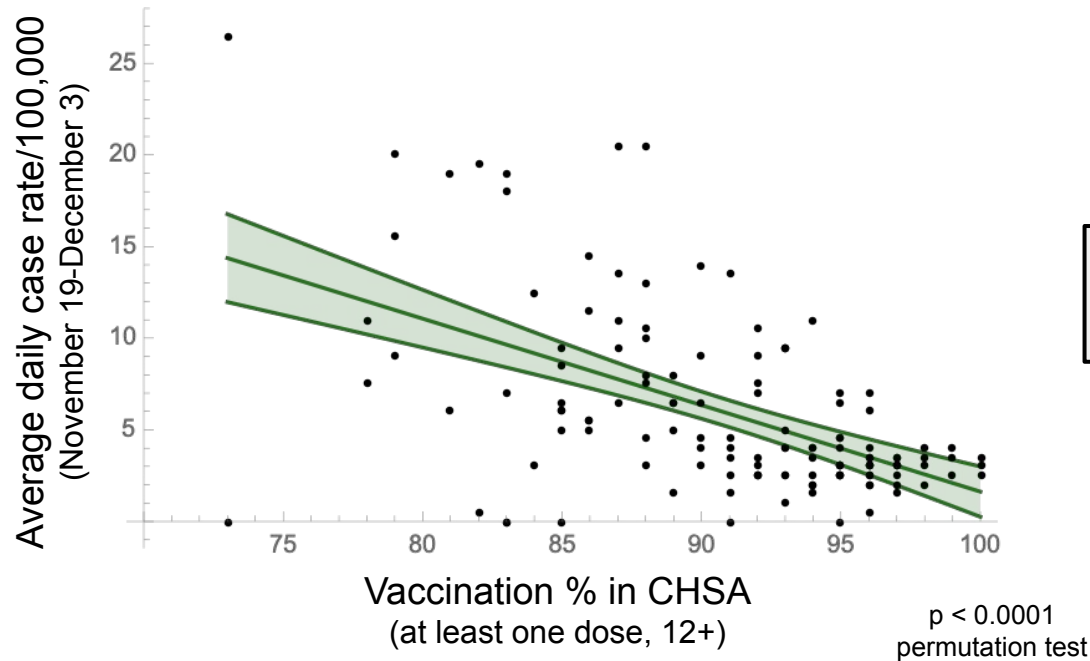
Slight progress:

The fraction of BC's entire population with either one or two doses increased only about 0.4% over the past week.

Adults aged 50-59 are the least vaccinated.

A pandemic of the unvaccinated: Communities at risk

We continue to see a major effect of vaccination levels across Community Health Service Areas (CHSA). For the most recent two-weeks of cases, communities with 95% of eligible people vaccinated have **3.4 times** fewer COVID-19 cases than those with 75% vaccination.



Vaccinations protect communities, as well as protecting individuals.

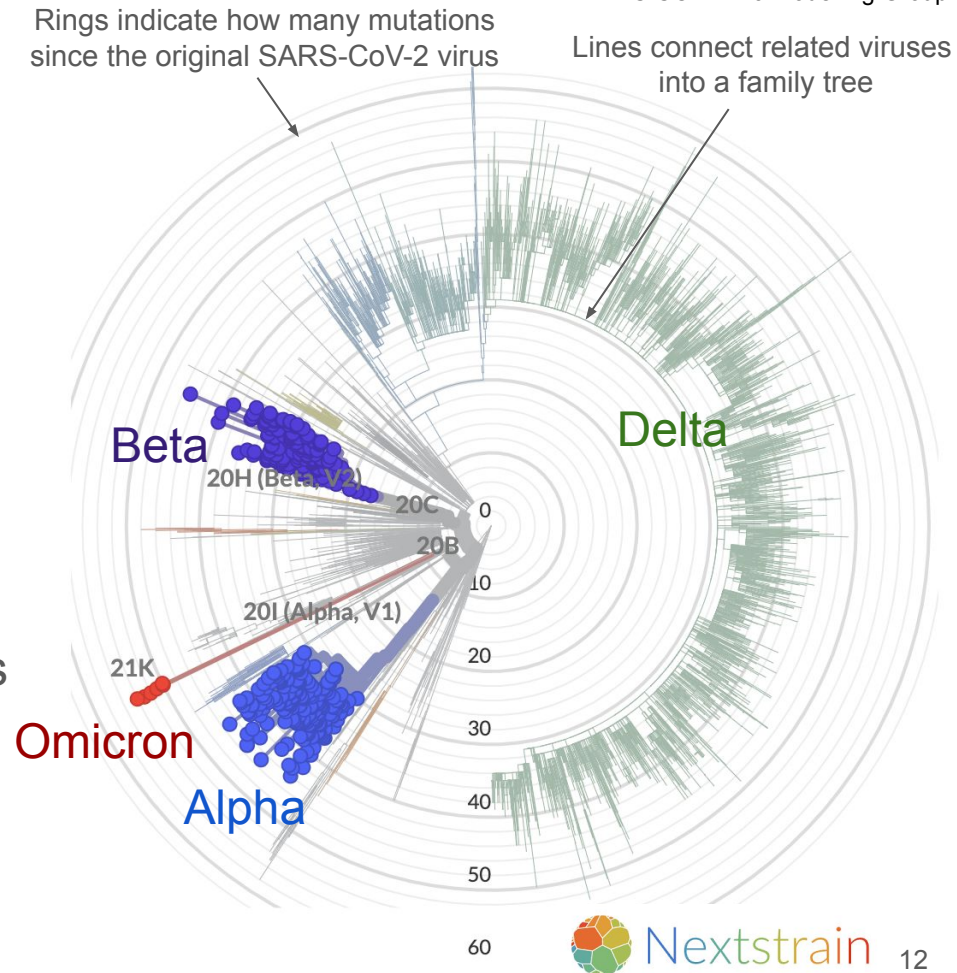
The uncertain future of the pandemic in BC (with Omicron)

