

Canada COVID-19 epidemic models situation report No 28 - 2022-01-10

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Combine and visualize international periodically updated estimates of
COVID-19 pandemic
at the country level, countries with subnational level estimates
Canada

Based on uptake 20220110 in <https://github.com/pourmalek/CovidVisualizedCountry>

Study update dates in uptake 20220110:

DELP 20220110, IHME 20220110, IMPE 20211213, SRIV 20220110

DELP: [model by Massachusetts Institute of Technology, Cambridge](#)

IHME: [model by Institute for Health Metrics and Evaluation, Seattle](#)

IMPE: [model by Imperial College, London](#)

SRIV: [model by Srivastava, Ajitesh, University of Southern California, Los Angeles](#)

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What is this report, and where does it come from?

This report shows the trajectory of daily deaths, infections, bed needs, and ICU bed needs for Canada and its provinces, estimated by five international and periodically updating COVID-19 epidemic models.

The graphs (see the following pages) show the predictions for *when, where, and how much* increase/decrease in infections, deaths, and bed needs.

This report summarizes the results of a project named *CovidVisualizedCountry*, an online tool developed to function as an early warning tool for technical advisers and health decision-makers.

Pre-print Data Note manuscript on Research Square, titled “CovidVisualized: Visualized compilation of international updating models’ estimates of COVID-19 pandemic at global and country levels”, 02 August 2021, PRE-PRINT (Version 1) available at Research Square [<https://doi.org/10.21203/rs.3.rs-768714/v1>] describes the methods and results of CovidVisualized tools: [*CovidVisualizedCountry* \(for Canada\)](#), [*CovidVisualizedGlobal* \(for global level\)](#), and [*covir2* \(for Iran\)](#).

Farshad Pourmalek MD MPH PhD, who has created the [*CovidVisualizedCountry*](#) tool (and [*covir2*](#) tool for Iran and [*CovidVisualizedGlobal*](#) tool for global level) and this report is a physician and epidemiologist who worked in the [School of Population and Public Health of University of British Columbia](#) and Vancouver General Hospital, [University of Washington](#), WHO, UNDEP, and UNICEF. ORCID ID <https://orcid.org/0000-0002-2134-0771>, PubMed.

This report is the **28th** situation report of predictions of five international and periodically updating COVID-19 epidemic models about the future trajectory of the epidemic in Canada and its provinces. The report is based on the “[CovidVisualizedCountry](#)” online tool, that is a GitHub repository for sharing data and codes, available at

<https://github.com/pourmalek/CovidVisualizedCountry>

This report is meant to serve as an offline and stand-alone version of the online tool. Situation Reports are available online at

<https://github.com/pourmalek/CovidVisualizedCountry/tree/main/situation%20reports>

Objectives of the “CovidVisualizedCountry” tool are to identify international and periodically updated models of the COVID-19 epidemic, compile and visualize their estimation results, and regularly update the compilations.

The ultimate objective is to provide an ***early warning system*** for technical advisors to the decision-makers. When the predictions of one or more models show an increase in daily cases or infections, hospitalizations, or deaths in the near future of ***one to three months***, ***technical advisors to the national and subnational decision-makers*** may consider suggesting augmentation of non-pharmacologic preventive interventions and vaccination. In doing so, the strengths and weaknesses of individual models need to be considered and those of this work. Models’ estimates demonstrate the trajectory of COVID-19 deaths, cases or infections, and hospital-related outcomes in one to three months into the future.

The “CovidVisualized” project includes <https://github.com/pourmalek/CovidVisualizedCountry> for Canada and its provinces, <https://github.com/pourmalek/covir2> for Iran, and <https://github.com/pourmalek/CovidVisualizedGlobal> for the global level.

Methods and technical details of this work are available in a pre-print Data Note manuscript on Research Square, titled “CovidVisualized: Visualized compilation of international updating models’ estimates of COVID-19 pandemic at global and country levels”, 02 August 2021, PRE-PRINT (Version 1) available at Research Square [<https://doi.org/10.21203/rs.3.rs-768714/v1>] describes the methods and results of CovidVisualized tools: [CovidVisualizedCountry](#) (for Canada), [CovidVisualizedGlobal](#) (for global level), and [covir2](#) (for Iran).

Strengths and weaknesses of international and periodically updating COVID-19 epidemic models are discussed in [Pourmalek F, Rezaei Hemami M, Janani L, Moradi-Lakeh M. Rapid review of COVID-19 epidemic estimation studies for Iran. BMC Public Health. 2021 Feb 1;21\(1\):257. doi: 10.1186/s12889-021-10183-3. PMID: 33522928.](#)

Stata codes written and used for this whole work can be examined online and/or downloaded and re-run to check, securitize, verify, or flag any mistakes.

<https://github.com/pourmalek/CovidVisualizedCountry#iii-inner-works-of-this-repository-1>

The five international and periodically updating COVID-19 epidemic models:

DELPHI, IHME, IMPE, (LANL), SRIV; JOHN (these abbreviations are used in the graphs)

DELPHI: DELPHI. Differential Equations Lead to Predictions of Hospitalizations and Infections. COVID-19 pandemic model named DELPHI by Massachusetts Institute of Technology, Cambridge. *Reference:* COVID Analytics. DELPHI epidemiological case predictions. Cambridge: Operations Research Center, Massachusetts Institute of Technology.

<https://www.covidanalytics.io/projections> and
<https://github.com/COVIDAnalytics/website/tree/master/data/predicted>

IHME: Institute for Health Metrics and Evaluation. COVID-19 pandemic model by Institute for Health Metrics and Evaluation, Seattle. *Reference:* Institute for Health Metrics and Evaluation (IHME). COVID-19 mortality, infection, testing, hospital resource use, and social distancing projections. Seattle: Institute for Health Metrics and Evaluation (IHME), University of Washington. <http://www.healthdata.org/covid/> AND <http://www.healthdata.org/covid/data-downloads>

IMPE: Imperial. COVID-19 pandemic model by Imperial College, London. *Reference:* MRC Centre for Global Infectious Disease Analysis (MRC GIDA). Future scenarios of the healthcare burden of COVID-19 in low- or middle-income countries. London: MRC Centre for Global Infectious Disease Analysis, Imperial College London. <https://mrc-ide.github.io/global-lmic-reports/> AND <https://github.com/mrc-ide/global-lmic-reports/tree/master/data>

SRIV: Srivastava, Ajitesh. COVID-19 pandemic model by University of Southern California, Los Angeles. *Reference:* Srivastava, Ajitesh. University of Southern California (USC). COVID-19 forecast. Los Angeles: University of Southern California. <https://scc-usc.github.io/ReCOVER-COVID-19> AND https://github.com/scc-usc/ReCOVER-COVID-19/tree/master/results/historical_forecasts

*

JOHN: Johns Hopkins. Coronavirus resource center, Johns Hopkins University, Baltimore. Curation of official reports of countries to World Health Organization. **Ground truth for comparison.** *Reference:* Johns Hopkins University. Coronavirus resource center.
<https://coronavirus.jhu.edu/map.html> AND <https://github.com/CSSEGISandData/COVID-19>

*

Graphs

Graphs of the most recent models' updates are shown here. These graphs, as well as graphs of previous updates, are available online at

<https://github.com/pourmalek/CovidVisualizedCountry>

Logical order of graphs:

(1) *Location levels*: National level, followed by provinces for which estimations are available: Alberta, British Columbia, Manitoba, Nova Scotia, Ontario, Quebec, and Saskatchewan.

(2) *Outcomes*: Daily deaths, Daily cases or infections, Hospital-related outcomes, Daily deaths estimated to reported ratio, Daily cases or infections estimated to reported cases ratio. Followed by additional outcomes estimated by IHME and added starting from uptake 20210916, i.e., R effective, Daily Infection-outcome ratios, Daily mobility, Daily mask use, and (Percent) cumulative vaccinated.

(3) *Calendar time of estimates coverage*: All-time, followed by 2021. To view the whole epidemic trajectory and further focus on the near future.

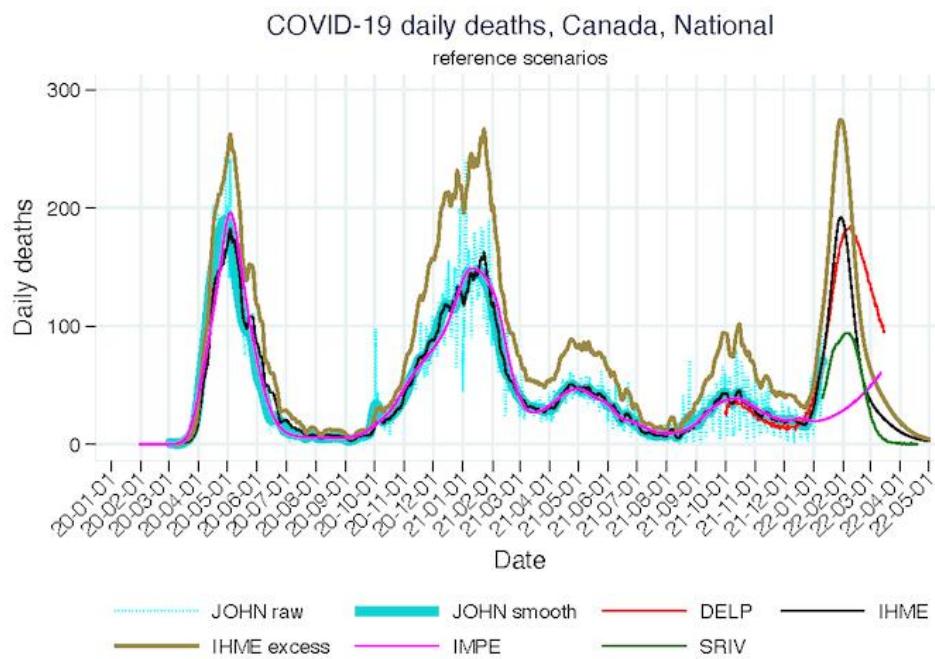
(4) *Scenarios*: Reference scenarios, followed by alternative scenarios. To examine the main or reference (aka. status quo) scenario and alternative (better and worse) scenarios.

(5) *Five models*: Different models *within* each graph (for which model estimates update release dates are maximally synchronized), plus official reports of the country to WHO (curated by Johns Hopkins University) as the under-reported benchmark for trends. To examine how heterogeneity in methods used by different models results in heterogeneous results for the same outcome (same time-place-person aggregated units)

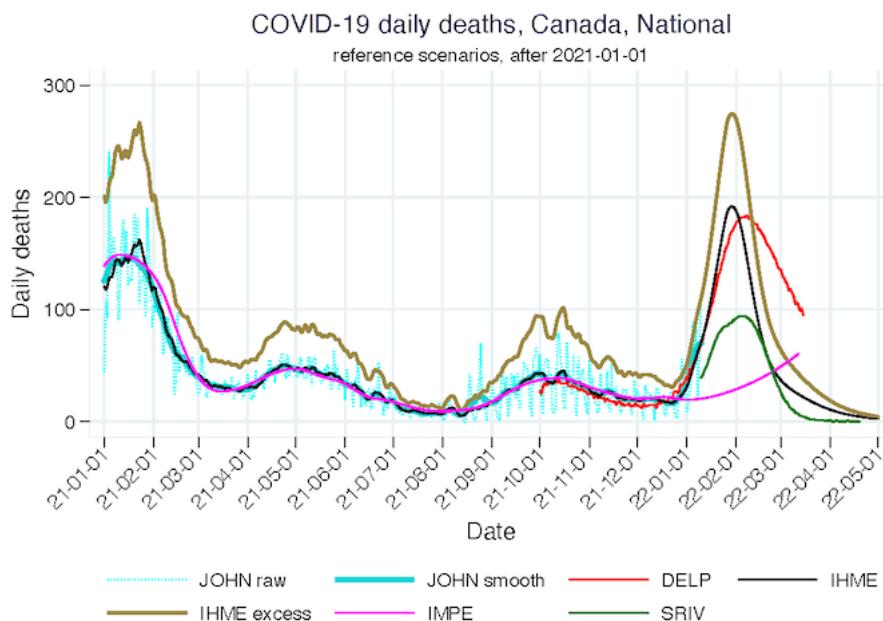
Among the five available international periodically updating studies or models of COVID-19 pandemic, only **TWO** studies, DELP and IHME, provide subnational level estimates for some countries. For Canada, they provide estimates for **SEVEN** provinces (AB, BC, MB, NS, ON, QC, SK).

Selected graphs - Canada, national

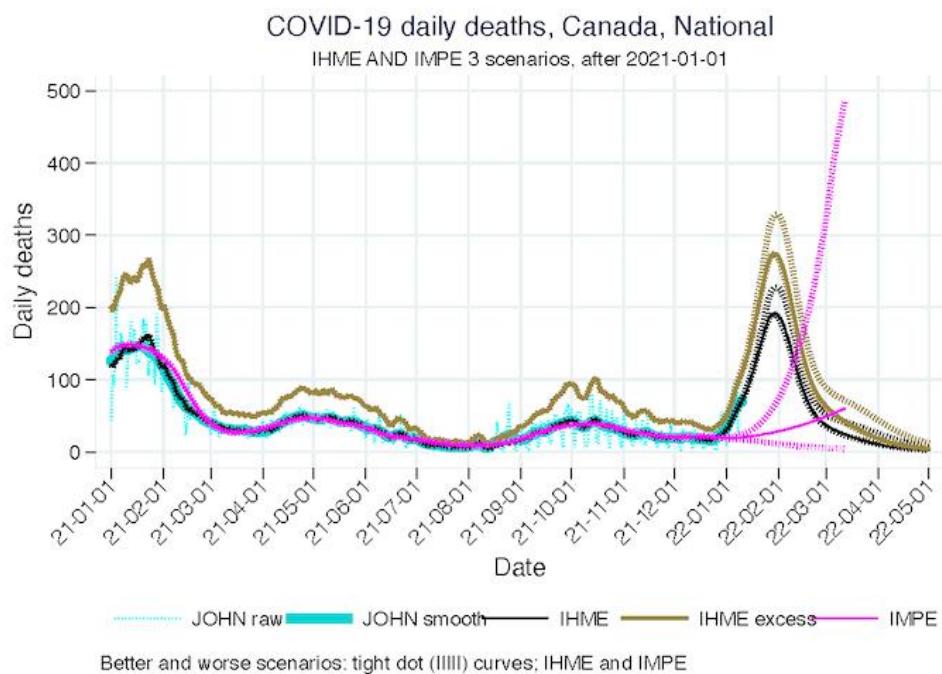
(1) Canada [Daily deaths, reference scenarios, all time](#)



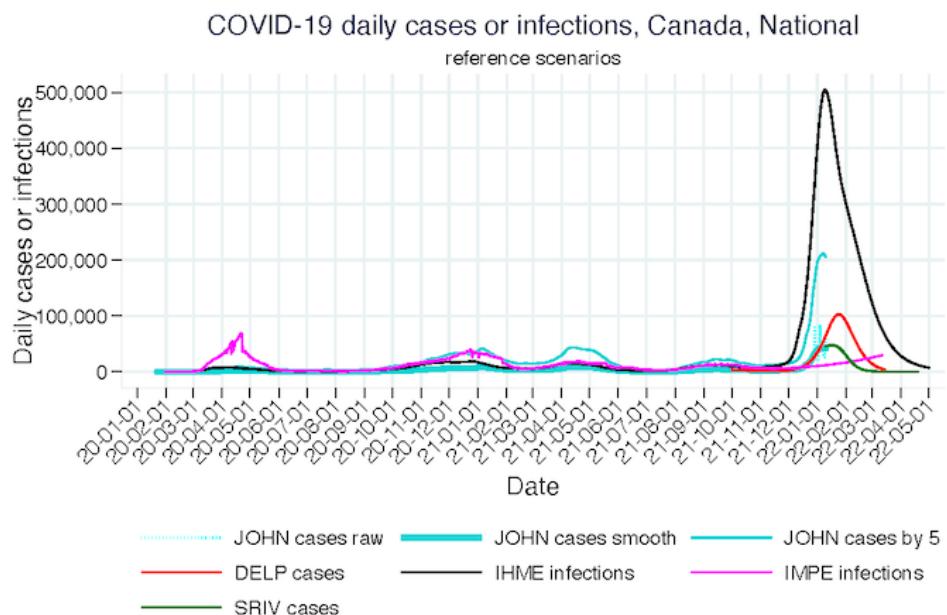
(2) Canada [Daily deaths, reference scenarios, 2021 on](#)



(3) Canada [Daily deaths, 3 scenarios, 2021 on](#)

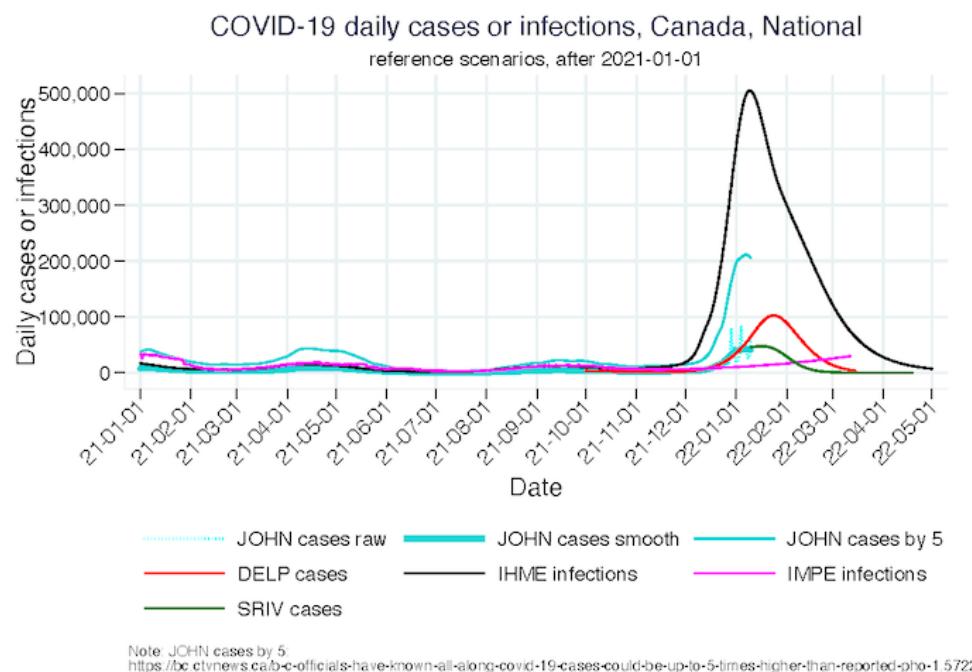


(4) Canada [Daily cases or infections, reference scenarios, all time](#)

