# 01 EXECUTIVE SUMMARY and CONTEXT

## 1 Executive summary

This is the November 19, 2020 overview of findings of modelling studies conducted by the PHAC Modelling Group with some additional findings from external modelling partners.

## ii Current situational awareness of the COVID epidemic in Canada and internationally:

*The reproduction number (Rt)* calculated for November 7, 2020 identified that:

- The *Rt* remains slightly above 1 for Canada (1.05).
- *Rt* is now more consistently >1 in British Columbia, Alberta, Saskatchewan, Manitoba and Ontario and it has risen >1 in Quebec.
- *Rt* was <1 in Alberta in this snapshot, but this was be due to reporting issues.

*The short-range statistical forecast* in Canada until November 26, 2020 is for continued increases in cases:

- 350,963 cumulative cases (range: 348,340 and 353,704)
- 11,666 cumulative deaths (range 11,473 to 11,854)

Projections in all affected provinces are for continued increases as well.

*A short-range forecast based on social media* analysis in four provinces predicted that numbers of reported cases in Quebec, Ontario and British Columbia are expected to be relatively stable from October 15 to November 28, 2020, while the number of reported cases in Alberta is expected to increase from October 15 to November 28.

*A forecast from dynamic modelling with machine learning* is obtained from data on cases, hospitalisations, ICU, deaths and testing to more accurately forecast the status of the epidemic over the next two weeks and provide the force of infection. Force of infection is rapidly increasing in British Columbia, Alberta, Manitoba, Saskatchewan and also increasing but somewhat less rapidly in Ontario. Force of infection has declined and then increased in Quebec, but is now appearing more constant suggesting current efforts to reduce contact rates are having an impact on the epidemic.

*The long-range dynamic modelling forecast* in Canada over the next two months predicts continued resurgence of the epidemic with current contact rates, a steeper increase in cases with a 20% increase in contact rates and a decrease in cases in a scenario in which public health measures result in a 25% deduction in contact rates.

*Importation risk by modelling* was used to assess the numbers of COVID-19 cases arriving at Canadian airports. For the week of November 8 to 14, 2020, it predicted 1,435 infected people came into Canada through airports, primarily from the United States of America (USA), France, the Netherlands, the United Kingdom (UK) and Germany.

*Assessment of the impact of interventions* on the COVID-19 epidemic in other countries found:

- Canada has not shown a demonstrable increase in public health measures (according to data derived by Oxford at the national-level – stringency index) despite the significant increase in cases during this second wave.
- Important lessons can be learned from dire experiences in several European countries. Countries with stringency indices less than 65 over a long period of time; all have experienced situations this fall that have dwarfed earlier experiences this year in terms of magnitude of cases.

## iii Modelling:

Planning scenarios for the near future trajectory of the epidemic are described.

## iv Special reports:

Three special reports are presented in this issue.
*The potential sensitivity of rapid antigen diagnostic tests* (Ag-RDTs) was explored and demonstrated that:

- Median PCR Ct values for samples taken 8-10 days post-symptom onset, from a subset of Canadian COVID-19 cases, were found to be within the limit of detection for those rapid tests that have sensitivity comparable to PCR when viral loads result in a Ct of <30.
- A majority of tests (80%) from a subset of Canadian COVID-19 cases were performed within the 8-10 days post symptom onset when viral loads are likely to be highest.

*A competing risk survival analysis approach to assess age-specific COVID-19 case fatality using surveillance data*. Estimation of the Case Fatality Rate (CFR) of diseases during an epidemic is difficult due to i) changes over time in the denominator due to changes in case definitions and the types of cases captured by surveillance, and ii) censoring of data due to the outcome of many recent cases (i.e. whether they died or recovered) remaining unresolved.

To overcome these issues, and to explore whether CFR of COVID-19 has changed over the course of the epidemic, only data with a recorded final outcome for period-specific cohorts were created. This survival analysis suggested that overall, the cohort.CFR has declined in all regions from the spring wave to the present. This trend was similar within each age group.

*A Hidden Markov model approach for early warning of changing trajectories of the COVID-19 epidemic* using COVID-19 ICU daily census data is presented. If data are timely, 'regime shifts' in their patterns may act as early warning of worsening trajectories of epidemics. ICU admission census data may be amongst the most timely and reliable for identifying regime shifts in the COVID-19 epidemic. However daily data available from CIHI provide information only on the number of ICU beds occupied, not precisely how many new patients entered to ICU.

A Hidden Markov Model method was used to model separately growth and decrease in ICU bed occupancy by COVID-19 patients. A forecast is then constructed from the growth model with points of zero growth obtained by a sampling technique from the decrease model. An example forecast using data from Ontario is presented, which suggests continued increase in ICU occupancy but not a regime shift for this province.