COVID Model Projections

November 24, 2021

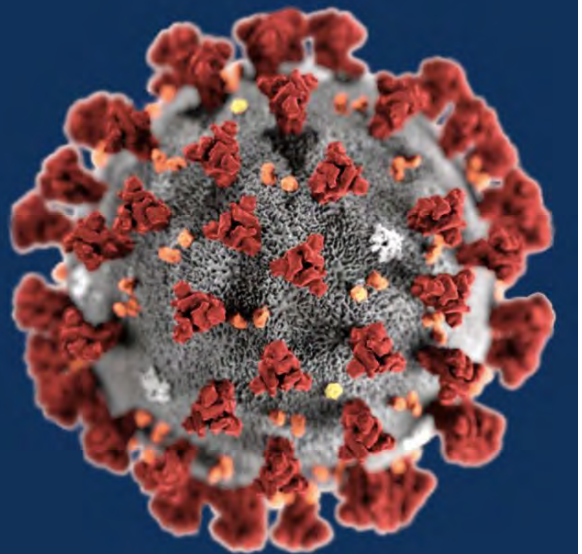
BC COVID-19 Modelling Group

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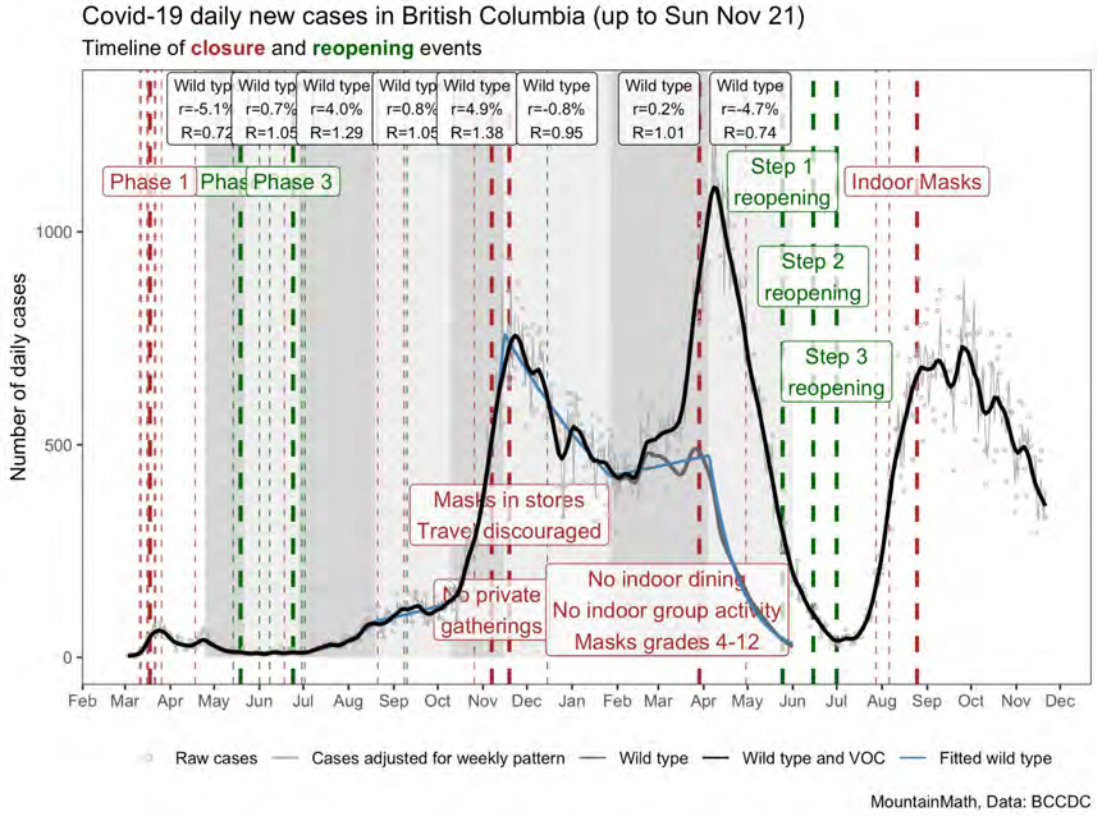
Independent and freely offered advice, using a diversity of modelling approaches.

Overview

State of the pandemic in BC:

- Case rates continue to decline slowly.
- Cases remain higher among children under 10, but not substantially higher
- All regions show declining case rates, following projections from previous reports
  - Northern Health continues to have the highest case rate per person.
- Short-term projections predict continued declines in cases and hospitalization rates
- Vaccine uptake
  - Very few people are now being vaccinated for the first time (0.2% per week)
  - 18-49 year olds are now more vaccinated than people 50-59 (at least 1 dose)
- Communities that are highly vaccinated have much lower COVID rates
  - 95% vaccinated communities have 5.1 times fewer cases than those with 75% vaccinated (12+)
- Vaccines have reduced the risk of infection 8.8-fold and hospitalization 21.4-relative to the risks faced by unvaccinated people; this protection has remained stable over the fall
- New variants within Delta are emerging
  - AY.25 and AY.27 subvariants of Delta now make up the majority of cases in BC
  - These subvariants are weakly favoured and do not display the strong advantage seen with Alpha or Delta

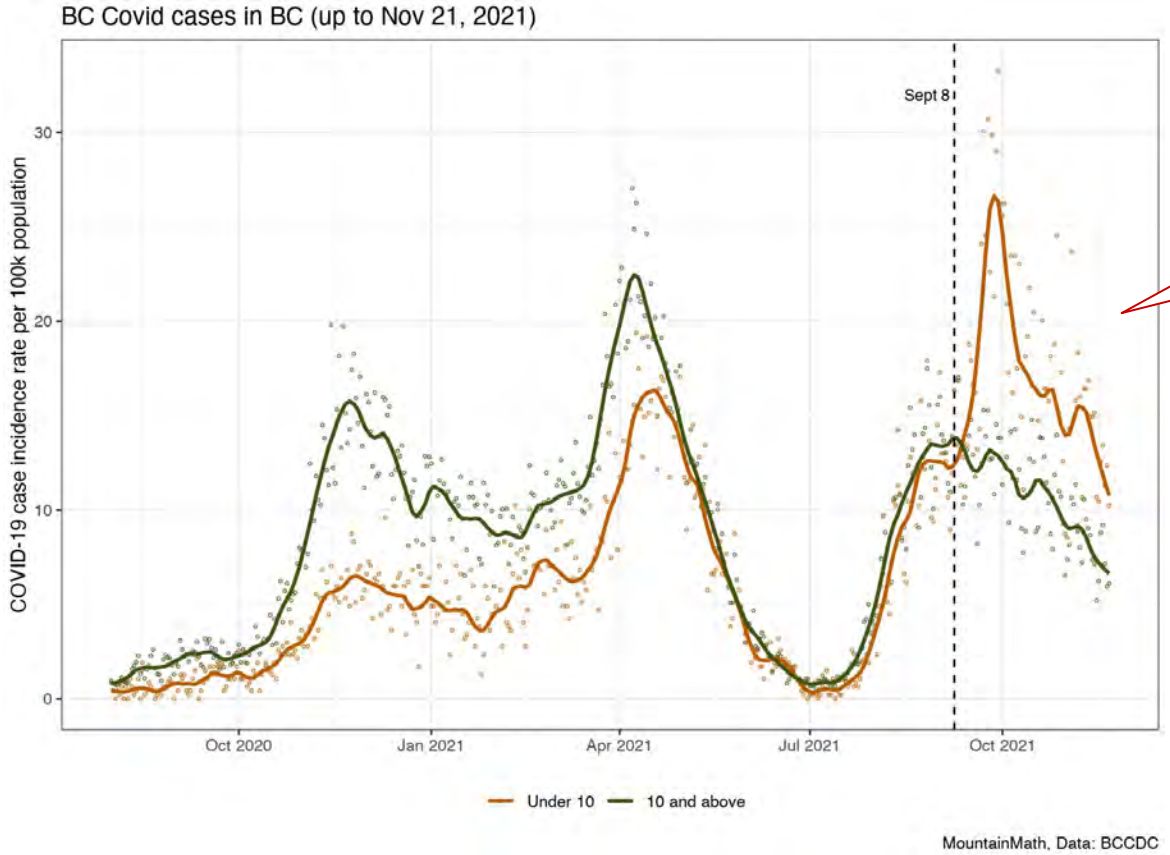
State of the COVID-19 Pandemic in BC



Indoor masking, proof of vaccination requirements, and localized measures in regions with high case counts (Interior and Northern Health Authorities) stabilized cases through the fall.