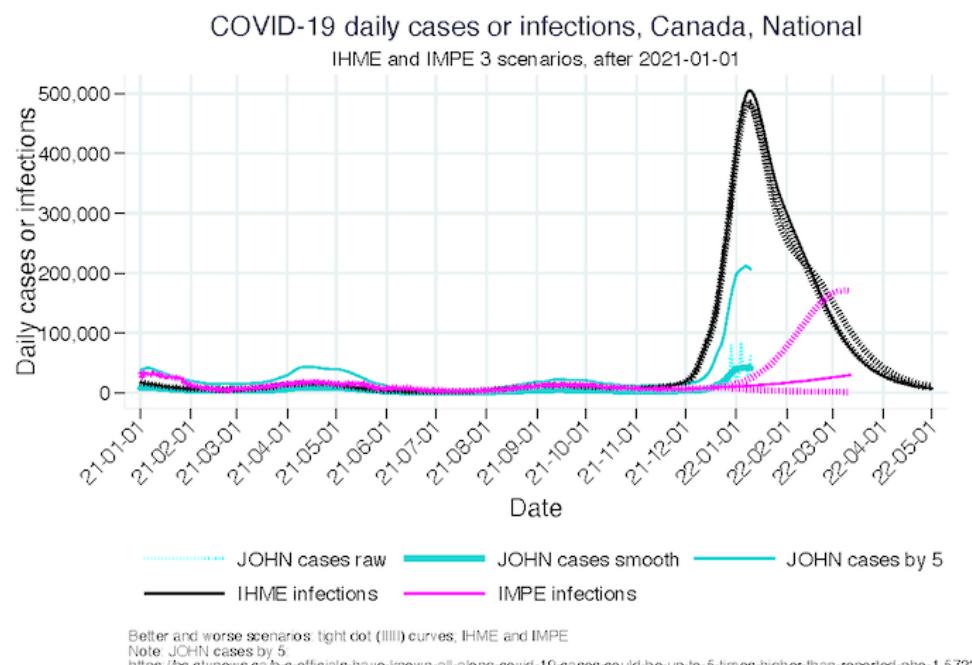


Note: JOHN cases by 5
<https://bc.ctvnews.ca/b-c-officials-have-known-all-along-covid-19-cases-could-be-up-to-5-times-higher-than-reported-pho-1.5722>

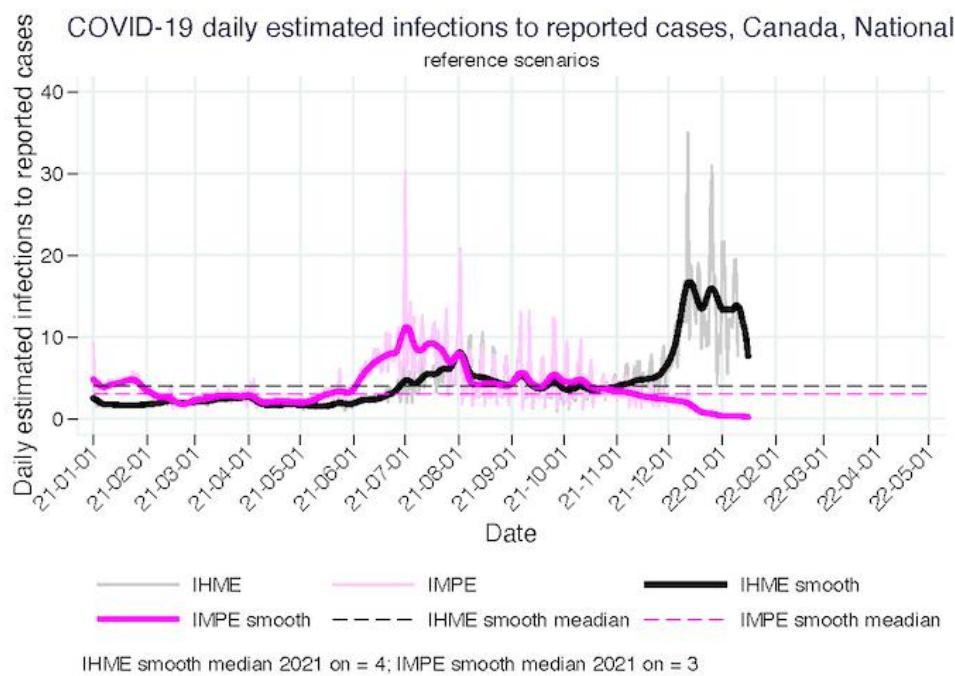
(5) Canada [Daily cases or infections, reference scenarios, 2021 on](#)



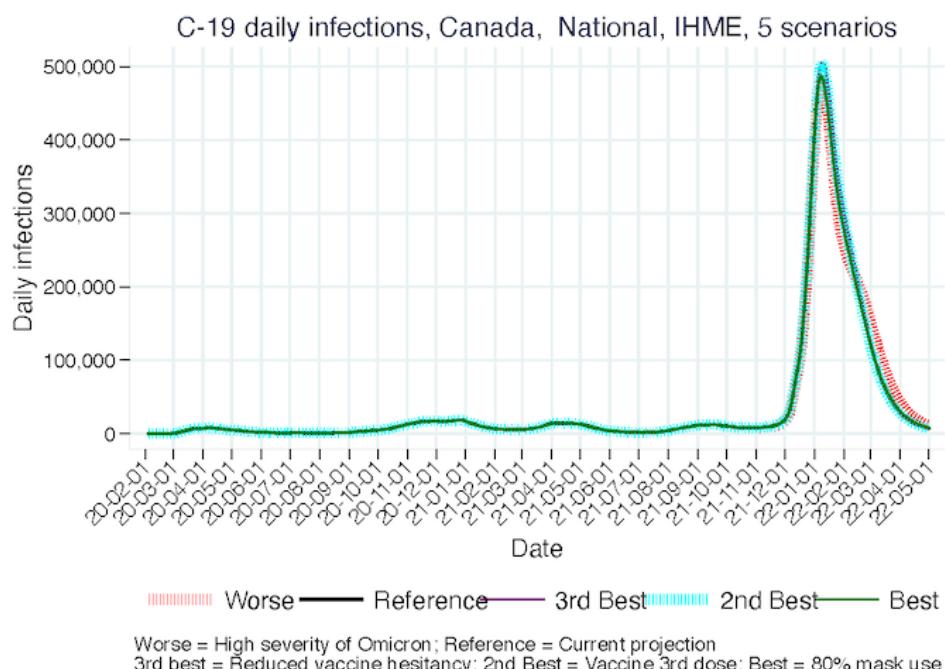
(6) Canada [Daily cases or infections, 3 scenarios, 2021 on](#)



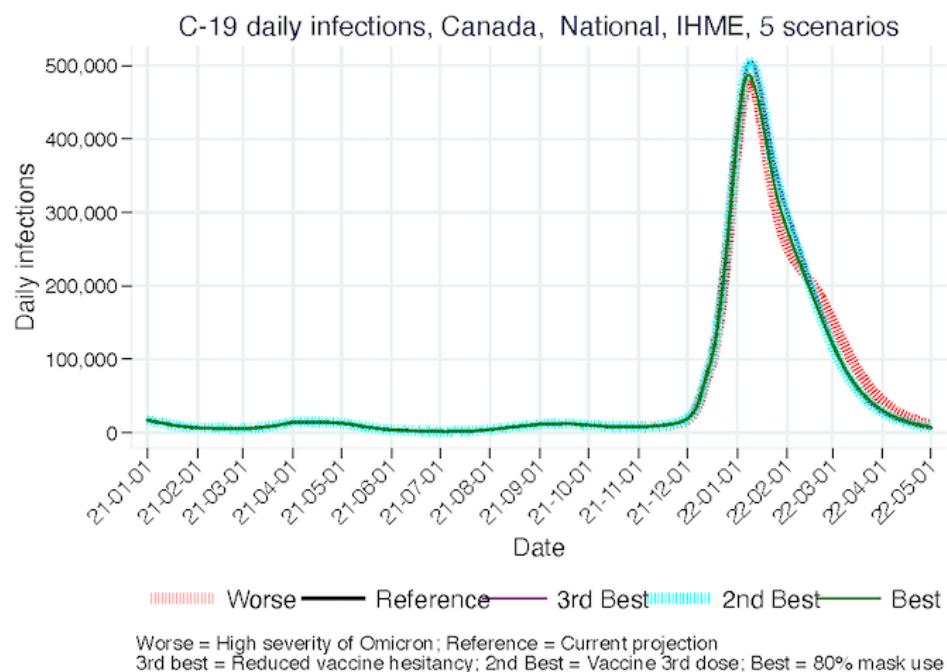
(6b) Canada [Daily estimated infections IHME IMPE to reported cases JOHN, main scenarios, 2021 on](#)



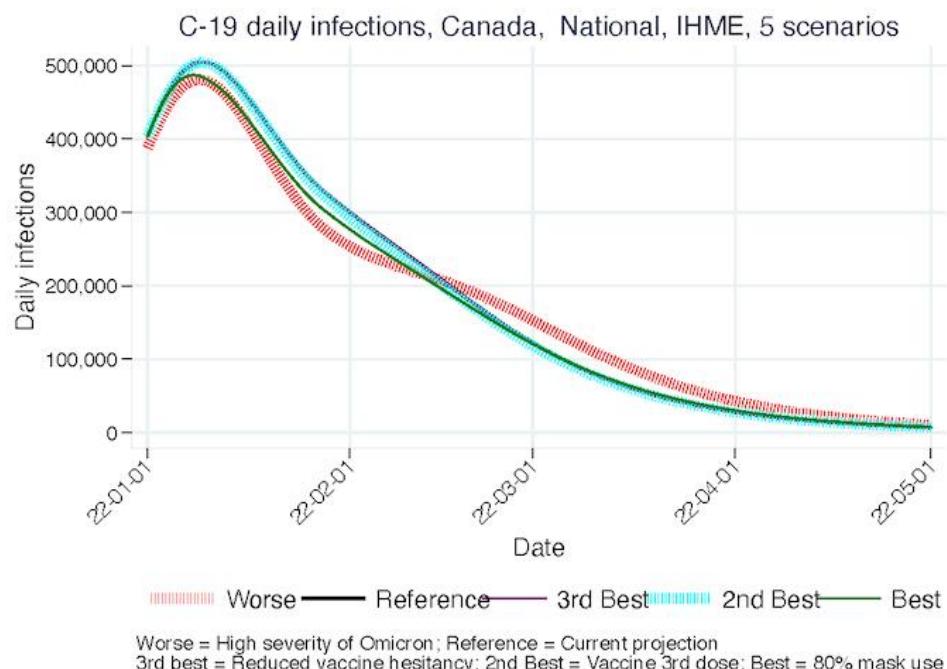
(6c) Canada [Daily estimated infections IHME, 5 scenarios, all time](#)



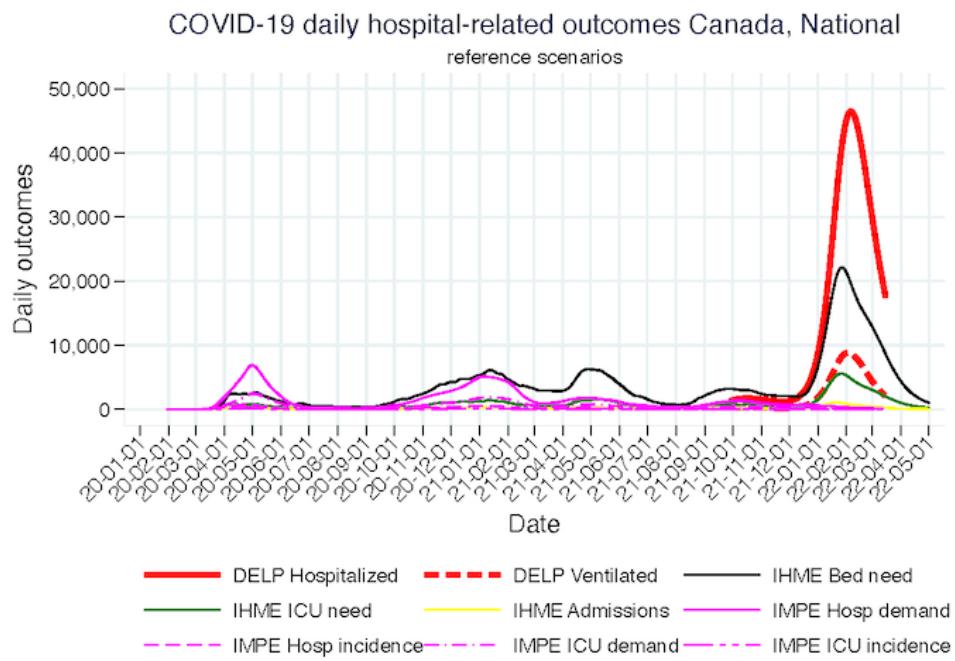
(6d) Canada [Daily estimated infections IHME, 5 scenarios, 2021 on](#)



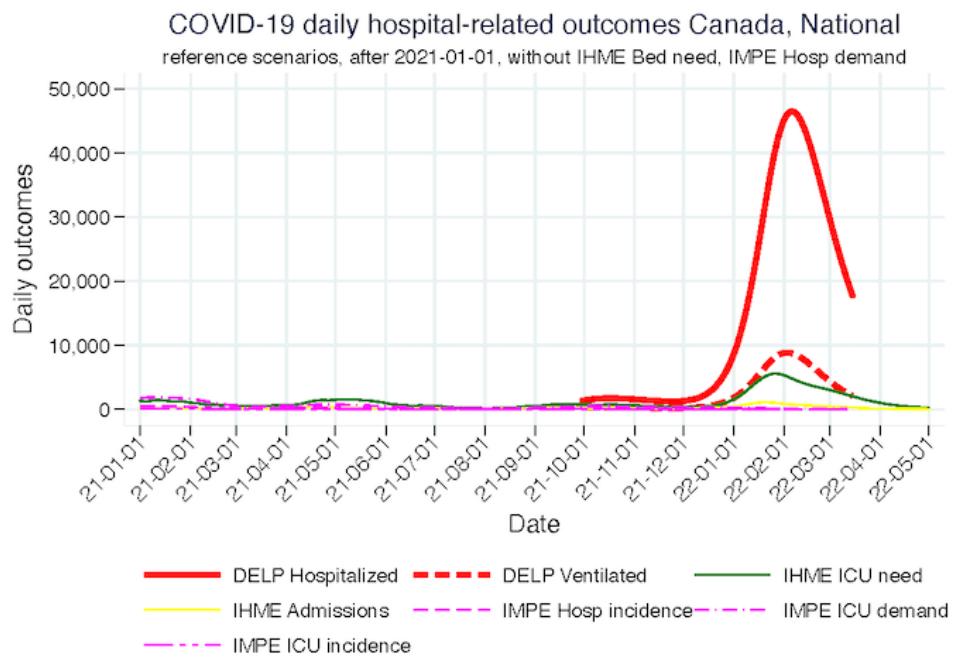
(6e) Canada [Daily estimated infections IHME, 5 scenarios, 2022](#)



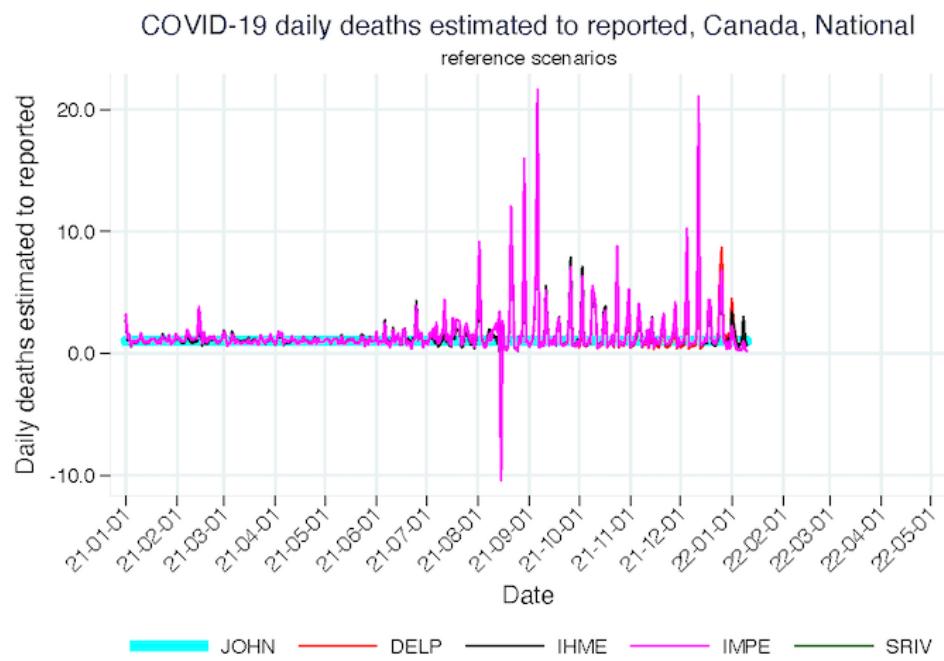
(7) Canada [Hospital-related outcomes, all time](#)



