COVID-19: Modelling in Yukon

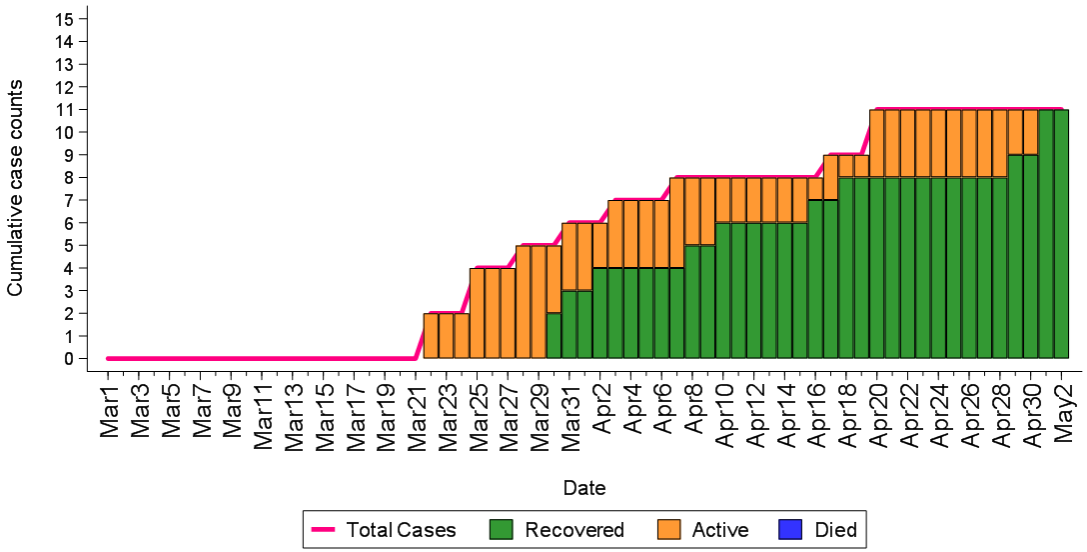
May 26, 2020
Technical Briefing

Yukon

Current Status

As of May 26, 2020:

- 11 cases (all recovered)
- 0 hospitalizations
- 0 deaths



COVID-19 timeline: public health measures, border security, and major milestones

What is a model?

- Mathematical tools to understand disease progression under various conditions
- Models are not clear predictions of the future, but rather best-guesses based on number of assumptions
- Not *every* model is appropriate to answer *every* question at *every* stage of the outbreak

> "...models are not a snapshot of the future. They always describe a range of possibilities—and those possibilities are highly sensitive to our actions."
>
> - Zeynep Tufekci for *The Atlantic*

Modelling Process

Modelling is a complex and iterative process. We start simple, then get more complex

1. Identify a question (e.g. “how many hospital beds will we need?”)
2. Choose the most appropriate method (e.g. compartmental model or agent-based model)
3. Build the model or adopt a model created by experts in another jurisdiction
4. Collect data
5. Run the model and analyze the model results
6. Repeat process

Types of Models

- Compartmental (SEIR) models
  - Simple (can be implemented in Excel)
  - Population-level, top-down approach
  - Represent populations in terms of compartments
  - Relies on the exponential growth rate of an epidemic. Most suitable in areas with community transmission.

- Agent-based models
  - Complex (need more computational power, harder to develop and validate)
  - Individual-level, bottom-up approach
  - Model behaviour and interactions of individuals within a population
  - Examines how small changes in behaviour and interactions may influence disease transmission