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)

State of the COVID-19 Pandemic in BC



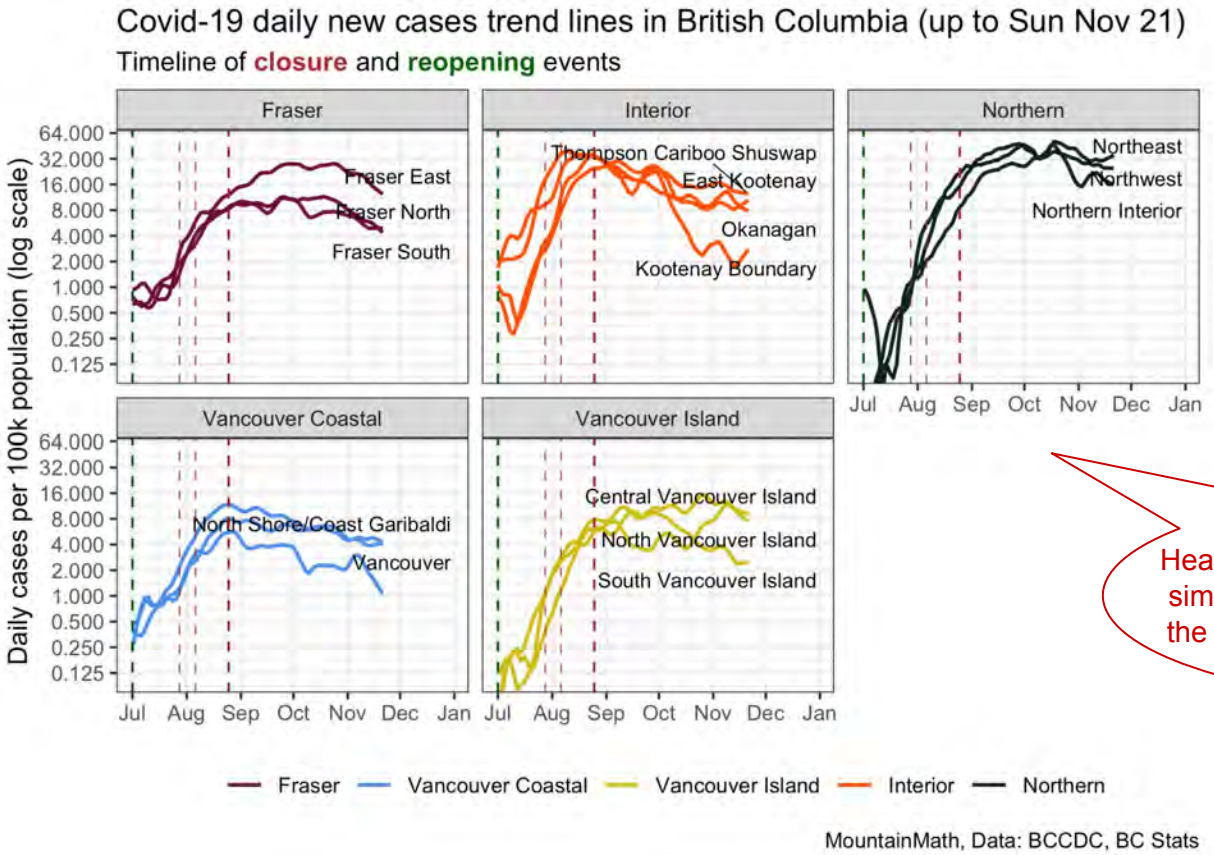
Rapid rise in <10 cases has largely reversed.

The rapid rise and fall in cases in this age group suggest more out-of-school contacts at the end of summer & beginning of the school year, stabilizing afterwards.

Testing also increased, but our previous analysis* suggested the increase in testing was caused by an increase in cases among school-aged children and not vice versa.

Source (J. von Bergmann) Case data from BC COVID-19 Database (http://www.bccdc.ca/health-info/diseases-conditions/covid-19/data). *See slide 10 in October 7 report: there was no evidence for an increase in background testing in the fall for school-aged children, instead the rise in testing reflected the rise in cases.

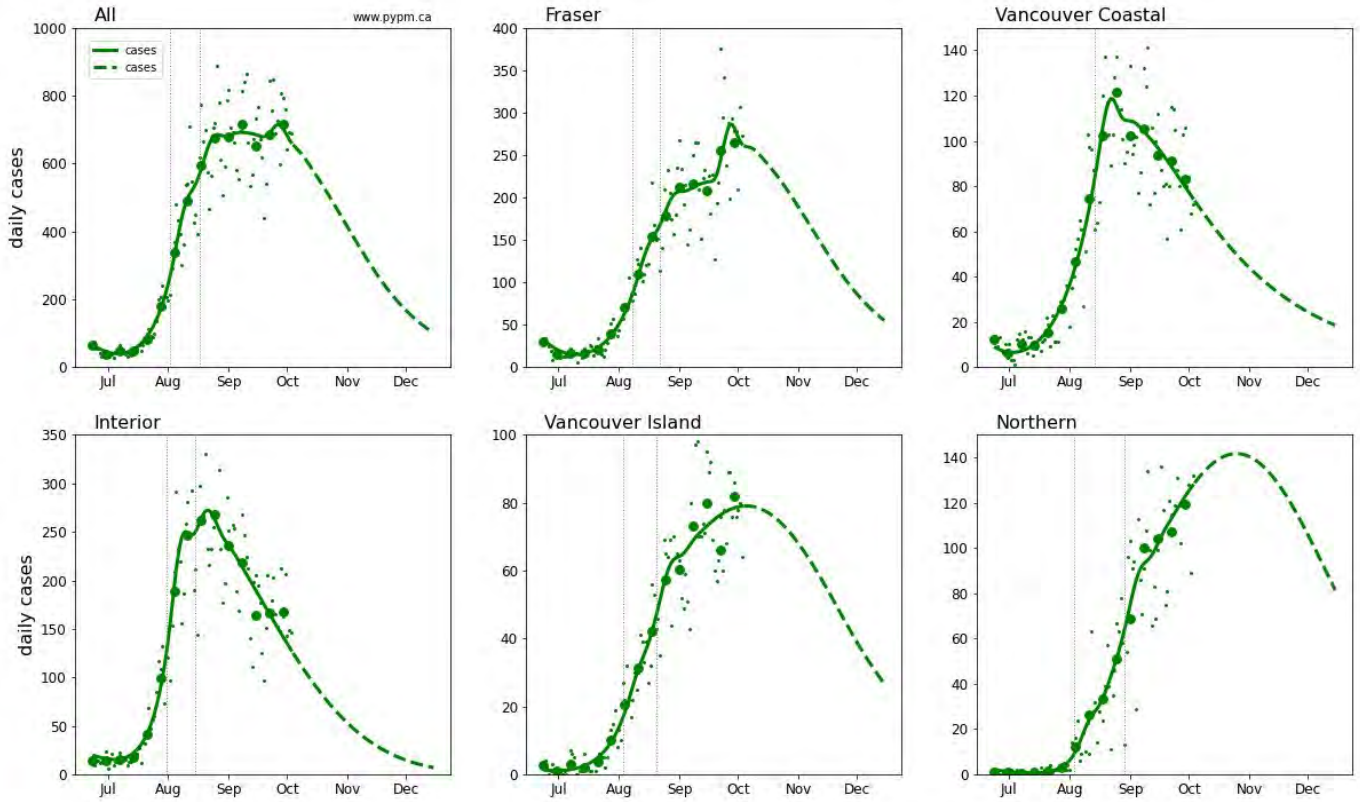
State of the COVID-19 Pandemic in BC



Health Service Delivery Areas (HSDA) follow similar trends within a Health Authority, with the highest per-capita case rates continuing in Northern Health.

