Some observations from Canadian Vital Statistics Death (CVSD) Database related to the “Elephant in the Room”[1]

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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.

Canada provides open access to their Canadian Vital Statistics - Death (CVSD) data [1] that show weekly mortality rates categorized by the cause of death defined by the "International Statistical Classification of Diseases and Related Health Problems" Revision 10 (ICD-10). These data are used to calculate basic indicators on deaths of residents of Canada as well as in the calculation of statistics, such as cause-specific death rates and life expectancy. Recently, these data have been used to analyze the effects of the COVID-19 pandemic and related public health measures on non-natural manners of death in Ontario [2]. In this paper, it is used to conduct temporal and regional cross-factor analysis of all reported and unreported causes of death in Canada since pandemic and the start of mass vaccination. For this purpose, an interactive Open Source Web Application (App) is developed [3], using which a number of (un)expected observations related to the pandemic and vaccination are made. These are described below (Figure, Appendix). ‘ME’ indicates Mean weekly mortality rate (number of deaths per million per week).

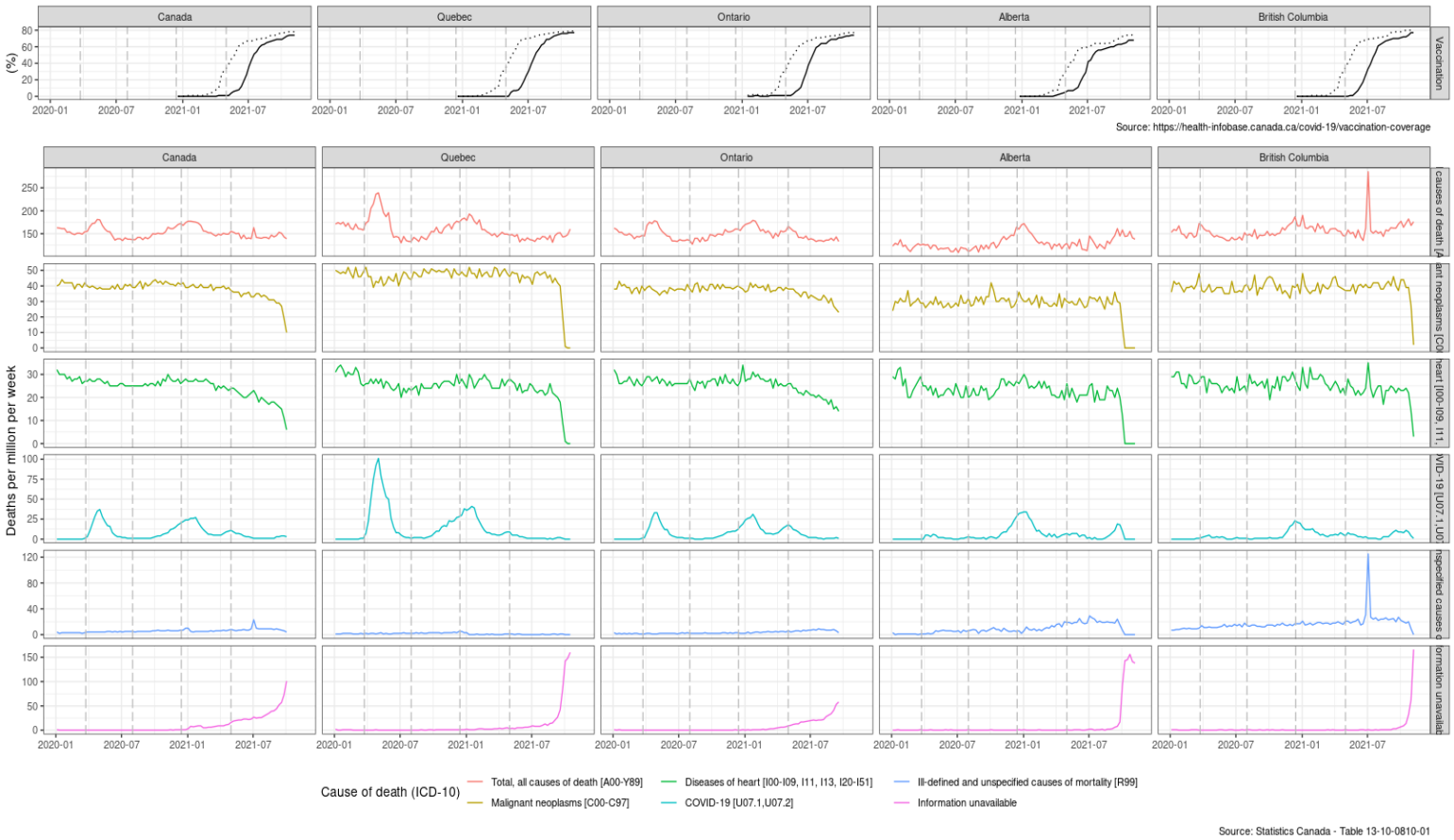

Figure 1: Vaccination and weekly death rates by cause in Canada and during the pandemic and vaccination.
Coloured time-series lines show CVSD statistics at the national level and in four most populated provinces for the total number of deaths and six death cause categories from January 2019 to October 2022. In the top graph, solid lines show full vaccination rate, dash lines show the rate of vaccinated with at least one dose. Vertical lines mark four distinct periods observed: early pandemic pre-vaccination (varying policies across provinces), late pandemic pre-vaccination phase (consistent policies across policies), early vaccination (vaccination rate 0-3%), mass vaccination (vaccination rate: 3- 75%). The use of different scales for each cause is noted. Varying dynamics of COVID deaths across the provinces in the early pandemic period and the rapid increase of Ill-defined and unspecified causes [R99] and the number of unreported causes [Information unavailable] in the mass vaccination period are observed.

[1] Submission (Unsolicited Comment) to The Lancet journal. Submitted: 2022/01/16. Decision (“it would be better placed elsewhere”): 2022/01/20.Suggested citation: Some observations from Canadian Vital Statistics Death (CVSD) Database related to the “Elephant in the Room” (D. Gorodnichy, R. Kulik, S Matwin). Submission to The Lancet Journal. 2022/01/16, https://open-canada.github.io/vitals.

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At national level, it is observed that, despite the large number of COVID case numbers that have been reported since the declaration of the pandemic, the total number of deaths has remained stable (ME=152.2). Furthermore, in contrast to the historically observed trends, one observes a slight decrease in the total number of deaths and consistent decrease in practically all (except COVID) death causes since the start of the pandemic (negative correlation with date). The number of COVID deaths (ME=7.7) is considerably lower than that of leading causes, which remain to be Malignant neoplasms [C00-C97] (ME=38) and Diseases of heart [I00-I09, I11, I13, I20-I51] (ME=24.7), and other reported causes combined (ME=64.3). The increase in reporting of COVID deaths correlates with the decrease in reporting of other causes of deaths.

Examining the death statistics during the pandemic closer, one can further identify four distinct periods, for each of which the following observations are made.

Period 1 (Early pandemic pre-vaccination phase) is characterized by varying policies between East (Ontario and Quebec) and West (Alberta and British Columbia) provinces [4] and includes data from the "first wave", starting from 14 March 2020 (first COVID-19 death in Canada) ending 30 July 2020 (end of the "first wave"). It is observed that in this period East provinces have significantly lower COVID death rate compared to that in West provinces (ME 1.9 and 1.8 in Alberta and British Columbia vs. 33.2 and 10.3 in Quebec and Ontario). Looking at the death toll only, one could state that West provinces did not experience the first COVID "wave". The number of Ill-defined and unspecified causes [R99] is slightly higher than but comparable to the historical data (ME=4.2 compared to 2.2). The “Information unavailable” category (NA) is introduced in this period, however no records under this category are yet reported.

