Ascertainment of laboratoy-confirmed COVID-19 deaths in Switzerland until January 2022

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There are two main approaches to quantifying the impact of SARS-CoV-2 and COVID-19 in a population in terms of mortality. The first approach relies upon the reporting of laboratory-confirmed COVID-19 deaths, i.e. deaths of people with a recent SARS-CoV-2 infection proven by a positive RT-PCR or rapid antigen test. This approach has the advantage of being available in real-time, and is considered as reliable in areas where testing is widely available. It is however not exhaustive, as some deaths will remain unascertained because of a lack of test (e.g. because of test shortages or overwhelmed health systems) or because of a false negative. Laboratory-confirmed deaths also do not include deaths that have been indirectly caused (or averted) by SARS-CoV-2 epidemics, e.g. in consequence of control measures. The second approach is based on excess mortality, and relies upon all-cause mortality data and counter-factual reasoning. The idea is to compare the observed number of deaths to what would have been expected had the SARS-CoV-2 pandemic not occurred, based on mortality data from the previous years and population changes. Excess mortality has the advantage of summing all the negative and positive effects of the occurrence of SARS-CoV-2 on mortality, at the cost of not being able to disentangle them. It is also highly dependent on assumptions and methodological choices. In this analysis of all available data in Switzerland until January 2022, we aimed to characterize the commonalities and discrepancies between laboratory-confirmed COVID-19-related deaths and excess mortality over time by age and location.

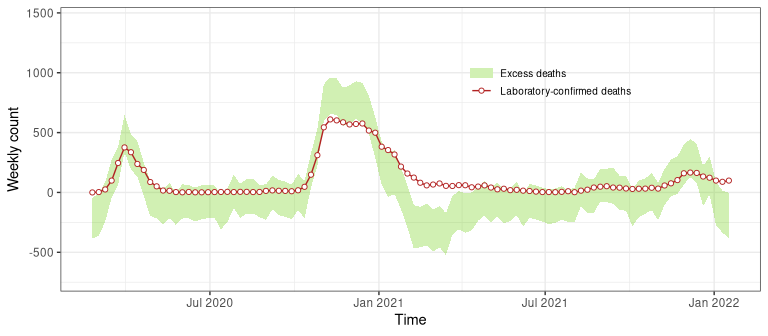
The declaration of laboratory-confirmed COVID-19 deaths has been mandatory in Switzerland since February 2020. All collected data are centralized at the Federal Office of Public Health. Case definition (…). Available information include age, sex, canton of residence, and the date and type of the positive SARS-CoV-2 test. Individual data on all deaths occurring in Switzerland from death certificates are collected by the Federal Office of Statistics. Information include (…). Details about the cause of death as listed in the death certificate are encoded with a delay of several months and were not available for this analysis. We used the approach proposed in [1] to compute the expected number of all-cause deaths for each week between 1 February 2020 and 30 January 2022 by age and canton of residence based on historical data. Excess mortality is the difference between the expected and observed number of all-cause deaths. Briefly, the methods relies upon the following assumptions (…).

We then developed a statistical model linking these two sources of data. We used a Poisson regression model with an identity link and no intercept of the form:

where is the observed number of all-cause deaths on week ; is the number of laboratory-confirmed COVID-19 deaths; and is the expected number of all-cause deaths given historical trends. Within this formulation, is the additional number of observed all-cause deaths for each unit increase in , so that, assuming that all additional deaths occurring during a SARS-CoV-2 wave can be directly or indirectly linked to SARS-CoV-2 infection, can be interpreted as the relative number of unascertained deaths that have been directly or indirectly caused by SARS-CoV-2 for each laboratory-confirmed death. In a similar way, is the additional number of observed all-cause deaths for each unit increase in the expected , so that it can be interpreted as the relative excess mortality adjusted for the effects of SARS-CoV-2.