Compartmental (SEIR) Model Example

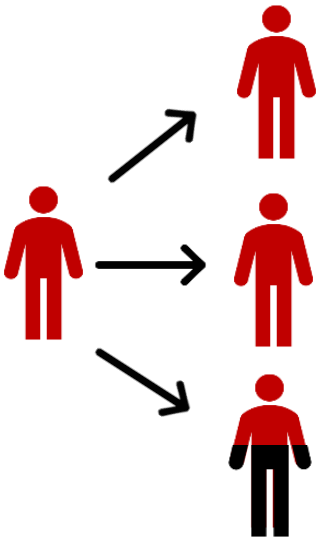
Assumptions

- Individuals found in one of four compartments – **S**usceptible to COVID-19, **E**xposed to COVID-19, **I**nfected with COVID-19, **R**ecovered from COVID-19
- Community transmission will occur
- All individuals belong to one well-mixed population in which individuals are equally likely to encounter each other
- There is no movement between mild, severe, and critical case status
- Individuals do not isolate and remain infectious for entire 7-day infectious period

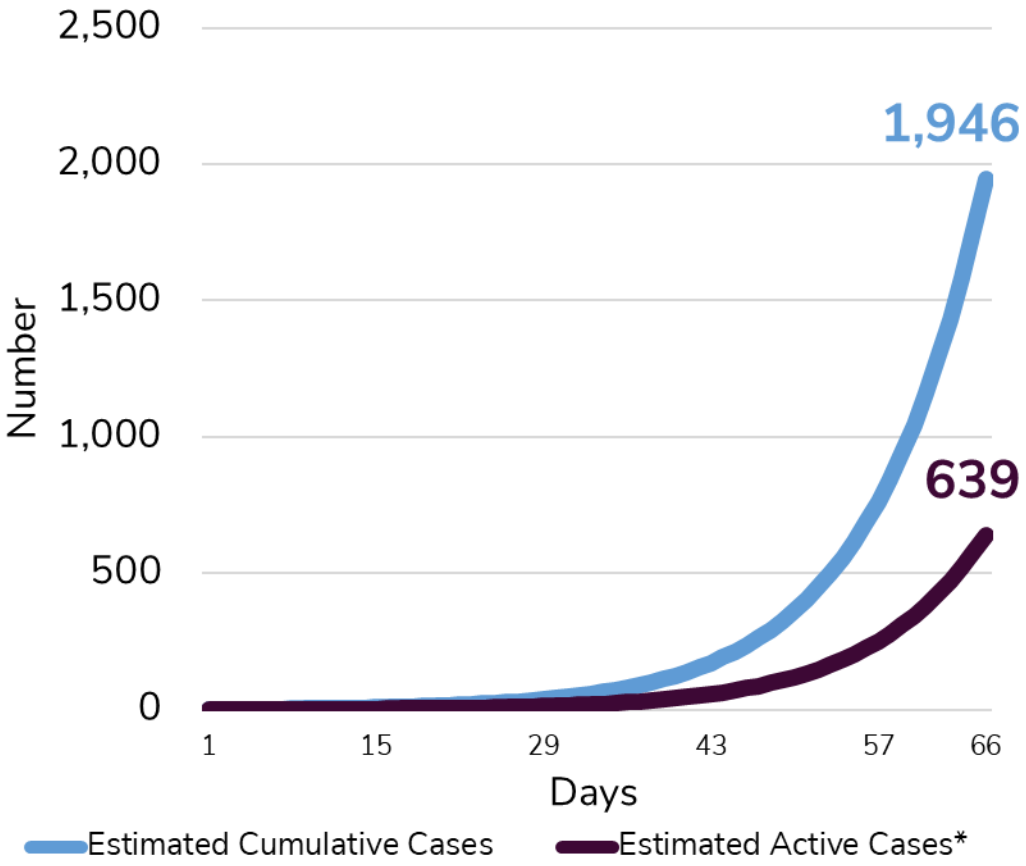
Scenario 1

No public health measures implemented

Assume that for each case, 2.4 more people are infected

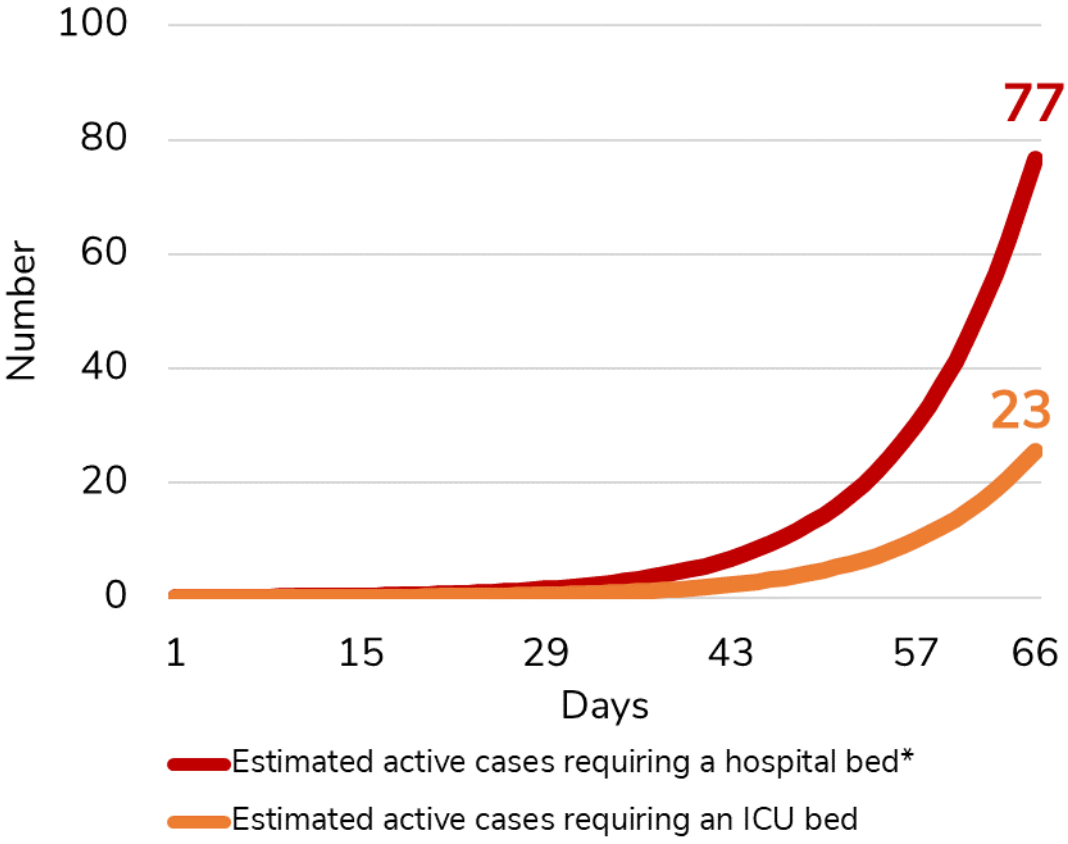


No Public Health Measures



