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Omicron BA.4/BA.5 epidemic analysis: Victoria

Modelling from 22 July 2022

This work was commissioned by the Victorian Department of Health

Aim and scenarios

AIM: To understand the possible epidemic trajectory of the BA.4/BA.5 variants in Victoria, explore hypotheses about the rapid increase in hospitalizations recently observed, and assess the potential impact of masks.

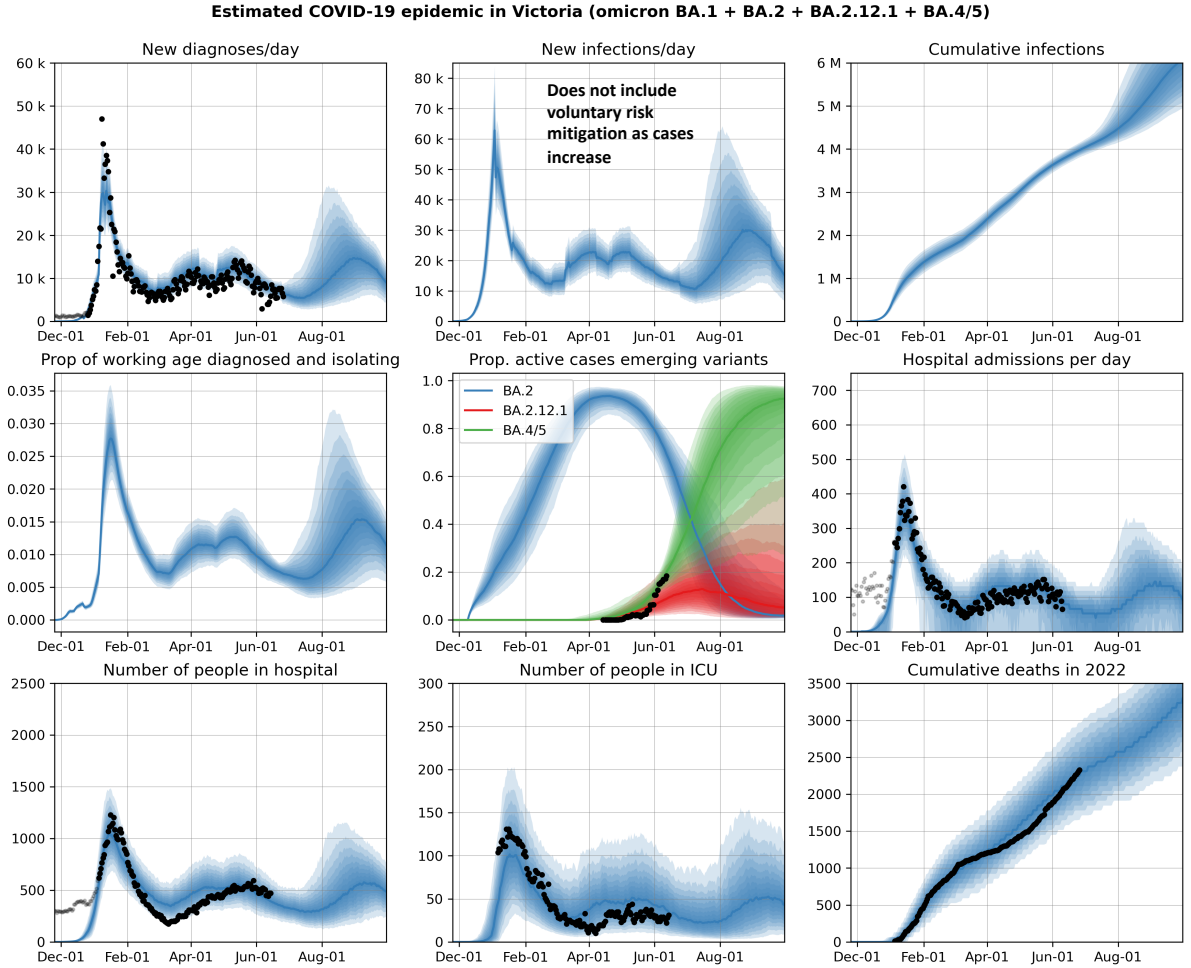
Scenarios include:

1. Baseline:
   - BA.4/BA.5 characteristics (infectiousness, cross-immunity, vaccine immune escape) were sampled to fit wastewater data.
   - Testing, quarantine, isolation, and policy scenarios based on Victorian settings (see appendix).

