Public Health Agency of Canada | Agence de la santé publique du Canada

Canada

COVID-19 in Canada: Using data and modelling to inform public health action

Technical Briefing for Canadians

April 9, 2020

PROTECTING AND EMPOWERING CANADIANS
TO IMPROVE THEIR HEALTH

Data and modelling are guiding Canada's response to COVID-19

- The Government of Canada uses data to keep Canadians up to date on where we are and models to understand where we might be heading in the COVID-19 epidemic
- We are using models based on a range of scenarios to guide planning; while models are imperfect, they are useful tools to support all of us in designing strategies to control the epidemic
- The data tell us that the measures we are taking now—physical (social) distancing, self-isolation of cases, quarantine of contacts, and preventing importation of infection from other countries—remain essential to controlling Canada's COVID-19 epidemic

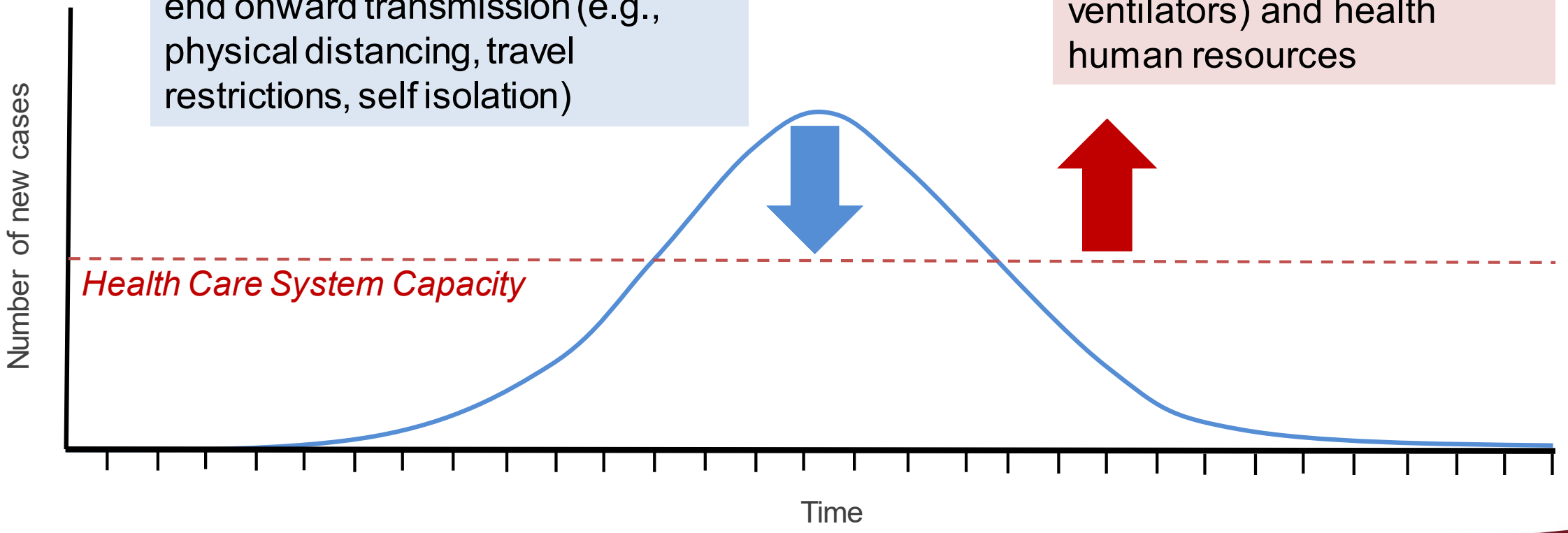
Our strategy: Control epidemic, increase health care system capacity

Control the Epidemic

Measures to reduce the number of people a person infects to < 1 to end onward transmission (e.g., physical distancing, travel restrictions, self isolation)