Period 2 (Later pandemic pre-vaccination phase) starts 1 August 2020 and ends on 13 December 2020 (last day before the commencement of vaccination). It is characterized by much more consistent (same) health measures across provinces, and includes second wave, which, in contrast to the "first one", is now equally observed (as a spike of COVID deaths) in all main provinces (ME=6.5 and 4.4 in Alberta and British Columbia vs. 10.8 and 3.9 in Quebec and Ontario). The rate of [R99] deaths grows (ME=5.7). The rate of NA records is insignificant (ME=0.2).

Period 3 (Early high-risk population vaccination phase) is characterized by the small percentage of vaccinated people, includes post-Christmas third wave and runs from 14 December 2020 (when the first vaccination shot was administered in Canada) to 1 May 2021 (when vaccination rate reaches 3%). In this period, the rate of [R99] deaths continued to grow (ME=6.0). The rate of deaths with NA started to grow more rapidly (ME=7).

Period 4 (Later general population vaccination phase) corresponds to the period when the majority population of the country has become vaccinated, including low-risk people and children, with full vaccination rate growing rapidly from 3% in 1 May 2021 to 74% on 11 October (the last record in the CVSD database at the time of writing this communication). The main difference of this period from previous periods is seen in a significant jump in the rate of NA records, which started to grow exponentially in all provinces (ME=35 at national level). In observing this it is noted that the provinces, as known from the description of CVSD database [1], collect and report statistics independently from each other.

To summarize, CVSD statistics show that since the start of mass vaccination, unreported cases have become (and remain to be) the most dominant portion of all deaths. There can be two main explanations for this. First, reporting of valid death causes has become significantly more difficult since the beginning of mass vaccination and one can wait until the reporting of valid death causes is resumed. Second, the data could in fact reflect the new normal in the Canadian death causes reporting, with the majority of deaths now being left unexplained. In either case, it is important to maintain a trustful Vital Statistics database, open for research and analysis. It is especially important during the mass vaccination campaign. Indeed, the presented above observations from the Canadian Vital Statistics Database, coupled with the data presented in other reports presenting statistics related to deaths due to COVID and/vs due to COVID vaccines [5-10] explain the challenges in keeping public trust in the vaccination as well as in other COVID-19 prevention measures, keeping of which is known to be an important task during the pandemic [11]. The recent Angus Reid poll [12] has also indicated that "health concerns" (besides "personal freedom") is now the most common argument against vaccination. In this regard, we applaud the efforts of the Government of Canada in keeping its death by cause statistics open and regularly updating it. We also encourage other data scientists and health practitioners around the world to take advantage of the free data visualization tools and open source codes, such as the ones provided with the Web App used here [3], to build similar comparative death causes trackers for other countries and regions.

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Appendix

This Appendix contains:

- The list of ICD-10 death categories reported in the CVSD database
- Table 1: The national weekly deaths rates per million for leading causes of death in four analyzed periods.
- Table 2: Death due to COVID-19 in Quebec, Ontario, Alberta and British Columbia in Period 1 (2020-03-14 - 2020-08-01) vs. Period 2 (2020-08-01 --2020-12-14)
- Additional images: Time-series, regression lines and correlation plots - at National level, four largest populated and four lower populated provinces
- Analysis of other official Government of Canada data (not included in original submission)
- Additional reference from the vaccine manufacturer (not included in original submission)

ICD-10 death categories reported in the CVSD database

Statistics Canada uses "International Statistical Classification of Diseases and Related Health Problems" Revision 10 (ICD-10), which reports death causes using the following categories:

[1] Total, all causes of death [A00-Y89]
[2] Malignant neoplasms [C00-C97]
[3] Diabetes mellitus [E10-E14]
[4] Alzheimer's disease [G30]
[5] Diseases of heart [I00-I09, I11, I13, I20-I51]
[6] Cerebrovascular diseases [I60-I69]
[7] Influenza and pneumonia [J09-J18]
[8] Chronic lower respiratory diseases [J40-J47]
[9] Nephritis, nephrotic syndrome and nephrosis [N00-N07, N17-N19, N25-N27]
[10] Accidents (unintentional injuries) [V01-X59, Y85-Y86]
[11] Intentional self-harm (suicide) [X60-X84, Y87.0]
[12] COVID-19 [U07.1,U07.2] (since January 2020)
[13] COVID-19, virus identified [U07.1] (since January 2020)
[14] COVID-19, virus not identified [U07.2] (since January 2020)
[15] Ill-defined and unspecified causes of mortality [R99]
[16] Information unavailable (since January 2020)
[17] All other causes of death

Table 1: The weekly deaths rates per million for leading causes in four analyzed periods in Canada.

The numbers in the table show weekly deaths rate means and dynamics (the slope of the regression). It is noted that in some cases linear modeling may not be appropriate to model the data.

Cause	Period 1	Period 2	Period 3	Period 4	Historical
All causes	153.8, -1.7	150.8, 1.8	159.5, -2.1	138.7, -0.8	139.4, 10.4
Malignant neoplasms	39.2, 0	41.3, 0.1	39.2,-0.1	29.8, -0.9	39.9, 1.3
Diseases of heart	26.2, -0.1	26.3, 0.2	25.8,-0.3	17.6, -0.7	26.4, 2.5
Influenza and pneumonia	2.8, -0.2	2, 0.1	2.1, 0	1.1, 0	3.6, 1.8
Accidents	7.7, 0.1	8.1, 0	6.5,	-0.1	3.5,	-0.2	6.9, 0.7	
Suicides	2, 0	1.9, 0	1.1, 0	0.5, -0.1	2, 0.3
COVID-19	12.1, -0.7	6, 1	13.9,-1.3	3, -0.4	NA
Ill-defined & unspecified	4.2, 0.1	5.7, 0.1	6.2, 0	8.3, -0.1	2.2, 1.4
Information unavailable	0, 0	0.2, 0	7.2, 0.4	34.8,3	NA

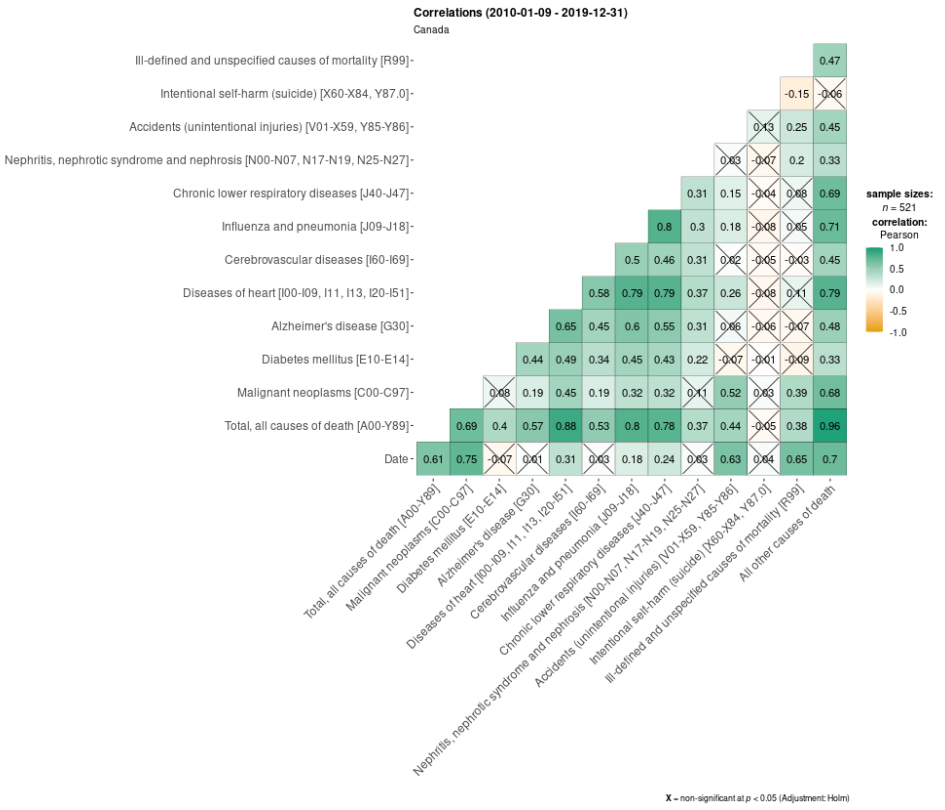
Table 2: Weekly rates of deaths due to COVID-19 in Quebec, Ontario, Alberta and British Columbia in Period 1 (2020-03-14 - 2020-08-01) vs. Period 2 (2020-08-01 - 2020-12-14)