A Primer on Omicron

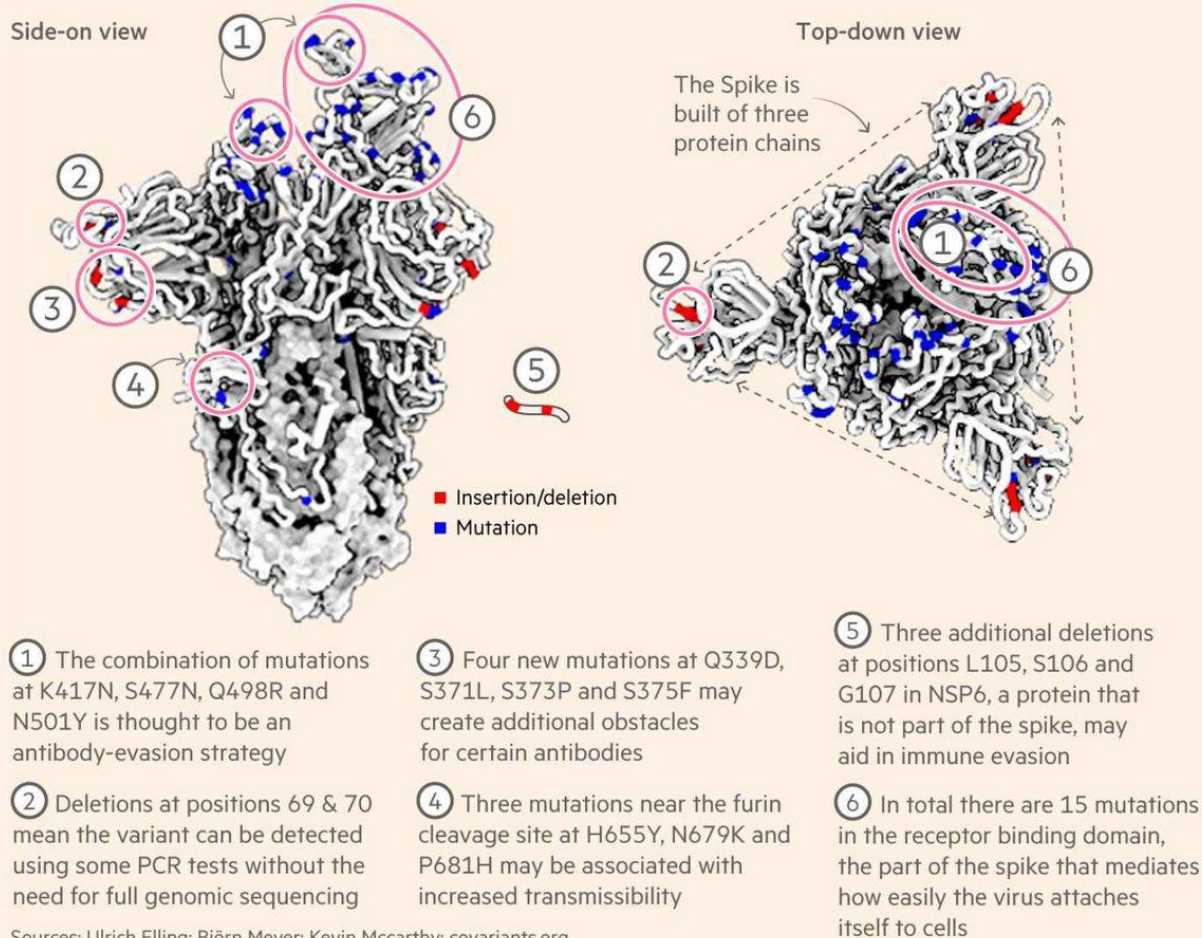
The recent appearance of a new Variant of Concern “Omicron” is raising concerns worldwide.