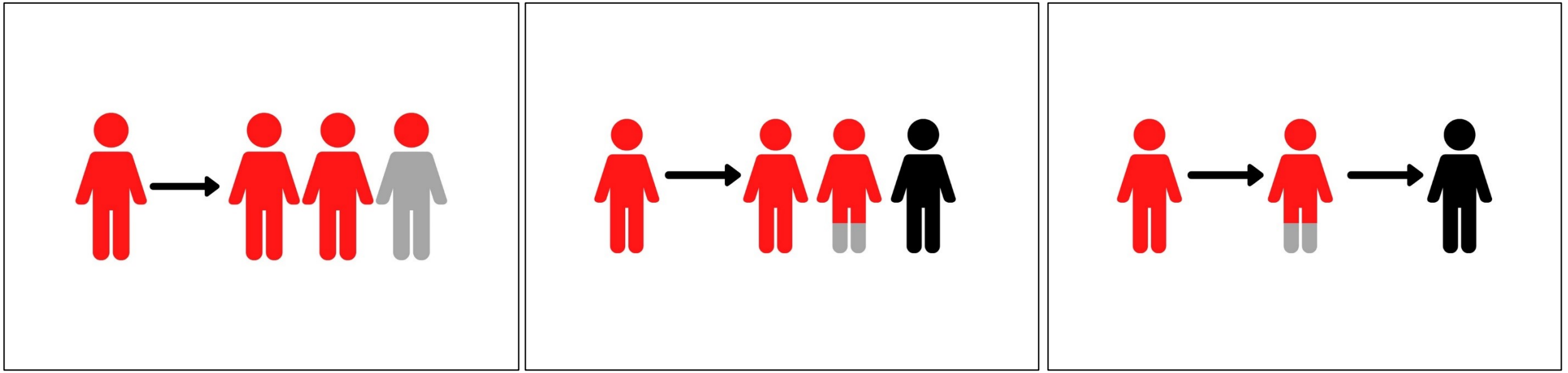
Increase health care capacity

Measures to increase the healthcare hard assets (e.g., ventilators) and health human resources



If each person infects fewer than one person on average, the epidemic dies out

Where we've been → Where we want to be



Prior to stronger public health measures, each infected person (case) in Canada infected 2.19 other people on average

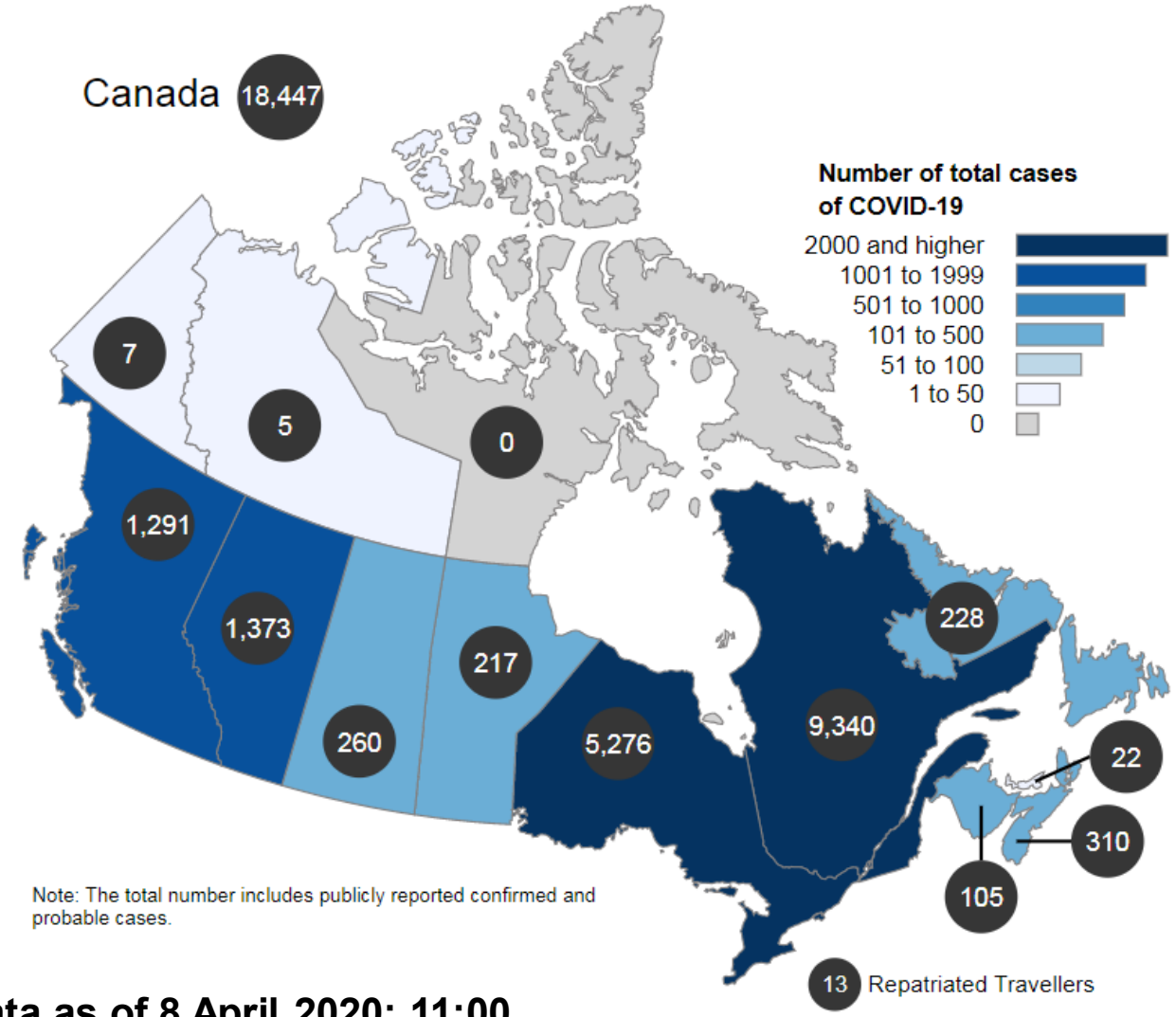
Today, stronger physical distancing and self-isolation are helping to reduce the average number of people each case infects