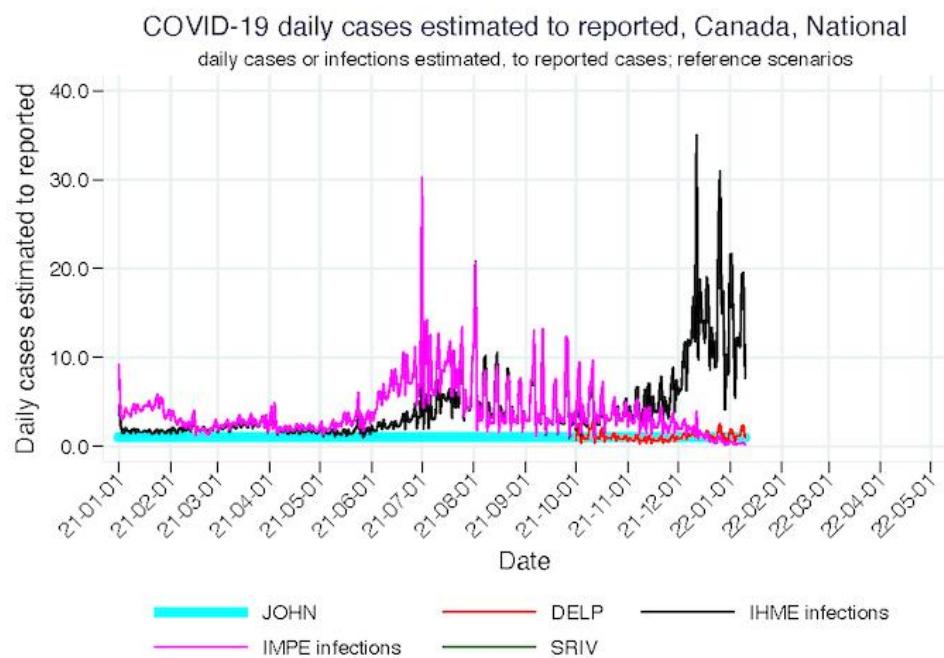
(8) Canada [Hospital-related outcomes, 2021 on, without IHME Bed need and IMPE Hospital demand](#)



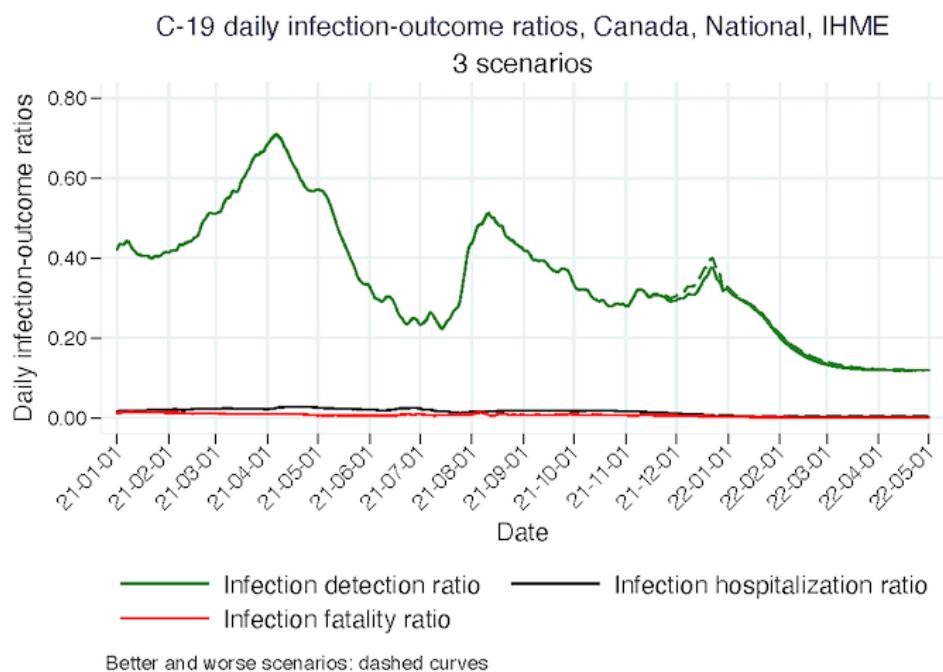
(9) Canada [Daily deaths estimated to reported, reference scenarios, 2021 on](#)



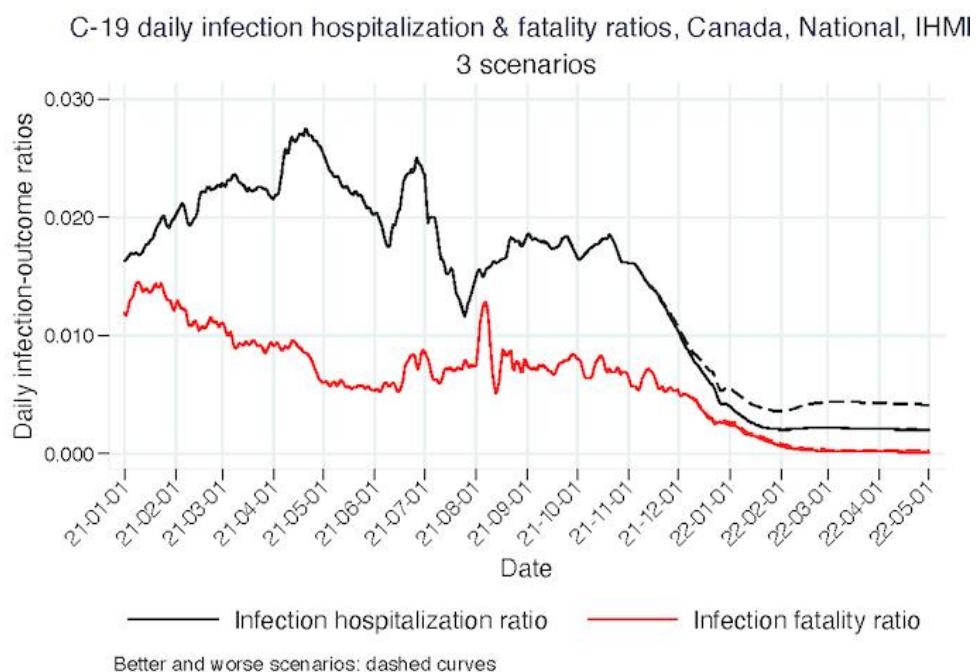
(10) Canada [Daily cases or infections estimated to reported, reference scenarios, 2021 on](#)



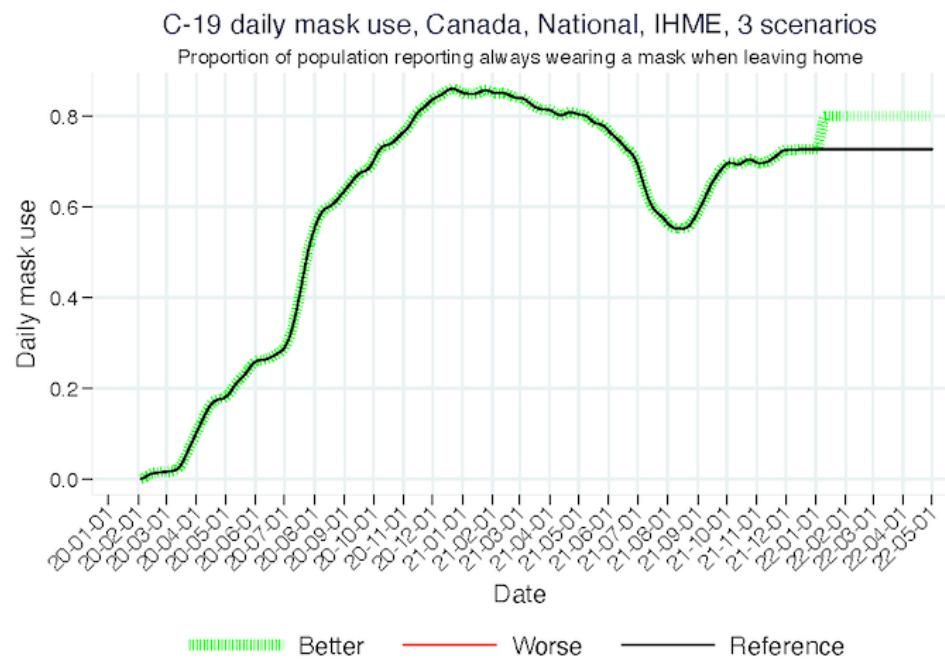
(11) Canada [Daily Infection-outcomes ratios, 3 scenarios, IHME, 2021 on](#)



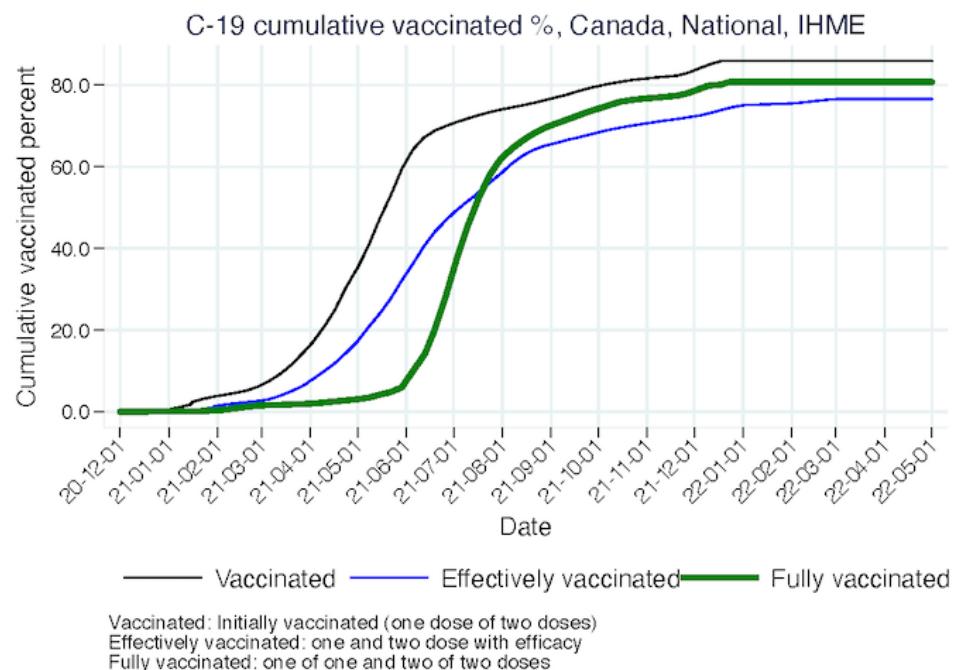
(11b) Canada [Daily infection hospitalization & fatality ratios, 3 scenarios, IHME, 2021 on](#)



(12) Canada [Daily mask use, 3 scenarios, all time, IHME](#)

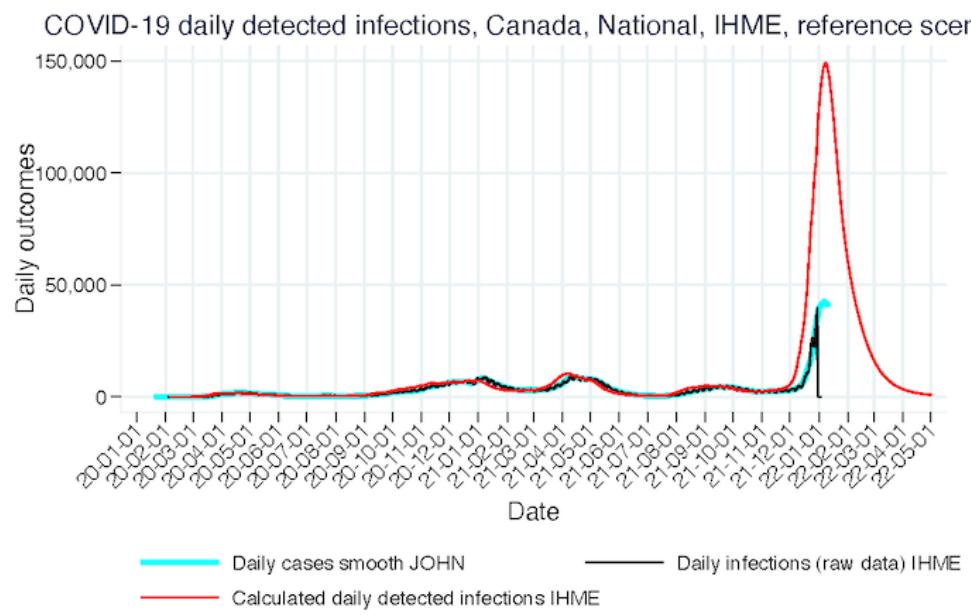


(13) Canada [Percent cumulative vaccinated, 2021 on, IHME](#)



(14) Canada [Calculated daily detected infections, reference scenario, all time, IHME](#)

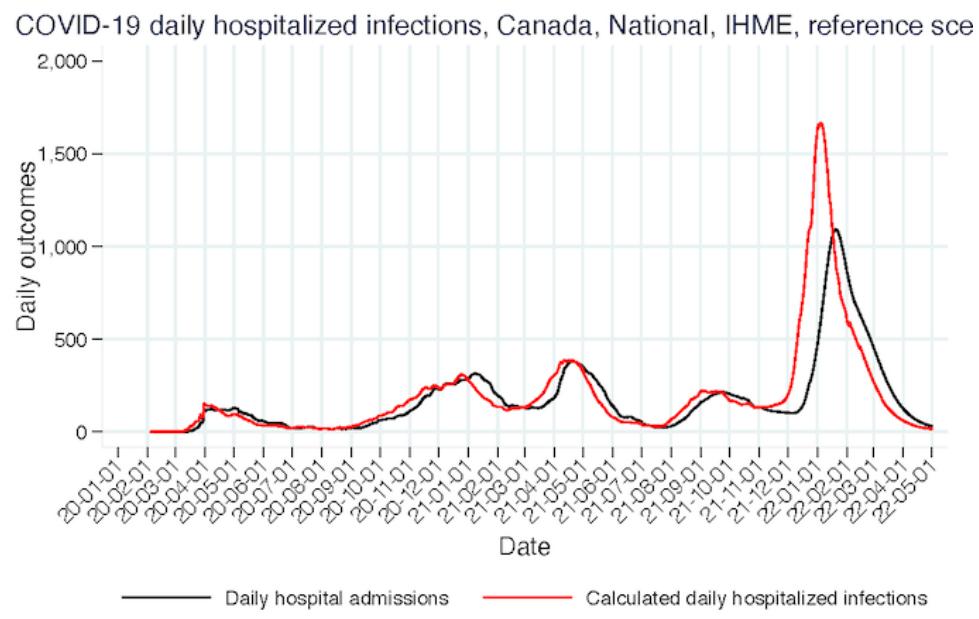
Calculated daily detected infections = Daily infections * Infection detection ratio



Reference scenario = Current projection:
Calculated daily detected infections = Daily infections * Infection detection ratio

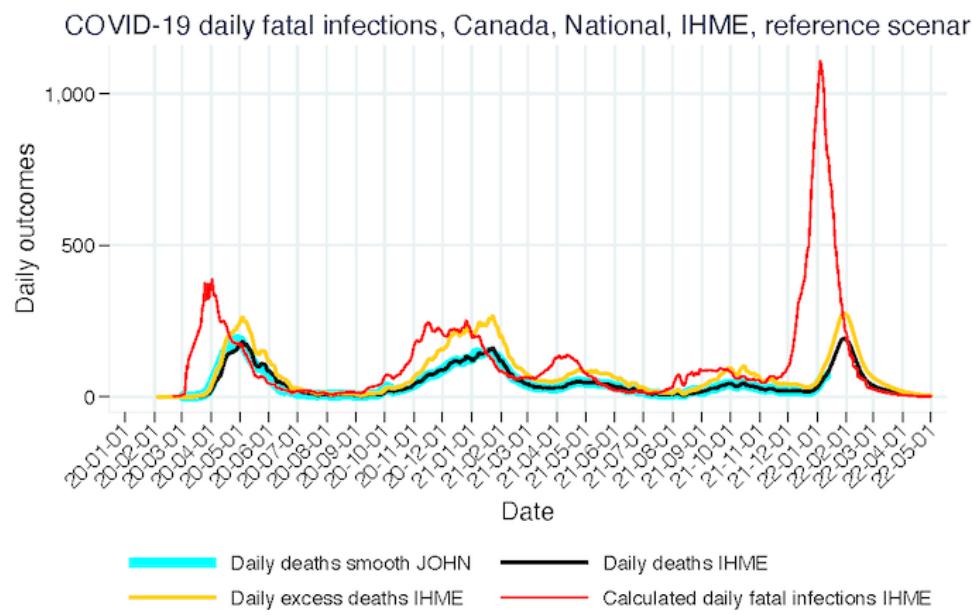
(15) Canada [Calculated daily hospitalized infections, reference scenario, all time, IHME](#)

Calculated daily hospitalized infections = Daily infections * Infection hospitalization ratio



