One Year since Vaccination. What we have learnt - using Open Canada Data and Data Science

Dr. Dmitry O. Gorodnichy

Ottawa, 4 February 2022
R4GC Community (Lunch and Learn) Meetup
open-canada.github.io/r4gc

Disclaimer

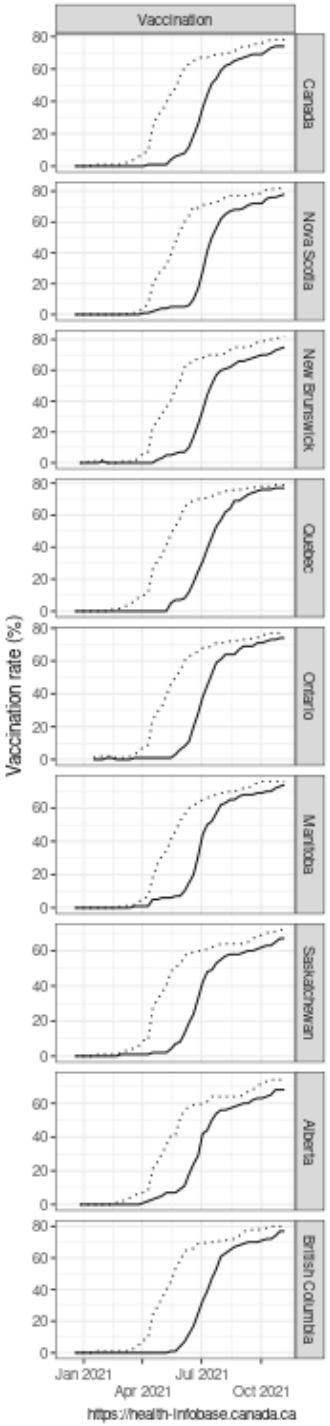
The views expressed in this publication are those of the authors.

They do not purport to reflect the views of any Canadian Agency, University, or Department.

The authoritative source for COVID-19 information is Canada.ca/coronavirus

Milestones

- December 14, 2020: First shot administered
- January 1, 2021: First Canadian fully immunized (2 shots)
- March 1, 2021: Full vaccination rate reached 1%
- May 1, 2021: Full vaccination rate reached 3%
- November 1, 2021: Full vaccination rate reached 75%



Lets put it in perspective

Diversity of Canadians:

- Affected by mental health (20%)
- Smokers (15%)
- Vegetarians (8%)
- Data scientists (~0.1%)
- Ice water dippers (~0.01%)