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). STL trend lines on log scale.

Older fits to BC data (from October 7 report)

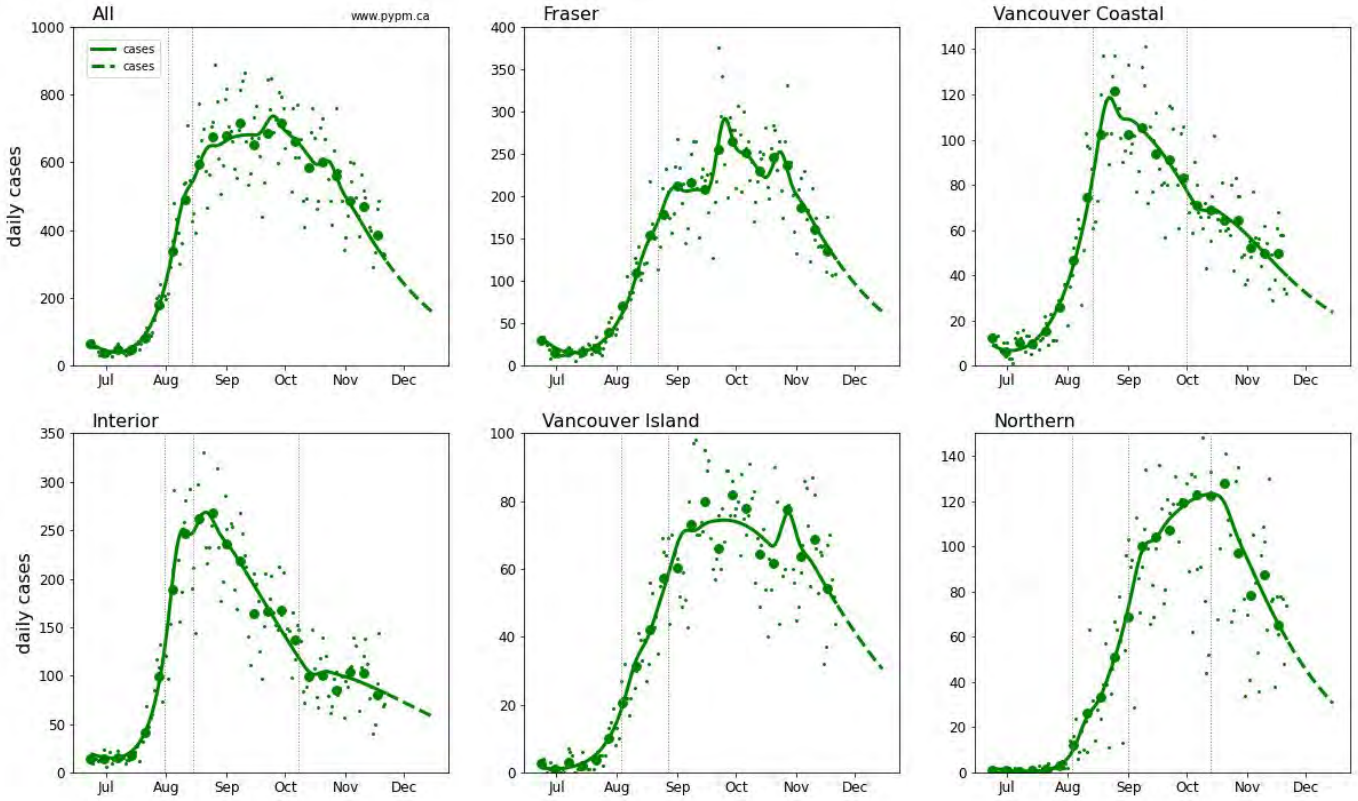


These show the model fits that were used for our report 7 weeks ago.

The projections assumed constant transmission rate after September 1. The declining growth rate (going negative) in the model is due to growing immunity of the population.

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. These fits were appeared in log scale in the October 7 report in which the projection was only shown until the beginning of November.

Current fits to BC data



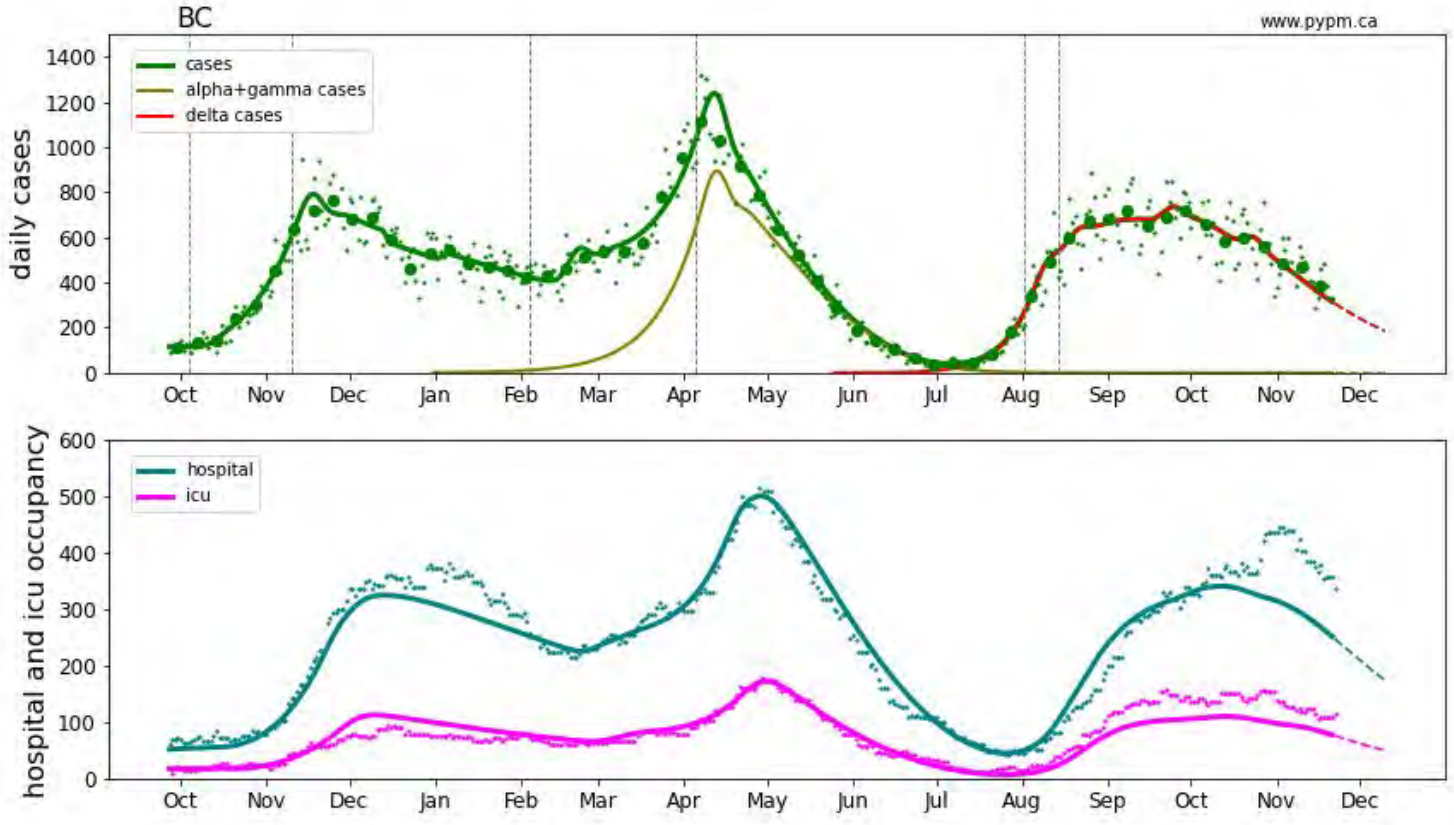
The data collected since October 7 follow the projected trends.

