01 EXECUTIVE SUMMARY AND CONTEXT

EXECUTIVE SUMMARY

This is the December 17, 2020 overview of findings of modelling studies conducted by the PHAC Modelling Group with some additional findings from external modelling partners.

Current situational awareness

The reproduction number (Rt) for Canada up to December 5, 2020 is around 1 (1.08).

- *Rt* is now more consistently >1 in Alberta and Ontario and slightly <1 in Quebec.
- *Rt* is <1 in British Columbia, Saskatchewan and Manitoba and is varying above and below 1 in Nova Scotia and New Brunswick.

The short-range statistical forecast in Canada up to December 24, 2020 is:

- 530,801 cumulative cases (range: 521,049 and 537,801)
- 14,607 cumulative deaths (range 14,336 to 14,834)

For the first time since the summer, mean case incidence is projected to decrease in Canada overall, driven by projected trajectories in the Western provinces

The nowcast of the force of infection suggests that epidemic is increasing rapidly in Alberta, and increasing, but less rapidly, in British Columbia, Saskatchewan, Ontario and Quebec. Force of infection is forecast to uptick in Manitoba and to remain low in Nova Scotia and New Brunswick.

The long-range dynamic modelling forecast in Canada over the next two months included three scenarios: With current contact rates, the model projects continued resurgence of the epidemic. With a 20% increase in contact rates, the model predicts a steeper increase in number of cases over time. With public health measures that result in the equivalent of a 25% reduction in contact rates, the model predicts control of the epidemic.

Importation risk by modelling for the week of December 6 to 12, 2020, estimated that 2,076 people with COVID-19 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 Canada and other countries by the Oxford University stringency index:

- In Canada, each of the provinces (for which data are available) are showing recent increases in stringency. In most provinces the stringency index is <64 and, if consistent with observations in other countries, this will not be sufficient to bring the epidemic under control.

- Lessons can be learned from resurgence in other countries. Australia, France and Ireland have been successful in bringing a resurging epidemic (i.e. a "second wave") under control when combined measures rose to a stringency index of >75.

Dynamic modelling

A study entitled *Age-stratified interventions in the absence of other public health measures using an agent-based model* explored the impact of two interventions applied to older adults: 1) isolation from the remainder of the community and 2) vaccination under two assumptions: the use of a sterilizing vaccine (resulting in 95% protection against infection) or a non-sterilizing vaccine (resulting in a 95% protection against symptomatic infection only). All scenarios resulted in a lower number of hospitalizations, ICU admissions, and deaths compared to the baseline scenario. However, implementing measures exclusively within older age groups was not sufficient to reduce hospitalizations and ICU admissions below the maximum Canadian hospital and ICU bed capacities in either the isolation or vaccination scenarios. This study highlights the difficulty in safeguarding healthcare capacity if public health measures are lifted and only vulnerable older age groups are protected by vaccination or isolation from the rest of the population.

A study entitled *Exploring ascertainment uncertainties in long term forecast of reported cases for major provinces in Canada* calculated long term projections of reported cases for major provinces. Projected reported cases will continue to increase for the major provinces in the short term except for Manitoba. However, it identifies that how high and how long this projected uncontrolled epidemic will be, depends on the level of ascertainment of cases.

The study entitled *Identifying the contact tracing rate that allows for epidemic control in the context of using rapid Antigen tests only* explored the increase in contact tracing that would be needed to maintain control of the epidemic if rapid antigen tests replaced PCR testing. Due to missed cases arising from the lower test sensitivity of rapid antigen tests compared to PCR, the study identified the need to trace a greater proportion of potentially-infected contacts (i.e. the completeness of contact tracing would have to be high). However, the rapid antigen tests would also mean a shorter time from infectivity to case isolation (and the instigation of contact tracing) meaning fewer contacts would have to be traced overall. The study concluded that rapid antigen tests with a sensitivity of <80% may not be suitable for replacing PCR as a routine test for surveillance for COVID-19 cases.

Special reports

Three special reports are presented this week:

The third special report on the *Fundamental Limitations of Contact Tracing for COVID-19 is presented*. When relaxing measures that control the COVID-19 epidemic by distancing, public health organizations aim to control the epidemic by testing cases and then tracing and quarantining contacts. Typically the delay from symptom onset of a case, to beginning to trace contacts is 3-4 days. This delay means that only a fraction of onward infections from contacts are prevented. Consequently, current testing and tracing policies likely have little

chance of controlling an epidemic of COVID-19 with $R_0 > 2$. The authors advocate for widespread testing of asymptomatic people by whatever method is possible to allow case detection to be fast enough for contact tracing to control disease spread.

A study on *SARS-CoV-2 testing strategies to reduce quarantine duration for incoming travellers* used a mathematical model focused on the individual's SARS-CoV-2 infectiousness dynamic and on sensitivity of tests to assess various testing strategies that aim to reduce quarantine duration. This study showed that with very sensitive tests and high isolation compliance, the residual risk of shorter quarantine duration is comparable to a full 14-day quarantine. However, the shorter the quarantine duration, the more sensitive the tests involved in the decision-making should be. If using pre-departure tests, these are most effective when performed close to the departure date.

The report *Minimizing overall disease-induced deaths in the population by balancing reduction of transmission by public health measures, and reducing disease severity by pharmaceutical measures: a mathematical insight* used a simplified mathematical approach to explore two possible approaches to minimising deaths from an epidemic: focusing on public health measures to reduce transmission, or on treatments/interventions to reduce case fatality rates. The final attack rate and death rate can be reduced by reducing R_0 by public health measures, or by reducing infection fatality rate, or a combination of the two. If R_0 is in the range <1.5, modest reductions in transmission can have large effects on reducing cases and deaths, but if R_0 is high, very high reductions in transmission are needed to have a large effect. If a sterilising vaccine is introduced after the onset of the epidemic, reducing R_0 by public health measures before and during roll-out of the vaccine is essential to minimise deaths.