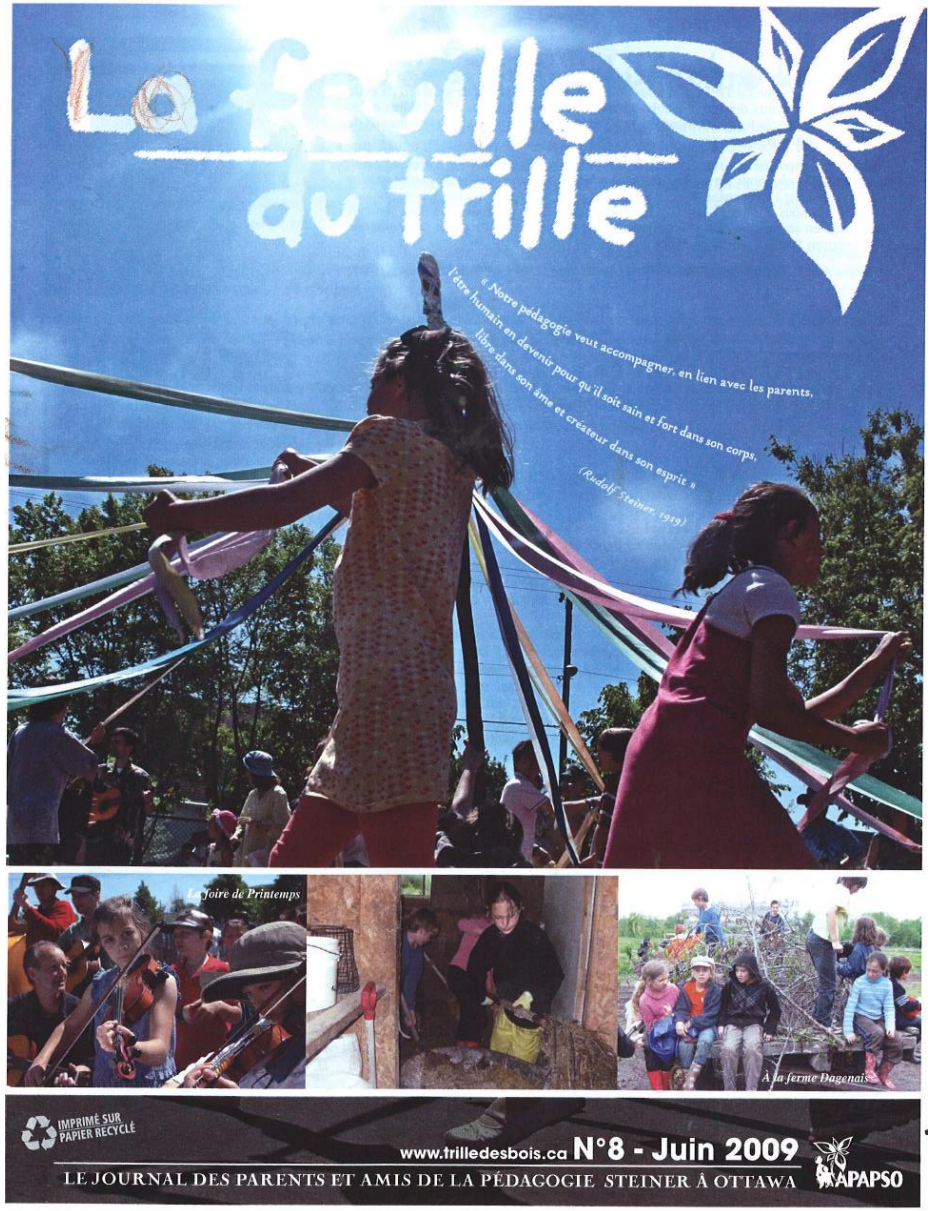
Google: “CBC Gorodnichy”

Luigina Fabrianesi, left, and Alexandra Gorodnichy, right, chill in the water. (Giacomo Panico/CBC)

Another perspective (generational)

Children are most affected

Why are we vaccinating children against COVID-19?, Toxicology Reports, Volume 8, 2021, Pages 1665-1684, ISSN 2214-7500 (14 September 2021). https://doi.org/10.1016/j.toxrep.2021.08.010



Another perspective (technological)

All claims made by Vendors need to be validated – by third party

- That's what we do

Example: AVATAR

- "Clear safeguards needed around technology planned for border checkpoints", CBC, May 2021

- "Design and Evaluation of Biometric-enabled Interview Assisting Traveller Screening Technology" (D. Gorodnichy), DRDC-RDDC-2018-C223

https://www.cbc.ca/news/opinion/opinion-technology-border-canada-1.6005907 - Google: "CBC AVATAR CBSA"
https://cradpdf.drdc-rddc.gc.ca/PDFS/unc331/p808530_A1b.pdf - Google: "DRDC Gorodnichy Traveller Screening"

Policy on Scientific Integrity

https://science.gc.ca/eic/site/063.nsf/eng/h_97643.html

- 2017: Govn't creates Chief Science Advisor post (Dr. Mona Nemer - uOttawa)
- 2018: Introduced Scientific Integrity Policy*
- Government has become (more) Open, (more) pro-science
- Many Open Canada databases are now available
- A lot with data related to COVID-19, vaccines and vital statistics (deaths).

So why not to use these Open Canada Datasets
to practice Data Science / Visualization skills,
and help Canadians at the same time?

That's what we do: https://open-canada.github.io/Apps

Policy on Scientific Integrity (cntd)

https://science.gc.ca/eic/site/063.nsf/eng/h_97643.html

"GC recognizes two complementary approaches to fostering a culture of scientific integrity:

- One focuses on instilling the virtues that underlie responsible conduct in research, science and related activities (s. 7.2.1).