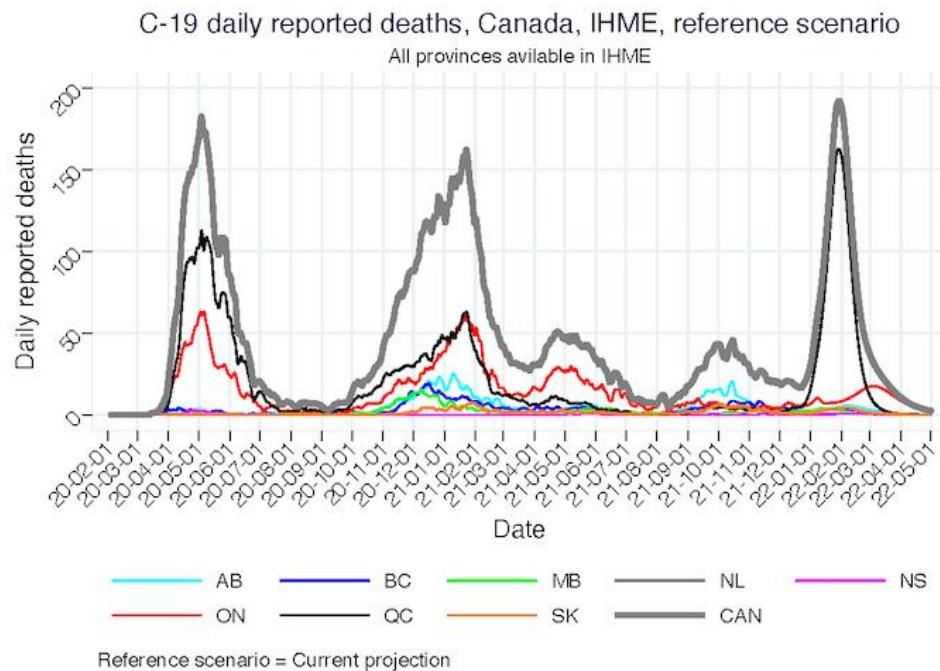
(16) Canada [Calculated daily fatal infections, reference scenario, all time, IHME](#)

Calculated daily fatal infections = Daily infections * Infection fatality ratio

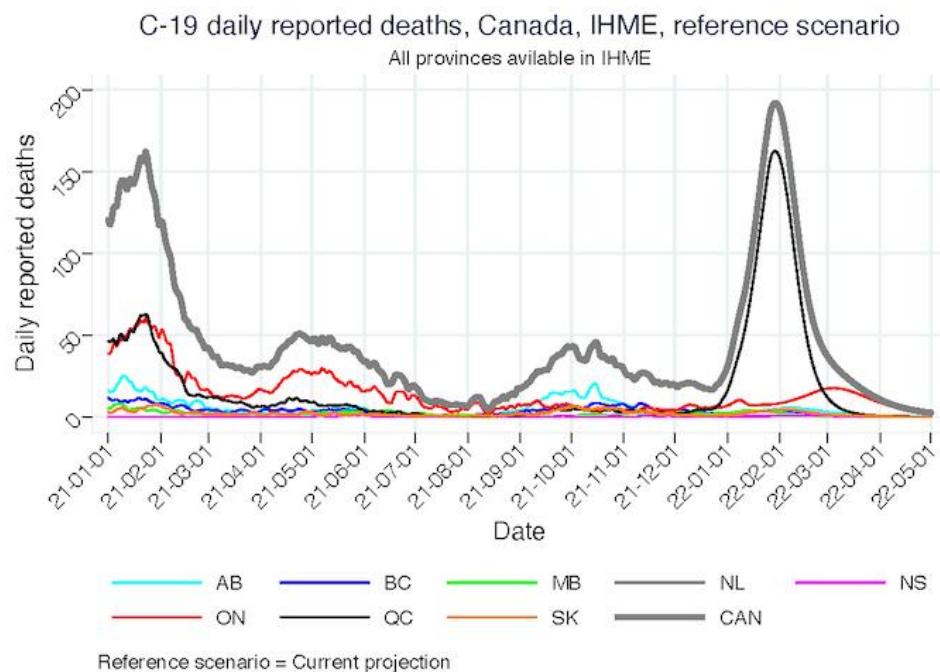


Selected graphs - Canada, provinces

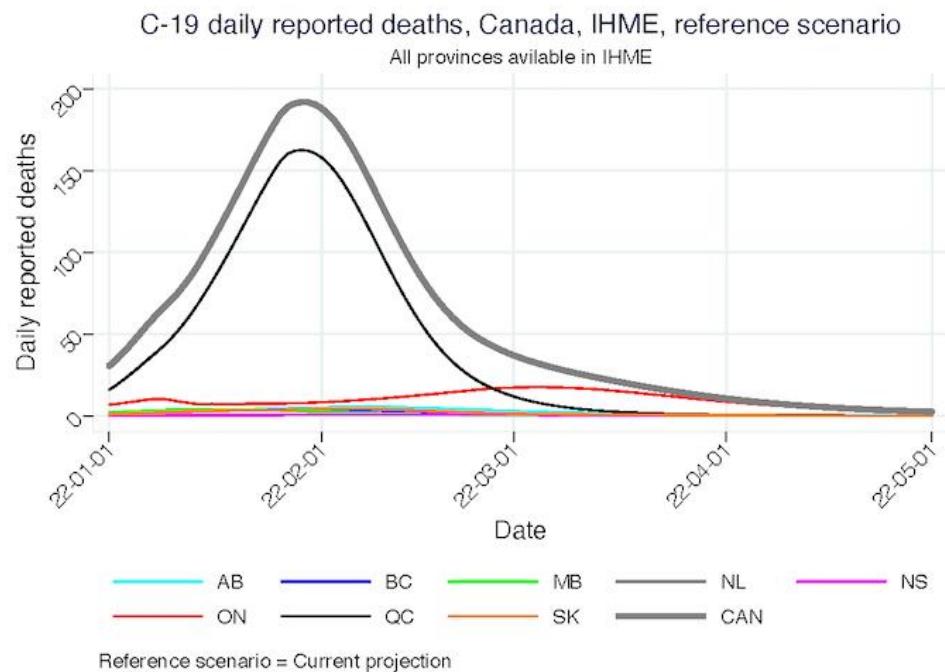
(1a) Canada provinces [Daily reported deaths, reference scenarios, all time, IHME, all time](#)



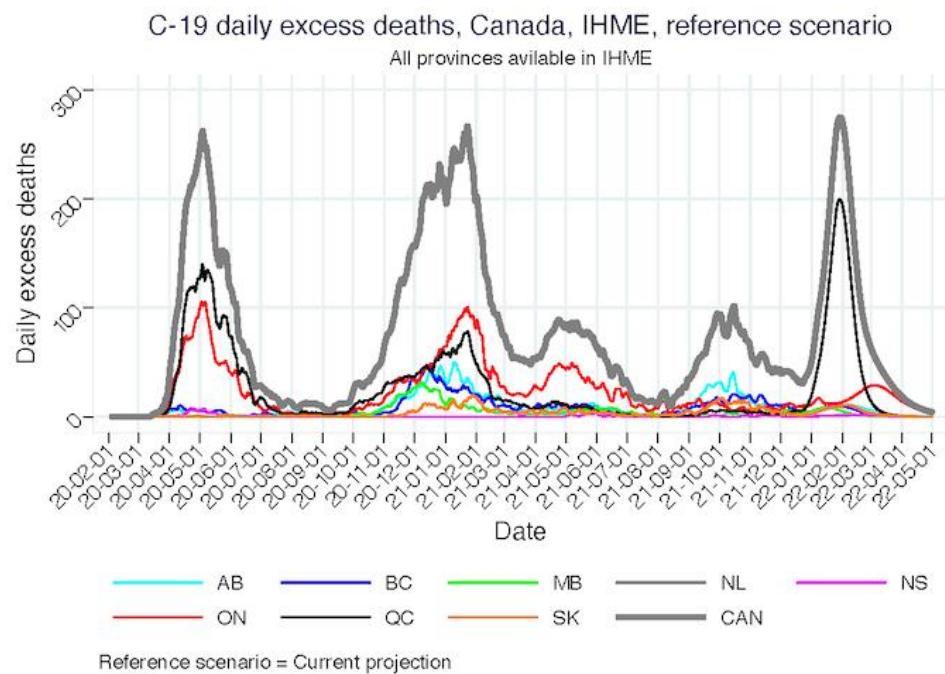
(1b) Canada provinces [Daily reported deaths, reference scenarios, all time, IHME, 2021 on](#)



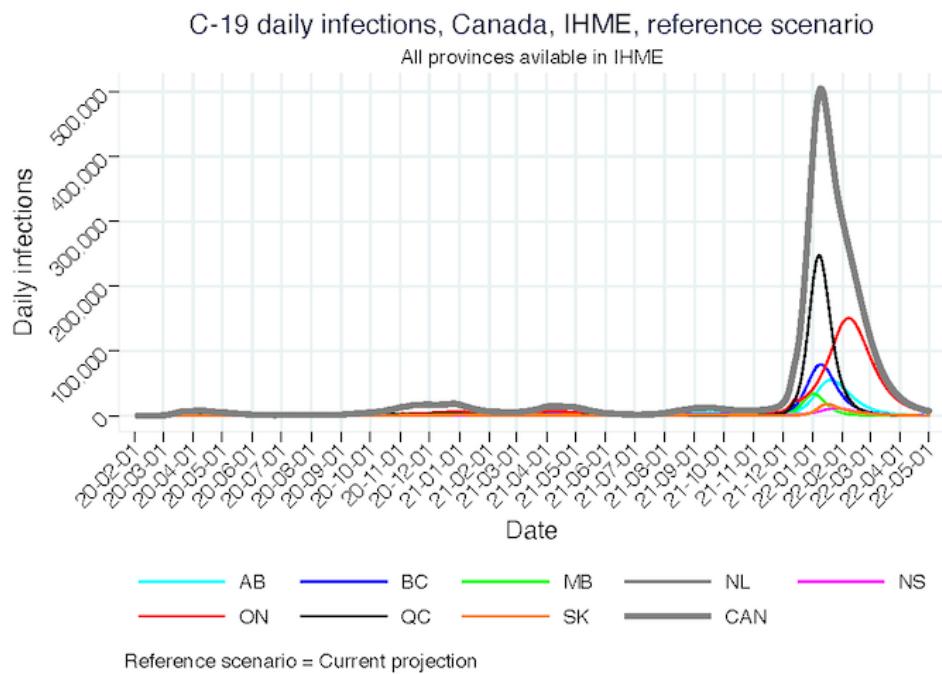
(1c) Canada provinces [Daily reported deaths, reference scenarios, all time, IHME, 2022](#)



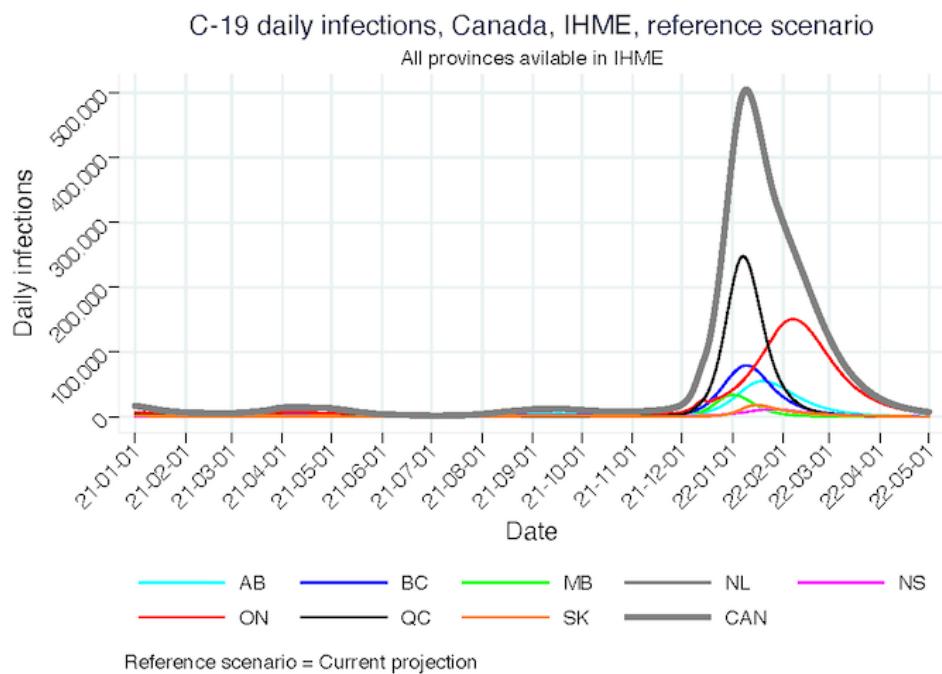
(2) Canada provinces [Daily excess deaths, reference scenarios, all time, IHME, all time](#)



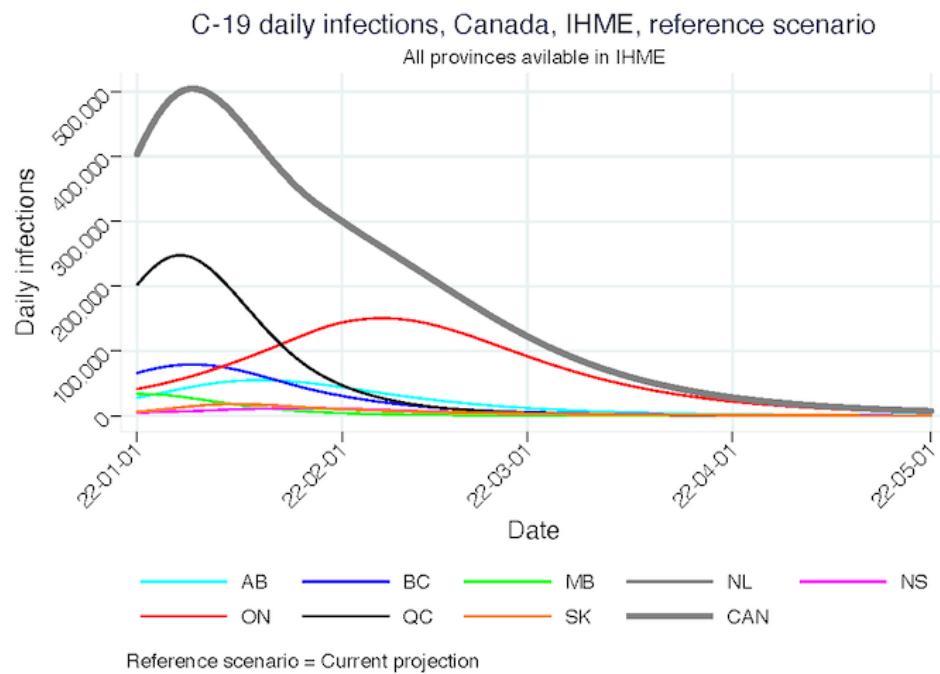
(3a) Canada provinces [Daily infections, reference scenarios, all time, IHME, all time](#)



(3b) Canada provinces [Daily infections, reference scenarios, all time, IHME, 2021 on](#)

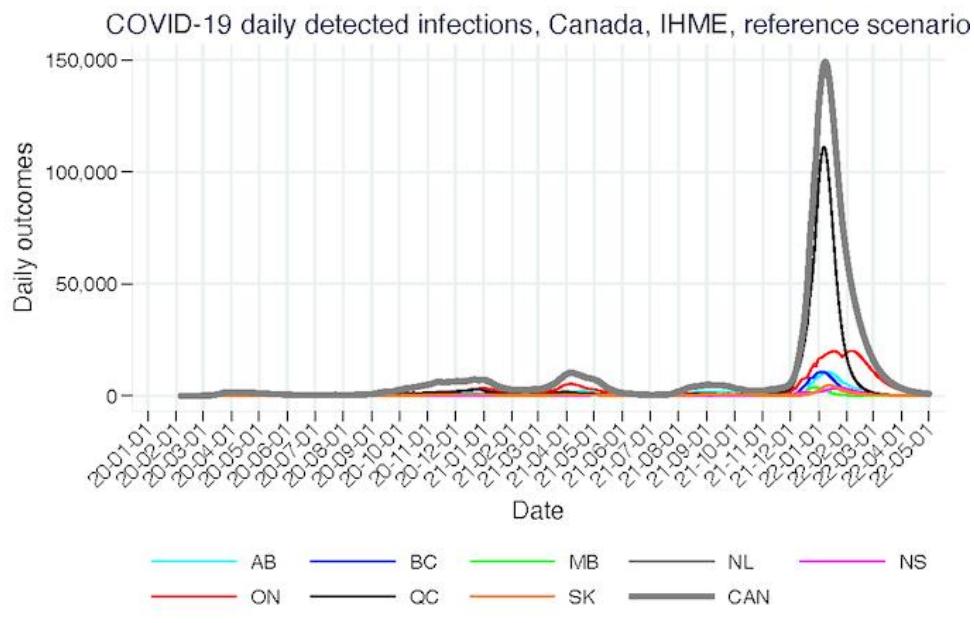


(3c) Canada provinces [Daily infections, reference scenarios, all time, IHME, 2022](#)