Why?

- Omicron has more mutations than other variants
- Many mutations (~30) are in the spike protein, including several key mutations
 - known to [increase binding](#) to human cells, which might explain why it is more transmissible
 - known to affect recognition by [some antibodies](#), which may lead to reduced immunity in vaccinated individuals and previously infected individuals



The key mutations that shape Omicron



Sources: Ulrich Elling; Björn Meyer; Kevin McCarthy; covariants.org
© FT

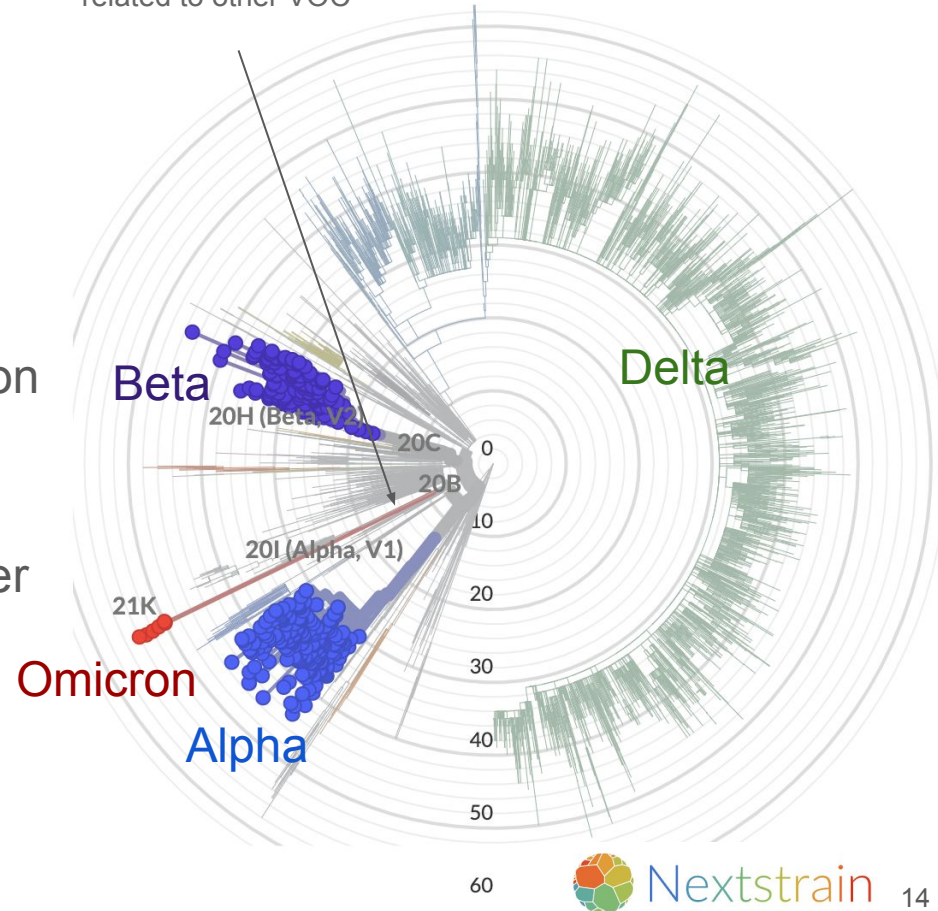
Summary of key mutations
in Omicron's spike protein.
From the *Financial Times*.

A Primer on Omicron

Where did Omicron come from?

- Scientists do not know, but we can tell that Omicron is different from other Variants of Concern.
- Omicron did not arise by simple mutation from another VOC or by recombination
- While the rapid spread of Omicron was first reported in South Africa, many other nations had cases in early November, making its exact origin unknown.