2. Masks, in addition to aged care and public transport: in schools +/- indoor settings (25%, 50% or 100% coverage / compliance).

Recap: 28 June modelling

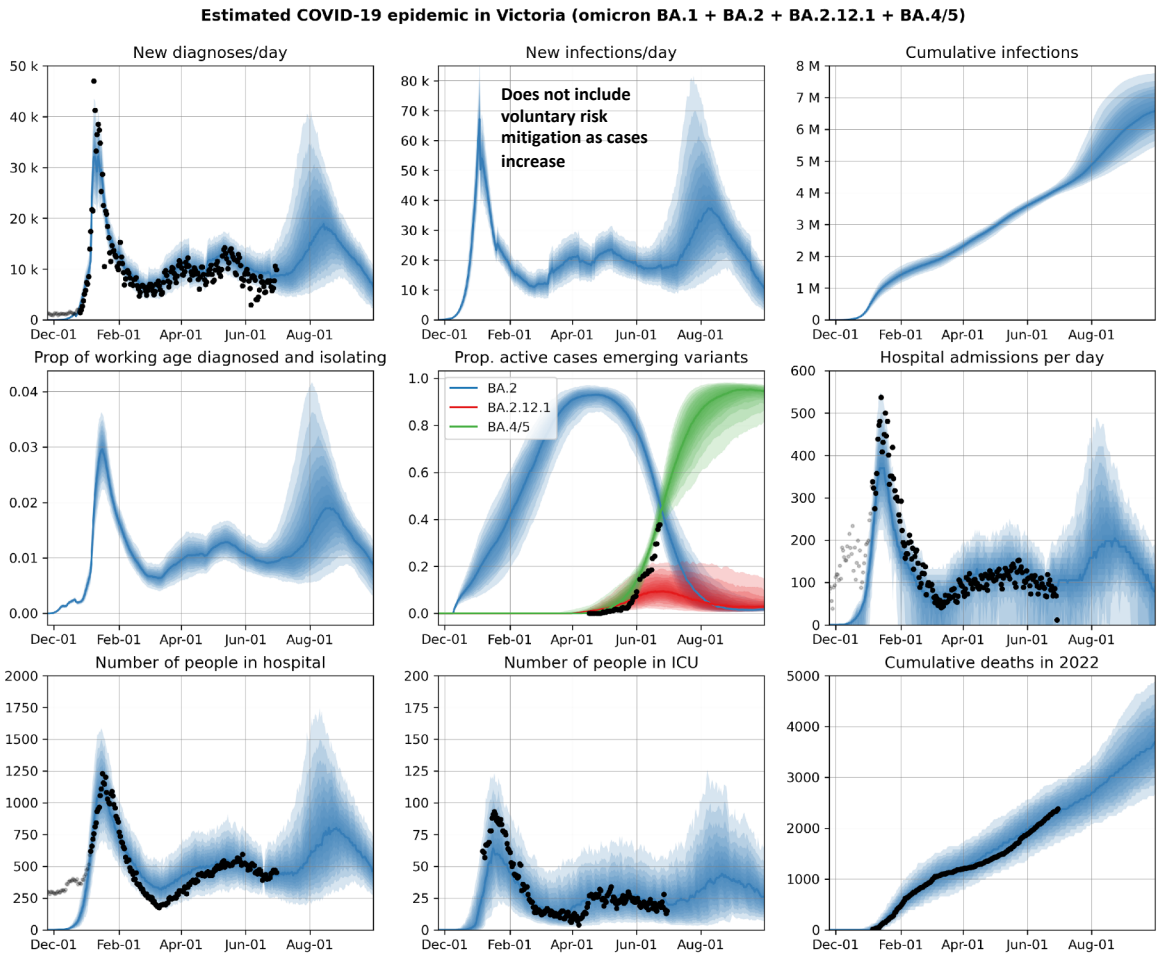
- This modelling was conducted with information available at 27 June
- Cases and hospitalisations due to BA.2 were declining at the time.
- The BA.2.12.1 variant did not appear to have sufficient advantage to become dominant.
- BA.4/BA.5 was expected to become dominant quickly.
- BA.4/BA.5 was expected to prevent the epidemic decline from continuing, leading an increased case trajectory.