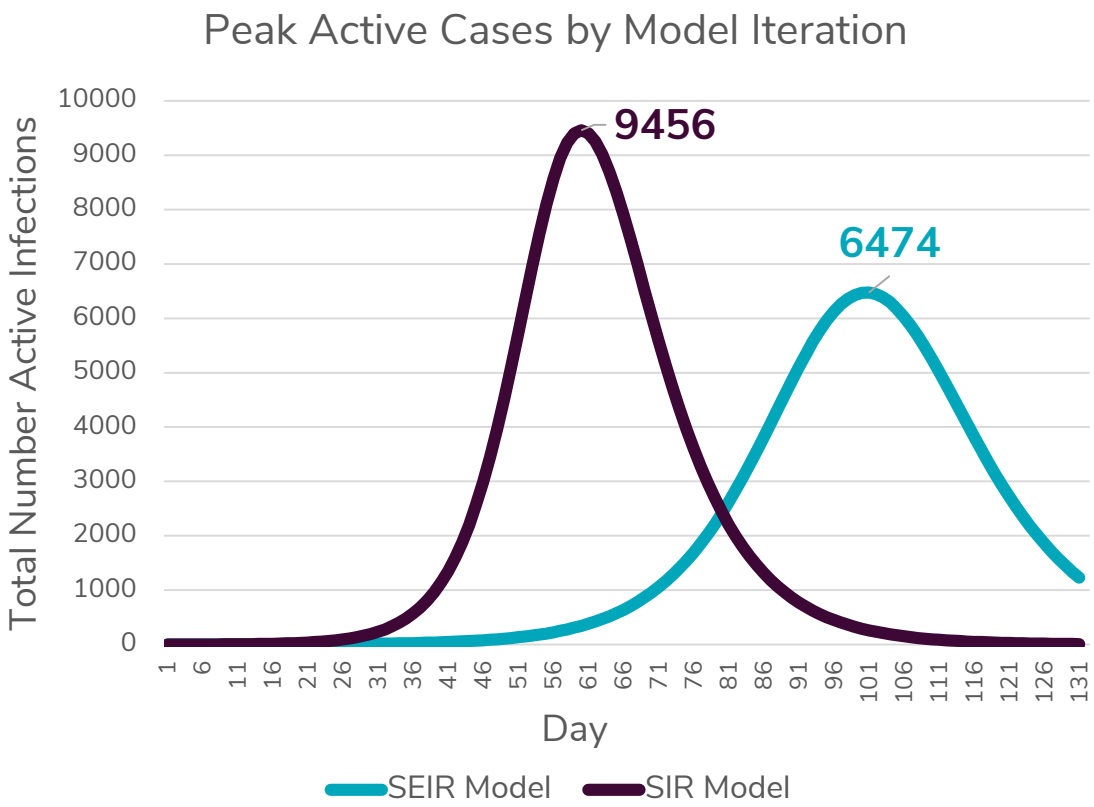
*Estimated active cases include all mild (no hospitalization), severe (requiring hospital bed), and critical (requiring ICU).

Health system demand with no public health measures in place



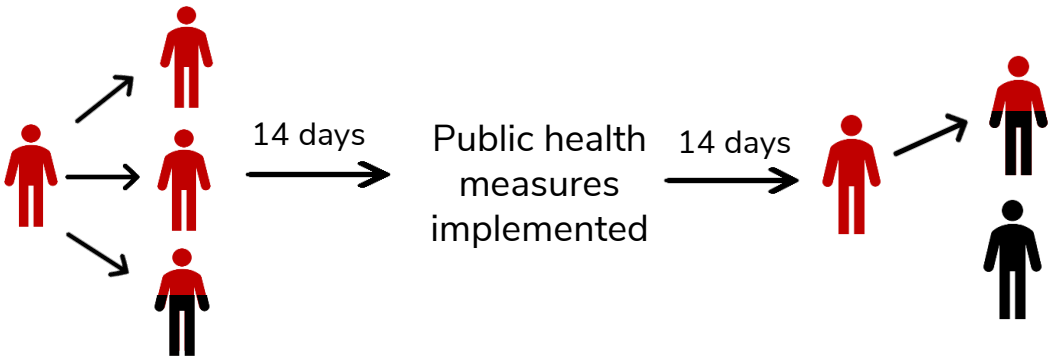
*Estimated active cases requiring a hospital bed, only includes severe cases. It does not include critical cases requiring an ICU bed.