- A second focuses on the procedure for bringing allegations of breaches forward, the investigation of these allegations, and the consequences of a finding that a breach has occurred (s. 7.2.2)"

Official sources

[1] ‘Cases following vaccination’, COVID-19 Daily Epidemiology Update, Public Health Agency of Canada, https://health-infobase.canada.ca/covid-19/epidemiological-summary-covid-19-cases.html

[2] Hospitalizations by vaccination status, COVID-19 (coronavirus) in Ontario, https://covid-19.ontario.ca/data/hospitalizations#hospitalizationsByVaccinationStatus, Weekly epidemiology report (PDF) available on the Government of Canada’s COVID-19 data trends page

[3] ‘Reported side effects following COVID-19 vaccination in Canada’, Canadian COVID-19 vaccination safety report, Public Health Agency of Canada, https://health-infobase.canada.ca/covid-19/vaccine-safety/

[4] Statistics Canada, Canadian Vital Statistics - Death database . Provisional weekly death counts, by selected grouped causes of death. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310081001 (Dashboard: https://open-canada.github.io/App/vitals)

[5] Recalls and safety alerts, Government of Canada: https://recalls-rappels.canada.ca/

Big Questions

- Should COVID-19 vaccines be mandatory? For everyone? Even now?
- What do we know now - compared to year ago?
- How really efficient and safe are they - based on data *after* the start of mass vaccination?
- How do they compare to natural immunity?
- What is the cost?
- Can Canadians have unbiased, safe, respectful discussion about it all?

Open Canada Data and Data Science (with R) allows to do that

What did Chief Science Advisor say (1)

https://science.gc.ca/eic/site/063.nsf/eng/h_98229.html

Scientific Considerations for Using COVID-19 Vaccination Certificates

Report of the Chief Science Advisor of Canada, March 31, 2021

Scientific uncertainties: Given the short time since the COVID-19 vaccines have become available, it is not surprising that many scientific uncertainties persist and are the subject of intense ongoing studies.

Ethical and Social Considerations: It should also be noted that while the anticipation of more freedom may be an incentive for some to get vaccinated, vaccine acceptance could decrease in others if there was a sense of coercion tied to using vaccination certificates.

Legal Considerations: The processes by which vaccine certificates are issued and controlled need to be fraud proof

Conclusion: all levels of government could work to develop a framework that Maximizes consistent post-vaccine monitoring,

What did Chief Science Advisor say (2)

https://science.gc.ca/eic/site/063.nsf/eng/h_98291.html

COVID-19 vaccine-associated myocarditis/pericarditis
Report of the Chief Science Advisor of Canada, July 16, 2021

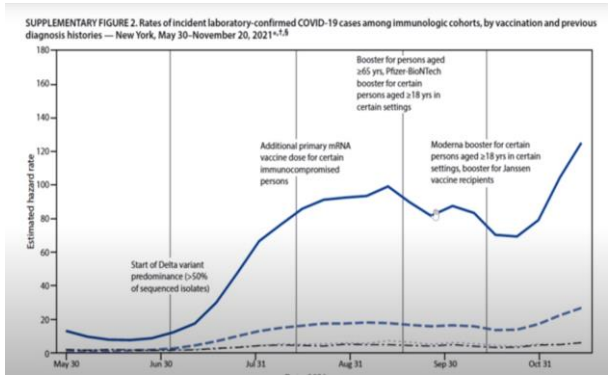
Priority actions moving forward: The emerging issue of vaccine-associated heart disease requires attention on two important levels: addressing data and knowledge gaps on the one hand, and promoting awareness and clinical care on the other

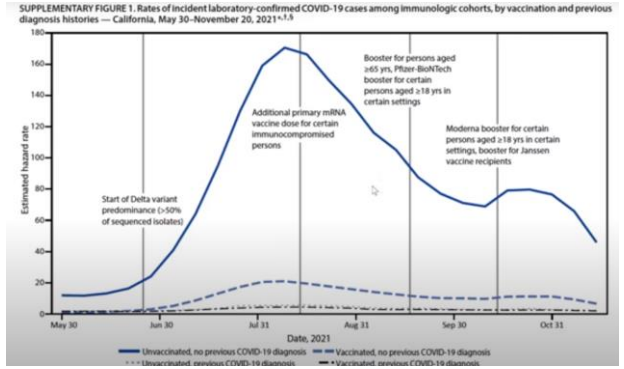
Nothing on the topic of vaccine since then…

So, What did other countries' governments say?

