01 EXECUTIVE SUMMARY AND CONTEXT

EXECUTIVE SUMMARY

This is the December 3, 2020 overview of findings of modelling studies conducted by the PHAC Modelling Group with some additional findings from external modelling partners.

Current situational awareness of the COVID epidemic in Canada and internationally

The reproduction number (Rt) calculated for dates of onset up to November 21, 2020 identified that:

- The *Rt* remains around 1 for Canada (0.97), but this may be an underestimate due to reporting issues from Alberta.
- *Rt* is now more consistently >1 in British Columbia, Saskatchewan and Ontario and slightly <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 December 10, 2020 is for continued increases in cases:

- 440,952 cumulative cases (range: 436,926 and 444,952)
- 12,945 cumulative deaths (range 12,751 to 13,220)

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

The nowcast of the force of infection suggests that epidemic is rapidly increasing in Alberta and Manitoba, and also increasing but somewhat less rapidly in Ontario and British Columbia. 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. Force of infection in Saskatchewan has increased rapidly but is declining slightly at this time.

The long-range dynamic modelling forecast in Canada over the next two months projects continued resurgence of the epidemic with current contact rates, a steeper increase in cases with a 20% increase in contact rates and control of the epidemic in a scenario in which public health measures result in the equivalent of 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 22 to 28, 2020, it predicted that 1,387 infected people came into Canada through the 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 only shown a small increase in public health measures (according to data derived by Oxford at the national-level – stringency index) in mid-November, despite the significant increase in cases during this second wave.

- Lessons can be learned from resurgence in other countries, both where control of the disease has been regained and where it has not. Australia, France and Ireland have been successful in bringing a resurging epidemic (i.e. a "second wave") under control when combined measures rose to have a stringency index of >75.
- Each of the Canadian provinces for which data are available are showing recent increases in their stringency indices. However, in most provinces the stringency index is ≤60 and, if consistent with observations in other countries, this may not be sufficient to bring the epidemic under control.

Dynamic modelling

An assessment of the impact of variations in time delays and test sensitivity on the epidemic attack rate showed that both longer delays between testing and isolation of infected individuals, and lower test sensitivities, resulted in higher peak prevalence and attack rates. However, the study suggests that, within a lower bound of test sensitivity of 80%, if the more rapid antigen tests facilitate faster onset-to-isolation time, they may enhance our response to the epidemic even if they have lower sensitivity than the 'gold standard' PCR test. However, further studies and data are needed to explore this.

A study on *Exploring shutdowns in the agent-based model* suggested that i) earlier shutdowns result in fewer cases; ii) shorter duration of shutdowns meant that shutdowns had to be more frequent but resulted in fewer cases and fewer shutdown days overall than longer shutdowns; iii) if periods between shutdowns were fixed and long, the epidemic may swamp healthcare; and iv) shutdowns of multiple sectors is most effective in controlling the epidemic, although in these simulations the effect of shutting down mixed age, leisure-type venues was greater than shutting down schools or workplaces.

An evaluation of office re-opening strategies suggested that elevators may be important contributors to infections for multi-floor office buildings. This study also suggested that:

- Reducing the number of employees in a multi-floor office at any one time may reduce risk of re-opening. However simulations suggest that, rather than reducing percentage occupancy of each floor, it is better allow the bottom floors to be at full capacity, while leaving the remaining upper floors empty.
- Preventing building entry for infected workers is the single most effective strategy (e.g. work from home if symptomatic, screening measures) in lowering infections in the office.

A new SEIR compartmental model with health care systems and testing regimes is introduced. This model uses a maximum likelihood estimation approach to calibrate to multiple COVID-19 time series (positive tests, negative test, hospitalizations and death) and time-varying parameters and a preliminary forecast using the model with the best performance is presented.

Special report

An update on case fatality estimates shows significant differences by chronological time periods, regions and by age groups. Differences over time may be partially attributed to the change of age distribution among cases, and regional differences may be attributed to the proportion of the older people in the cases, especially those 80+ years, as well as the proportion of cases in long term care (LTC).