

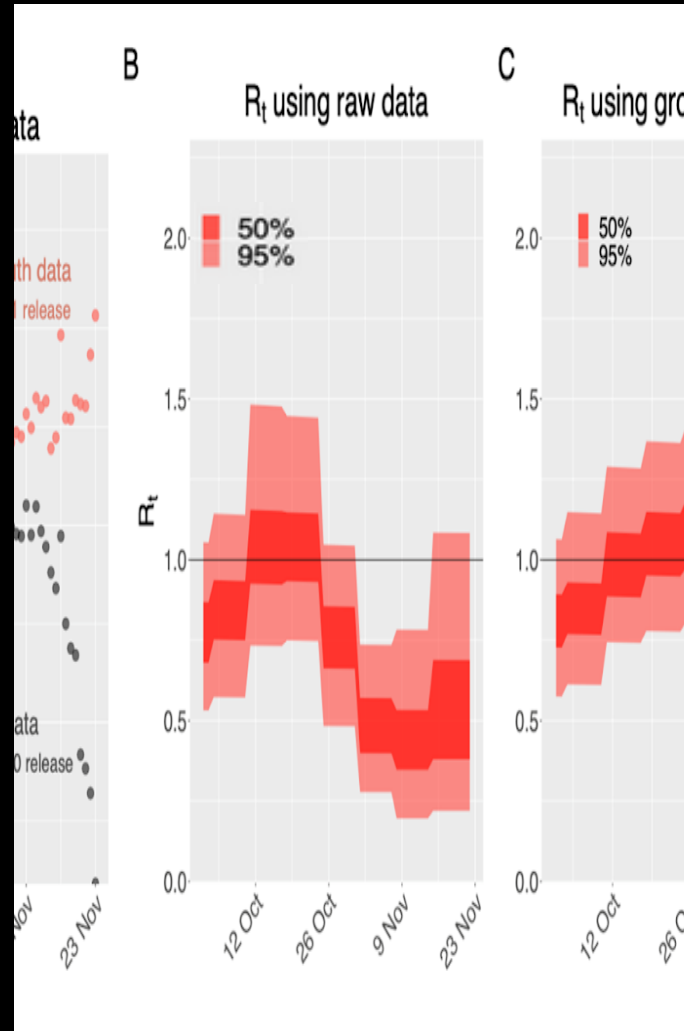
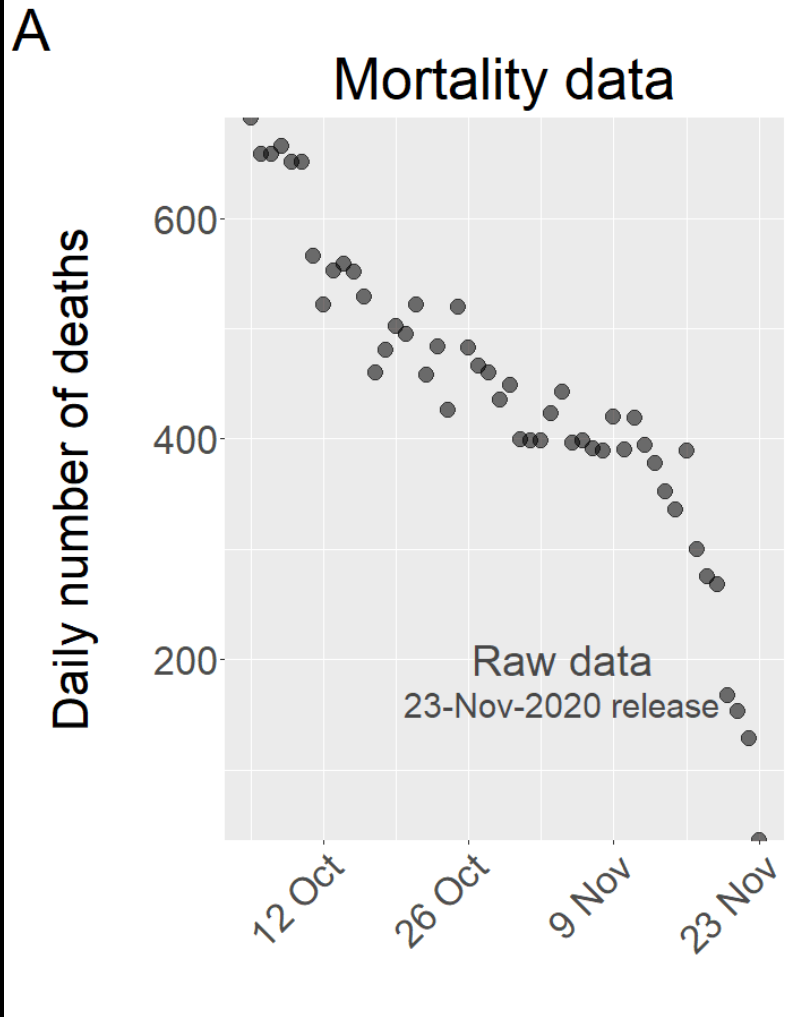
# Gaussian Process Nowcasting: Application to COVID-19 Mortality Reporting