Deviations from the projections:
- outbreaks in Fraser and Island
- transmission rate increases in Coastal and Interior (early-Oct)
- measures brought in for Northern (mid-Oct)

It is unusual to see 7-week projections to match this well.

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.

Estimating demands on health care



The COVID-19 pandemic is tracked using positive tests (cases), yielding an infection model (green curve).

The infection model well describes past hospital occupancy.

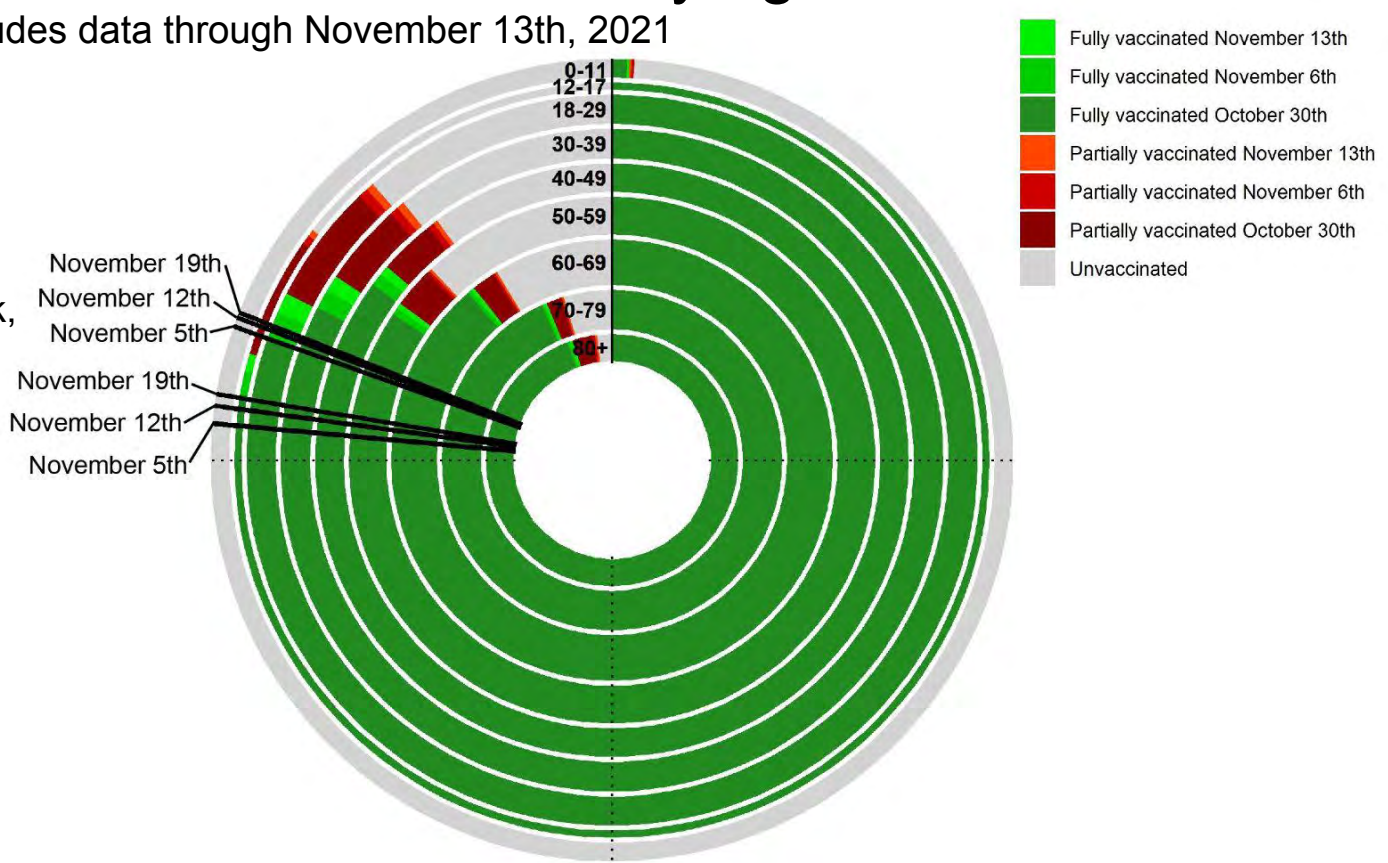
Recent hospital and ICU occupancies exceed projections calibrated by data from the third wave.

Source (D. Karlen). See www.pypm.ca. These models include vaccination but have no age structure.

Closing the circle: Vaccination status by age

November 19th update includes data through November 13th, 2021

Slight progress:
The fraction of BC's entire population with one or two doses increased only 0.2% and 0.5% over the past week, respectively.