Recap: 7 July modelling

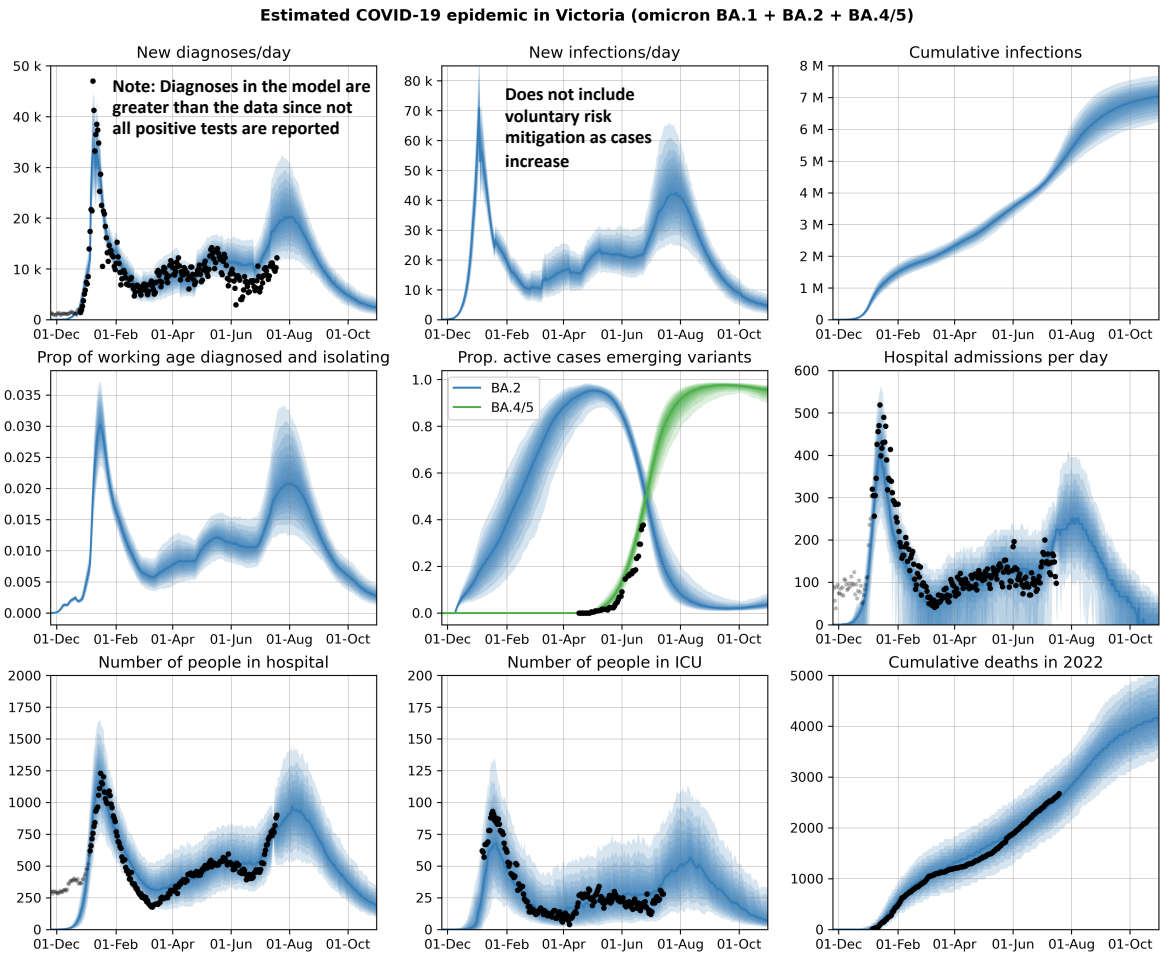
- This modelling was conducted with information available at 6 July.
- Based on fitting BA.4/BA.5 characteristics to wastewater data, an epidemic resurgence with an expected peak in Aug was considered plausible.
- The magnitude of the peak was expected to be between the BA.1 (Jan) and BA.2 (Apr/May) peaks.