Stats: vaccines vs. natural immunity

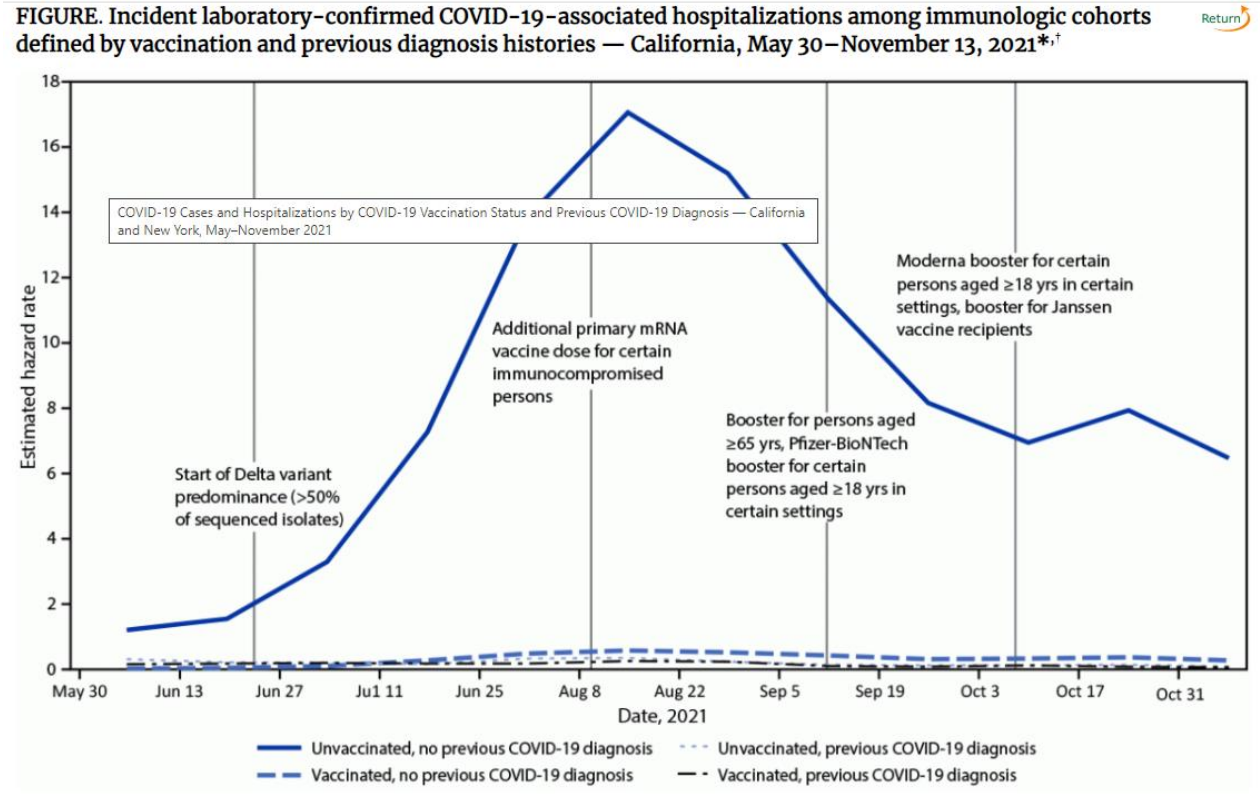
https://www.cdc.gov/mmwr/volumes/71/wr/mm7104e1.htm





Based on data from California and New York from May to November 2021:

- Vaccination (upper dash line) significantly reduced risk of hospitalization (solid line) (x10-x20)
- However, natural immunity (lower dash line) reduces this risk even more



* The SARS-CoV-2 Delta variant exceeded 50% of sequences in U.S. Department of Health and Human Services Region 9 (containing California) during the week of June 26. https://covid.cdc.gov/covid-data-tracker/#variant-proportions

† Estimated hazard rate is laboratory-confirmed COVID-19-associated hospitalizations per 100,000 person-days visualized at midpoint of each reporting interval.

Based on these new data, the main question becomes:

What is less costly, safer, and to whom: having a vaccine or become infected with COVID ?

Stats: Google “Canada, covid”

Population: 38.246.108

Total (since the start of pandemic)

- COVID Cases: 3.1 M
- COVID Deaths: 34 K ~= 1% Cases
  - Most are comorbidities (>90% based on UKG and USG data)
  - Most in people 65+ (>90% based on GC, UKG, USG data)

- COVID Deaths for people <65 with no health problems < 0.01% Cases

Lets put it perspective

Within the same period

- All deaths :
- Cancer:
- Heart problems:
- Homicides:
- Suicides:
- COVID:
- COVID w/o comorbidities*:
- COVID w/o comorbidities for people <65 *:

To compute these, use Vitals App Calculator:
https://open-canada.github.io/Apps/vitals (click on Statistics Tab)

* needs to be estimated using other data

Numbers, numbers, numbers…

The way Stats are reported tells …
… about the (embedded) bias of Stats reporters

Related terms:

- political bias
- vendor bias
- confirmation bias
- group bias
- propaganda

Reverse-engineering Algorithmic Bias from COVID data

What is Algorithm?