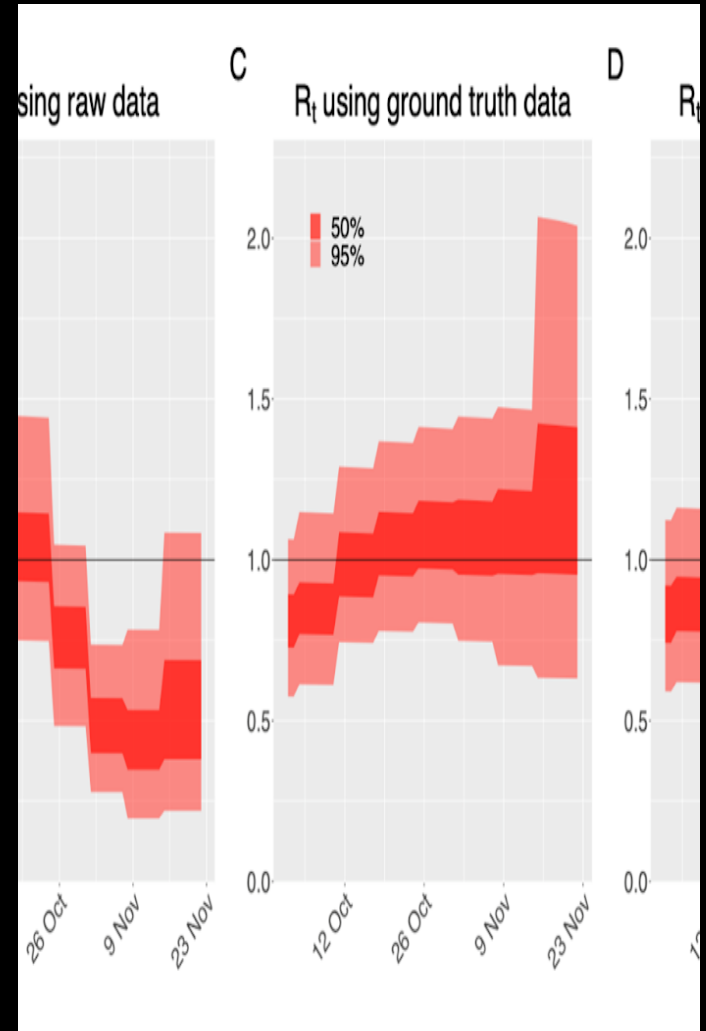
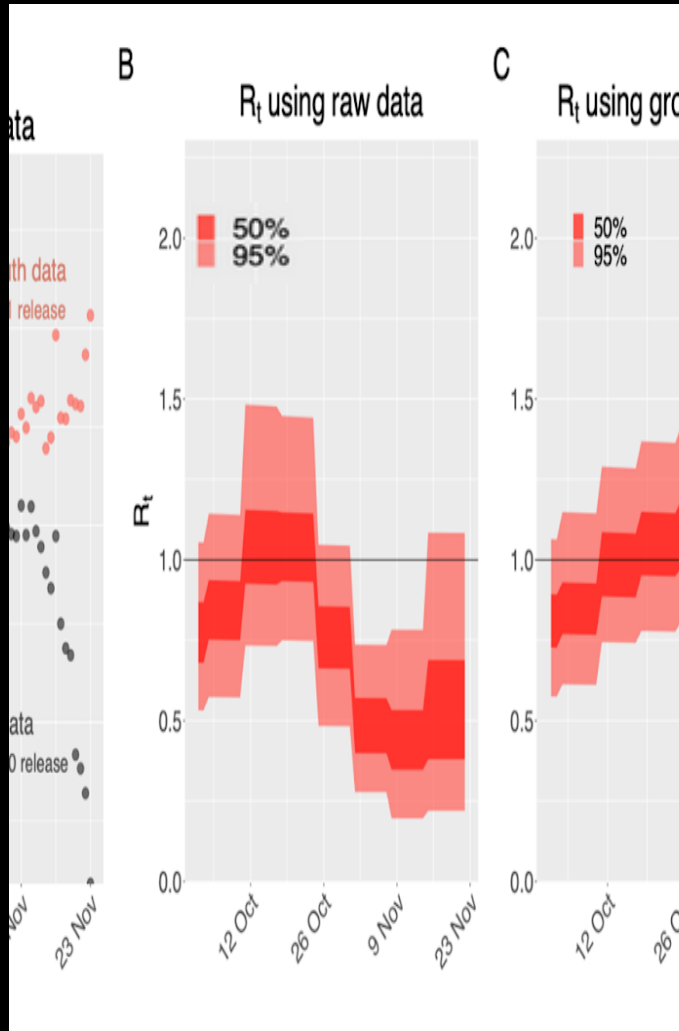