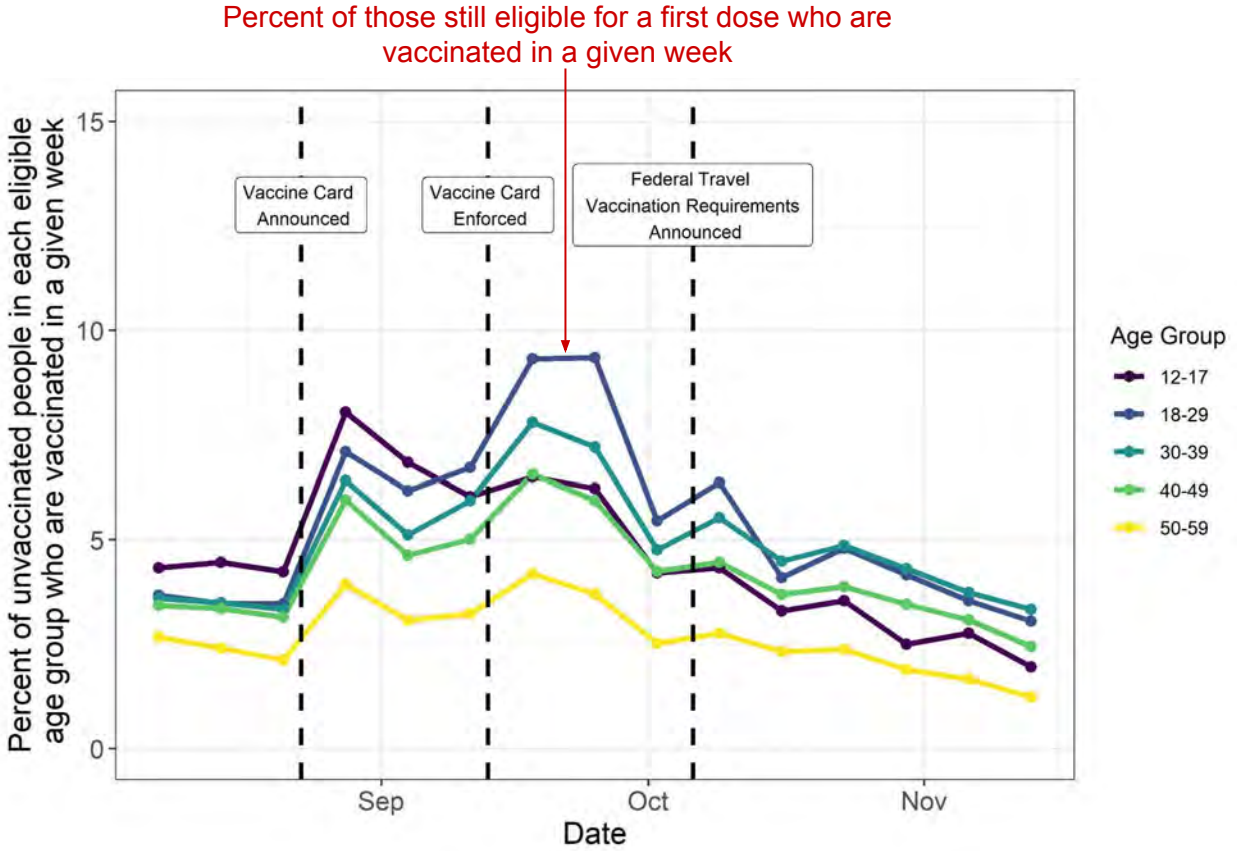


Source (B. Wiley). Design by Blake Shaffer (https://blakeshaffer.shinyapps.io/app_vaccines/) BC Vaccination data from https://health-infobase.canada.ca/covid-19/vaccination-coverage/, with area of each circle segment proportional to BC's population in that age class. BC 2021 Population projections for vaccination percentages from BC Stats: https://www2.gov.bc.ca/gov/content/data/statistics/people-population-community/population/population-projections

Slow movement on vaccinations in BC

Slowing progress:
Fewer of the remaining unvaccinated are seeking vaccinations each week.

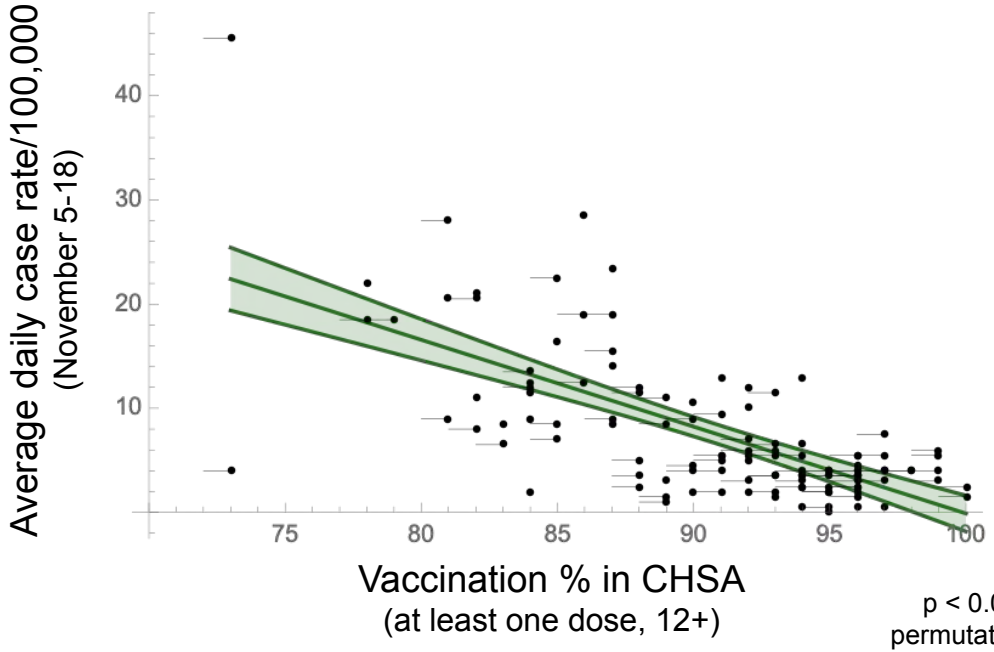
The availability of vaccines for 5-11 year olds will increase their protection from COVID-19 and the overall level of vaccination, protecting their families and communities.



Source (B. Wiley). BC Vaccination data from https://health-infobase.canada.ca/covid-19/vaccination-coverage/. BC 2021 Population projections for vaccination percentages from BC Stats: https://www2.gov.bc.ca/gov/content/data/statistics/people-population-community/population/population-projections

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 **5.1 times** fewer COVID-19 cases than those with 75% vaccination.



Check out the animation!

Thin lines show vaccination progress over the past two weeks.

Vaccinations protect communities, as well as protecting individuals.

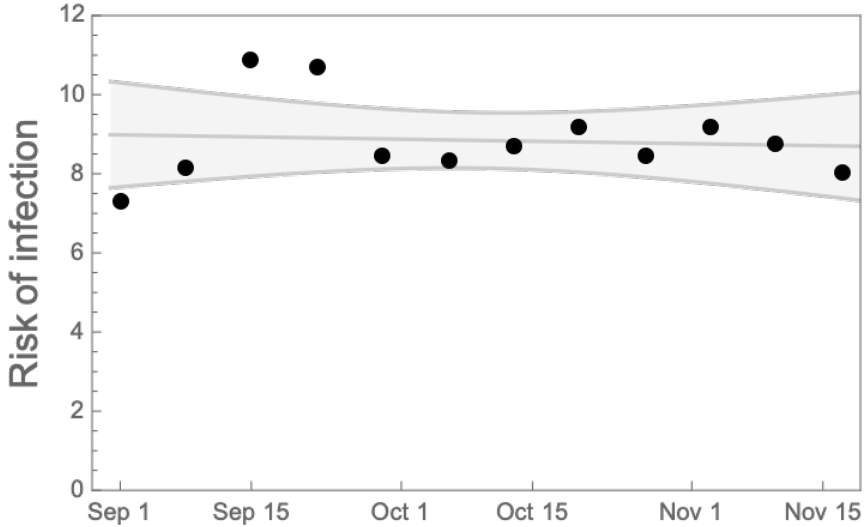
Source (S. Otto). BCCDC data portal's surveillance dashboard data; see maps for regions that would most benefit from community vaccination drives (accessed October 25, 2021).

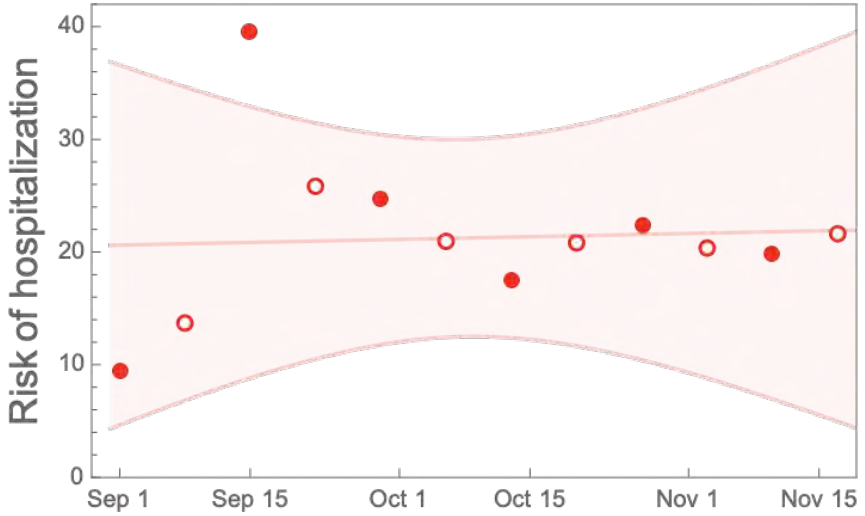
http://www.getvaccinated.gov.bc.ca

No signs of waning immunity at a population level

The risk of COVID-19 for an unvaccinated person relative to a fully vaccinated person has remained stable over the past three months in BC. Being unvaccinated increases the relative risk of infection by an average of 8.8 fold (left) and the risk of hospitalization by an average of 21.4 fold (right).

[Relative risks are for an average person (age corrected) and do not reflect patterns in specific ages.]