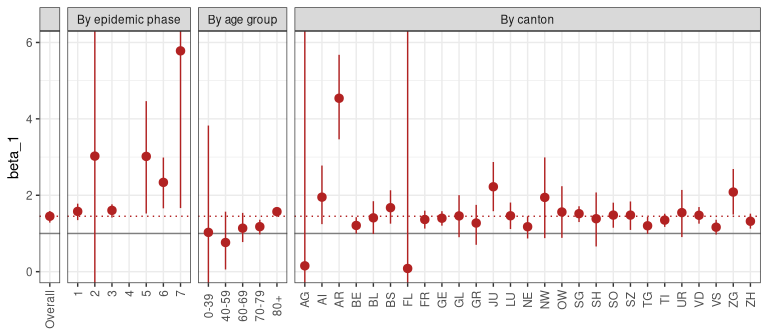
Discussion of figures:

- panel A on top (I will add phases)

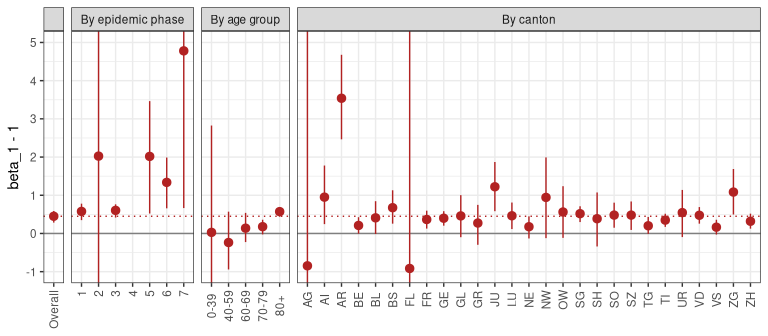


- panel B:

either beta\_1, “how many total deaths directly or indirectly caused by covid for each laboratory-confirmed death”?

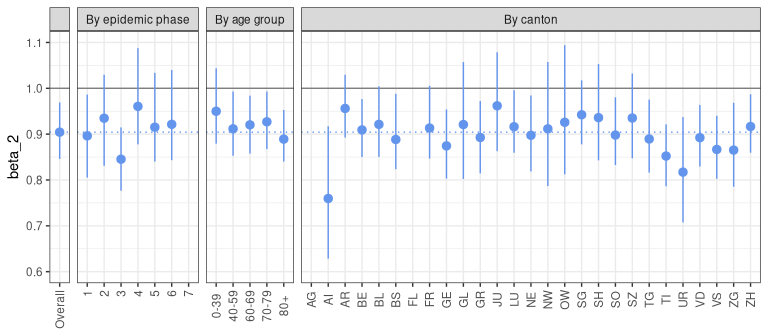


or beta\_1-1 “how many unascertained”

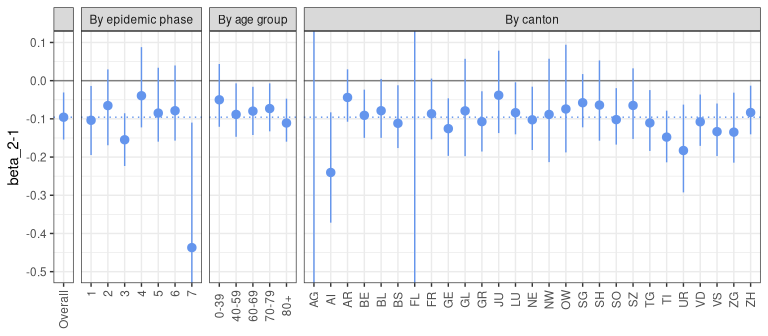


- panel B:

either beta\_2 “how many deaths occur for each expected, that is the mortality deficit if you ignore the effect of covid?



or beta\_2-1 “how many deaths are missing”



# References

[1] G. Konstantinoudis *et al.*, “Regional excess mortality during the 2020 COVID-19 pandemic in five european countries,” *Nature Communications*, vol. 13, no. 1, pp. 1–11, 2022.

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