- *Note: these projections do not include voluntary risk mitigation, which is unknown but likely to blunt the peak.*



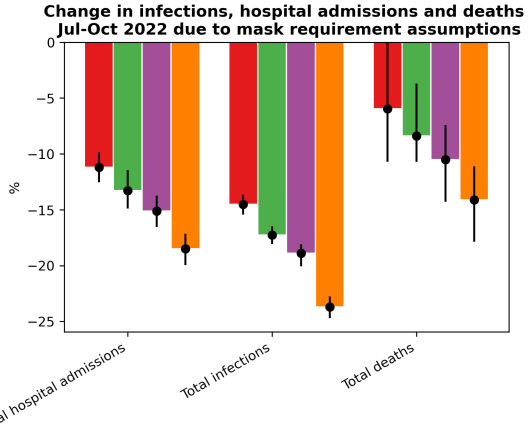
22 July modelling

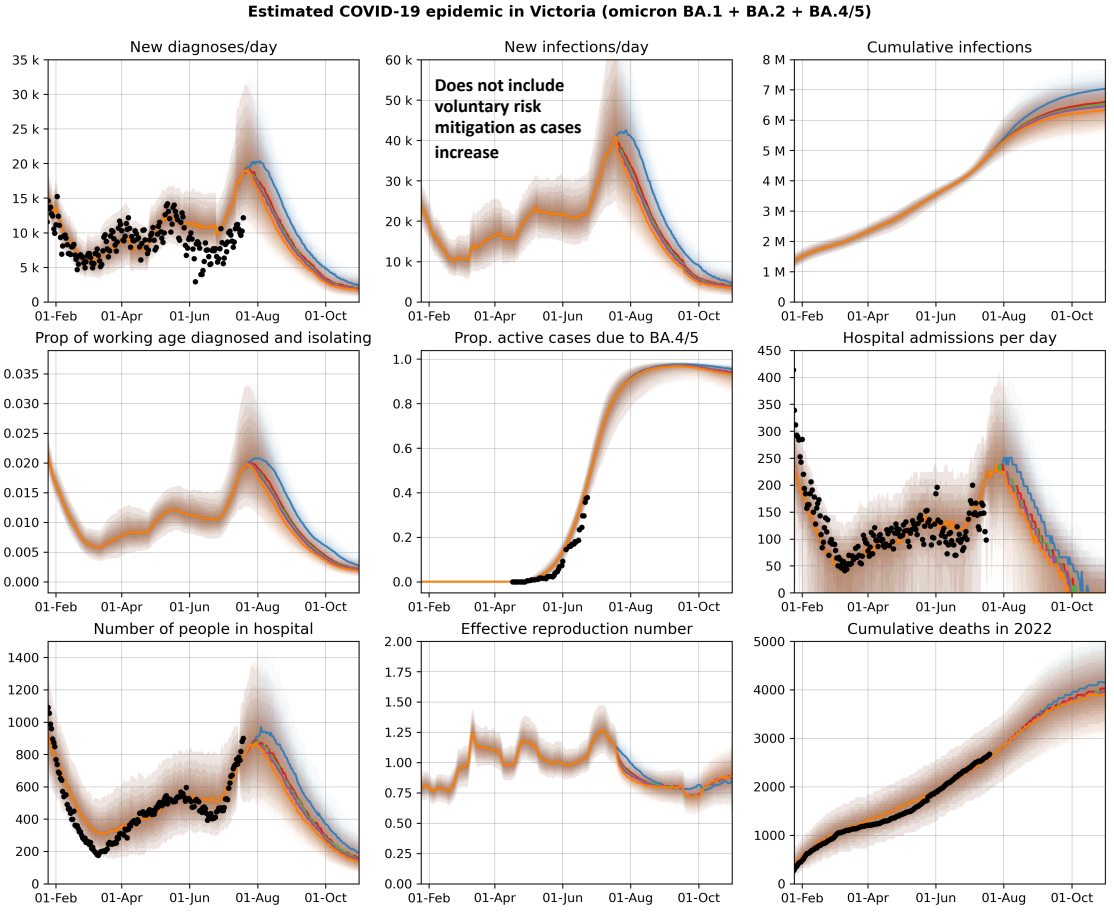
- This modelling was conducted with information available at 21 July.
- Hospitalizations had been increasing faster than anticipated.
- The sharp uptick was <u>not</u> well explained by the BA.4/BA.5 variants having increased severity compared to BA.1/BA.2. Scenarios with increased severity suggested that increased hospitalizations would likely have been observed earlier.
- When increased social mixing on school holidays was included, in addition to the highly immune-evasive characteristics of BA.4/BA.5, the model was able to explain the wastewater and hospital data better.
- *Further data is required – these theories are not conclusive.*



Results: Masks

- Increased mask uptake in the model (from 22 July) reduced the duration of the peak and increase the rate of decline afterwards.
- In the model, over Jul-Oct this resulted in a reduction in cumulative infections by 10-20%, hospital admission by 15-23%, and deaths by 5-14%, depending on uptake.
- Increased coverage of masks had increased impact.