Omicron is not closely related to other VOC



→ **Because Omicron is so different, we have less knowledge about its impacts.**

* Other explanations, such as evolution in a geographically isolated location or in an animal, are possible but **considered less likely**.

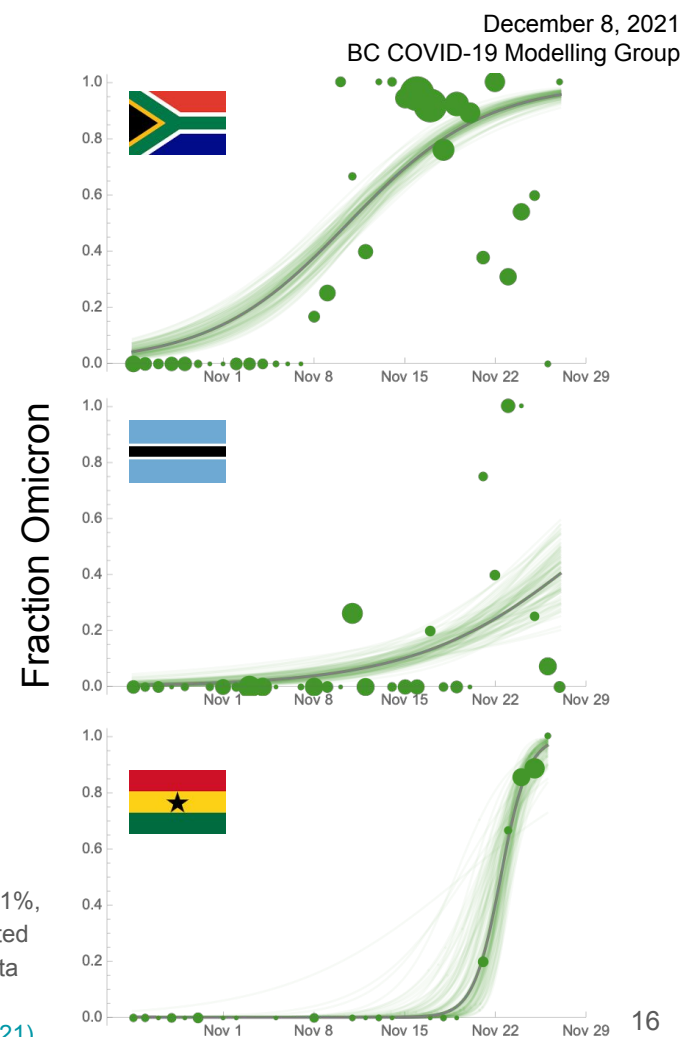
A Primer on Omicron

How fast does Omicron spread?

Genomic data from GISAID in South Africa (top), Botswana (middle), and Ghana (bottom) indicate that the number of Omicron cases has rapidly overtaken that of all other variants, **within a matter of weeks**. By comparison, similar changes took 2-4 months with Alpha or Delta.

Caveat: Genomic data are likely biased because only a small and non-random sample of cases are chosen for sequencing & country-wide estimates obscure what happens locally.

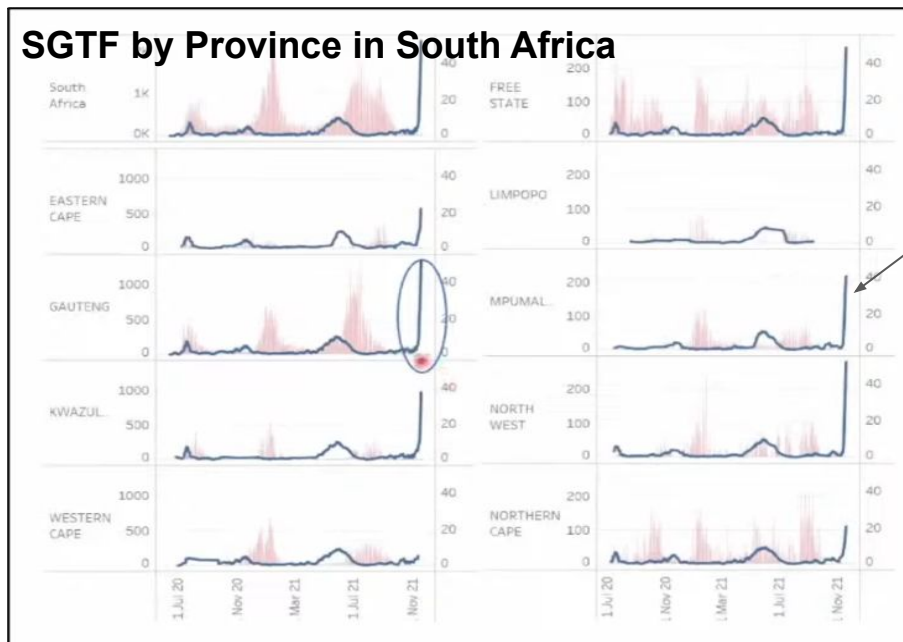
Source (S. Otto). Estimated selection coefficients are $s=19\%$ (15%-23%, $n=359$) in South Africa and $s=15\%$ (8%-21%, $n=219$) in Botswana. Ranges describe minimum amount of uncertainty, accounting only for the 95% range expected from random sampling of sequences. Estimates from Ghana are too uncertain to estimate s ; too little genomic data exist for Omicron from other countries. For context, Alpha had a $s = 6\text{-}11\%$ advantage per day over preexisting SARS-CoV-2 lineages, and Delta had a $s = 9.8\%$ advantage per day over Alpha. See methods in [Murall et al. \(2021\)](#).