Predefined sets of commands which produces desired output from input: Deterministically or Stochastically (in Probabilities)

Algorithms for computers = AI

Algorithms for humans = Policies

By examining the input (raw data) and the output produced by the algorithm (posted stats), one can uncover the algorithm and the bias embedded in it. This is called “reverse-engineering”.

Case study 1: Vaccine efficacy reporting

Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine, C4591001 Clinical Trial Group, N Engl J Med 2020; 383:2603-2615, https://www.nejm.org/doi/full/10.1056/nejmoa2034577

21,720 with BNT162b2 - 8 cases
21,728 with placebo - 162 cases

Difference:
(162 - 8) / 21,720 = 0.7%

which is reported as 95%

Table 1: COVID-19 vaccines currently in use in different countries

Platform	Name	Number of Doses	% Efficacy**
mRNA:	Moderna*	2	~94
	Pfizer-BioNTech*	2	~95
Viral Vectors:	AstraZeneca & Serum Institute of India COVID-19*	2	~76
	Janssen*	1	~66
	CanSino	1	~65
	Gamaleya ('Sputnik')	2	~92
Inactivated Virus:	Sinovac	2	~50
	Sinopharm (Bejing)	2	~79
	Sinopharm (Wuhan)	2	~72
	Bharat biotech	2	~81
Protein/VLP:	Vektor Institute/EpiVacCorona	2	N/A

** Vaccines approved for emergency use in Canada.*

"COVID-19 vaccine efficacy and effectiveness—the elephant (not) in the room", The Lancet, 7, E279-E280, https://doi.org/10.1016/S2666-5247(21)00069-0
Principles of Epidemiology in Public Health Practice: https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section6.html

Case Study 2: Vaccinated vs. Non-vaccinated deaths

https://health-infobase.canada.ca/covid-19/epidemiological-summary-covid-19-cases.html

Recall: There were no fully-vaccinated before January, <1% before March, <3% before May, and … most* (50-75%), deaths happened exactly then.

Try it yourself:
- Open link above, write down numbers in red boxes and compare them a week later!
- Or, compare these numbers in past reports since November (archived here).

Observe:
These numbers monotonically change (one down, one up) every week - according to math behind them…

*computed using Vitals App Calculator

Table 2. Characteristics and severe outcomes associated unvaccinated, partially vaccinated and fully vaccinated confirmed cases reported to PHAC, as of December 18, 2021