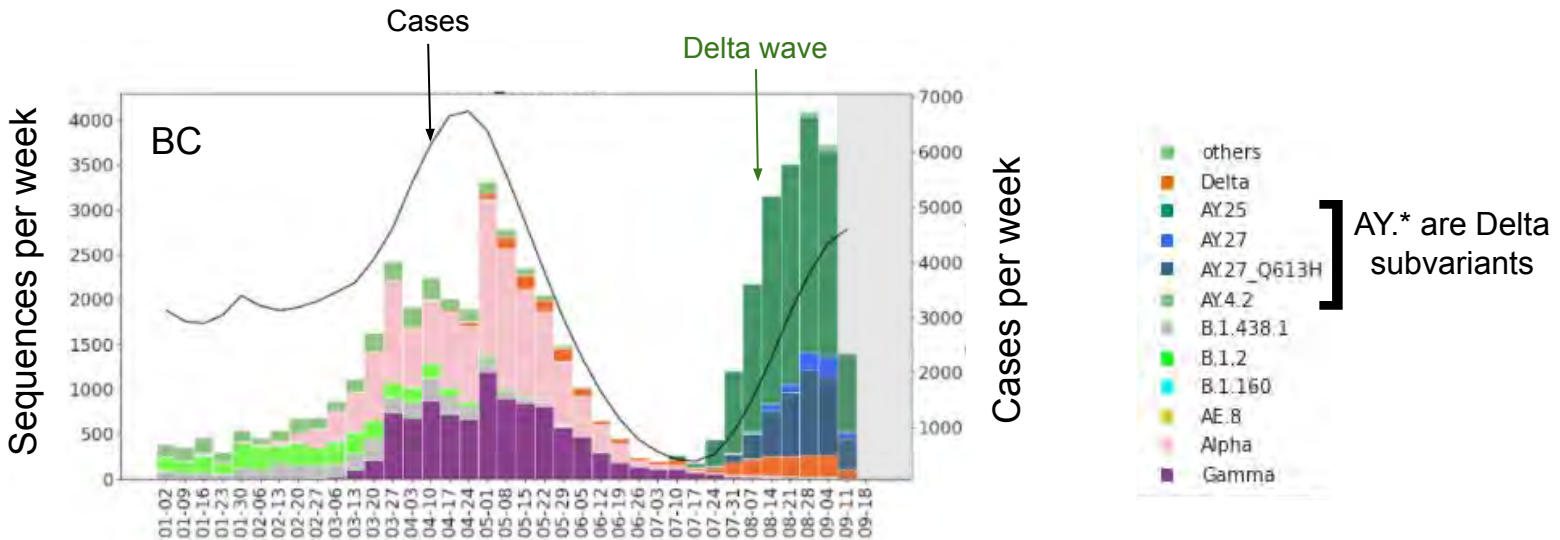


Source (S. Otto) Risks for unvaccinated and fully vaccinated per person (age corrected) were obtained from the daily BC Gov News reports. Because risk of infection is calculated across the past week, we use only data from only one day per week (Wednesday). Risk of hospitalization is calculated over the past two weeks of data, so we fit the data from every other week (analysing solid and hollow dots separately) and average the results.

Delta subvariants

Across Canada, two subvariants of Delta have been spreading: AY.25 (dark green) and AY.27 (dark blue). AY.25 is common in the United States and differs mainly in genes outside of spike. AY.27 carries one of the same spike mutations (A222V) as “Delta Plus” (AY.4.2) but is almost only found in Canada.

In BC, AY.25 rode the “Delta wave” in July/August, rising rapidly to high numbers. AY.27 has risen more steadily.

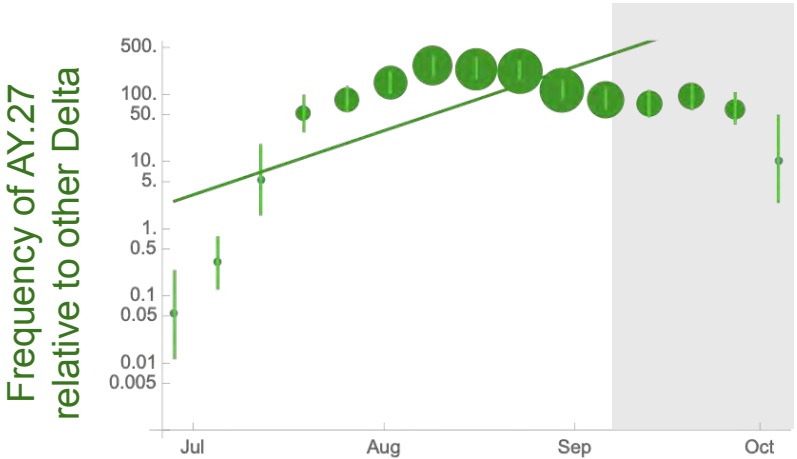


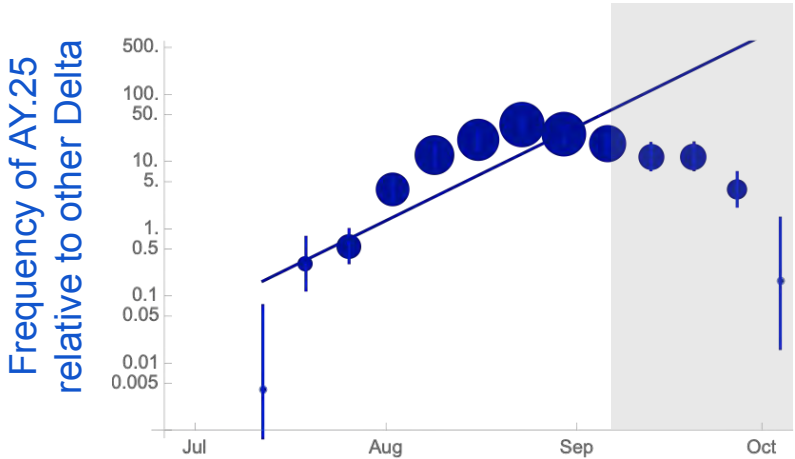
Source (S. Otto). See Virological post (Murall et al.) for more details. Gray shading indicates period with much less complete sequence information. Dates are the collection dates of the sample for testing and sequencing.

Delta subvariants

The selective advantage of AY.25 and AY.27 over other Delta is estimated at 2-6% per day across provinces, seen in these plots for BC as a rising trend in the frequency relative to other Delta.