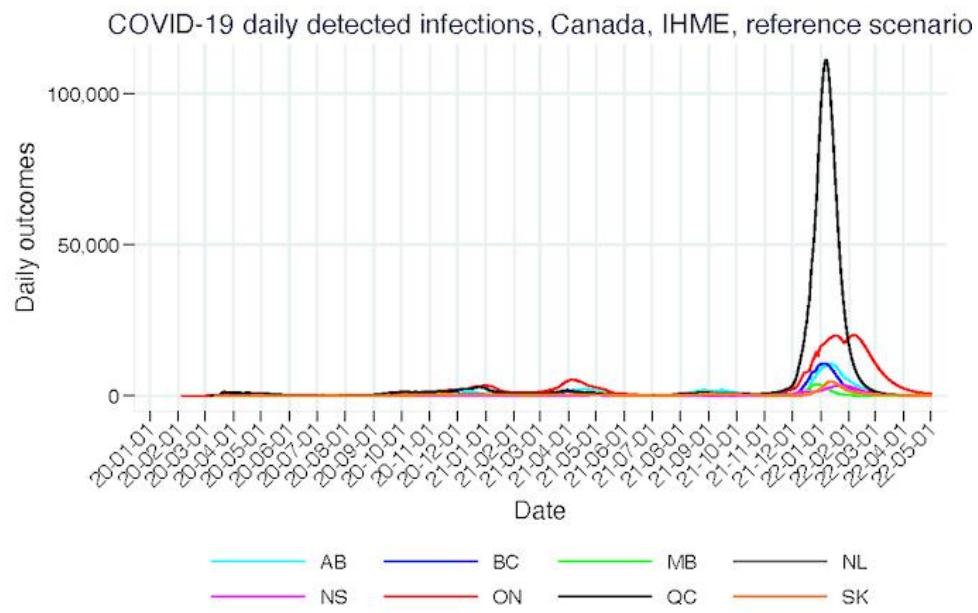
(4a) Canada provinces [Calculated daily detected infections, provinces with national, reference scenario, all time, IHME](#)

Calculated daily detected infections = Daily infections * Infection detection ratio



(4b) Canada provinces [Calculated daily detected infections, provinces without national, reference scenario, all time, IHME](#)

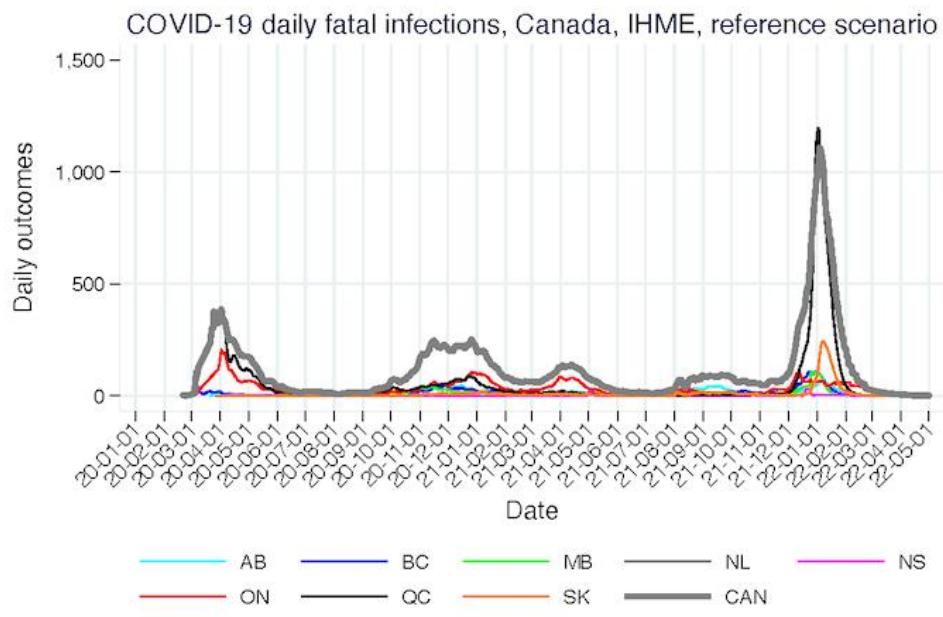
Calculated daily detected infections = Daily infections * Infection detection ratio



Reference scenario = Current projection;
Calculated daily detected infections = Daily infections * Infection detection ratio

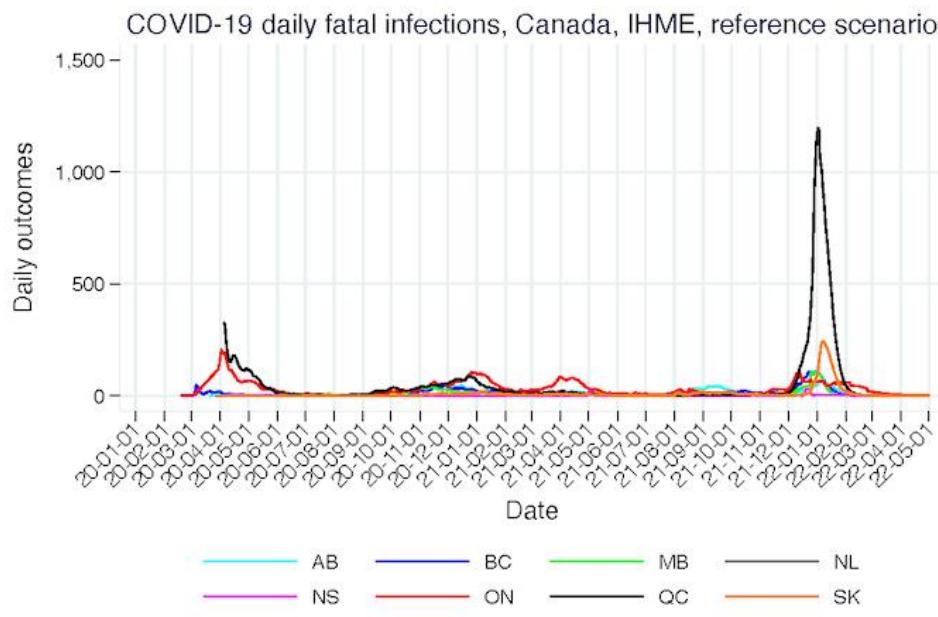
(4a) Canada provinces [Calculated daily fatal infections, provinces with national, reference scenario, all time, IHME](#)

Calculated daily fatal infections = Daily infections * Infection fatality ratio



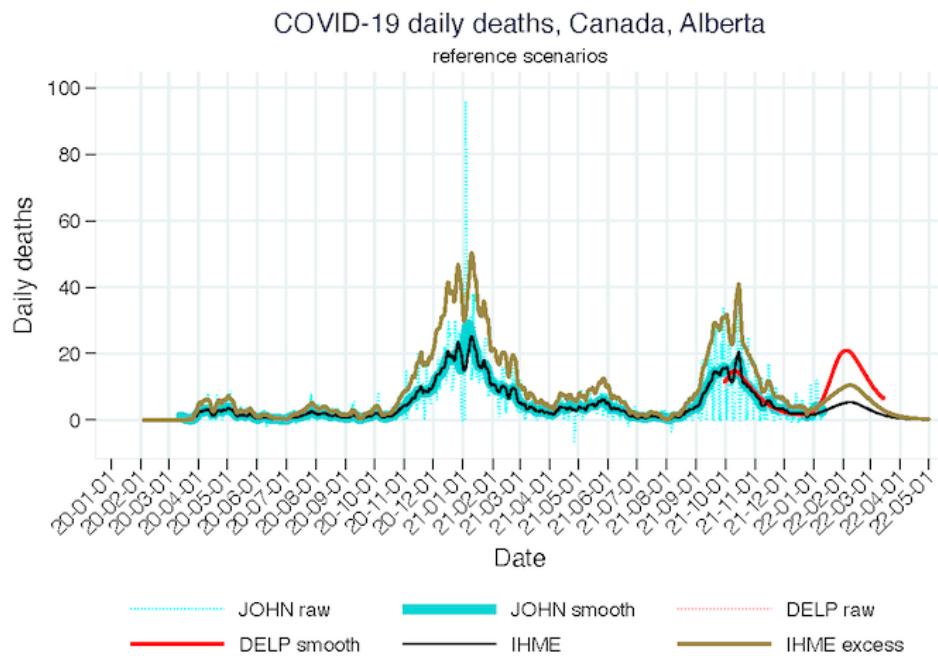
(5b) Canada provinces [Calculated daily fatal infections, provinces without national, reference scenario, all time, IHME](#)

Calculated daily fatal infections = Daily infections * Infection fatality ratio

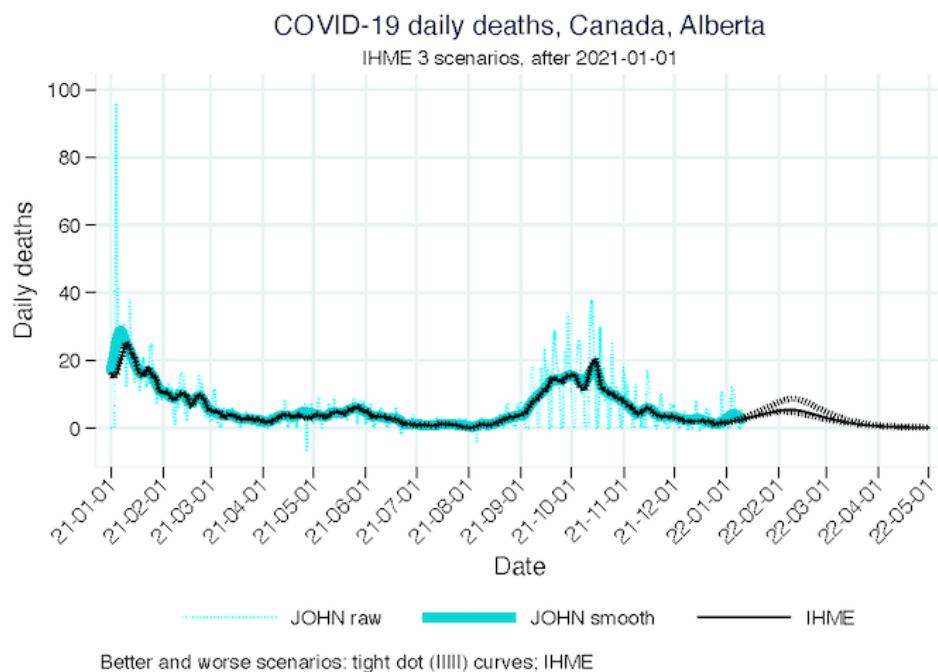


Selected graphs - Alberta

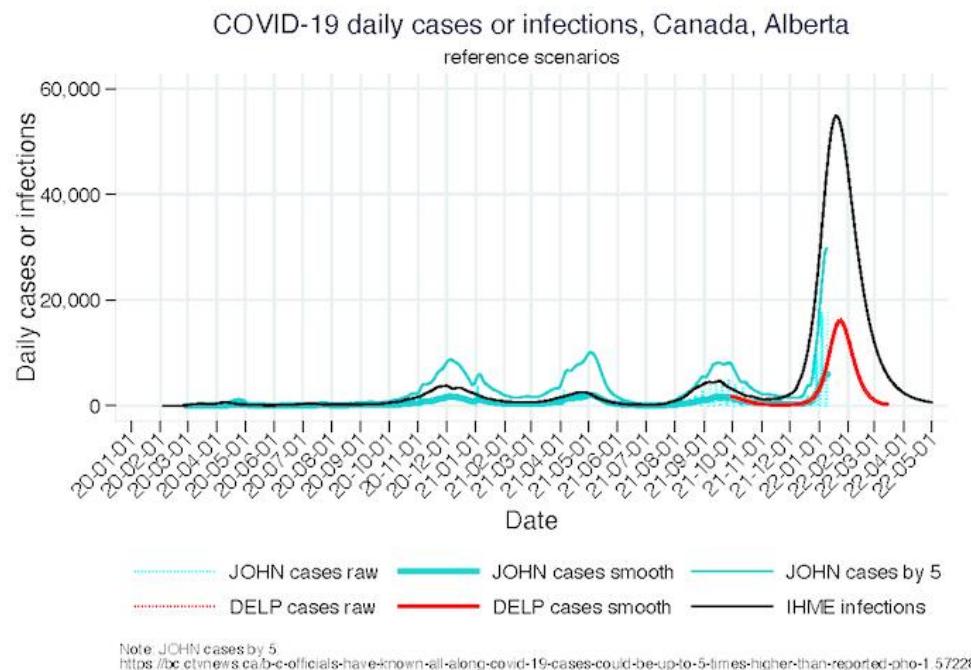
(1) Alberta Daily deaths, reference scenarios, all time



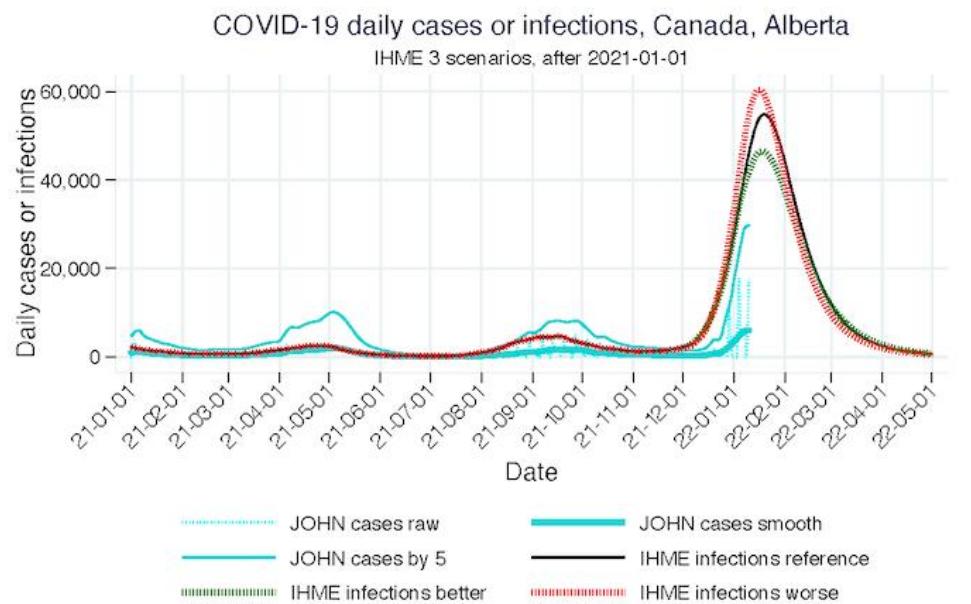
(3) Alberta Daily deaths, 3 scenarios, 2021 on



(4) Alberta Daily cases or infections, reference scenarios, all time

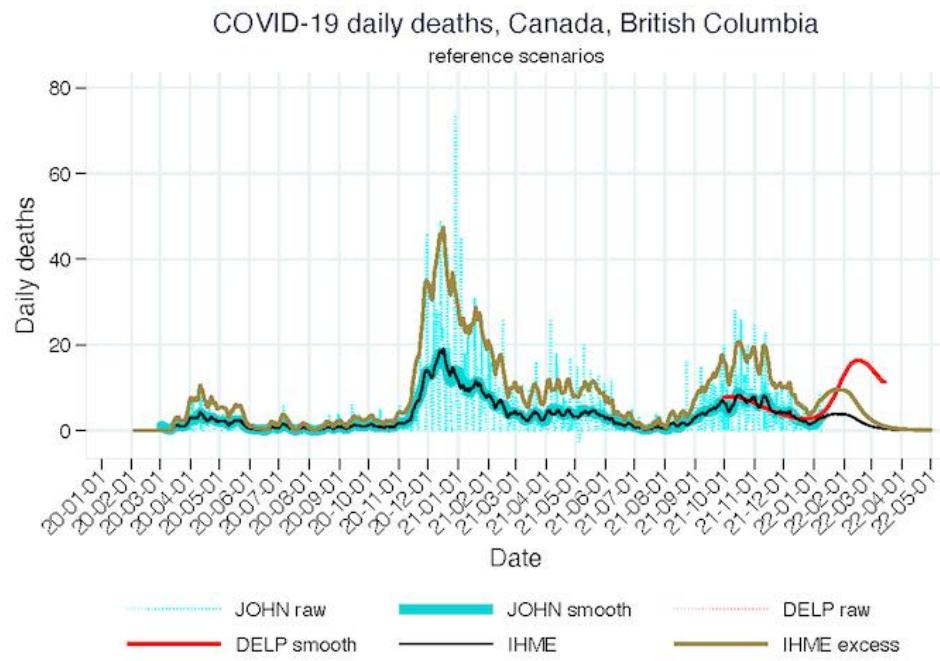


(6) Alberta Daily cases or infections, 3 scenarios, 2021 on

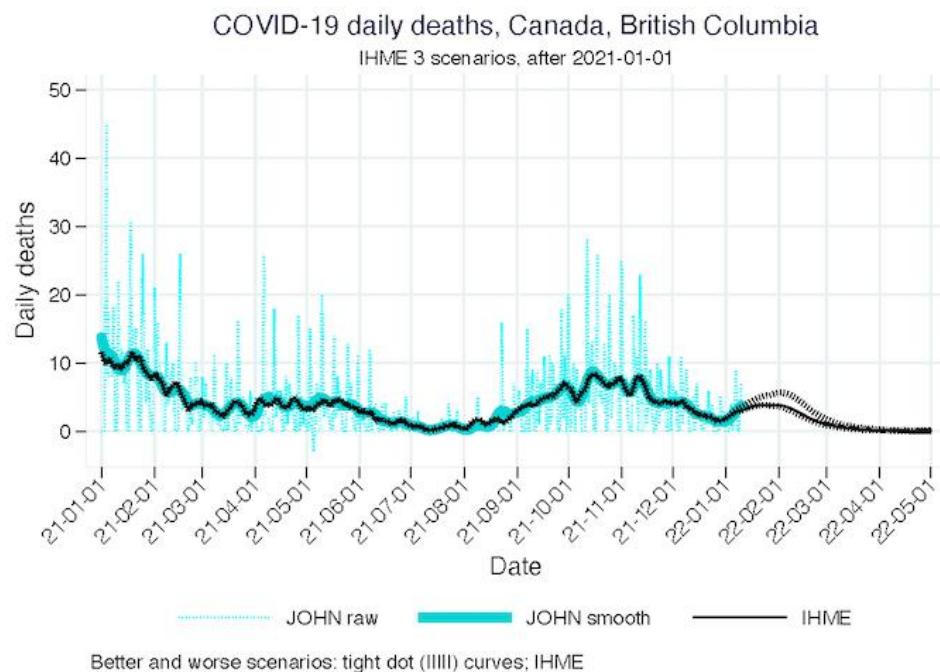


Selected graphs - British Columbia

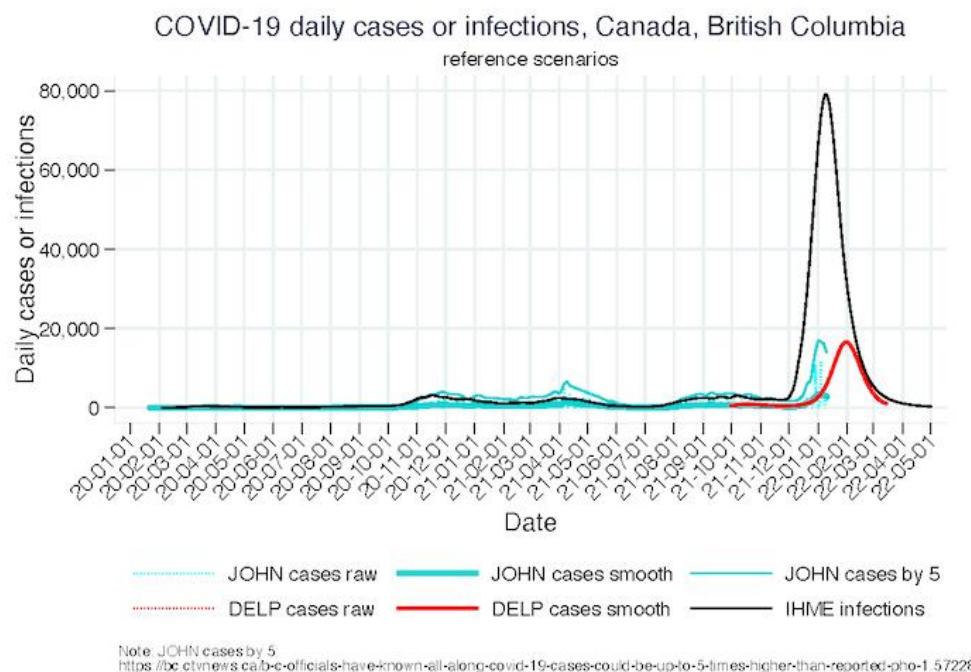
(1) British Columbia [Daily deaths, reference scenarios, all time](#)