Goal: Each person infects fewer than one person on average; epidemic dies out

Epidemiology

THE PANDEMIC IN CANADA TODAY

The situation today – a snapshot

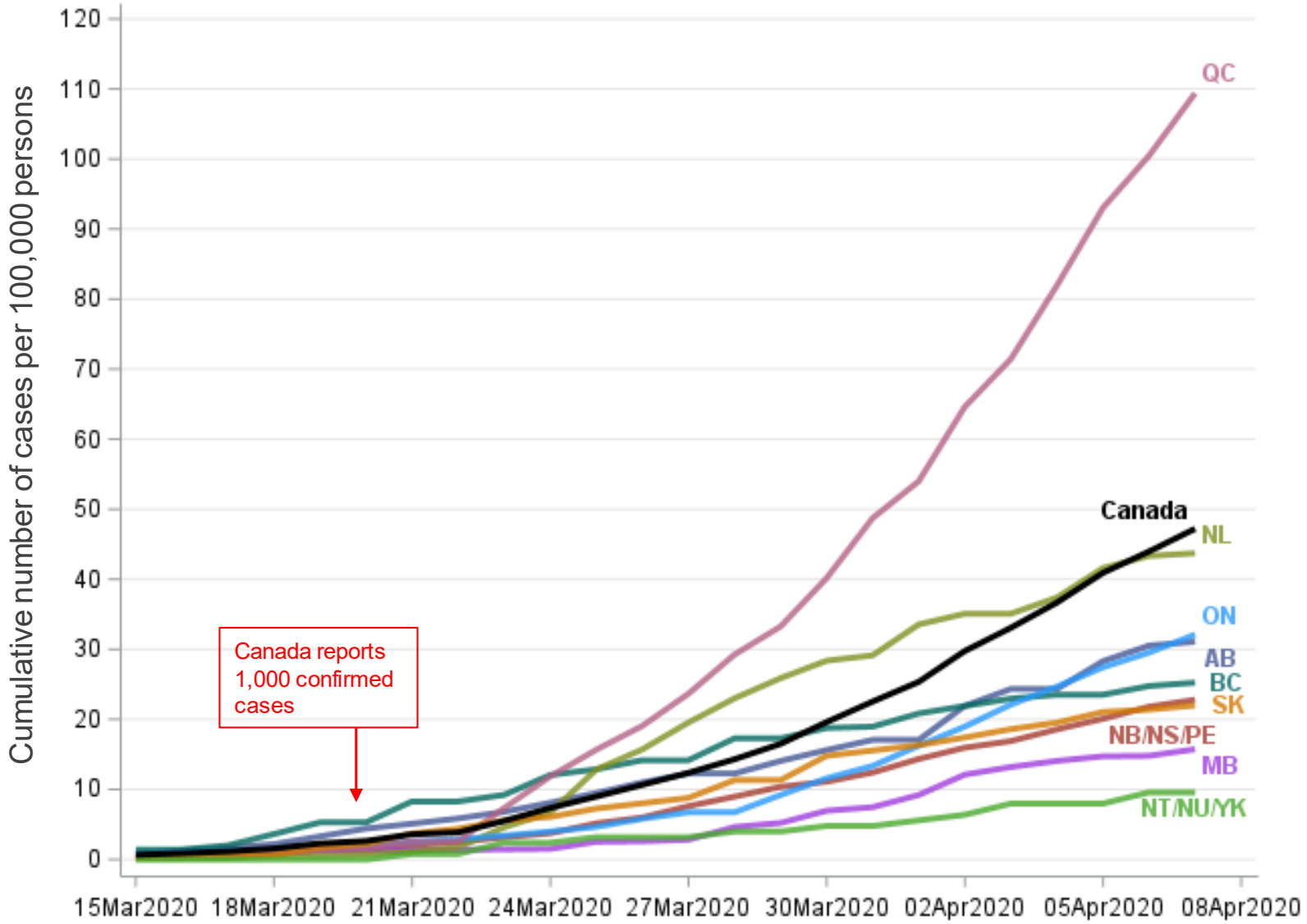


Data as of 8 April 2020: 11:00

Severity indicator	Total number	%
Deaths	401	2.2% of 18,447 (all cases)
Hospitalizations	1,118	19% of 5,823 (case reports)
Admissions to ICU	326	6% of 5,823 (case reports)