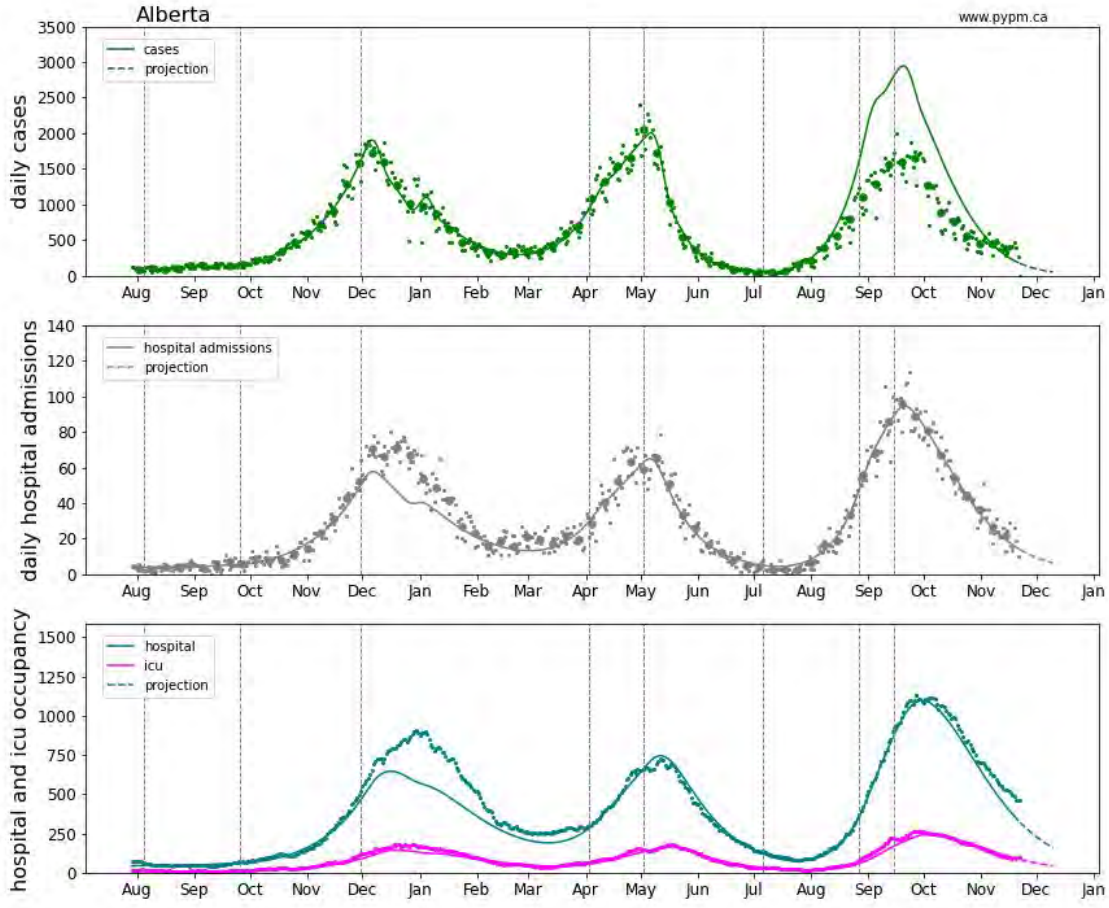
While spreading, the selective advantage of AY.25 and AY.27 over Delta is milder (less than half) that seen for Alpha over pre-Alpha or for Delta over Alpha.





Source (S. Otto). See Virological post (Murall et al.) for more details. Gray shading indicates period with much less complete sequence information. “Other Delta” includes B.1.617.2 and other AY.* (not including AY.25 and AY.27).

Alberta update



Fits hospital admission data (grey) rather than case data.

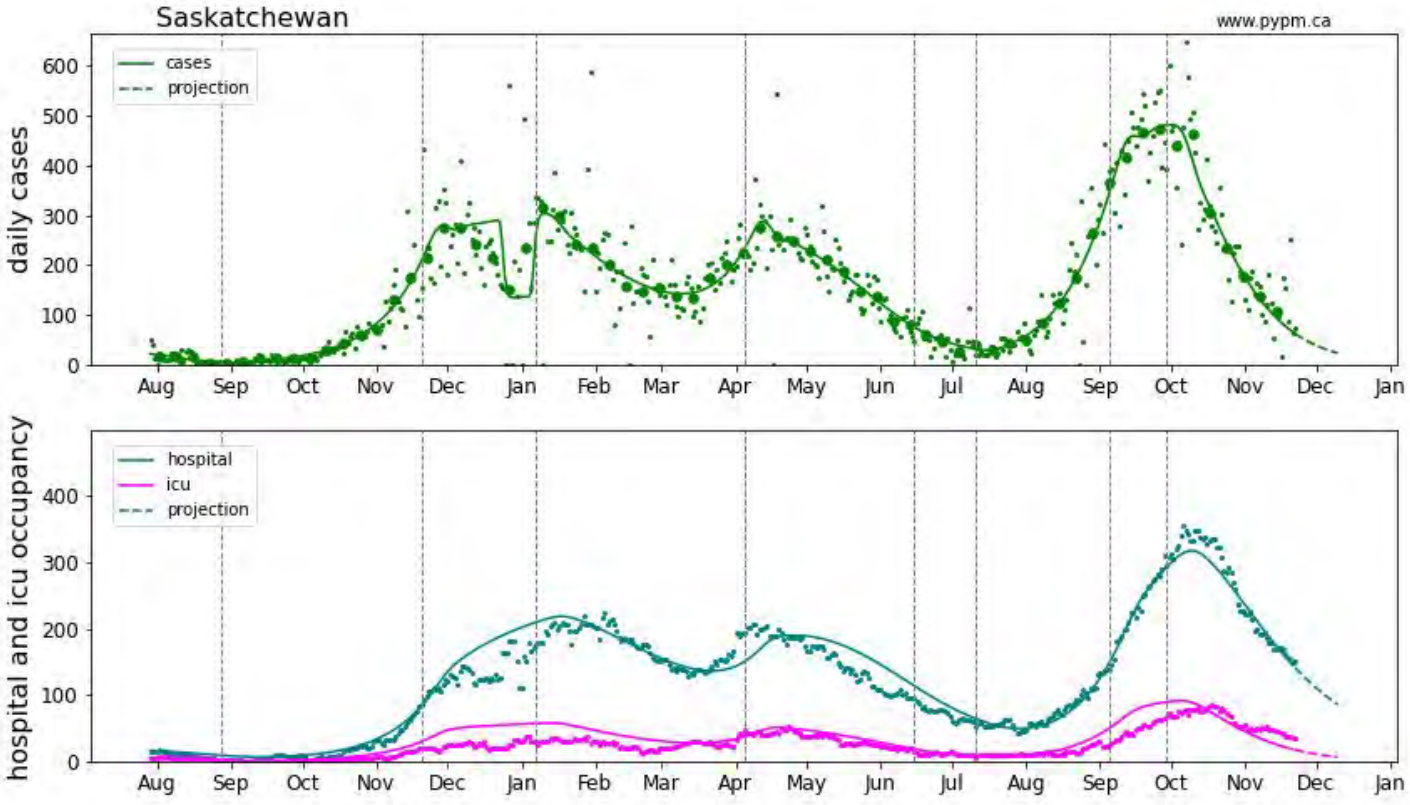
The October 7 report showed that case rates could no longer be relied upon to track infection rates, likely due to changes in testing practice. Hospital admission data indicated a significant reversal in growth, coinciding with measures announced on September 15.

Drop in hospitalization has followed our previous projections.

This analysis indicates that many more infections went undetected in the 4th wave.

Source (D. Karlen): COVID-19 Alberta Statistics, www.pypm.ca

Saskatchewan update



The rapid decline in infection rates continue to follow projections from previous reports.

Hospital occupancy decline follows projections derived from the case history.

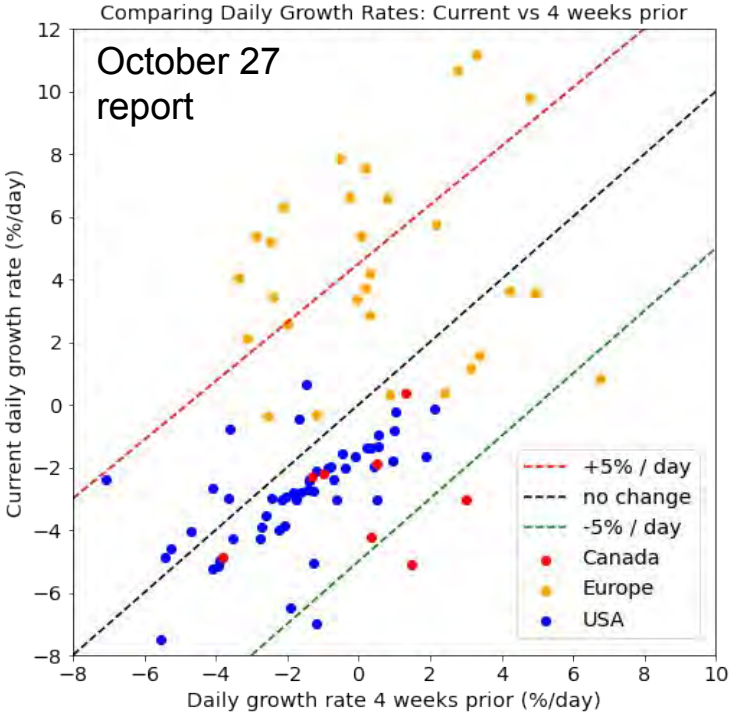
Source (D. Karlen). See www.pypm.ca. These models include vaccination but have no age structure.