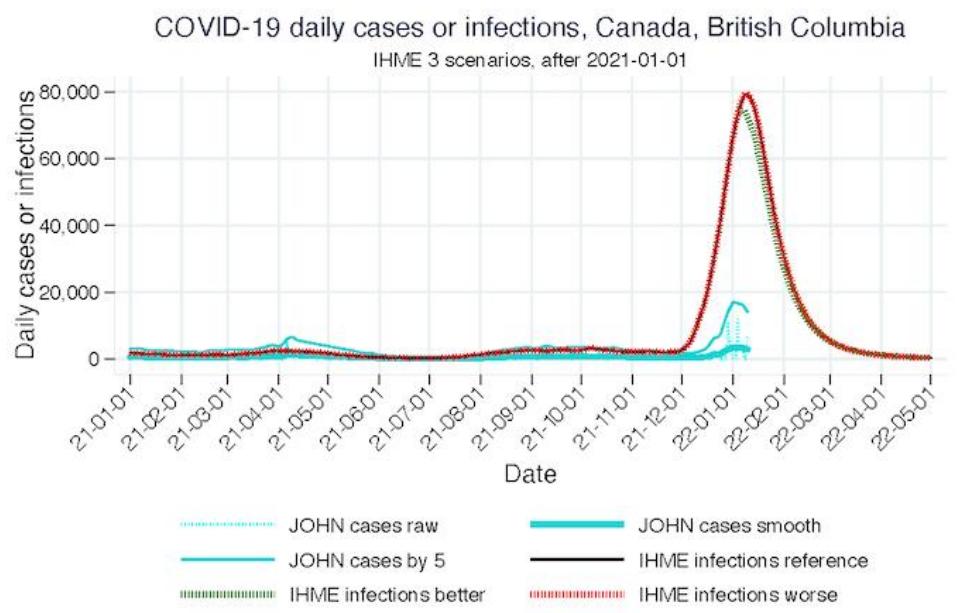
(3) British Columbia [Daily deaths, 3 scenarios, 2021 on](#)



(4) British Columbia [Daily cases or infections, reference scenarios, all time](#)

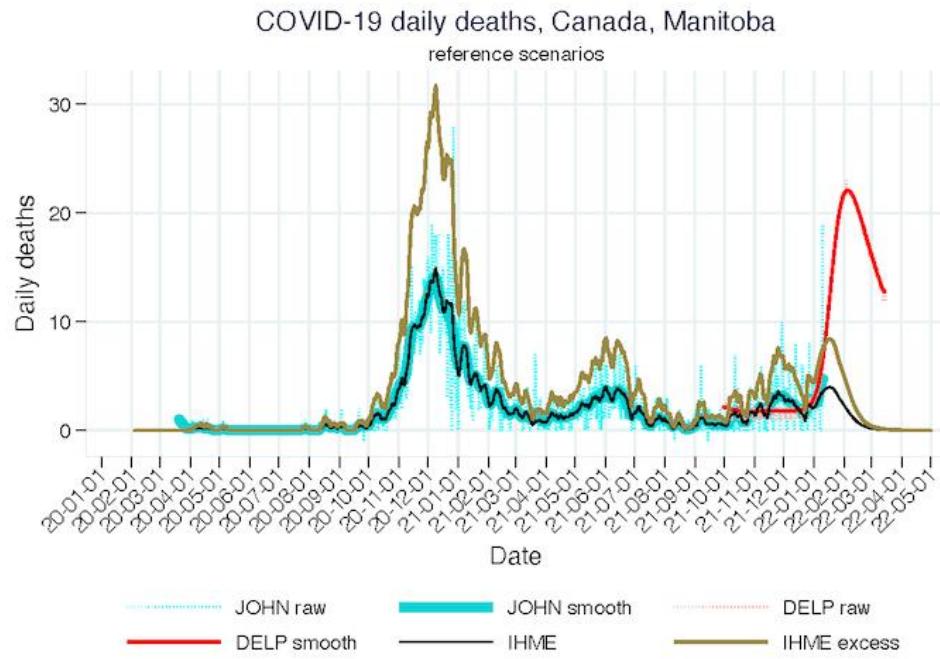


(6) British Columbia [Daily cases or infections, 3 scenarios, 2021 on](#)

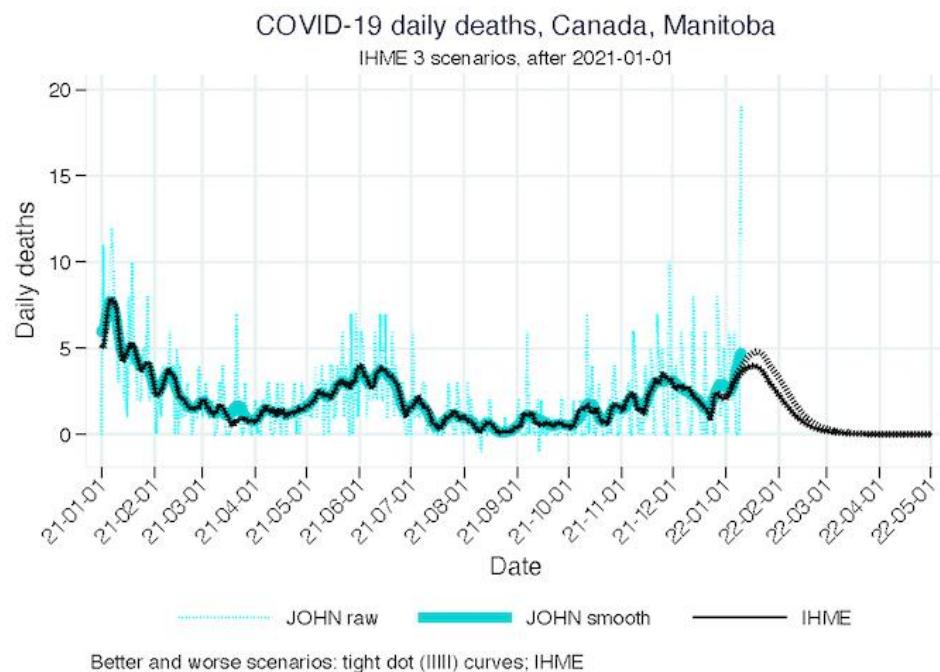


Selected graphs - Manitoba

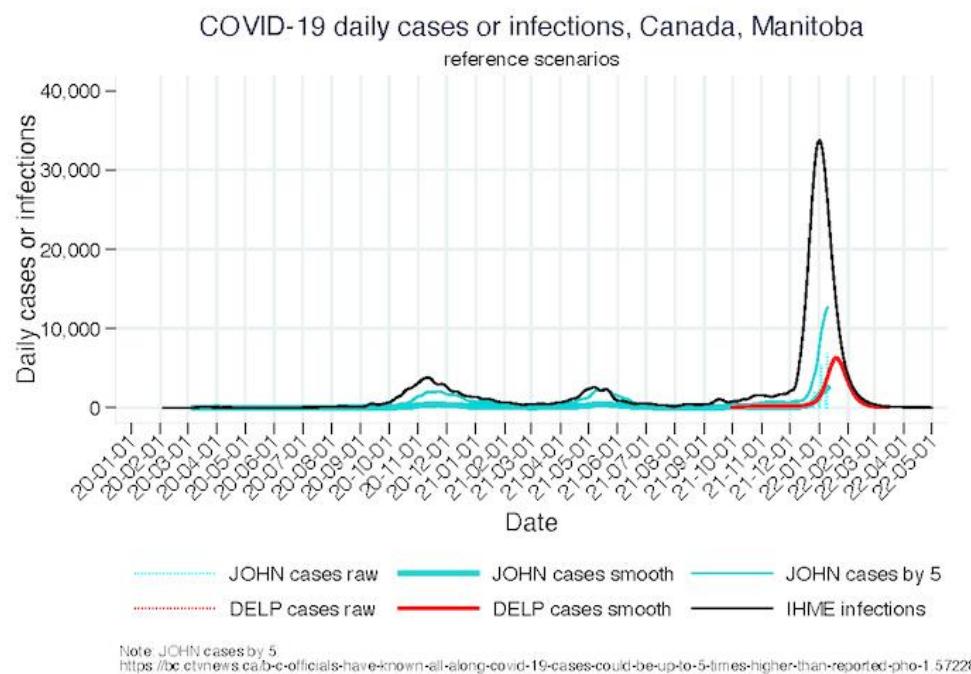
(1) Manitoba [Daily deaths, reference scenarios, all time](#)



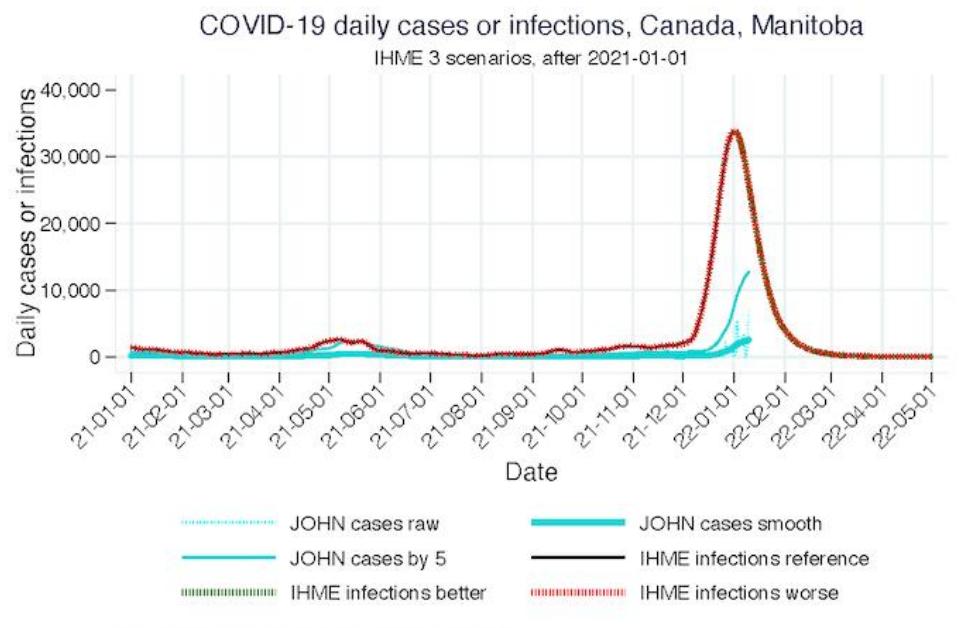
(3) Manitoba [Daily deaths, 3 scenarios, 2021 on](#)



(4) Manitoba [Daily cases or infections, reference scenarios, all time](#)



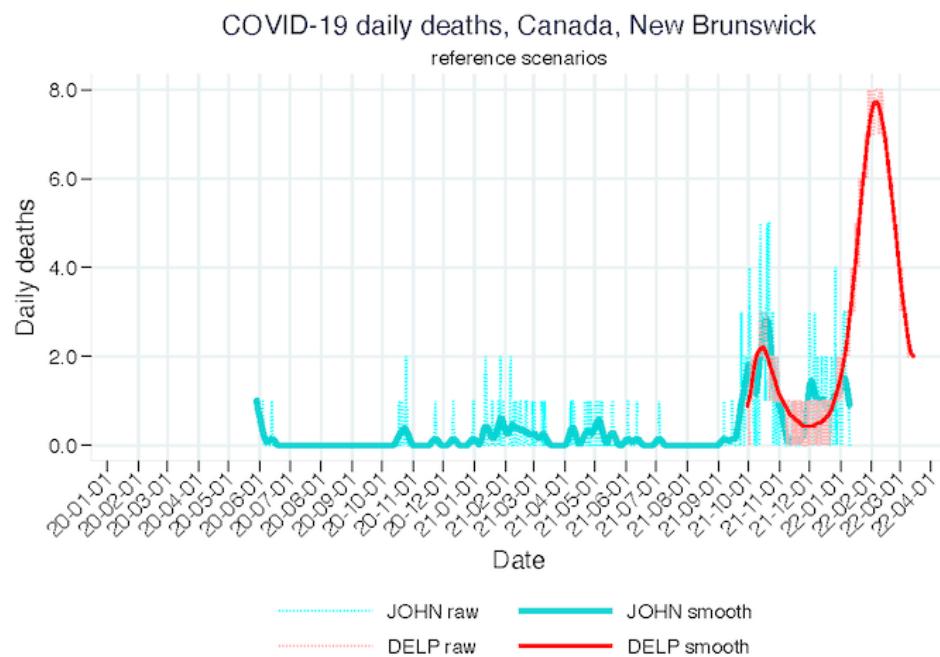
(6) Manitoba [Daily cases or infections, 3 scenarios, 2021 on](#)



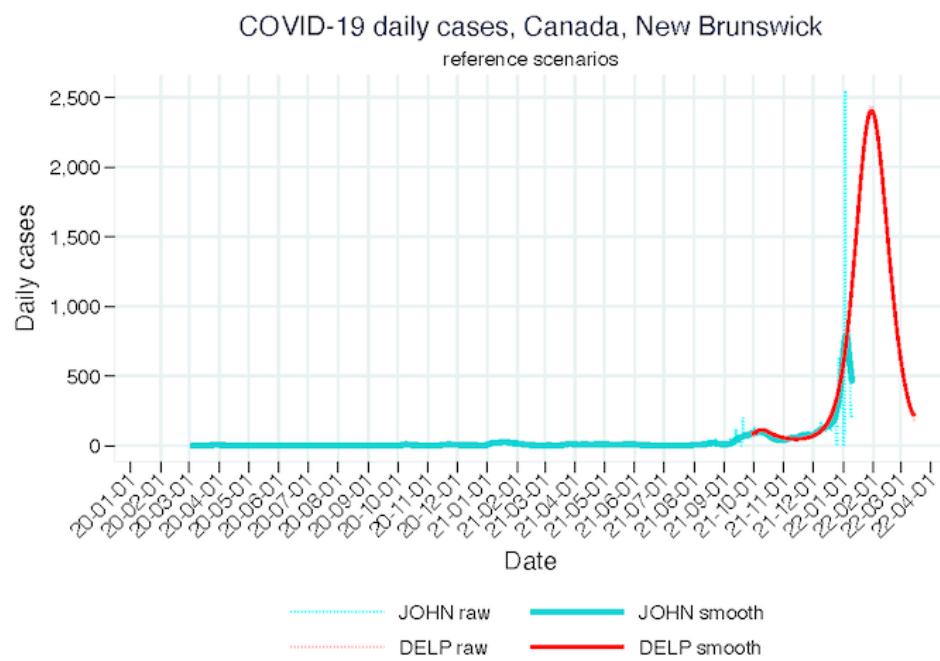
Selected graphs - New Brunswick

New Brunswick only predicted in DELP model.