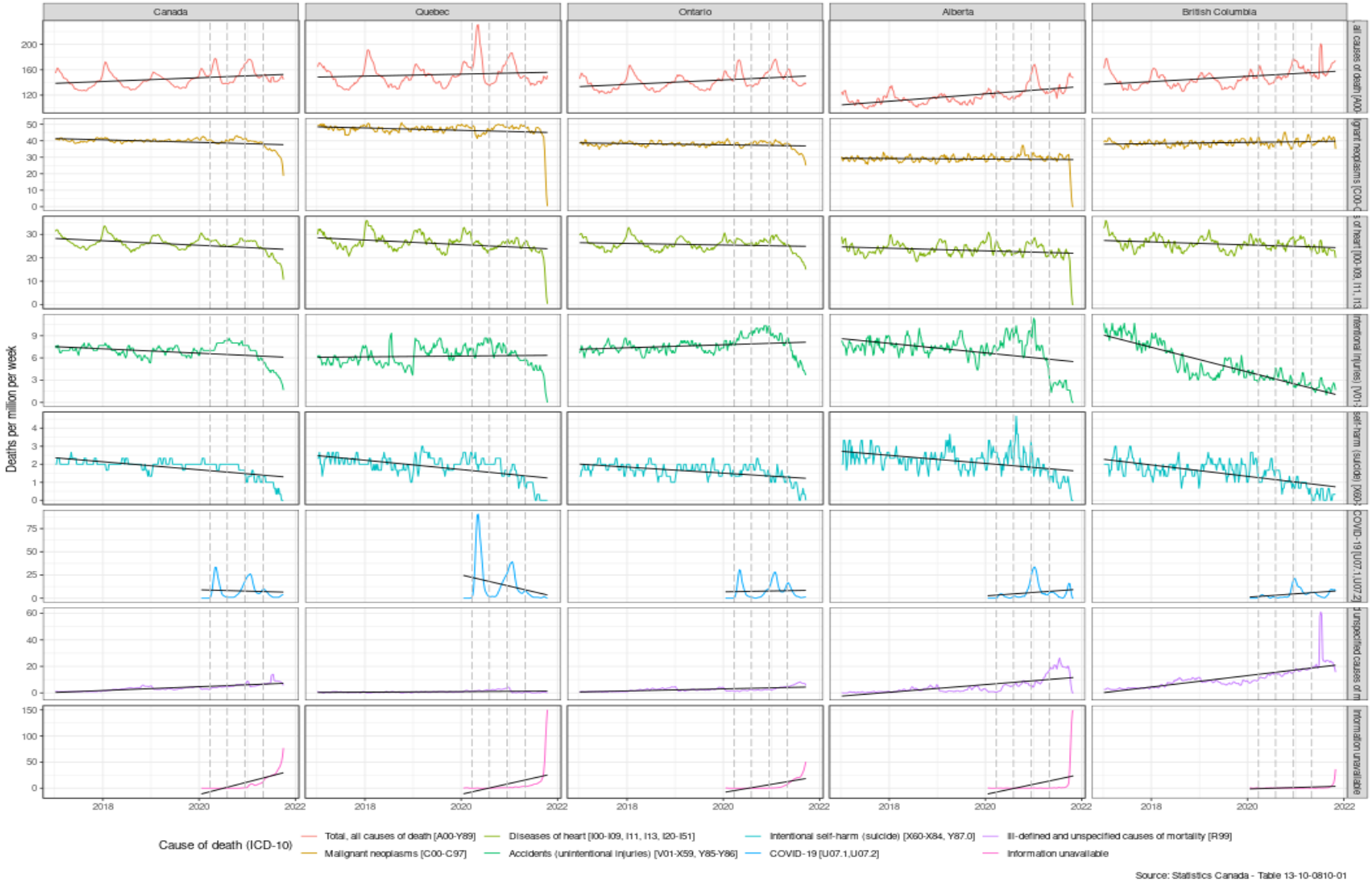
		Unvaccinated (n=727,925)	Cases not yet protected (n=43,471)	Partially vaccinated (n=53,171)	Fully vaccinated (n=122,843)	Total cases (n=947,410)
Gender*	Male	371,897 (78.5%)	20,959 (4.4%)	24,980 (5.3%)	56,197 (11.9%)	474,033 (100%)
	Female	354,365 (75.2%)	22,454 (4.8%)	28,113 (6.0%)	66,344 (14.1%)	471,276 (100%)
Hospitalizations		40,788 (79.5%)	3,062 (6.0%)	3,374 (6.6%)	4,099 (8.0%)	51,323 (100%)
Deaths		8,013 (75.6%)	759 (7.2%)	744 (7.0%)	1,077 (10.2%)	10,593 (100%)

Source: Detailed case information received by PHAC from provinces and territories, since December 14, 2020

As of today, February 4, 2022 : Total cases (n=1,458,433)
Fully vaccinated 2,032 (16.8%), +3% since last week, +8% since November

Case Study 3: ‘COVID’ deaths reporting

Go to https://open-canada.github.io/Apps/vitals



Latest News:

- Denmark (where full vaccination rate is 81%) just lifted all COVID restrictions:

https://www.telegraph.co.uk/global-health/science-and-disease/land-covid-now-no-worse-cold/, 1 February 2022. *"The land where Covid is now no worse than a cold"*

- *A Literature Review and Meta-Analysis of the Effects of Lockdowns on COVID-19 Mortality, Studies in Applied Economics,* The Johns Hopkins Institute for Applied Economics, Global Health, and the Study of Business Enterprise (January 2022)

https://sites.krieger.jhu.edu/iae/files/2022/01/A-Literature-Review-and-Meta-Analysis-of-the-Effects-of-Lockdowns-on-COVID-19-Mortality.pdf