Trends in Canada, USA, and Europe

Source (D. Karlen): www.pypm.ca

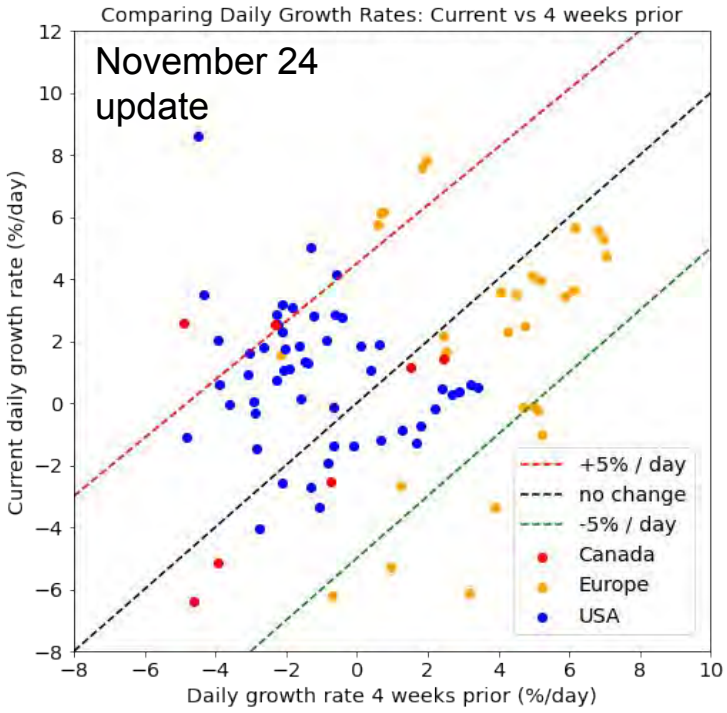
From October 27 report:

- USA and Canada growth rates: negative and about 2%/day less than 4 weeks prior.
- Europe growth rates: dramatic increase



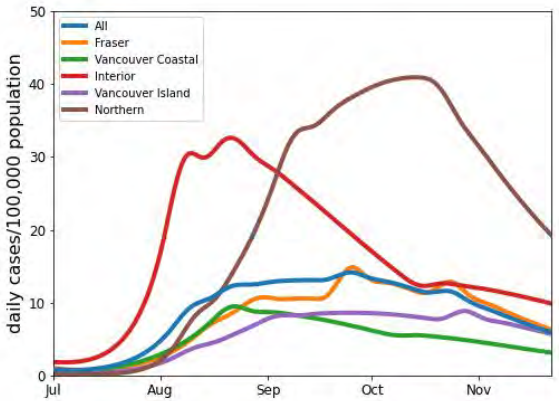
Update:

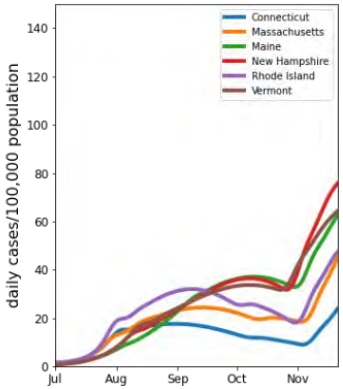
- USA and Canada growth rates: several are about 5%/day greater now than 4 weeks prior.
- Europe growth rates: some reductions

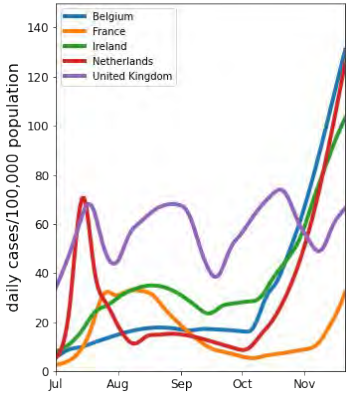


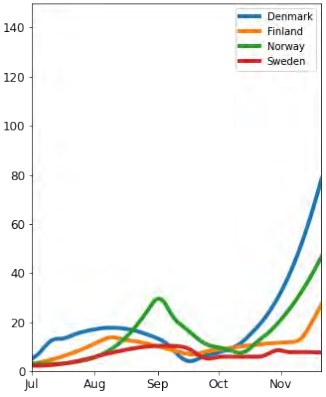
Comparing case prevalence: Canada, USA, Europe

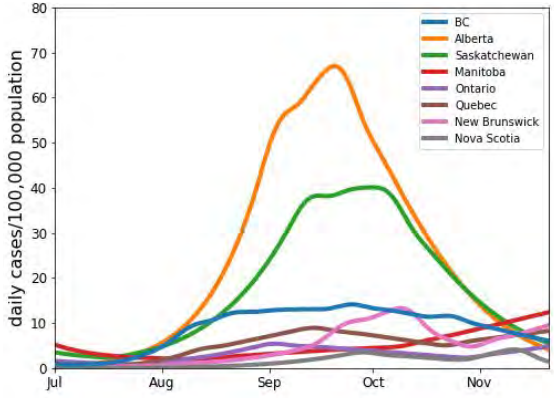
Source (D. Karlen): www.pypm.ca

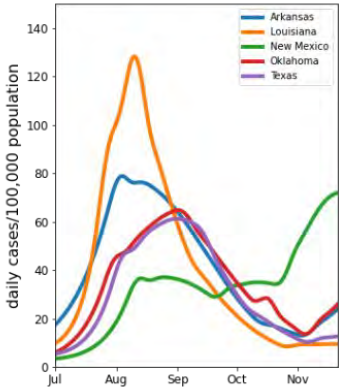


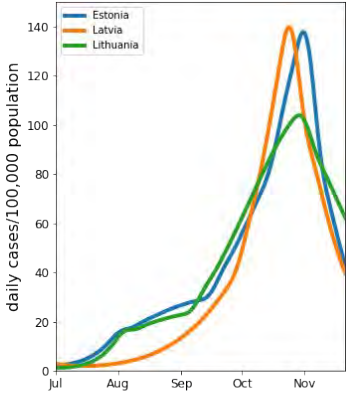


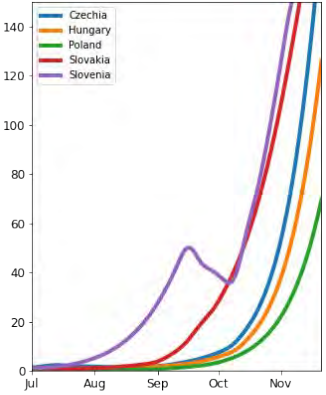












Key messages

State of the pandemic in BC:

- The COVID-19 pandemic in BC, largely following projections from October, is now declining at a rate of about 2.5% per day
- Vaccination rates have slowed considerably.
- There is no indication of significant waning of vaccination immunity at the population level.
- Two Delta subvariants are predominant in BC, AY.25 and AY.27, which have a weak selective advantage over other Delta types. We will continue to monitor COVID-19 as it evolves for variants that affect the disease.

Alberta and Saskatchewan: Case and hospitalization rates are declining, following earlier projections.

USA and Europe: Many jurisdictions are seeing rapid growth in case and hospitalization rates.

Maintaining health measures will help BC avoid the 5th wave that is now underway in many other jurisdictions. Increased immunization, including among the now eligible 5-11 year olds, will eventually allow a relaxation of those measures without infections growing rapidly.