(1) New Brunswick [Daily deaths, reference scenarios, all time](#)



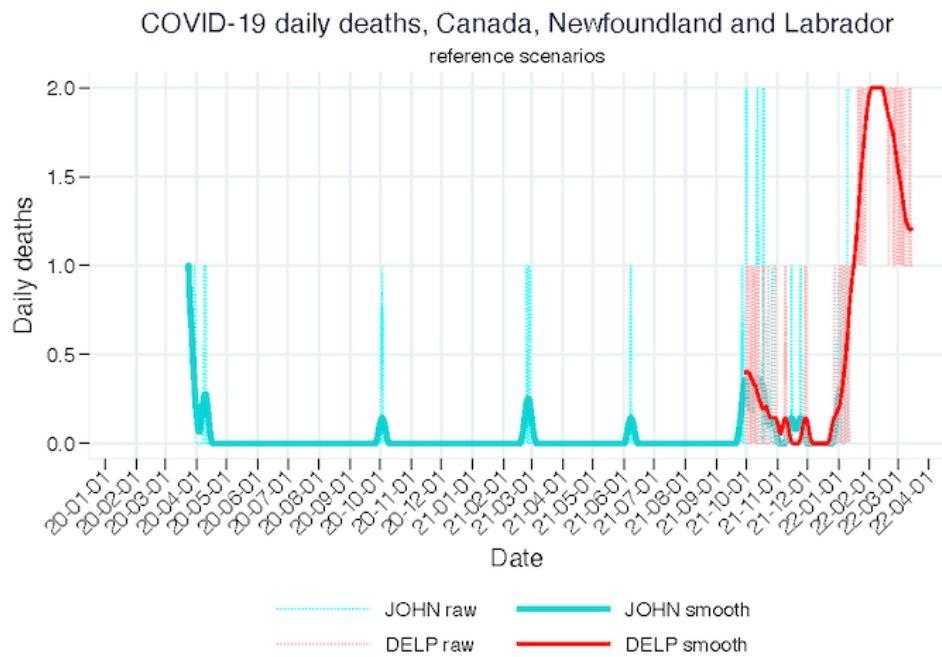
(2) New Brunswick [Daily cases, reference scenarios, all time](#)



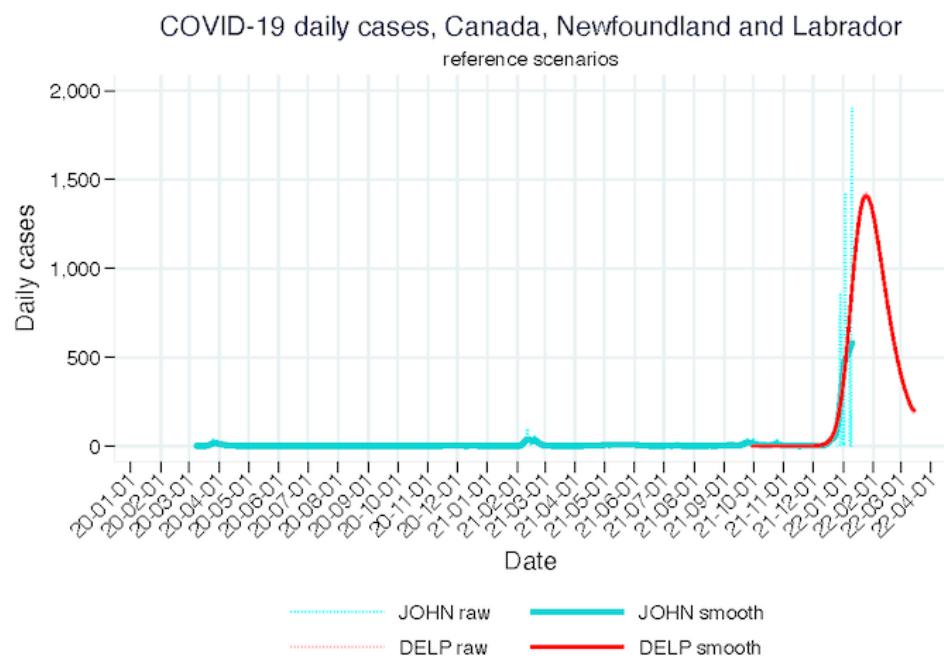
Selected graphs - Newfoundland and Labrador

Newfoundland and Labrador only predicted in DELP model.

(1) Newfoundland and Labrador [Daily deaths, reference scenarios, all time](#)

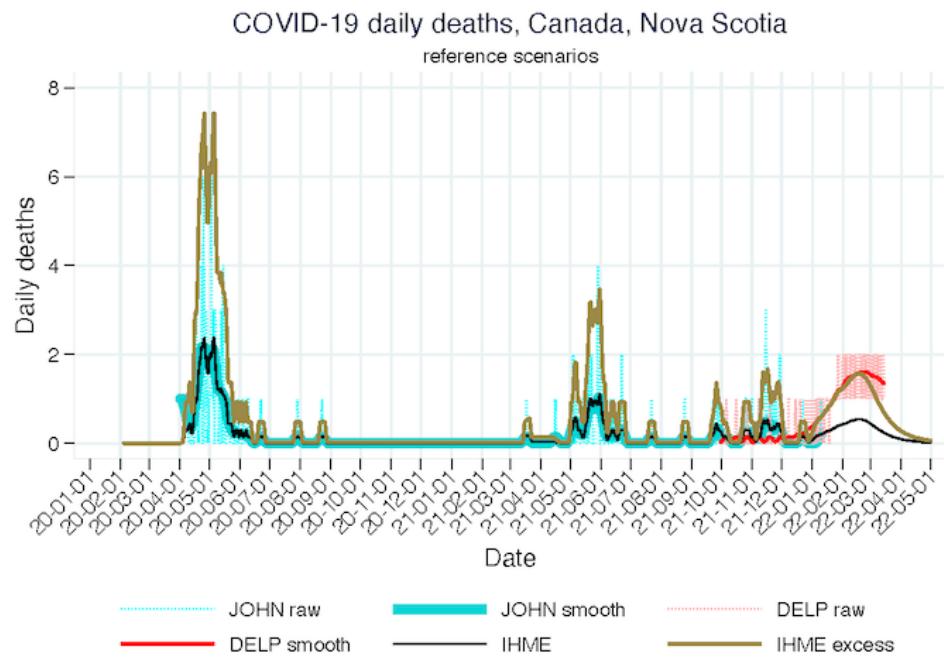


(2) Newfoundland and Labrador [Daily cases, reference scenarios, all time](#)

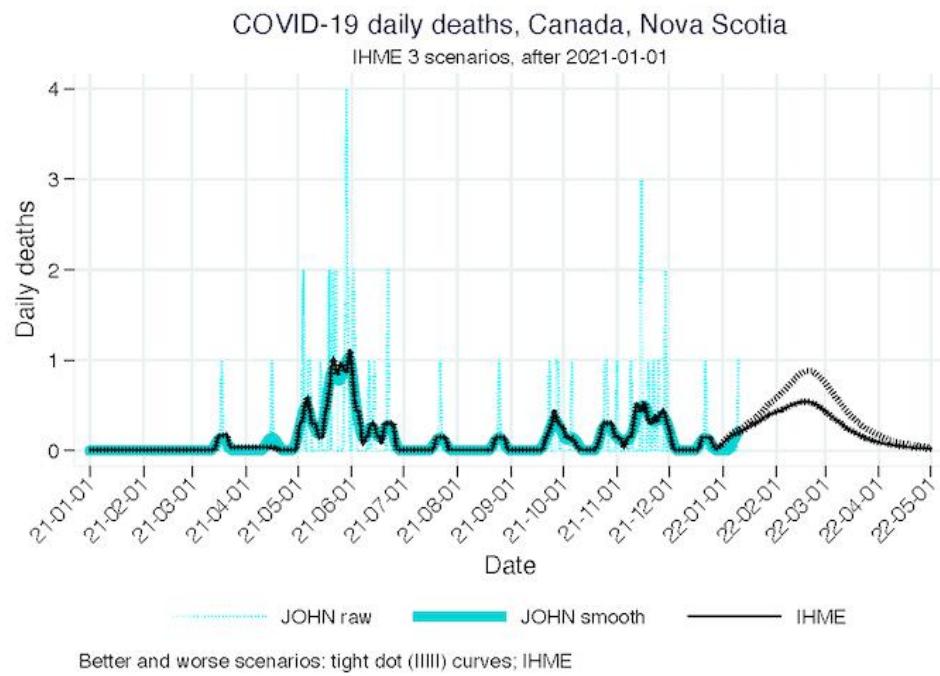


Selected graphs - Nova Scotia

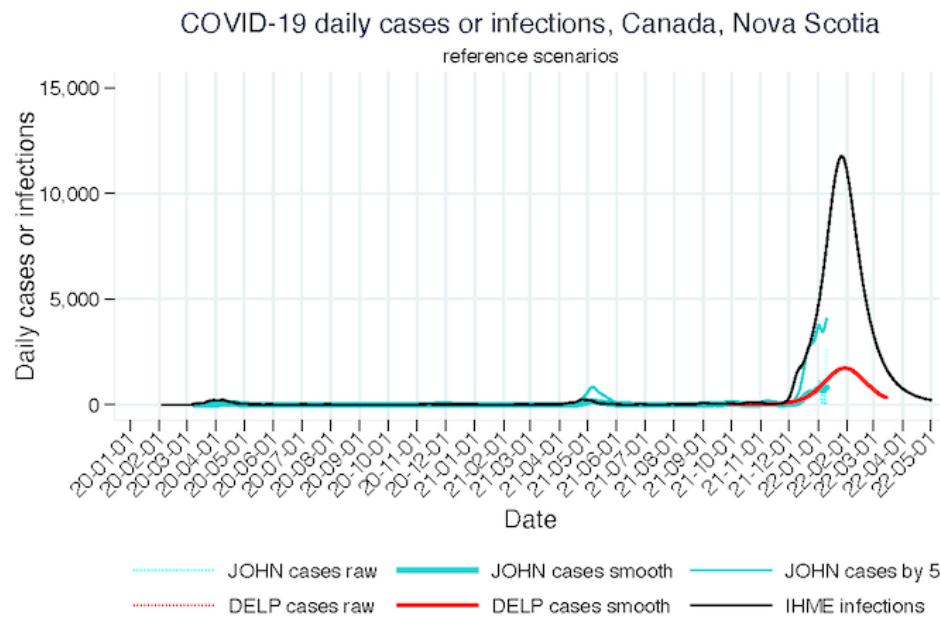
(1) Nova Scotia [Daily deaths, reference scenarios, all time](#)



(3) Nova Scotia [Daily deaths, 3 scenarios, 2021 on](#)

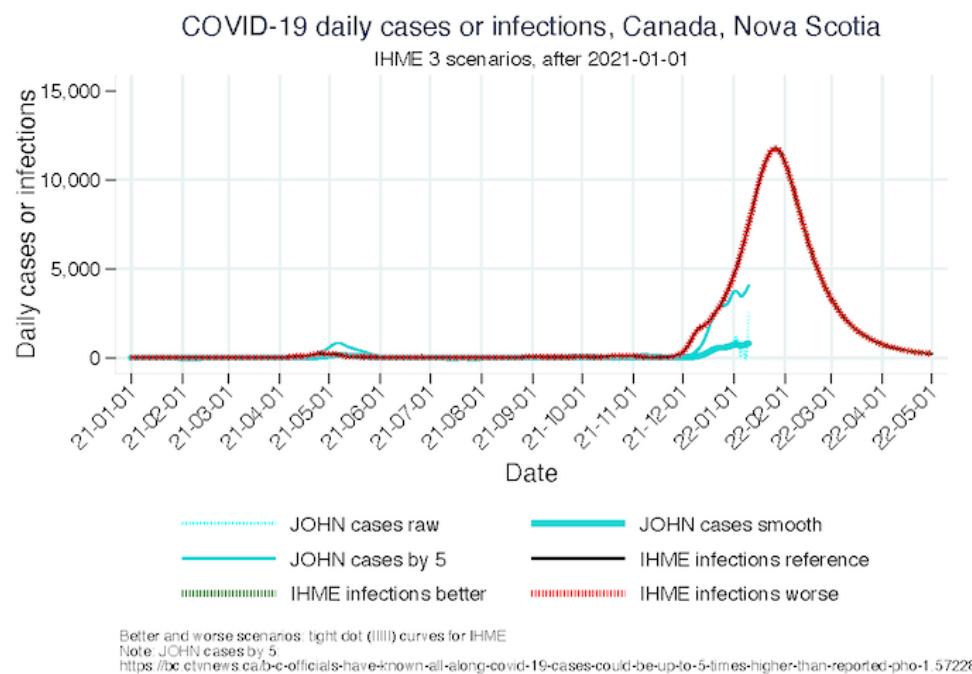


(4) Nova Scotia [Daily cases or infections, reference scenarios, all time](#)



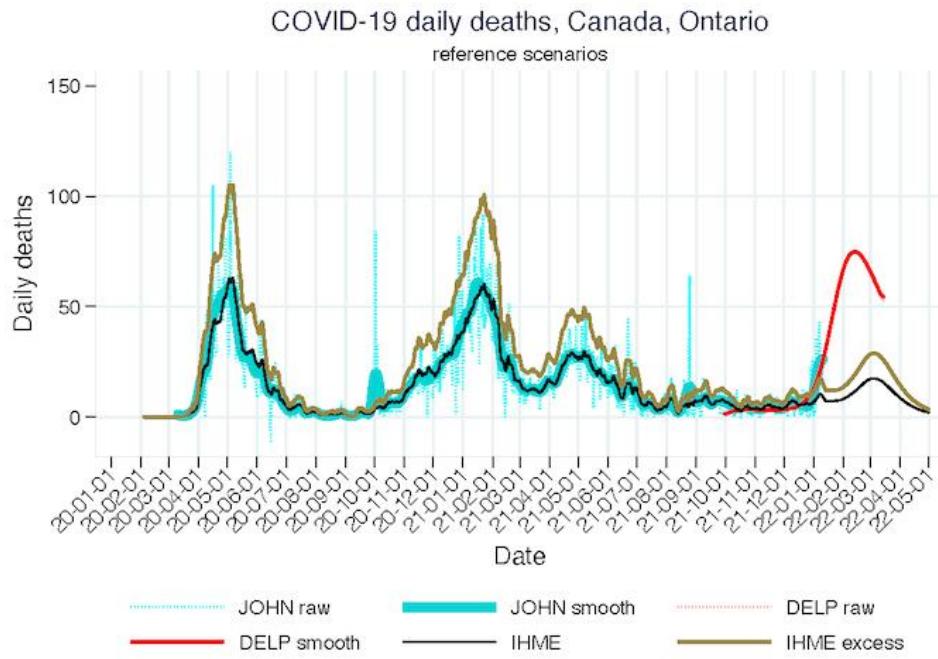
Note: JOHN cases by 5
<https://bc.ctvnews.ca/b-c-officials-have-known-all-along-covid-19-cases-could-be-up-to-5-times-higher-than-reported-pho-1.57228>

(6) Nova Scotia [Daily cases or infections, 3 scenarios, 2021 on](#)

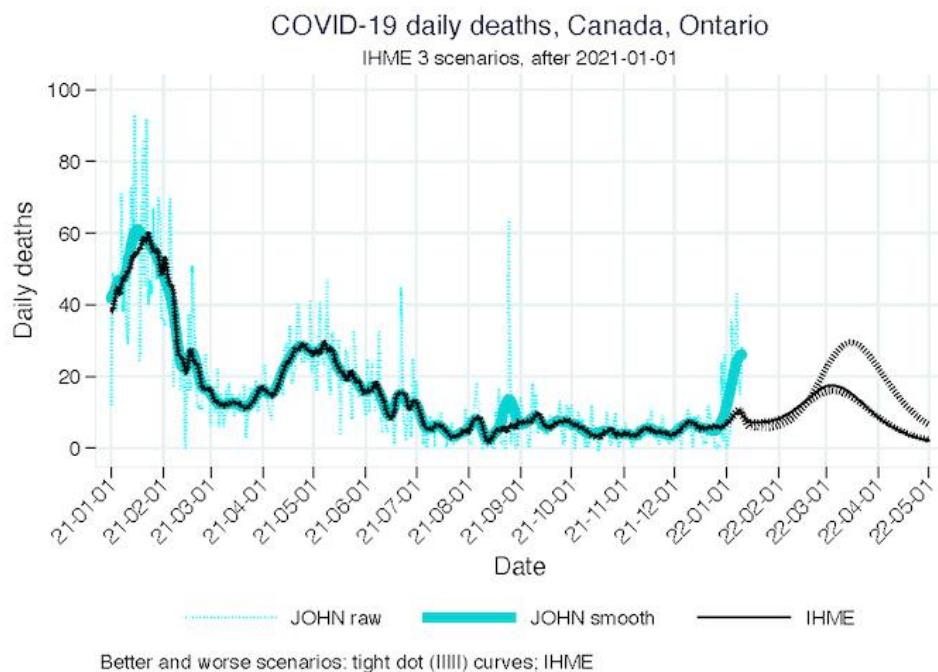


Selected graphs - Ontario

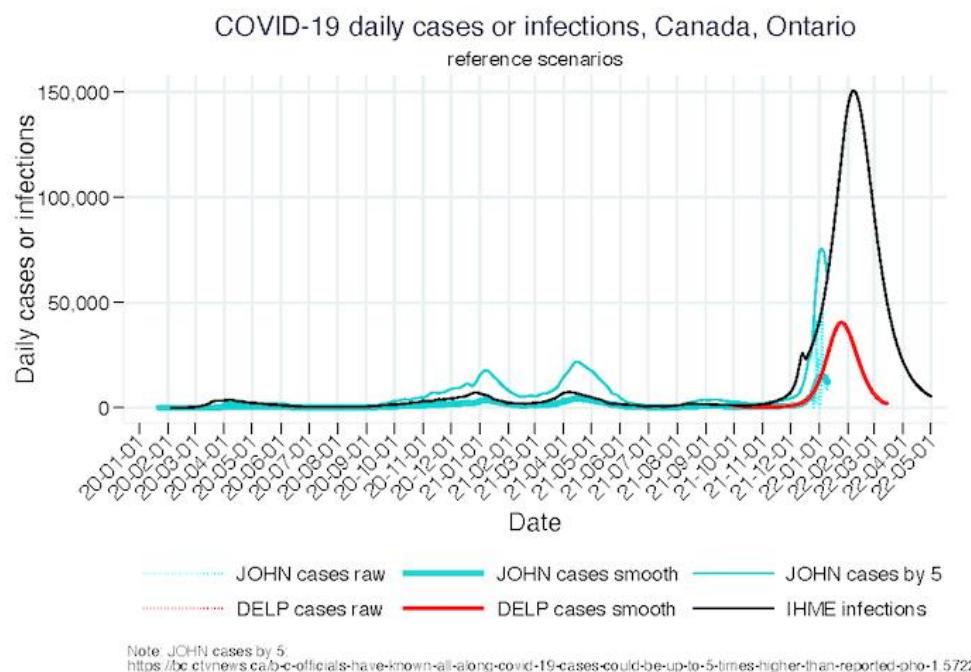
(1) Ontario [Daily deaths, reference scenarios, all time](#)