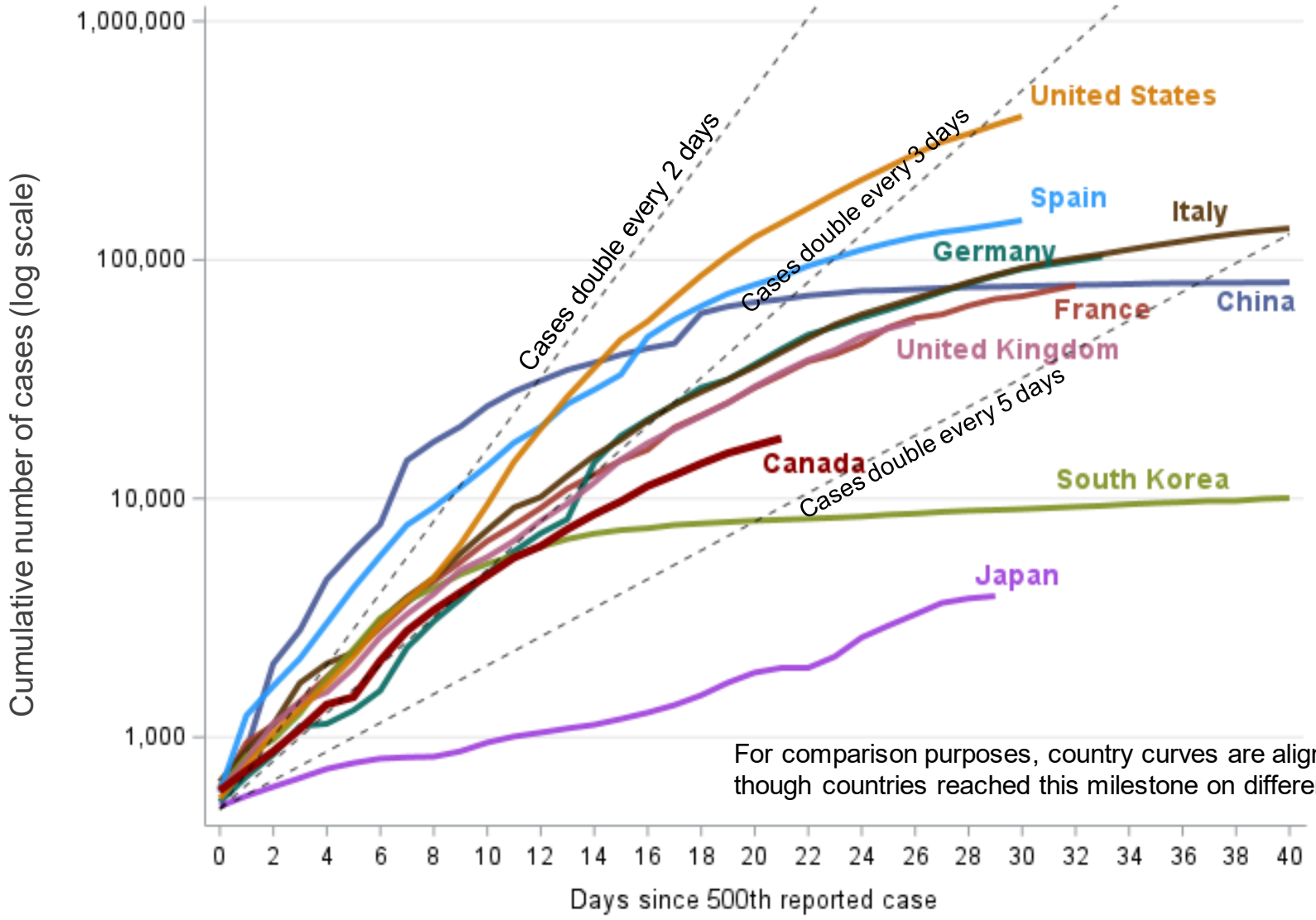
- **94% of cases are in four provinces:** Quebec, Ontario, British Columbia, Alberta
- **98% of deaths are in four provinces:** Ontario, Quebec, British Columbia, Alberta
- At least **198 deaths** among residents of long-term care homes

Canada has a series of regional epidemics



- Differences in laboratory testing and confirmation strategies explain some variation by province/territory
- Territories have very low rates of transmission so far

Community transmission started later in Canada allowing us to act early



- Canada's epidemic is in earlier stages
- Canada has a slower increase in total number of cases
- Canada's per capita testing rate is higher than most countries
- Many countries reached their first 500 cases before community transmission started in Canada
- This allowed Canada to learn from other countries' experiences and approaches and to act earlier in the epidemic's progression

For comparison purposes, country curves are aligned to day 0, the day the country reached 500 cases, even though countries reached this milestone on different calendar dates