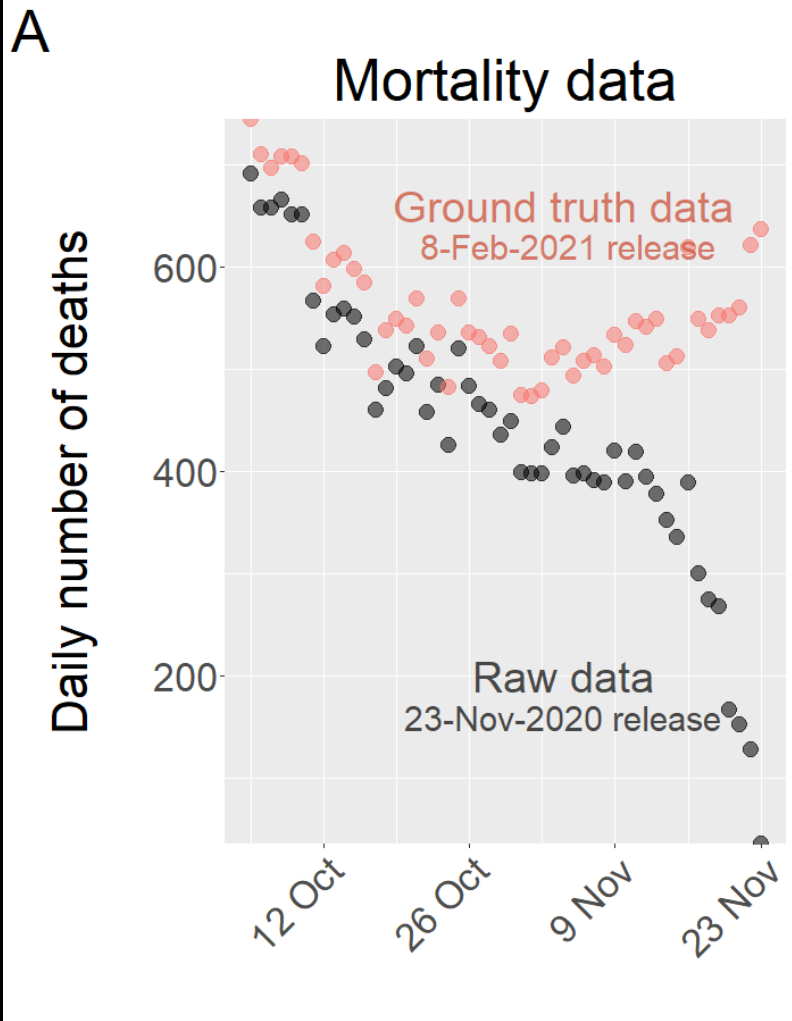
**Iwona Hawryluk**

