

01 EXECUTIVE SUMMARY AND CONTEXT

EXECUTIVE SUMMARY

This is the April 8, 2021 overview of findings of modelling studies conducted and collated by the PHAC Modelling Group.

Current situational awareness

The effective reproduction number (R_t) for Canada on March 27, 2021, estimated using date of illness onset, was 1.14. There has been an increasing trend in R_t in most provinces since early February, and on March 27, R_t was >1 for all provinces except Manitoba.

The short-range statistical forecast for Canada up to April 15, 2021 is:

- 1,077,800 cumulative cases (range: 1,072,078 to 1,082,913)
- 23,408 cumulative deaths (range 23,302 to 23,508)

Overall, in the next two weeks mean case incidence is projected to increase in British Columbia, Ontario, and Saskatchewan, remain stable in Manitoba, and decrease in Alberta and Quebec. Case incidence is projected to increase in Canada overall. The incidence of new deaths is projected to remain unchanged in Canada.

The nowcast of the force of infection suggests that the epidemic is stable in Quebec, New Brunswick and Nova Scotia. However, the force of infection is forecasted to continue to increase in British Columbia, Alberta, Saskatchewan, Manitoba and Ontario.

The long-range dynamic modelling forecast for Canada, not accounting for variants of concern (VOC), suggests ~15,000 cases by end of April without enhancements to control cases.

The long-range ensemble forecast, including introduction of variants of concern suggests that nationally in Canada, and in all major provinces, current controls are not sufficient to control more transmissible variants of concern. If variants successfully spread and replace existing strain, and control measures remain unchanged, there could be ~ 35,000 cases per day by the end of April.

Importation risk modelling for the week March 28 to April 3, 2021, an estimated 4,845 people with COVID-19 came to Canada, primarily from India, the United States of America (USA) and France. For the top 10 countries estimated to contribute infected travelers, the percent contribution from variants of concern or interest are from B.1.1.7 (UK variant) at 16%, B.1.427 and B.1.429 (Californian variants) at 3%, B.1.351 (SA variant) at 2% and P.1 (Brazilian variant) at $<1\%$.

Assessment of the impact of interventions on the COVID-19 epidemic in Canada and other countries using the Oxford University stringency index:

- In Canada the stringency index has increased to 75 as of April 1, 2021, while the number of reported cases have been increasing for a month.
- COVID-19 cases are increasing in Canada. In the majority of provinces where cases are rising, the stringency index has remained relatively constant for the past several weeks. This suggests the stringency index in these regions has been too low to control the epidemic.

Dynamic modelling

The study Agent-based model analysis: the impact of variants of concern (VOC) with increased transmission and virulence on vaccination and reopening the Canadian border to non-essential travel explored lifting border controls with two different vaccine efficacy scenarios. Border reopening scenarios were explored, with more transmissible and more virulent VOC, and various dates for lifting of restrictive closures. Results suggest that with a highly effective vaccine, opening the borders had little effect on transmission in Canada if restrictive closures were lifted in mid-August, and a COVID-19 resurgence did not occur. With a less effective vaccine, lifting restrictive closures in mid-August resulted in a COVID-19 resurgence that came close to overwhelming current healthcare capacity with a more transmissible VOC, and slightly exceeded healthcare capacity with a VOC that is more transmissible and more virulent. With this vaccine, opening borders had a slightly greater effect on COVID-19 resurgence. As long as vaccine coverage was high, vaccine effectiveness had a greater impact than border opening on the risk of COVID-19 resurgence when restrictions are lifted.

The study Preliminary exploration of the impact of emergence of a variant of concern (VOC) with the ability to evade vaccine-induced immunity using the PHAC SEIR deterministic model explored the introduction and establishment of a strain or complex of strains with the ability to evade vaccine-induced immunity. For the levels of immune escape simulated, results suggest that the ability of a VOC to escape immunity had more impact than factors that have been found to be key in previous studies: i) the scenarios for vaccine efficacy against infection and disease caused by pre-existing strains, and ii) the date of lifting of restrictive closures. This study suggests that preventing invasion of immune escape VOC will be of great importance in allowing lifting of restrictive closures without overwhelming healthcare capacity.