Looking Forward

MODELLING SCENARIOS

Canada's approach to modelling

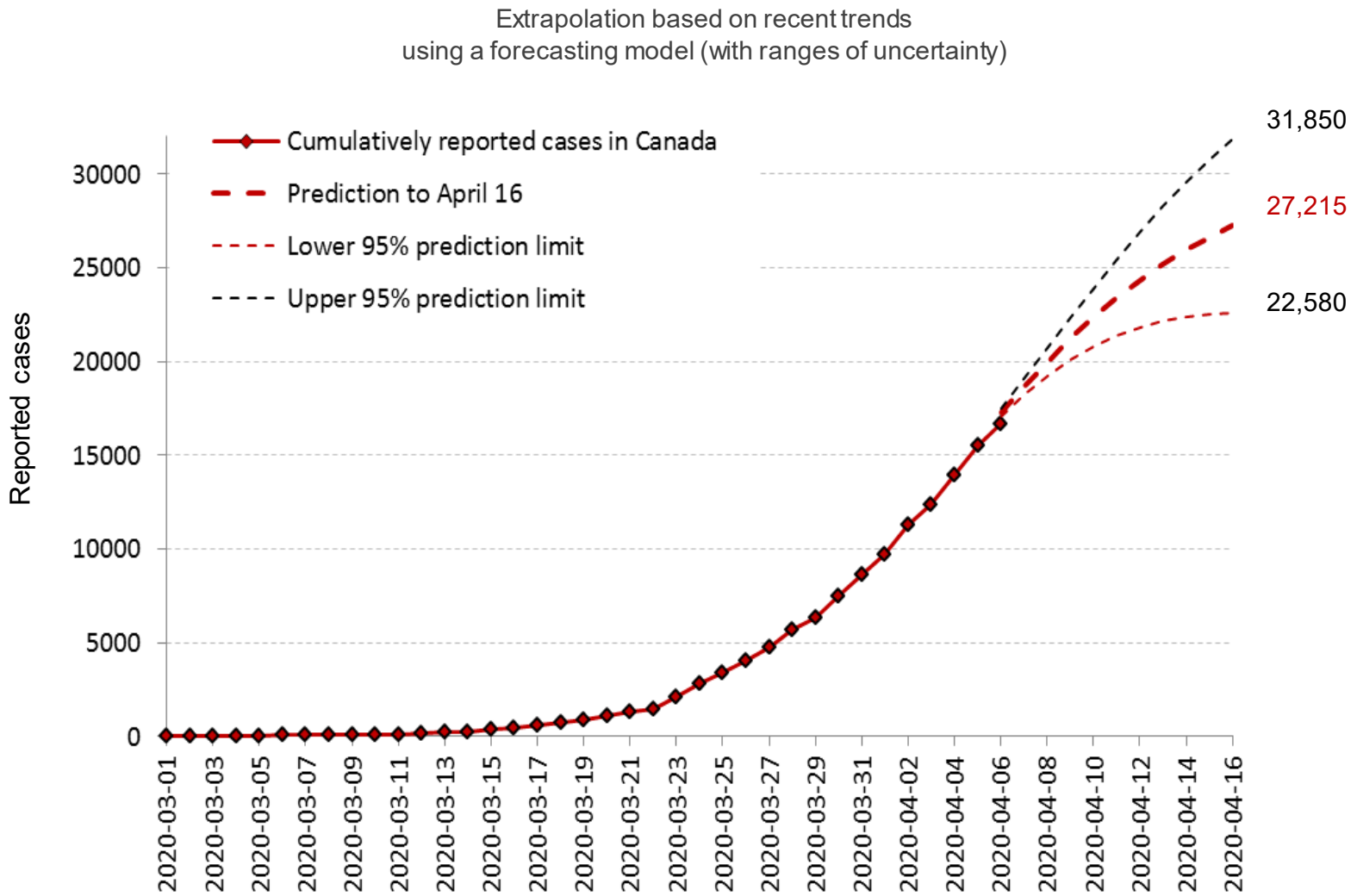
- Models cannot predict what will happen, but rather can help us understand what might happen to ensure we can plan for worst cases and drive public health action to achieve the best possible outcome

- Models can support decisions on public health measures and help the health care sector plan for the number of expected COVID-19 patients

- We are using two modelling approaches:
  - **Forecasting models** use data to estimate how many new cases we might expect to see in the coming week
  - **Dynamic models** show how the epidemic might unfold over the coming months, using knowledge of how the virus behaves and of the potential impact of public health measures. These models help create scenarios using a range of values such as:
    - average number of people that one infected person will contact each day
    - % of cases that will be identified and isolated
    - % of people who have been in contact with a COVID case and who will be traced and isolated

- Important to recognize that models have inherent limitations (e.g., simulate controlled scenarios, not real world)

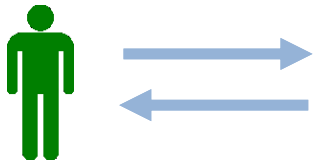
Forecasting the short-term epidemic trajectory