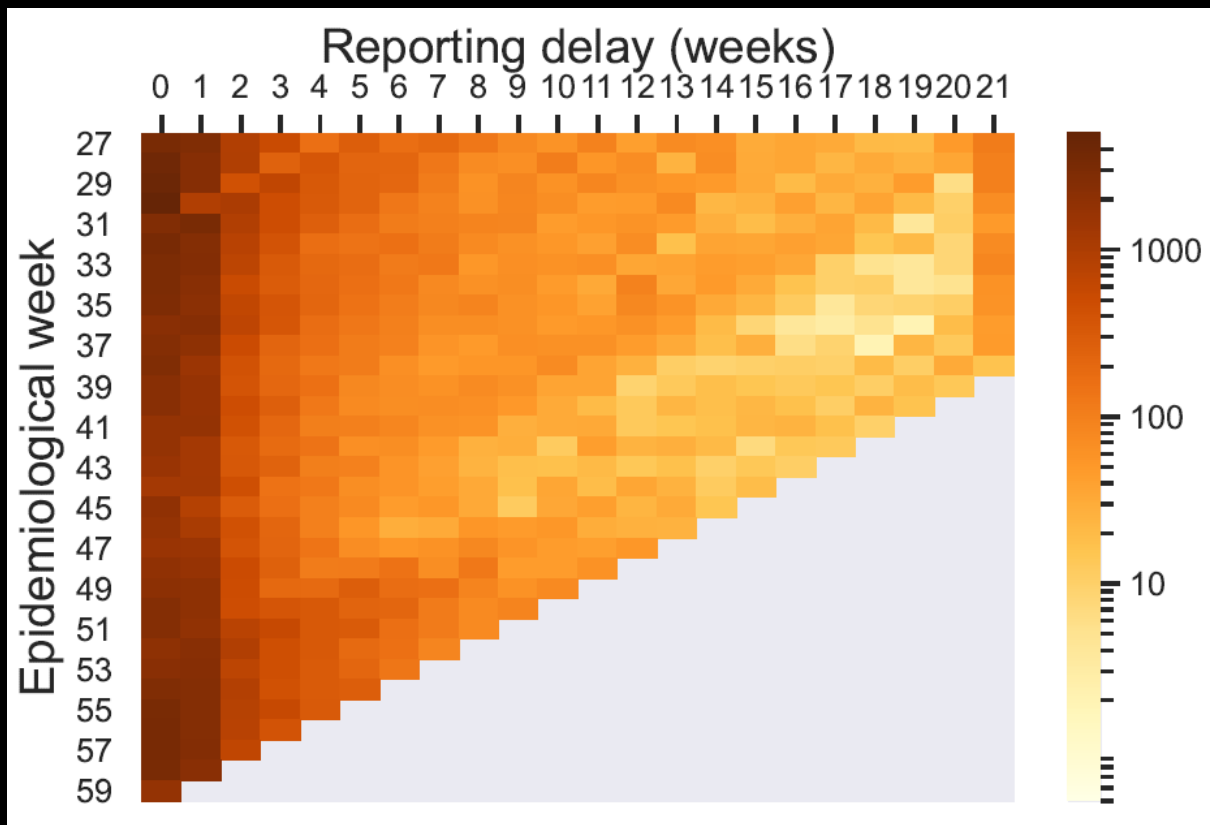