SIR (Old) vs. SEIR (New) Predictions



Scenario 2

Public health measures implemented 14 days after identification of first case

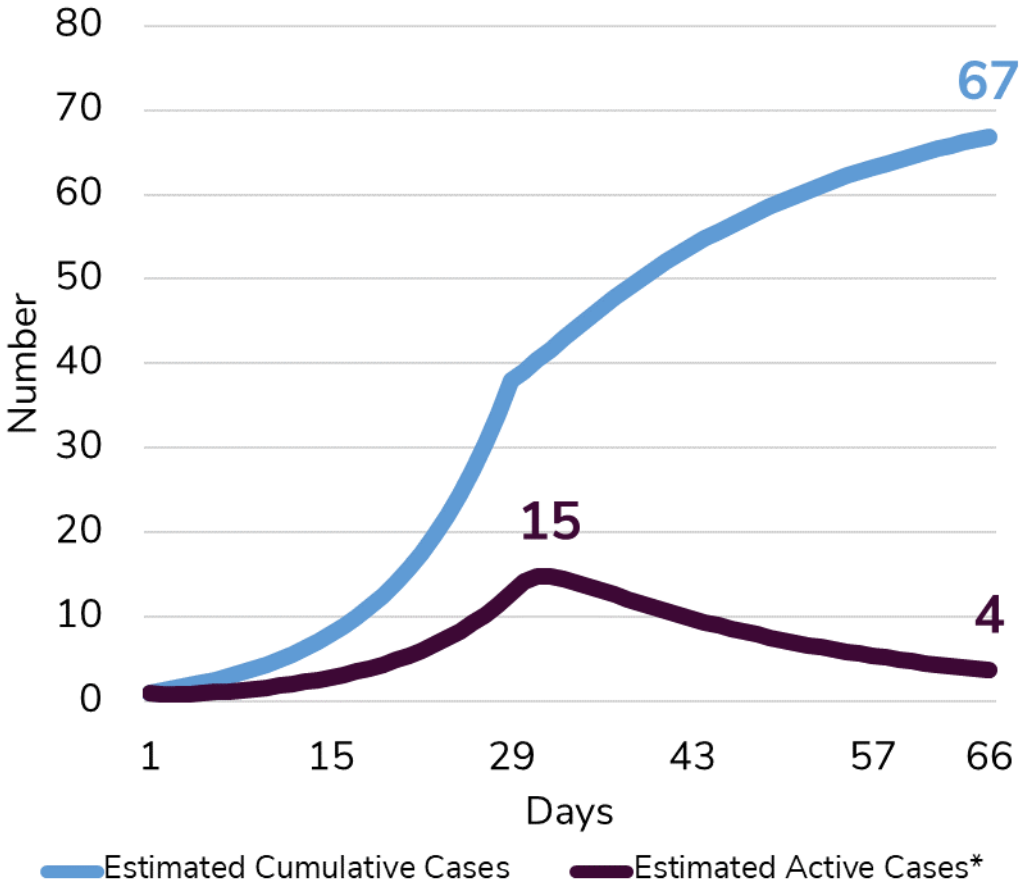


Average of 2.4[1] more people infected per case

Average of 0.62[2] more people infected per case

[1] Within range of values commonly used in Canada.
[2] Jarvis, Zandvoort, Gimma, et al. (2020). Quantifying the impact of physical distance measures on the transmission of COVID-19 in the UK. BMC Medicine. 18:124.

Public health measures implemented 14 days after identification of first case

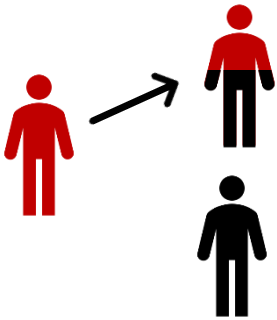


*Estimated active cases include all mild (no hospitalization), severe (requiring hospital bed), and critical (requiring ICU).

Scenario 3

Public Health Measures implemented before identification of first case

Assume that for each case, 0.62 more people are infected, on average



Result: approximately 2.5 cases expected

Next Steps

- Assess the risk of importing new cases
- Run scenarios aligned to restarting phases to assess the effects of relaxing public health measures
- Explore models based on individual behavior, which do not rely on community transmission and better represent Yukon's current reality

Conclusions

- Our actions have made a difference
- We have a unique opportunity to prevent as opposed to control an outbreak
- Modelling can help us balance COVID prevention with prevention of unintended consequences
- The 6 Steps to Stay Safe continue to be paramount in keeping Yukoners healthy

Please visit Yukon.ca/COVID-19 for more information