- 22,580 to 31,850 cases by April 16
- This could result in approximately 500-700 deaths by April 16

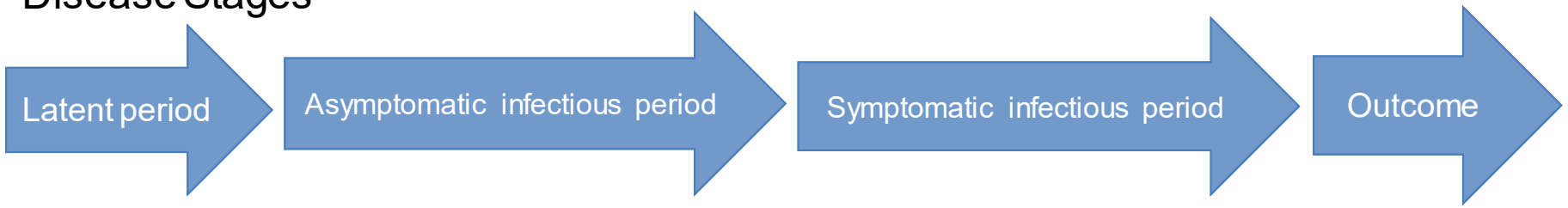
Dynamic models of scenarios

Model moves people through different states of infection. All start out as susceptible.



Individuals are then exposed. They either become infected, or remain susceptible.

Disease Stages



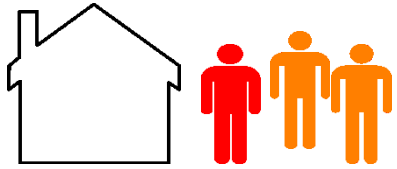
The duration of each stage has an impact on the speed of spread of the disease. The models are run with different values for these periods.

Mitigating factors

Model includes factors that reduce transmission, with different scenarios for different levels of public health measures possible. Hospitalization in the models is also assumed to include no further transmission.

Exacerbating factors

Model includes factors that increase transmission, i.e., the movement of infectious (symptomatic / asymptomatic) people, where contacts take place (e.g., school, work, etc.).



Modelled scenarios—varied public health measures

- A series of models were used to generate a number of scenarios including three key scenarios: 'no control', 'weaker controls (delay and reduce the peak)', and 'stronger epidemic control'. This lets us estimate the range of the population infected and the potential duration of the epidemic.
- Other interventions, such as border controls and domestic travel restrictions, have also been explored in modelling studies
- We continue to use models on an ongoing basis to help us identify which combinations of public health measures, applied with what intensity, are most likely to reinforce epidemic control

Stronger epidemic control models include:

- A high degree of physical distancing
- A high proportion of cases identified and isolated
- A high proportion of contacts traced and quarantined

Weaker control models include:

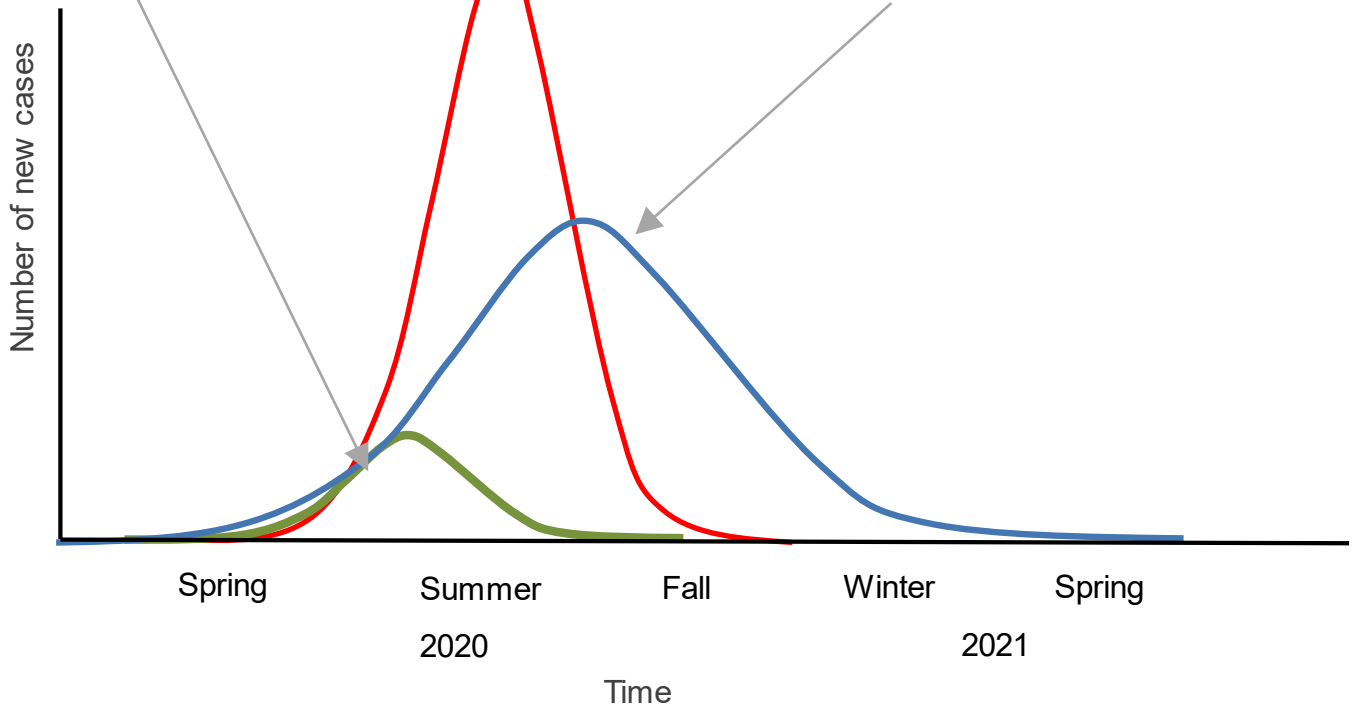
- A low degree of physical distancing
- A low proportion of cases identified and isolated
- A low proportion of contacts traced and quarantined

