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# The use of electronic health records during the COVID-19 (C19) pandemic: what impact for observational studies not assessing COVID-19?

## Background

### Electronic health records and COVID-19: what recommendations?

*Electronic Health Records (EHR) are increasingly used to investigate epidemiologic research questions, as they provide high power and easily available data. Recent studies found a dramatic reduction of healthcare consumptions during the C19 pandemic[1]. Recommendations were published on how to conduct clinical studies during the C19 pandemic, but no equivalents exist for observational studies using EHR[2].*

## Objectives

**To provide insights and tentative recommendations on statistical analyses to perform for incoming observational studies not assessing C19 using EHR during the C19 pandemic period.**

## Methods

- Sources of bias could occur in the context of C19 pandemic for the measurement of incidence of pathologies and the association between an exposure and an outcome under scrutiny.
- The statistical analyses to evaluate the magnitude of these biases and to account for them will be described.

**An illustrative example using surgical data is provided.**

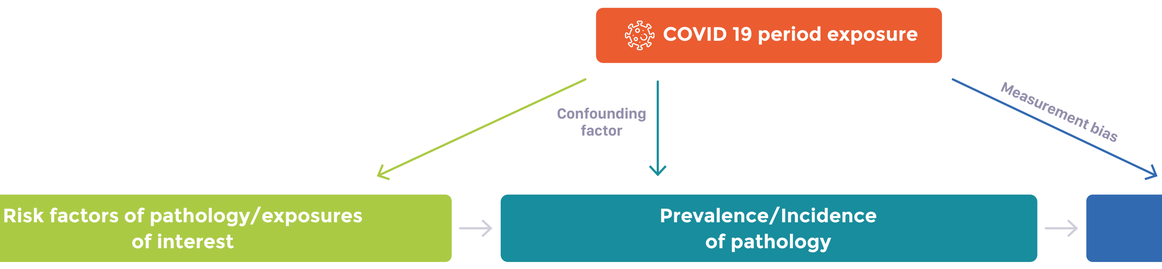
## Conclusion

*This work highlights the importance of evaluating the impact of C19 even in studies not initially related to C19 because measurement bias can occur and C19 may be a confounding factor or an effect modifier for the associations of interest.*

*EHR are a powerful tool that should continue to be harnessed to investigate varied medical research questions and not be limited to their already proven usefulness in evaluating the C19 pandemic. While extra care is warranted when examining endpoints unrelated to C19 during the pandemic, statistical tools already exist to carefully address methodological challenges that may arise in observational study settings.*

## Results

### Sources of bias




**C19 can influence the risk factors/exposures of interest**

- Treatments and procedure positively or negatively correlated to incidence of C19 → change in guideline during the C19 pandemic.
- Lower pollution-related crises (e.g., asthma) due to lower air pollution levels.

**Consequence:** Different levels of exposure according to the period of interest.

**C19 can directly influence the prevalence/incidence of pathology**

The patients deceased of C19 will not be at risk of developing the pathology of interest.

**Consequence:** Marked changes of incidence and prevalence of the pathology of interest in 2020-2021 can be due to the context in general population.

**C19 can influence the population selected into studies and the detection of cases**

- Absence of diagnosis during the C19 period or diagnosis of most severe patients only.
- Lower quality of coding due to high workload at the hospital.
- Important decrease of non-essential healthcare visits, impacting the detection of cases related to these elements.

**Consequence:** Selection bias:

- Extracted population will be incomplete.
- Extrated population in 2020-2021 may be different from other years (likely with higher severity).

### Recommandations

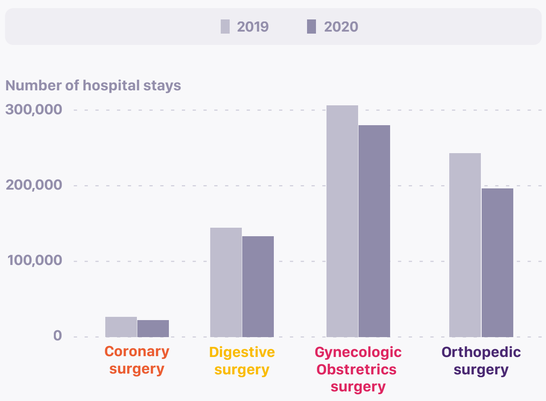
#### Recommandations on design

- Avoid before/after designs (with subjects as their own control) and prefer case-control studies.
- Plan longer follow-back periods (≥ 2 years) to detect comorbidities and medical history in order to prevent the detection only during the C19 period (because an underestimation is likely to occur).
- To have multiple years prior to C19 onset as comparator to evaluate the effect of C19 in incorporating the expected trend in addition to the seasonality difference.