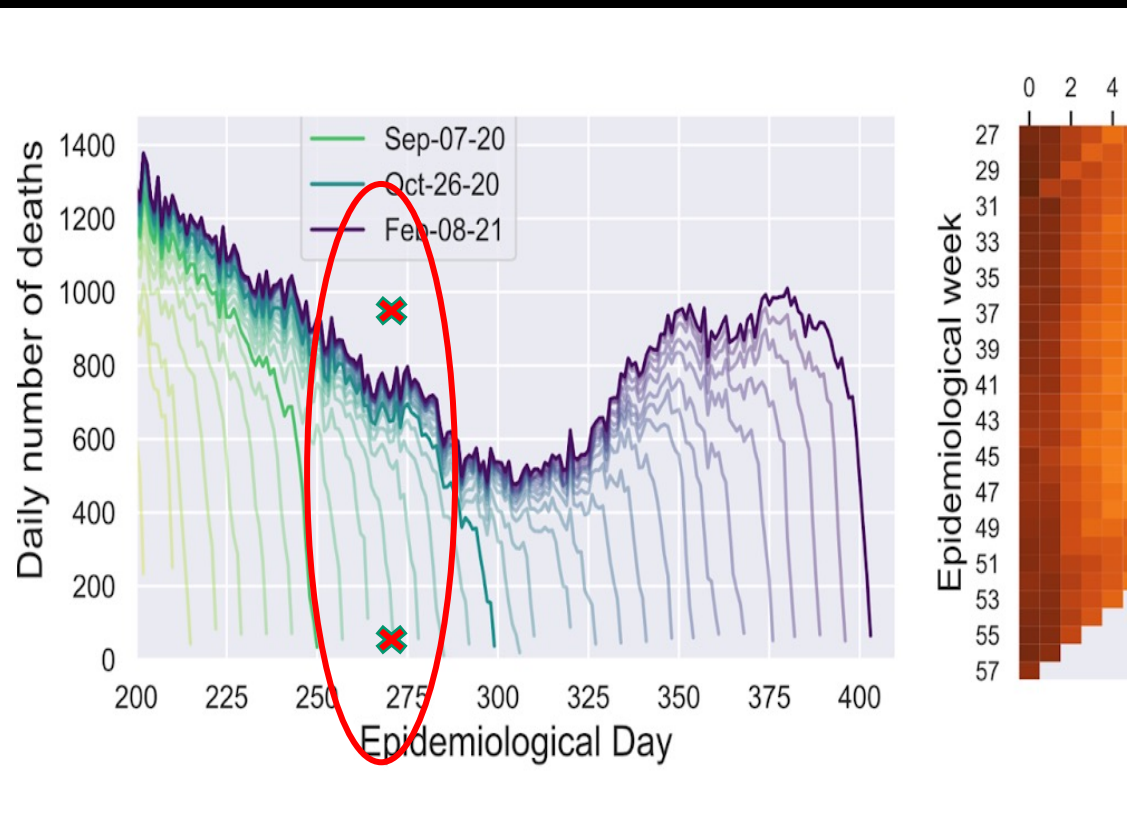
SPH symposium, May 2023