Modelled scenarios show impact of public health measures

Stronger epidemic control = high degree of physical distancing + high % of cases and their contacts traced and isolated or quarantined
1% to 10% infected

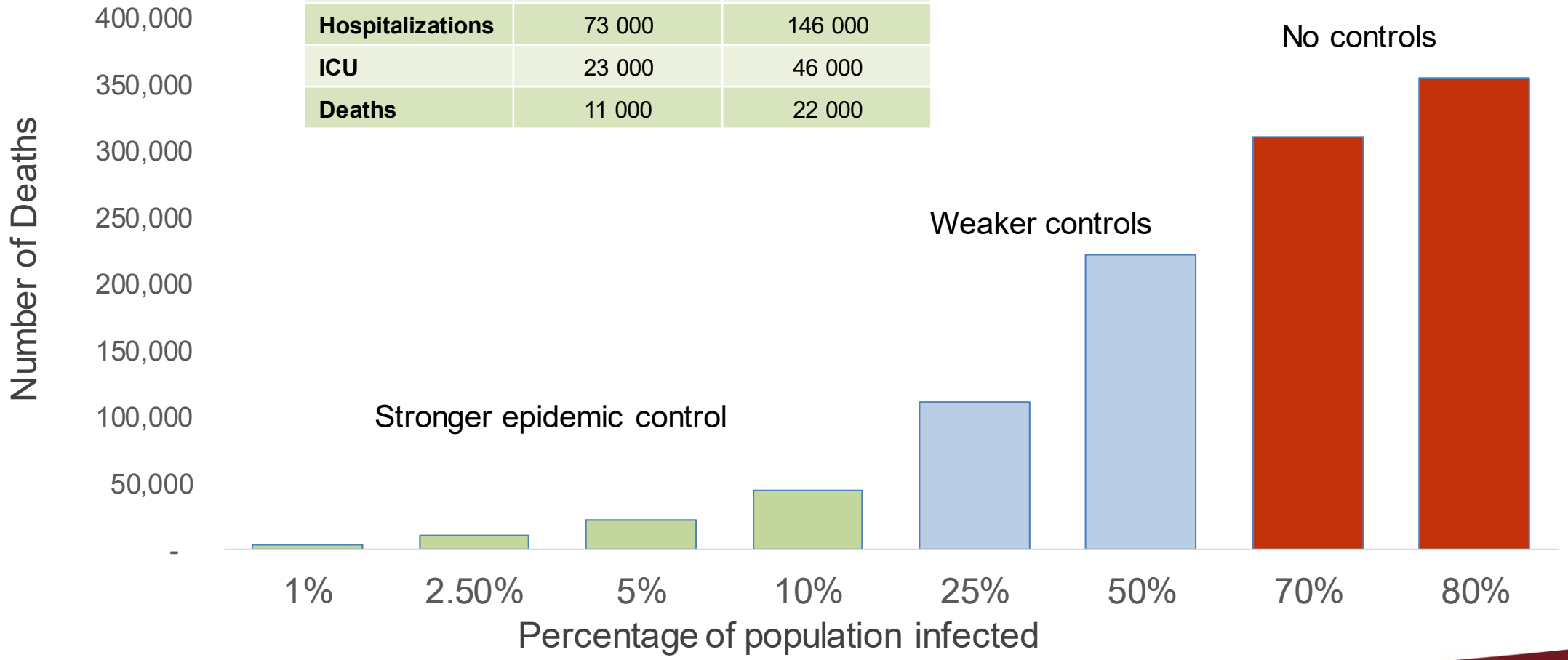
No control effort
70% to 80% infected

Weaker controls (delay and reduce the peak) = low degree of physical distancing + low % of cases and their contacts traced and isolated or quarantined
25% to 50% infected