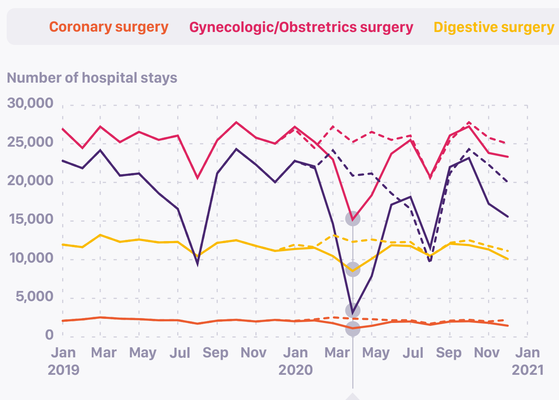
#### Description and analysis of C19 impact

- Describe patients included before versus after the C19 period.
- Describe monthly and yearly evolution of number of patients included, main risk factors and outcomes.
- Compute the expected number of patients according to seasonality and compare with the observed number of patients[3]. These differences can be analysed using time series or Poisson regression to formally test the presence of persistent difference.

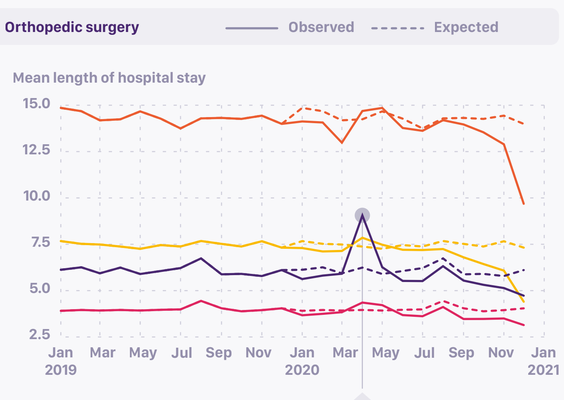
### Illustrated example on surgeries




Overall decrease of number of hospital stays in 2020 versus 2019




The overall decrease of number of hospital stays is mainly explained by the first lockdown dropout




During the first lockdown, higher duration of hospital stays for orthopedic surgery (possibly due to more severe patients)

### Influence of C19 at the month or the year scale?

**Low**

- Analyses can be pooled on all patients.
- In case of matched analyses, the month of inclusion should be included as a matching variable in order to have similar patients in terms of inclusion during the C19 period.
- In case of survival analyses, a competing risk analysis could be considered using C19-related death as competing event (using proxy of C19-related death).
- All evolution after 2020 versus before should be interpreted with caution as it may be related to the natural evolution of the disease but also to C19.

**High**

- Understand the mecanisms and the causes of these changes (measurement bias, direct influence of C19 on exposure and/or outcome).
- If feasible, restrict primary analyses on the period before C19.
- Sensitivity analyses on pooled patients.

[1] Moynihan, Ray, Sharon Sanders, Zoe A. Michaleff, Anna Mae Scott, Justin Clark, Emma J. To, Mark Jones, et al. « Impact of COVID-19 Pandemic on Utilisation of Healthcare Services: A Systematic Review ». BMJ Open 11, no 3 (2021): e045343. https://doi.org/10.1136/bmjopen-2020-045343.

[2] Webster-Clark, Michael. « Ways COVID-19 May Impact Unrelated Pharmacoepidemiologic Research Using Routinely Collected Data ». Pharmacoepidemiology and Drug Safety 30, no 3 (2021): 400-401. https://doi.org/10.1002/pds.5182.

[3] Roland, N., L. Duranteau, F. Cuenot, R. Dray-Spira, A. Weill, et M. Zureik. « Impact de l'épidémie COVID-19 sur l'utilisation des contraceptifs en France en 2020 et jusqu'en avril 2021 ». Revue D'Epidemiologie et De Sante Publique 70 (mars 2022): S20. https://doi.org/10.1016/j.respe.2022.01.095.