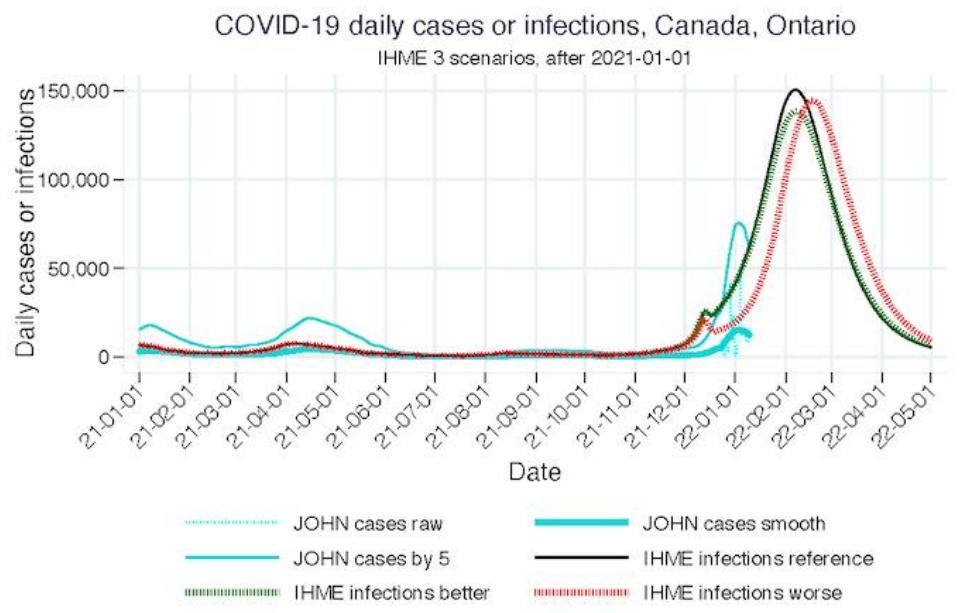
(3) Ontario [Daily deaths, 3 scenarios, 2021 on](#)



(4) Ontario [Daily cases or infections, reference scenarios, all time](#)

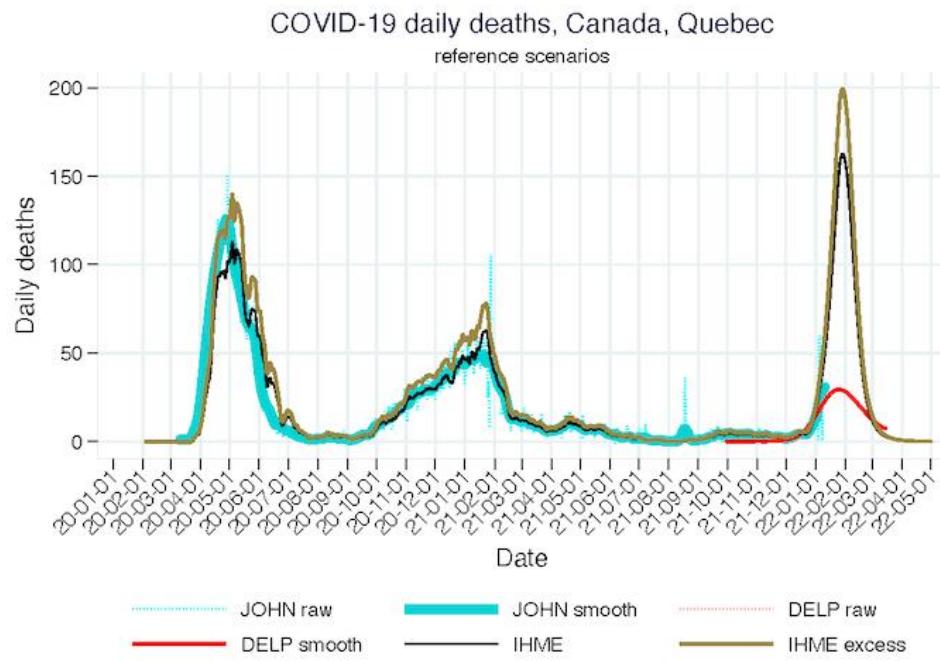


(6) Ontario [Daily cases or infections, 3 scenarios, 2021 on](#)

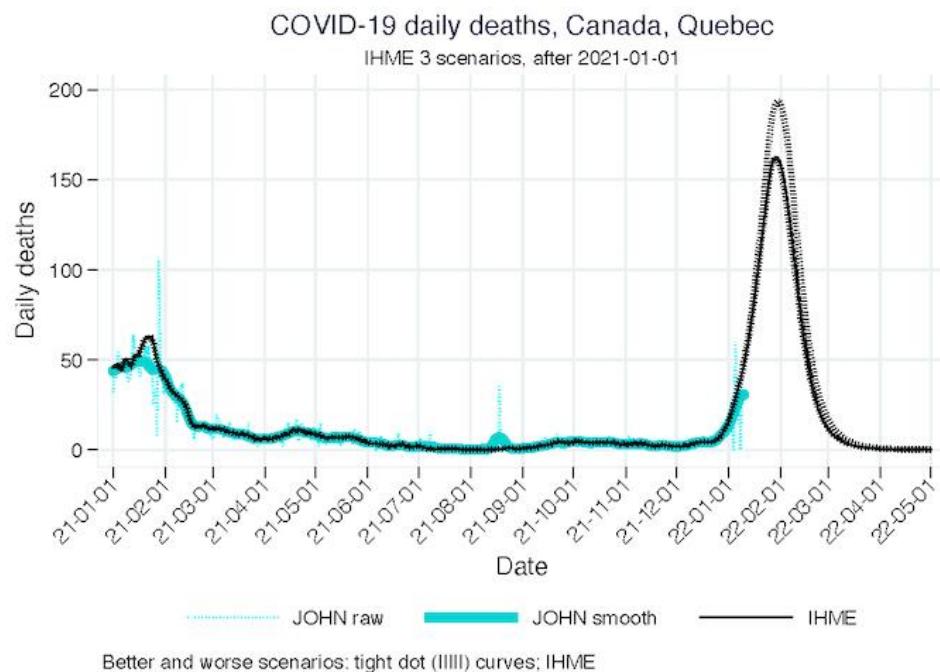


Selected graphs - Quebec

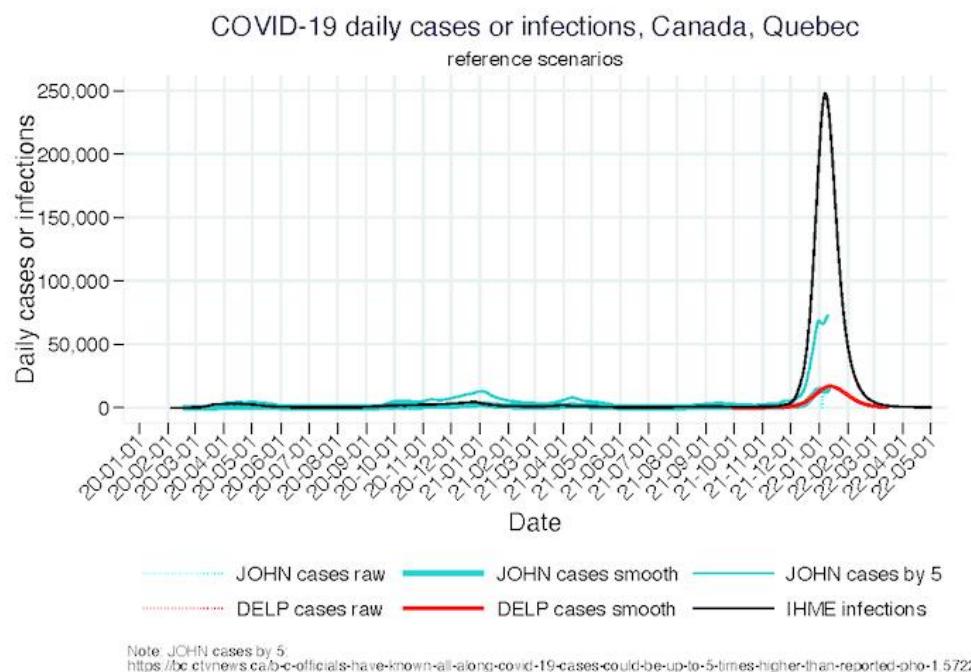
(1) Quebec [Daily deaths, reference scenarios, all time](#)



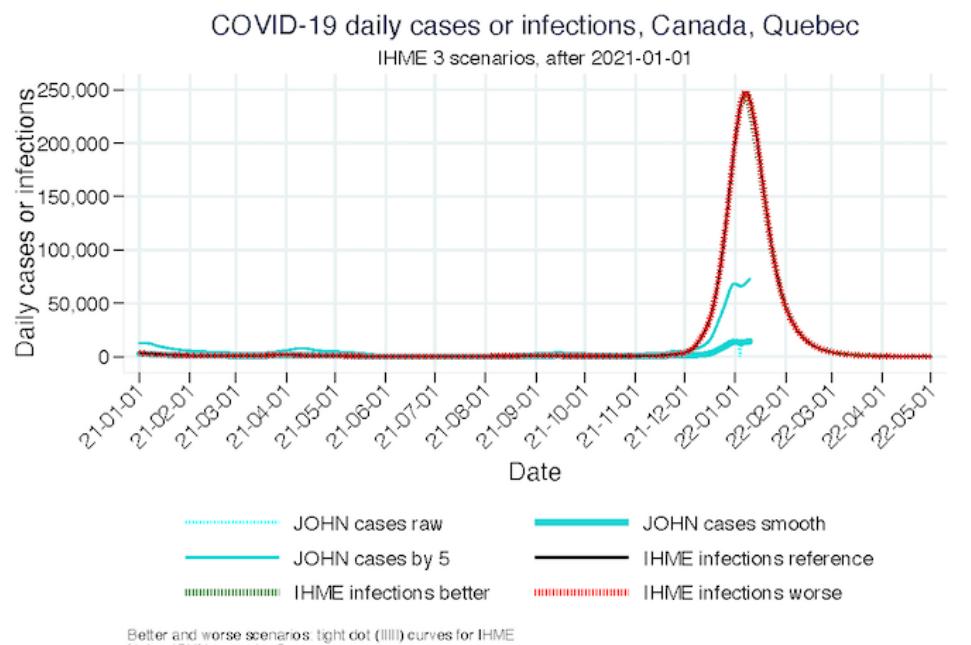
(3) Quebec [Daily deaths, 3 scenarios, 2021 on](#)



(4) Quebec [Daily cases or infections, reference scenarios, all time](#)

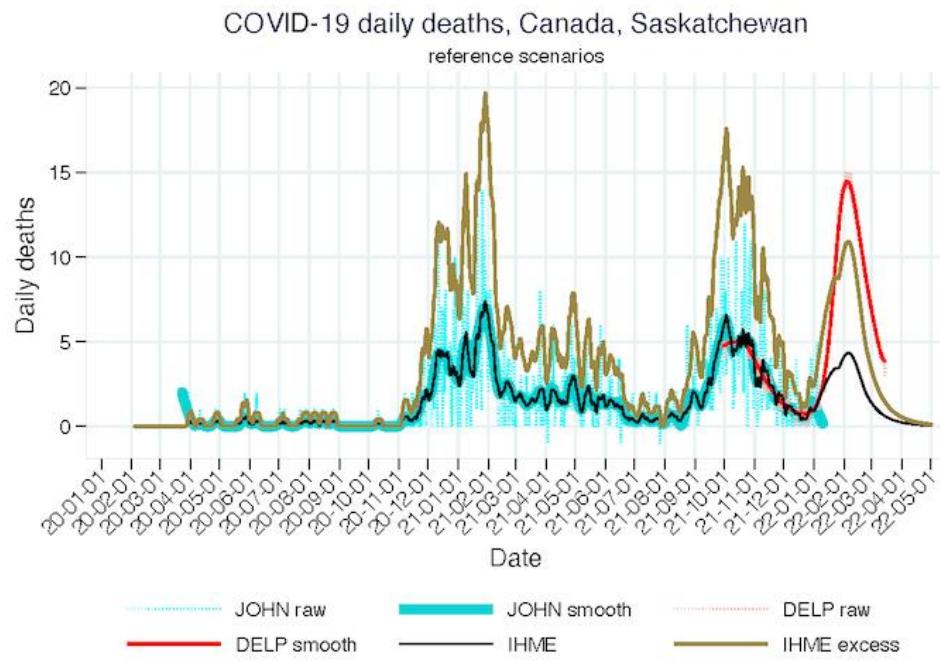


(6) Quebec [Daily cases or infections, 3 scenarios, 2021 on](#)

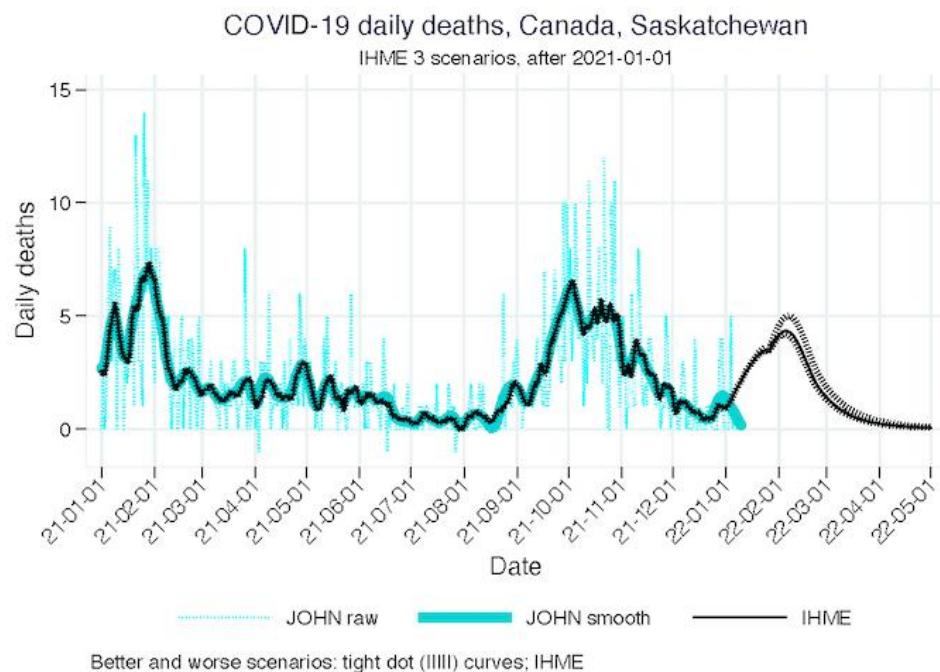


Selected graphs - Saskatchewan

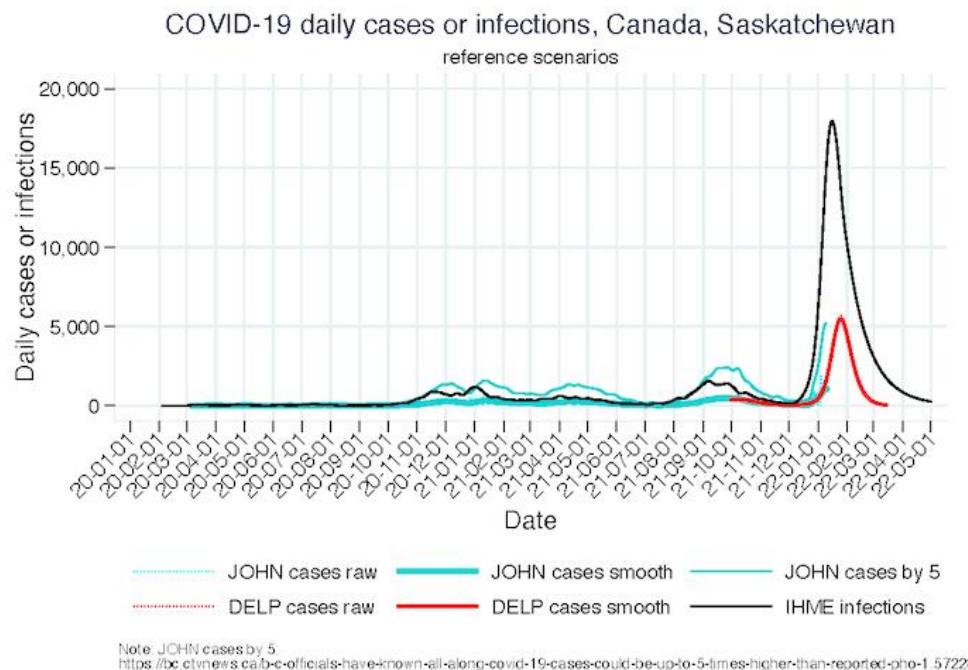
(1) Saskatchewan [Daily deaths, reference scenarios, all time](#)



(3) Saskatchewan [Daily deaths, 3 scenarios, 2021 on](#)



(4) Saskatchewan [Daily cases or infections, reference scenarios, all time](#)



(6) Saskatchewan [Daily cases or infections, 3 scenarios, 2021 on](#)