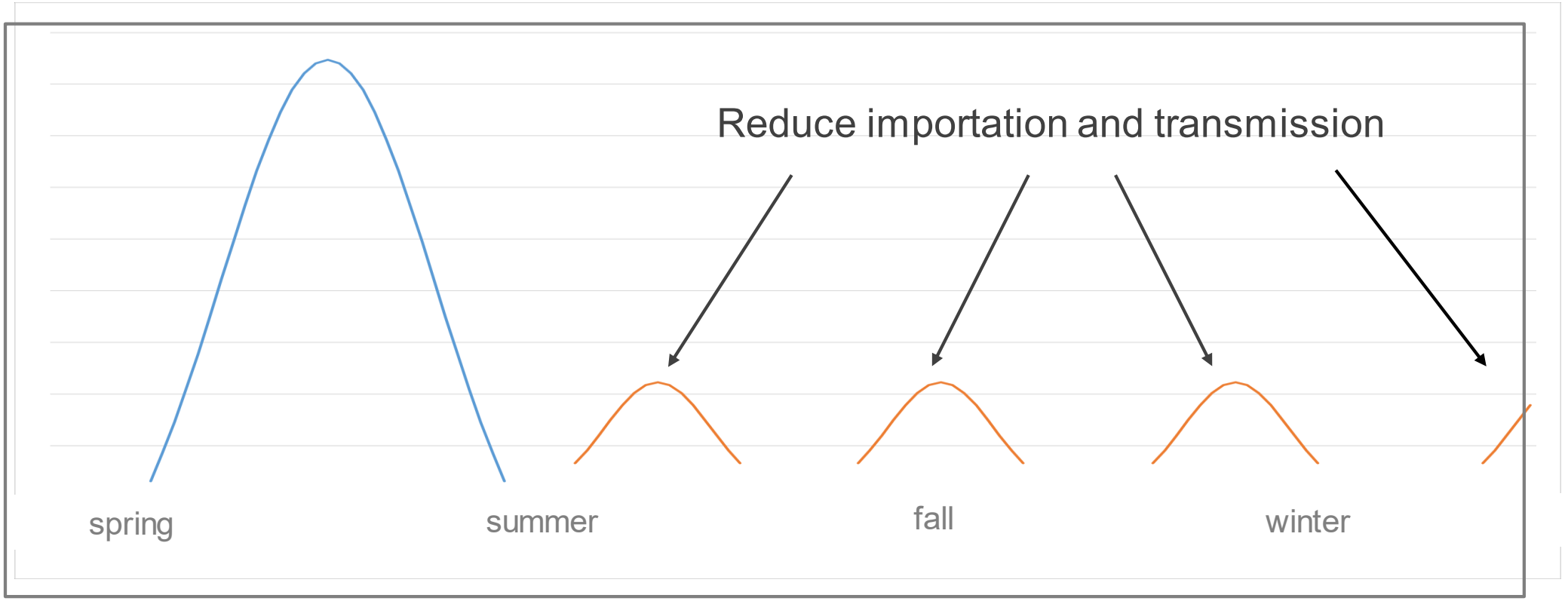


Cumulative deaths under different scenarios over the course of pandemic

	% of Population Infected	
	2.5%	**5%**
All cases	940 000	1 879 000
Hospitalizations	73 000	146 000
ICU	23 000	46 000
Deaths	11 000	22 000



Our ambition: Early and rapid epidemic control



With early epidemic control, responses to outbreaks will likely continue to be required over time

Strategy

ACTION NOW DETERMINES OUR FUTURE

What success looks like

Success is staying in the epidemic control scenario

- This means we are aiming for the lowest possible infection rate to minimize illness and death and to shorten the period of intense disease transmission in Canada
- We recognize that even if we are successful, continued public health measures will be required over time to manage future waves, including:
  - Physical distancing
  - Hand hygiene and respiratory etiquette
  - Restrictions on international and domestic travel
  - Case detection and isolation
  - Quarantine of contacts and incoming travellers

Success is preparedness of our health system, working together with provinces and territories:

- Equipping hospitals to provide care for more severe cases
- Increasing bed and clinic capacity for COVID-19 patients
- Expanding health workforce

Success requires a whole-of-country response

Conclusion

- Canada is at an earlier stage of the COVID-19 pandemic than some other countries
- We have an opportunity now to control the epidemic and prepare the health system
- Other countries have shown that this can be done
- We know what needs to be done: keep up physical distancing, increase testing, self-isolate cases, and rapidly trace contacts
- This is the best way for Canada to get out of the epidemic in the shortest time possible with the fewest number of deaths
  - If not, other scenarios have severe impacts

What we do together now to stop the spread of COVID-19 will determine the impact it has on Canadians