Cause	Period 1 (QE, ON, AB, BC)	Period 2 (QE, ON, AB, BC)
COVID-19 [U07.1,U07.2]	33.2, 10.3, 1.9, 1.8	10.8, 3.9, 6.5, 4.4

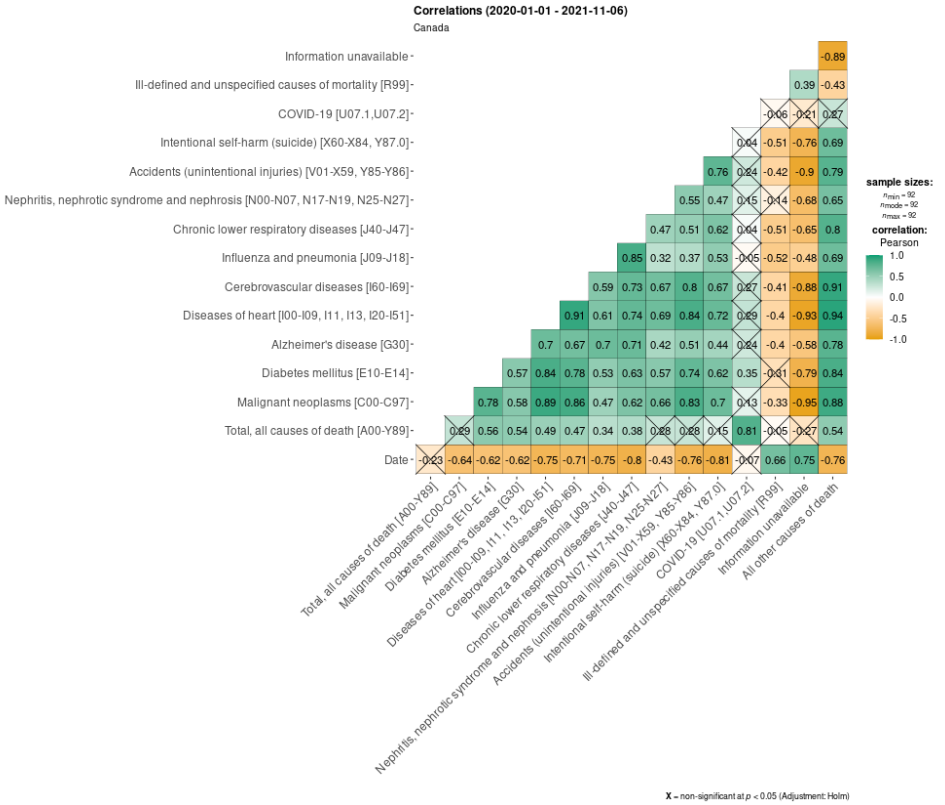
Death causes at national level: cross-correlations and correlations with time (Date)

Green colour indicates positive correlation, orange colour indicates negative correlation. Statistically non-significant correlations (at p<0.05%) are crossed over. Change in the sign of the correlation with Date (last row) is observed between pre-pandemic and pandemic periods.

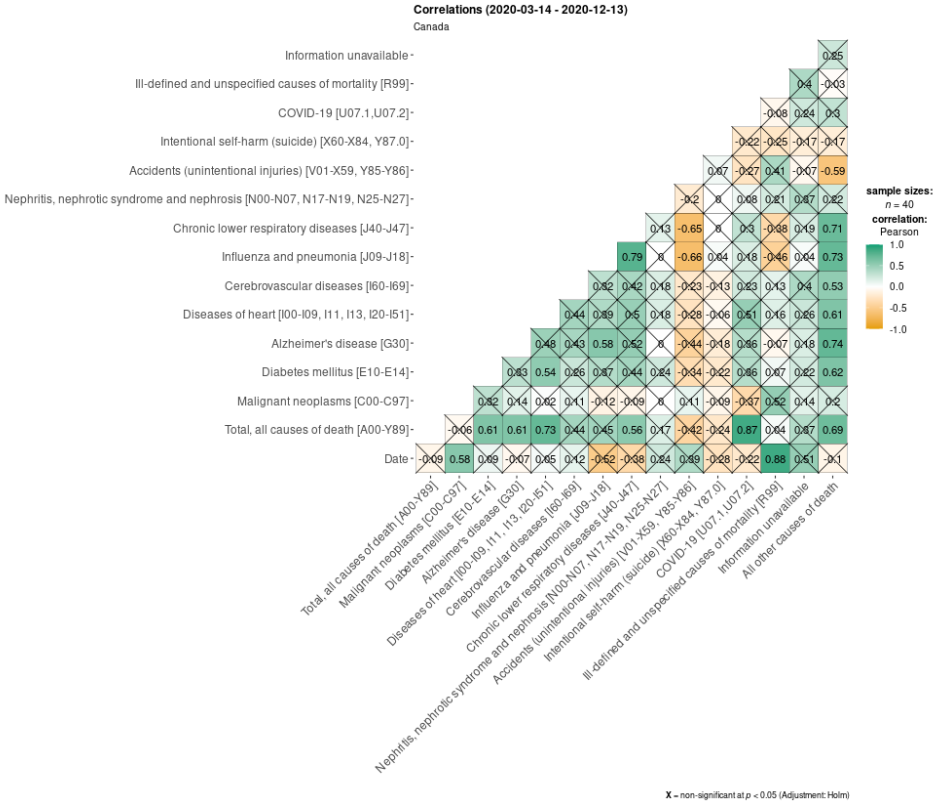
Pre-pandemic:



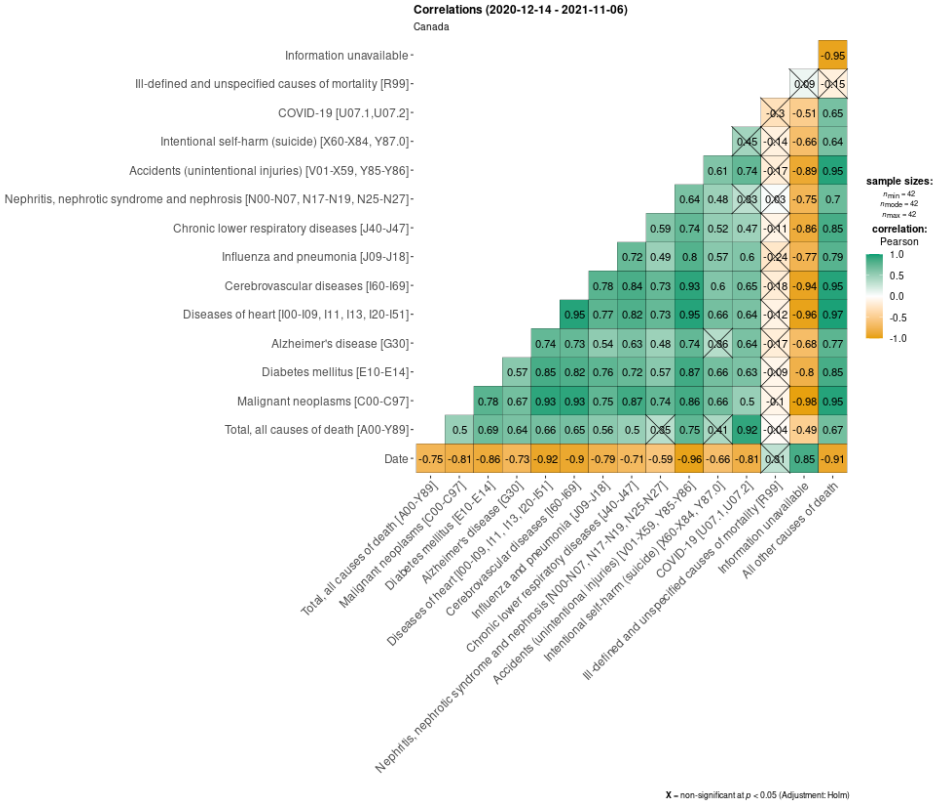
Entire Pandemic:



Pandemic pre-vaccination:



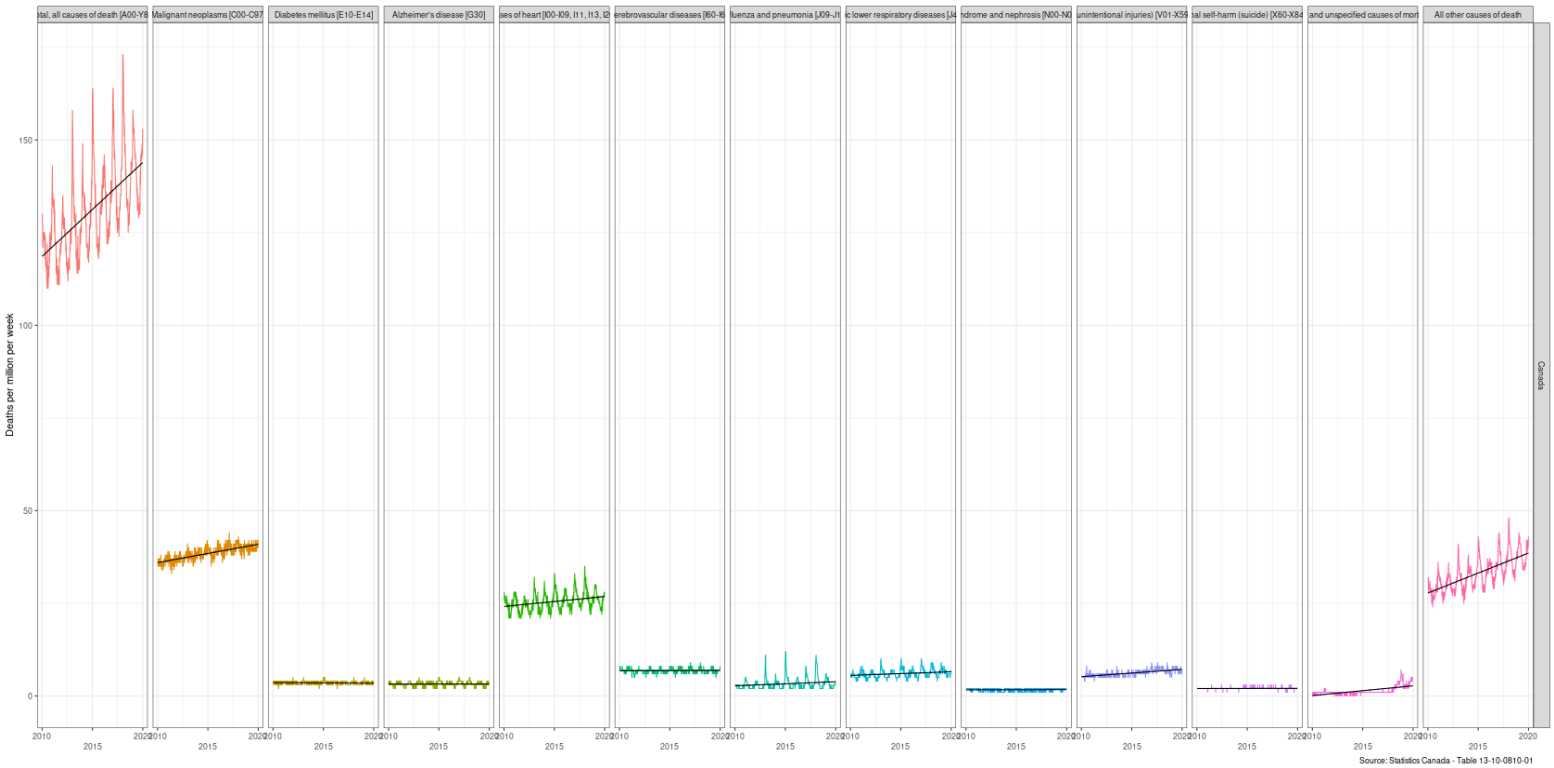
Pandemic since vaccination:



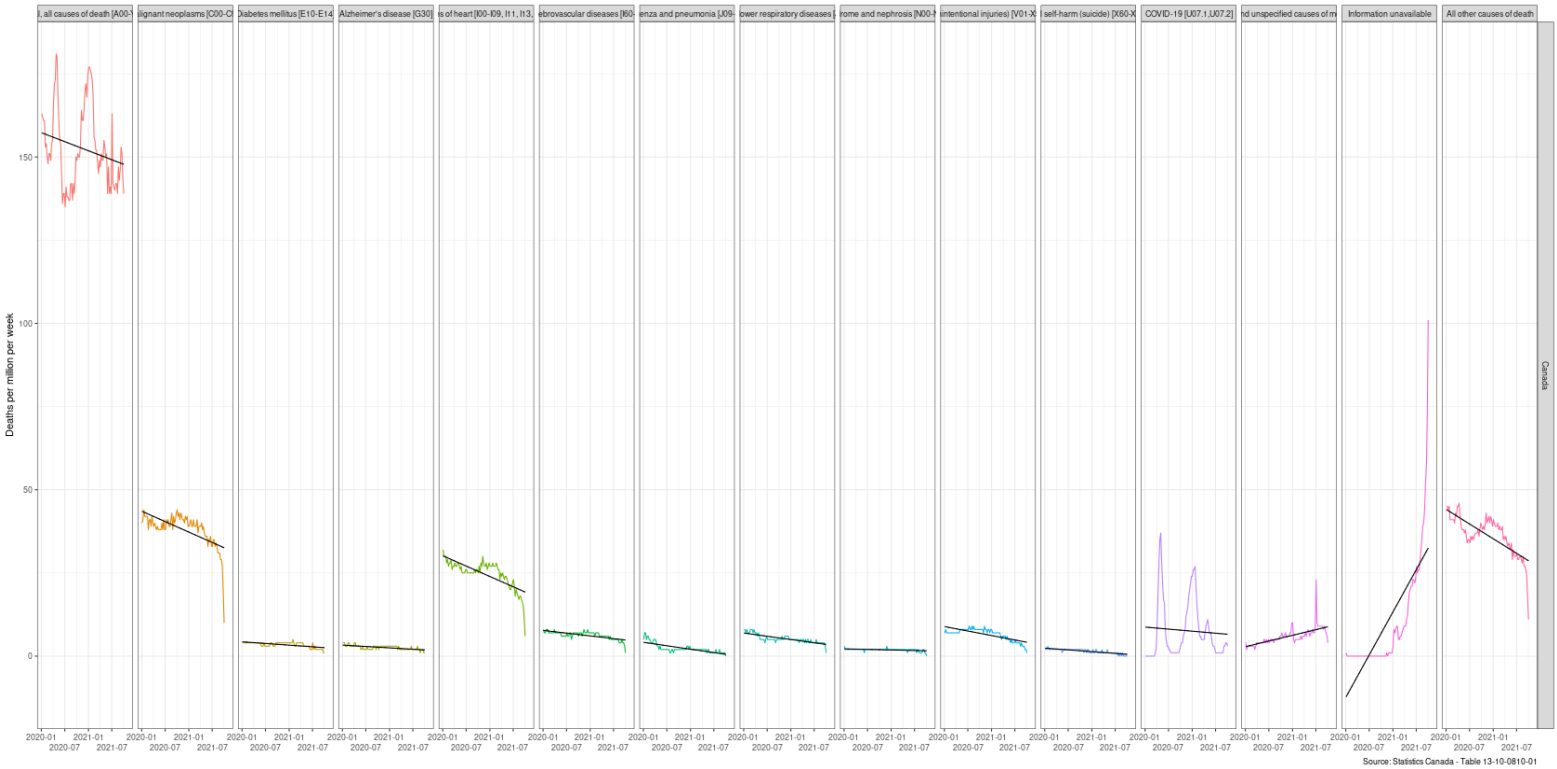
Deaths by cause - at national level: time-series and linear regression (trendlines)

In the following we provide additional images that show the time-series (dynamics and changes) in each death cause category, before and during the pandemic and vaccination. First we show time-series at the National level - for all death cause categories. Then we show time-series for four largest populated provinces and four lower population provinces - for six most frequent death cause categories. The change in dynamics (regression slope) before and during the pandemic is observed.

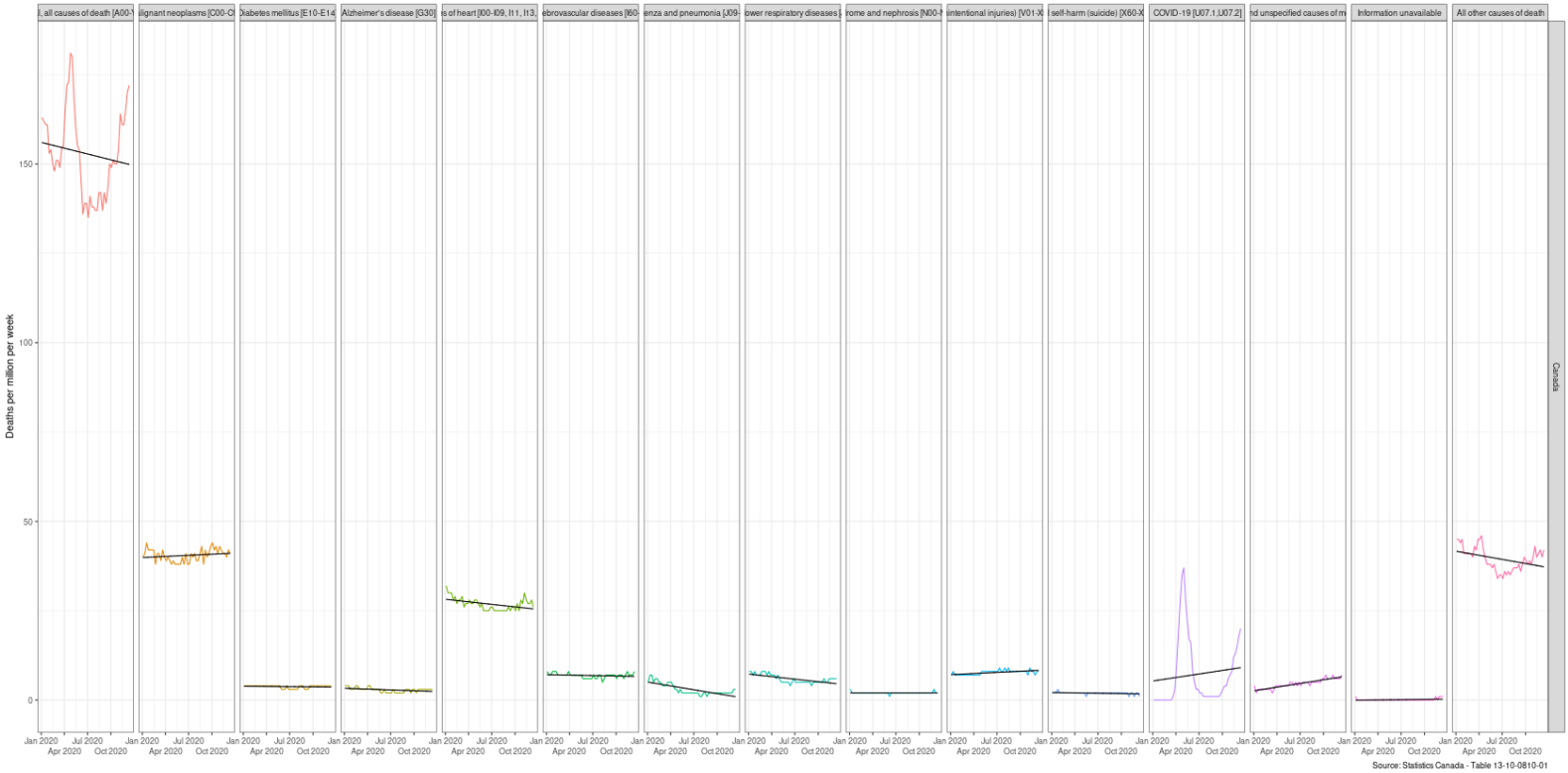
Historical pre-pandemic (January 2010 - December 2019):