A Primer on Omicron

How fast does Omicron spread?

Better data, which includes every tested case, is available if we look at the rise in the frequency of a particular deletion within South Africa (S:Δ69-70 or “spike-gene target failure”, SGTF). This genetic deletion occurs in most Omicron but not in other variants present in South Africa.



The frequency of S:Δ69-70 has risen rapidly across provinces in South Africa, consistent with strong selection [\[Olivieri in Health Dept of South Africa report\]](#)

Numbers of cases remain small in most provinces, but large amount of data from Gauteng (circled) suggests $s = 21\%$ (95% CI: 15%-28%) [\[Pearson et al.\]](#)

Preliminary data from the UK show similar signals, suggesting $s = 13\%$ per day [\[UK Technical Briefing 30\]](#).



A Primer on Omicron

How fast will Omicron spread in Canada?

This question **cannot be answered**, because we do not know how much of Omicron's advantage comes from transmitting better to those with no prior exposure, how much comes from reinfecting those who have had COVID-19 (Omicron reinfection rates are about double that of Delta, [Pulliam et al.](#)), and how much comes from transmission among vaccinated people.

What we do know:

- Fewer South Africans than Canadians have been fully vaccinated (25% vs 76% of the entire populations)
- More South Africans have had COVID-19 (~40% accounting for 3M known cases and [8 fold underreporting](#))
- Globally, many fully vaccinated travellers have caught Omicron
- Anecdotal evidence of rapid airborne transmission between fully vaccinated participants at gatherings
- A lab study with Omicron virus finds [neutralizing antibody protection](#) from vaccines drops but is not lost

→ **Substantial risk of rapid spread in Canada, even among vaccinated**

A Primer on Omicron

How fast will Omicron spread in Canada?

If Omicron spreads approximately as rapidly in Canada as seen in South Africa and UK, with selection per day between 10% (low) and 20% (high), all provinces would see rapid growth in cases, with Omicron dominating in the next month.

| | BC | AB | SK | MB | ON | QC | NB |
|---------------------------|---------|---------|---------|--------|--------|--------|--------|
| Recent growth per day | -0.03 | -0.06 | -0.05 | +0.01 | +0.02 | +0.01 | +0.03 |
| ...with Omicron (low) | +0.07 | +0.04 | +0.05 | +0.11 | +0.12 | +0.11 | +0.13 |
| ..with Omicron (high) | +0.17 | +0.14 | +0.15 | +0.21 | +0.22 | +0.21 | +0.23 |
| Doubling time of O (low) | 10 days | 17 days | 14 days | 6 days | 6 days | 6 days | 5 days |
| Doubling time of O (high) | 4 days | 5 days | 5 days | 3 days | 3 days | 3 days | 3 days |

A Primer on Omicron

How fast will Omicron spread in Canada?