Summary and key results

1. Over the past couple of weeks there has been a sharper increase in hospitalizations than expected:
   - This analysis suggests that the increase may be due to a combination of the BA.4/BA.5 immune-evasive properties *and* increased mixing over the holiday period, but this is not conclusive and further data is needed.
   - We did not find evidence to suggest that BA.4/BA.5 are more severe than BA.2 or BA.1. If BA.4/BA.5 were more severe, we may have expected to observe it sooner in the hospital data.
   - There was no evidence that rapid repeat infections going undiagnosed within the testing/quarantine exemption window (currently 4 weeks post infection) were a major factor in the sharp increase in hospitalizations. Scenarios with a testing / quarantine gap implemented were not notably different.
2. The timing and magnitude of the BA.4/BA.5 peak is difficult to predict, and results should be interpreted with caution given the challenges in fitting the model:
   - It is plausible that the BA.4/BA.5 peak will occur over the next couple of weeks.
   - Hospitalizations may slightly increase before stabilizing, but **uncertainty ranges include either a stabilization or an increase**.
   - Reported diagnoses may not reflect true diagnoses if positive cases are going unreported.
3. In the model, masks reduced infections and hospital admissions by up to about 20%, and deaths by up to about 14% over July-Oct, despite the epidemic declining for much of this period. Outcomes would depend heavily on mask uptake.
4. Ongoing monitoring of the BA.4/BA.5 variants is required to better understand their characteristics.

Limitations

Projections could be pessimistic (meaning the real world may be better than the model) because:

- They do not include voluntary risk mitigation (i.e. people choosing to stay home while cases are high).
- Increased mask uptake, or higher than anticipated vaccine uptake, could lead to reduced cases and hospitalizations.

Projections could be optimistic (meaning the real world may be worse than the model) because:

- New variants are not included yet could lead to additional epidemic waves.
- Compliance with isolation rules may reduce as people become infected multiple times.

Major sources of uncertainty include:

- Under-reporting of positive tests mean that reported diagnoses are not a completely reliable indicator.
- There are still many uncertainties about BA.4/BA.5 variant characteristics.
- These outcomes are not set - behaviour or policy changes would lead to changes in projected outcomes.
- Seasonal effects are not included and unknown.
- *Continual re-calibration is required as more data becomes available.*

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Key assumptions

Baseline scenario

- Testing:
  - Reduction in PCR symptomatic testing in May/June consistent with PCR test numbers and positive rate
  - School surveillance program ended May 23, modelled as tapering off with reduced testing May 23 - June 16 (calibrated, can be interpreted as testing due to symptoms from other viruses circulating in schools in May/June)
  - RAT symptomatic testing probability determined through calibration (time-varying from ~80% in May to ~70% in June)
- Quarantine and Isolation:
  - Diagnosed cases continue to require 7-days isolation; household-like contacts required to rapid antigen test 5/7 days and wear masks
- Vaccination:
  - Third doses reach a maximum 70% coverage among 16+ years (83% 55+ years; 72% 35-54 years; 56% 16-34 years)
  - Coverage among 5-11 year olds reaches 60%
  - Fourth doses reach a maximum coverage of 62% in 65+ years
  - From 23 April two-dose vaccine mandates removed for hospitality/retail

Model technical details

Model technical details are not in these slides, but can be found as outlined below:

- Model code: Covasim GitHub repository. https://github.com/InstituteforDiseaseModeling/covasim.
- Model disease dynamics specifications: Kerr et al. PLOS Computational Biology 2021, 17(7):e1009149. https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1009149
- Model contact networks and Victoria-specific characteristics / applications:
  - Scott et al. MJA 2021, 214(2):79-83. https://onlinelibrary.wiley.com/doi/full/10.5694/mja2.50845
  - Abeysuriya et al. BMC Infectious Diseases 2022, 214(2):79-83. https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-022-07180-1
  - Abeysuriya R, Delport D, Sacks-Davis R, Hellard M, Scott N: Modelling the Victorian roadmap. 18 September 2021. Available from: https://www.burnet.edu.au/system/asset/file/4942/Burnet_Institute_VIC_Roadmap_20210918_-FINAL.pdf
- Specifications on immunity from vaccines and exposure to different variants : Cohen et al. medRxiv, 2021 https://www.medrxiv.org/content/10.1101/2021.05.31.21258018v2