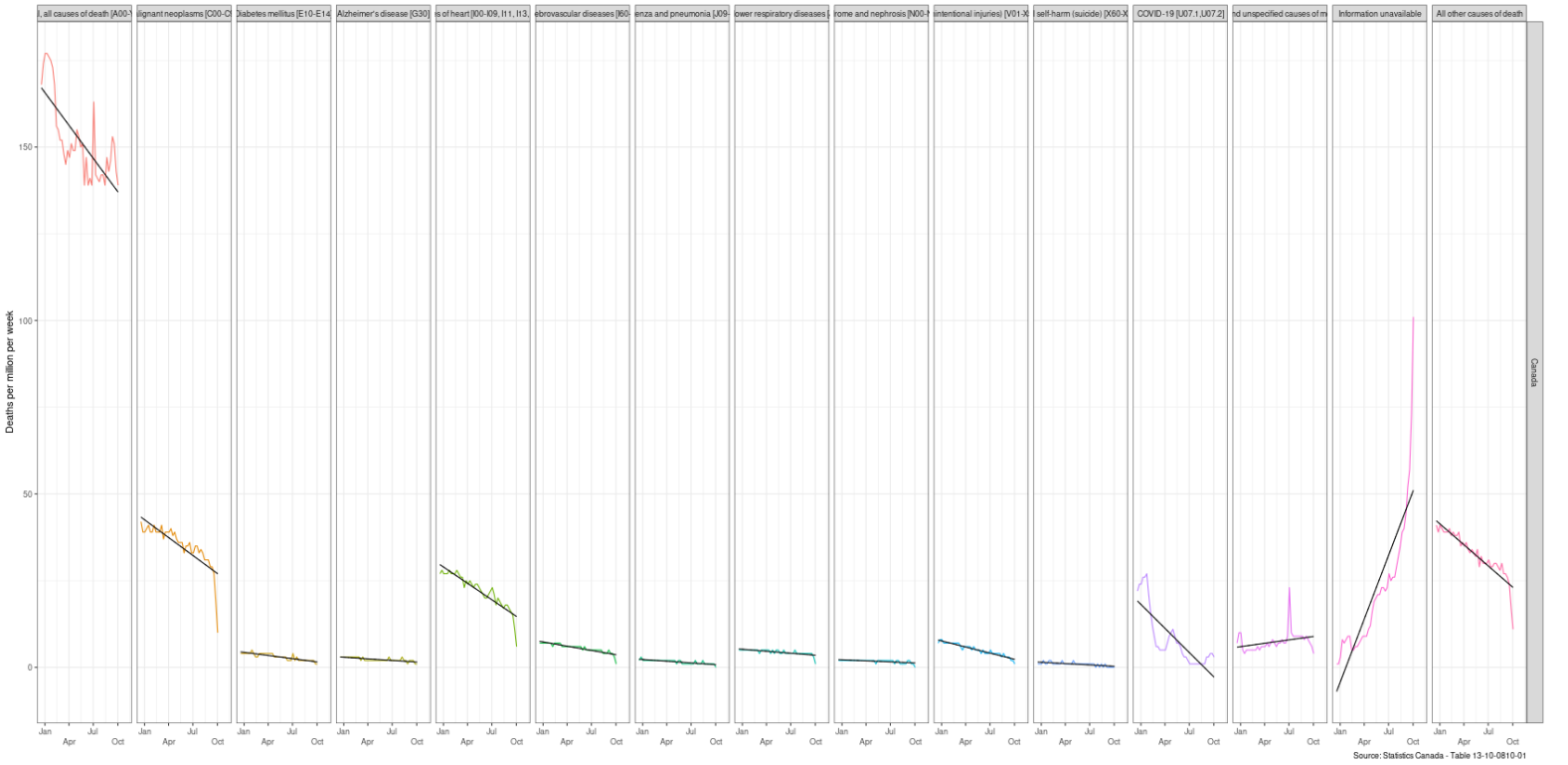
During entire pandemic (1 January 2020 - 6 November 2021):



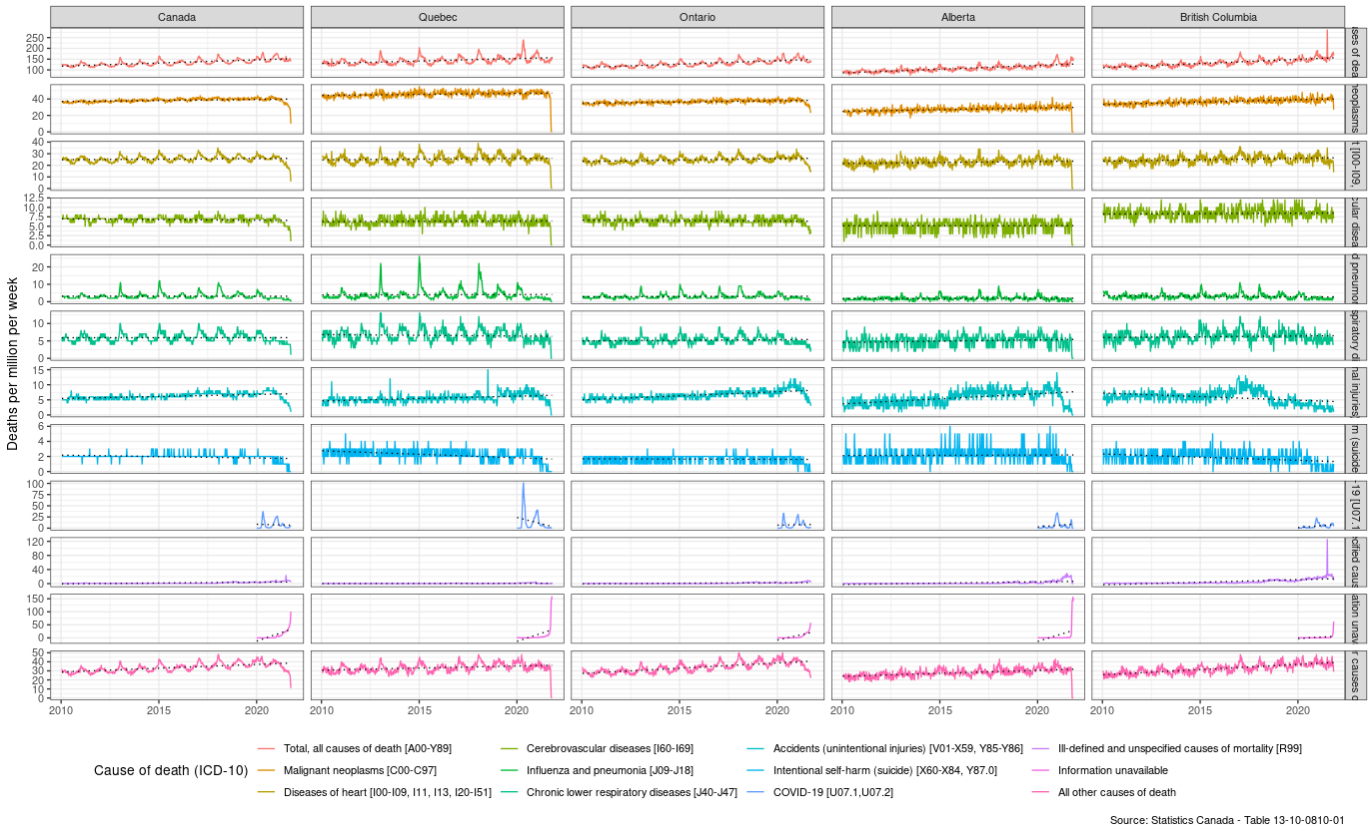
Pandemic pre-vaccination:



Since start of vaccination:

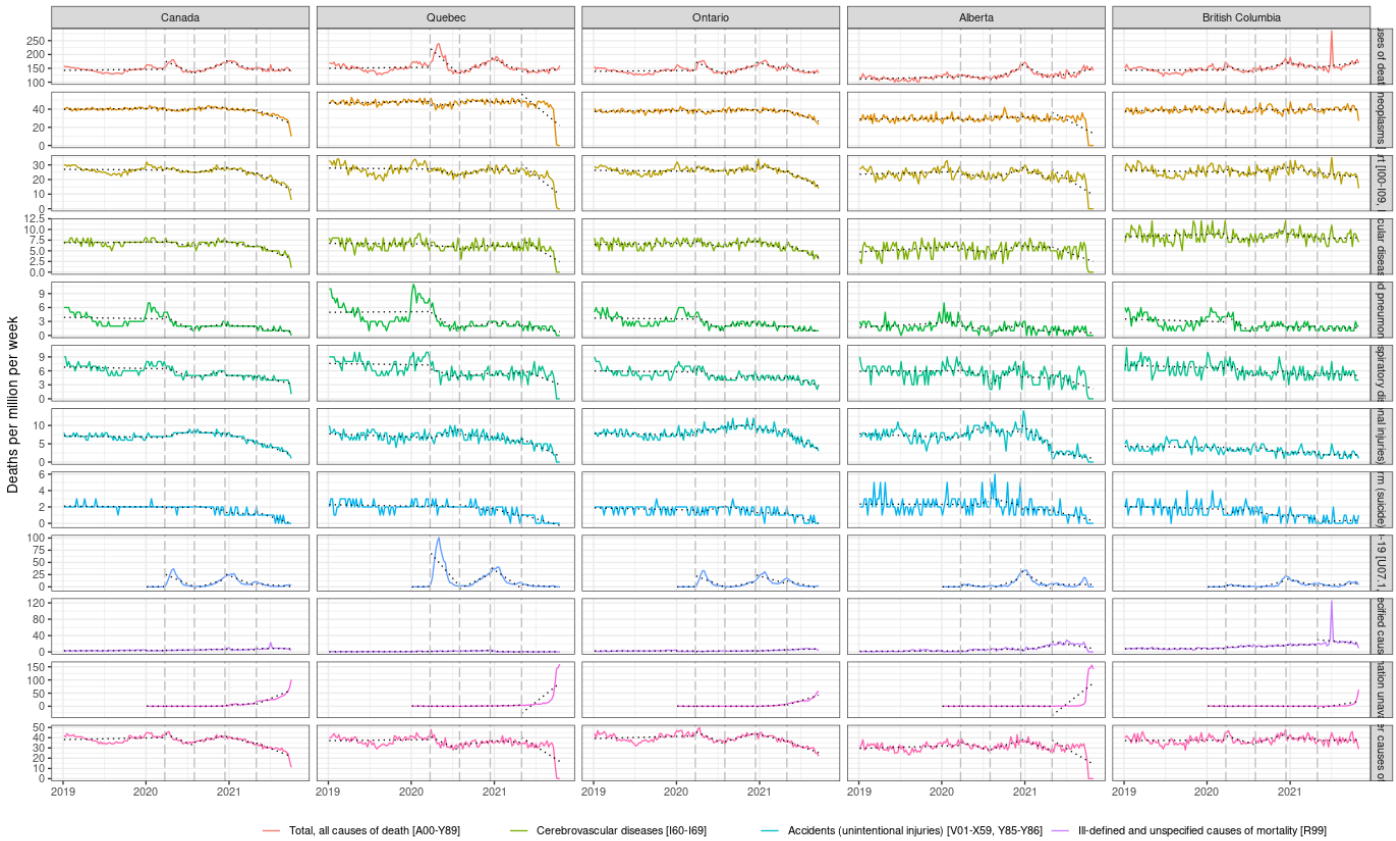


Deaths by cause - at National level and four largest provinces: 2010-2021



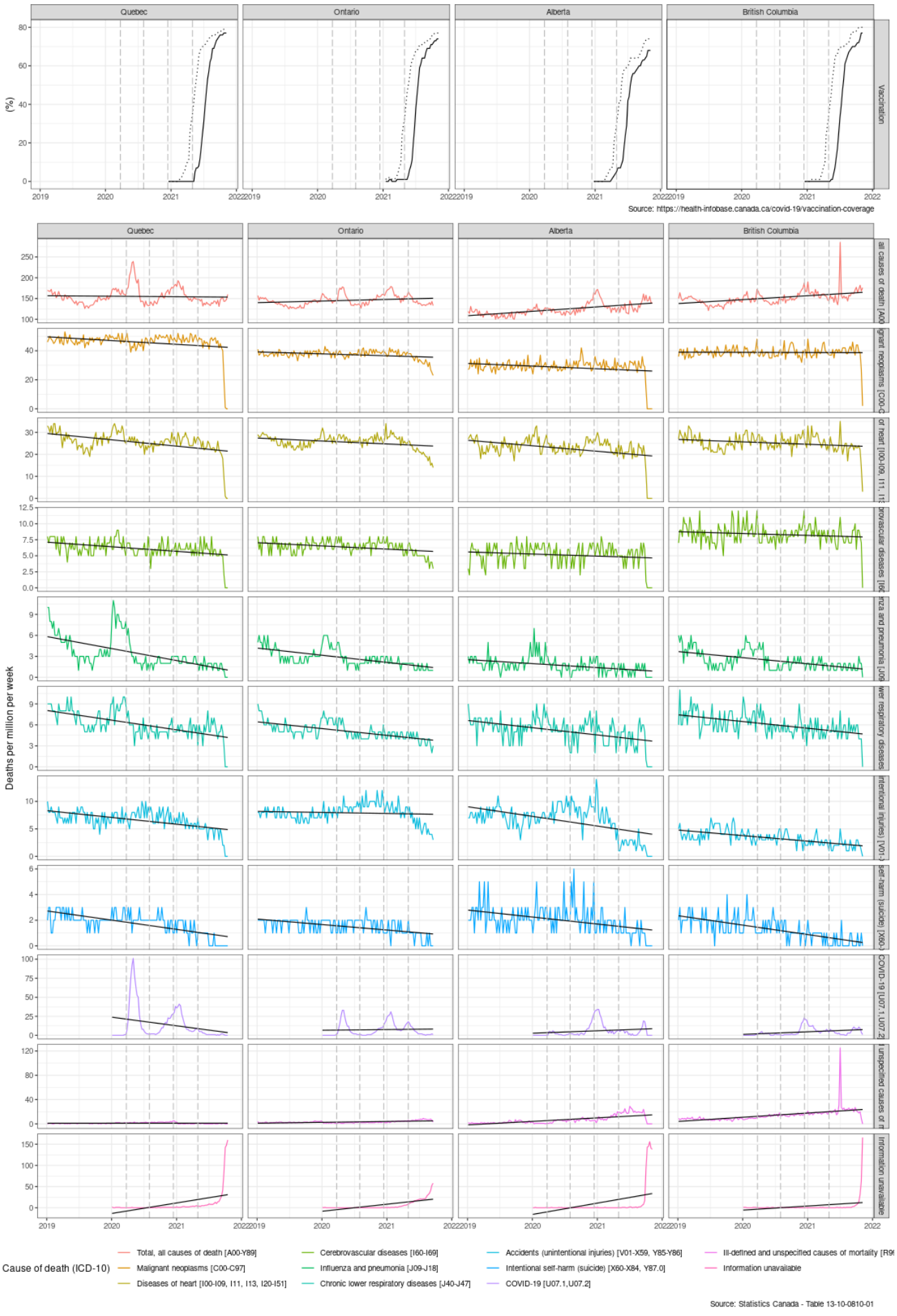
Source: Statistics Canada - Table 13-10-0810-01

Deaths by cause - at National level and four largest provinces: zoomed on 2019-2021