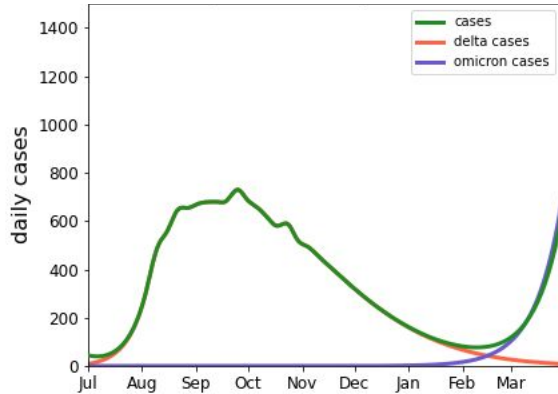
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| | BC | | | | | | | B |
|---------------------------|---------|---------|---------|--------|--------|--------|--------|----|
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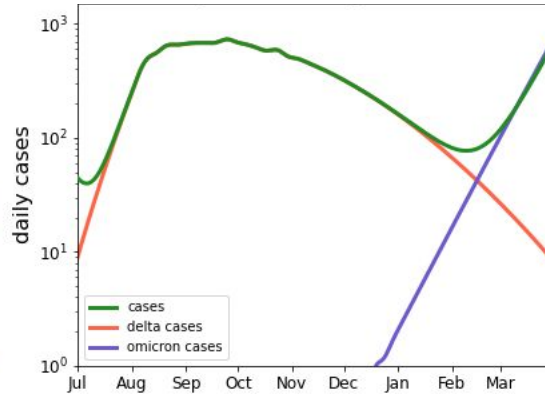
What would these growth rates per day mean for the pandemic in BC?

BC projections for Omicron with daily growth of 7% and 17%

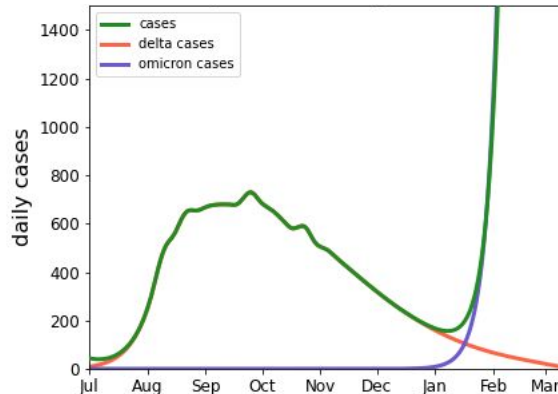
7% (linear scale)



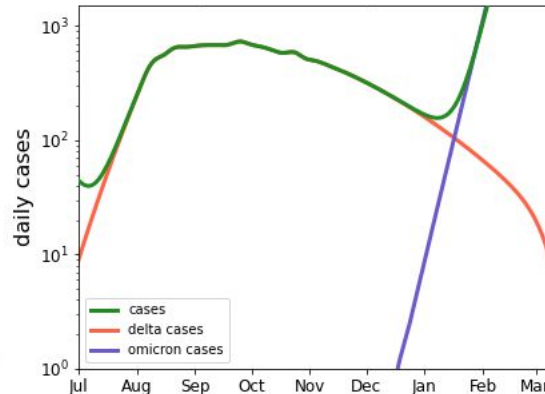
7% (log scale)



17% (linear scale)



17% (log scale)



Model assumptions:

- Maintain current health measures
- Community transmission of Omicron starting in mid-December

Findings:

- 7% daily growth would be similar to the start of the fourth wave (July/August)
- 17% daily growth would give little time to respond with additional measures

The fraction of cases leading to hospitalization and deaths is unknown. If unchecked, health care demands will grow rapidly, as seen in South Africa.

A Primer on Omicron

What does Omicron mean for our health?

Very preliminary data indicates that COVID-19 with Omicron:

- may be associated with [mild symptoms](#), especially among vaccinated individuals
- may be more [common in children](#)
- has led to a [rise in hospitalized cases](#) in South Africa, [predominantly among unvaccinated individuals](#)

→ **Getting vaccinated now, including eligible children, trains the immune system and will help avoid severe disease, even with Omicron.**

→ **A rapid rise in cases will inevitably increase the number of severe cases, especially among the unvaccinated, and will impact the medical care system.**

The uncertain future of the pandemic in BC with Omicron

Data on Omicron is scant and should be interpreted cautiously

- Rates of spread in highly-vaccinated populations in Canada may differ from those observed in South Africa and elsewhere
- Risks of *severe disease*, *hospitalization*, and *death* are not yet well-defined for this variant. It may take many weeks before adequate data is compiled to estimate these risks and distinguish between vaccinated vs unvaccinated people, different age groups and co-morbidities, etc.
- Nonetheless, we believe there is a significant risk of a new wave of infection. We will monitor the situation over the next weeks with the goal of providing the best possible forecasting for BC.

Our best protection against Omicron is to use the tools that we have already learned: **get vaccinated, wear tight fitting masks, avoid large gatherings, isolate when sick, improve ventilation, increase testing, & trace contacts to limit spread of Omicron.**