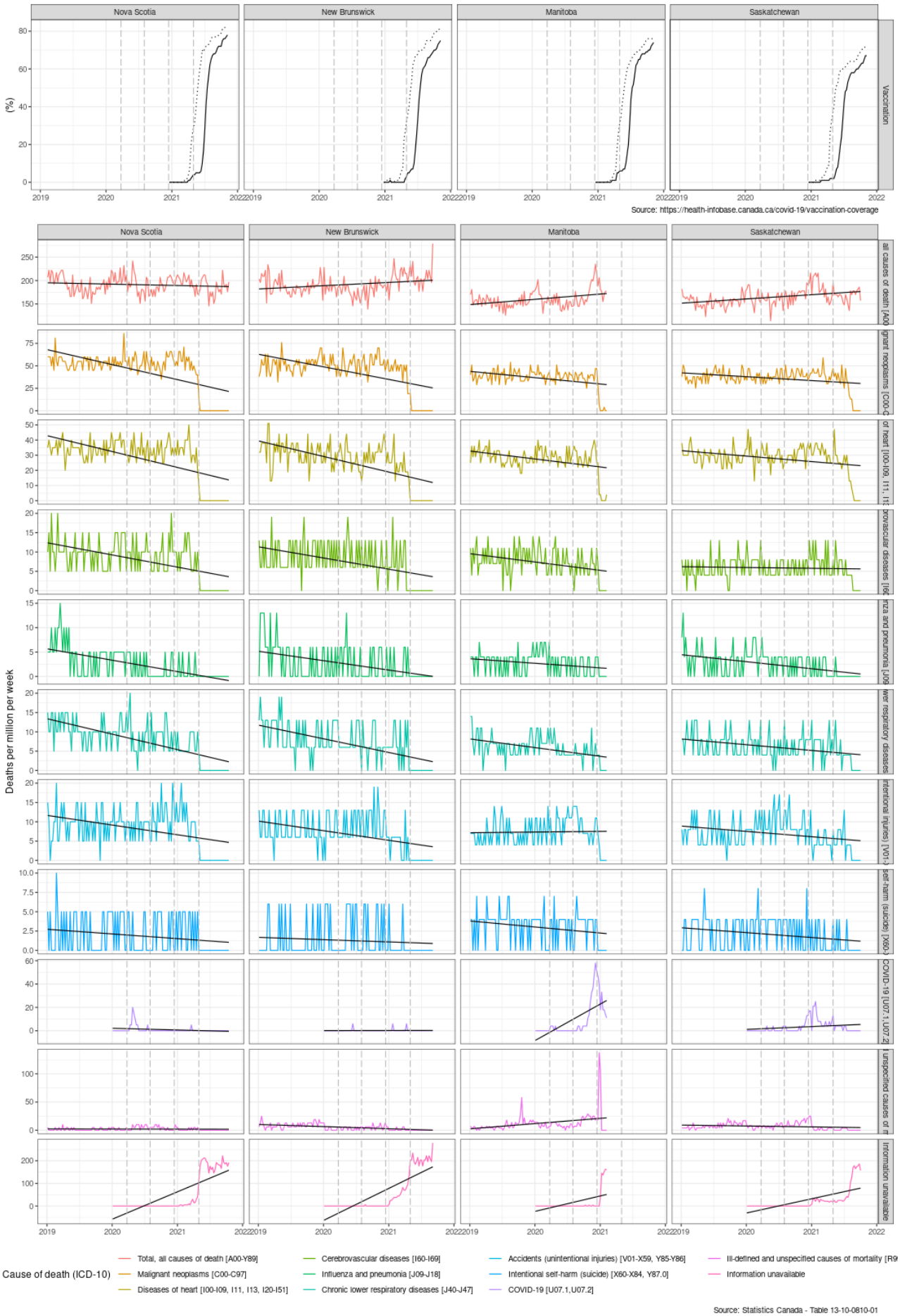


Source: Statistics Canada - Table 13-10-0810-01

Deaths by cause and vaccination rate at four largest provinces



Deaths by cause and vaccination rate at four populated provinces



Analysis of the official Government of Canada data related to the efficacy and safety of COVID-19

The information below is not part of the original submission to The Lancet journal and is included below for the completeness of the presentation.

Source 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
Quote: *"For cases from December 14, 2020 up until November 27, 2021, fully vaccinated cases were 68% less likely to die as a result of their illness, compared to unvaccinated cases (Table 3).*
Observation: Using the App [3], one can find that in the considered period (December 14, 2020 – November 27, 2021) over 75% (10100 / 13075) of all deaths occurred prior to May 1, 2021, when the majority of population (over 97%) was unvaccinated. Recomputing these numbers for the period *after May 1* (when the proportion of vaccinated was approximately equal to the proportion of unvaccinated) results in the conclusion that between May and November fully vaccinated cases were *more (or much more) likely* to die as a result of COVID-19, compared to unvaccinated cases.

Source 2: '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/

Quote: *"Table 1. Count of reported adverse events of special interest up to and including October 22, 2021 (n = 3,793). This includes: 166 Auto-immune diseases, 1,111 heart diseases (including 64 Cardiac arrests and failures, 77 Heart Attacks, 970 Myocarditis1/Pericarditis), 947 thrombosis and blood clots, 37 Acute kidney injury, 25 Liver injury,781 Nerves and central nervous system failures (including 594 Bell's Palsy), 487 Anaphylaxis, and 208 deaths (some of which are still under investigation)."Cumulative serious reports: 6124 (January–October), 5038 (May-October).*

Observation: The quoted above numbers are taken from reports for up to November 6 2021 (to allow comparison with death statistics which are reported with two months delay). Since then the number of adverse events from vaccination continues grows at the rate faster than that of vaccination and faster than that of deaths due to COVID. For comparison, the total number of deaths due to COVID-19 in the same period (May-October), which can be computed using the App [3], is only 2975 (or in average 8.1 deaths per week per million).

Sources 3 and 4: Hospitalizations by vaccination status, COVID-19 (coronavirus) in Ontario, https://covid-19.ontario.ca/data/hospitalizations#hospitalizationsByVaccinationStatus,
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Quote: "*Incidence among fully vaccinated cases has surpassed those among unvaccinated since mid-December 2021."*

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

Quote: *"Health Canada updates Pfizer-BioNTech and Moderna COVID-19 vaccine labels to include information on myocarditis and pericarditis"* and *"…to reflect very rare reports of Bell's Palsy"*

Observation: The listed three complications count for less than third of reported serious complications, and less 7% of all reported adverse events. Noone knows how many adverse events are not reported yet.

Source 6: Side Effect Reporting, Drug Health Product Register, Voluntary Reporting, URL: https://hpr-rps.hres.ca/side-effects-reporting-form.php?form=voluntary. Tel: 1-866-234-2345.

Observation: In Canada, Voluntary Reporting can only be done by a medical doctor. Reporting of events that did not happen at the time of vaccination can take several months.

Additional reference from the vaccine manufacturer

The following reference is also not part of the original submission to The Lancet Journal, provided for completeness.

CUMULATIVE ANALYSIS OF POST-AUTHORIZATION ADVERSE EVENT REPORTS OF PF-07302048 (BNT162B2) RECEIVED THROUGH 28-FEB-2021, Prepared by Pfizer, Released to Public Health and Medical Professionals for Transparency (https://phmpt.org/) under the court order on 17 November 2021.
Direct link: https://phmpt.org/wp-content/uploads/2021/11/5.3.6-postmarketing-experience.pdf

This report provides data that was collected, but not disclosed prior to 17 November 2021, by the vaccine manufacturer on real world adverse events that occurred in the first 2.5 months after Emergency Use Authorization. It lists: over 1,200 deaths; over 25,000 nervous system adverse events; and Anaphylaxis and Vaccine-Associated Enhanced Disease (listed under “Safety concerns”).