# Nowcasting

The prediction of the present, the very near future and the very recent past.







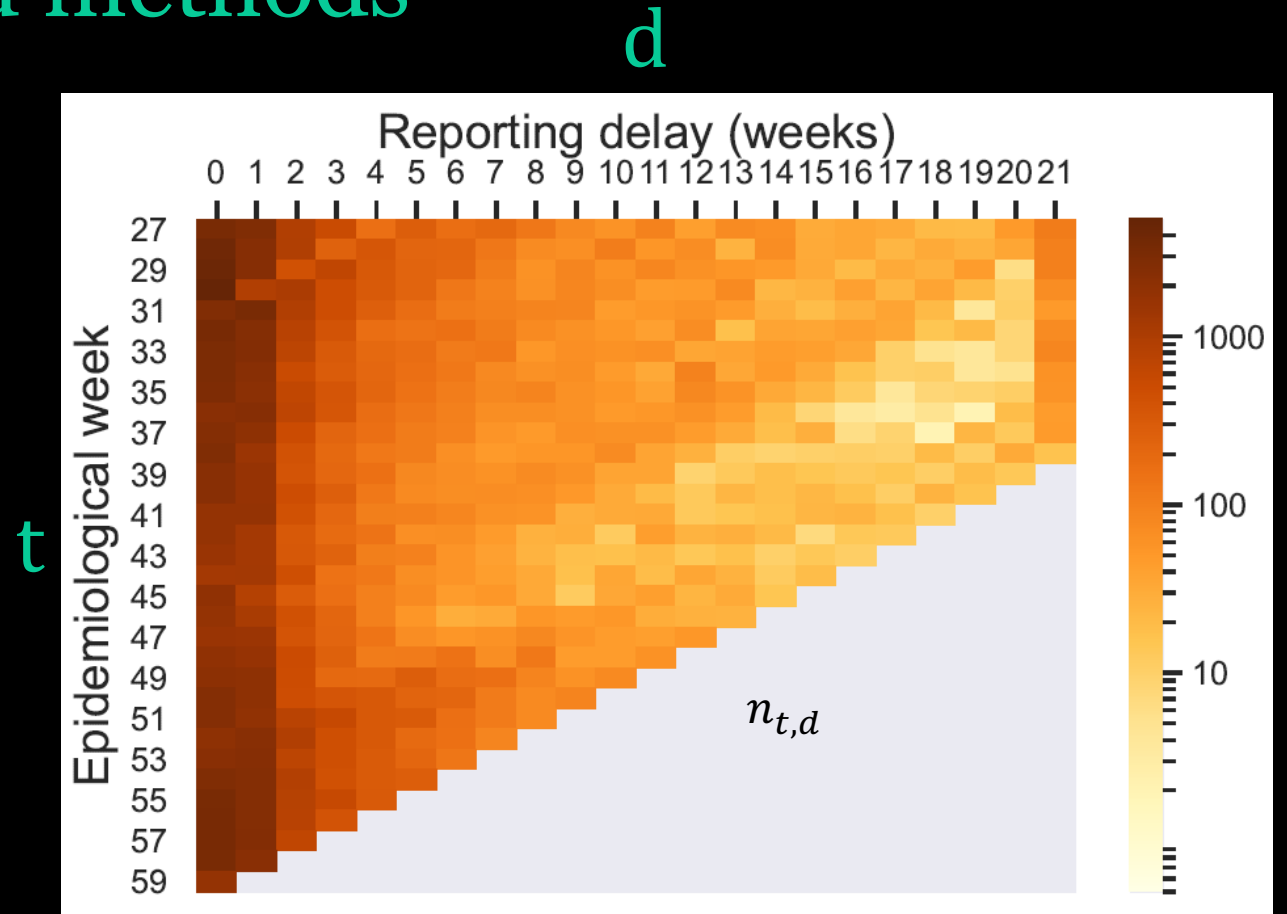
# Nowcasting – related methods

$$n_t = \sum_d n_{t,d}$$

$$n_{t,d} \sim NB(\lambda_{t,d}, r)$$

$$\lambda_{t,d} \sim \text{Random walk} [*]$$

$$\lambda_{t,d} \sim \text{AR} [**]$$



[\*] Bastos et al. 2019, Statistics in Medicine

[\*\*] McGough et al. 2020, PLoS Comp Biol

# Our work: Gaussian Process Nowcasting

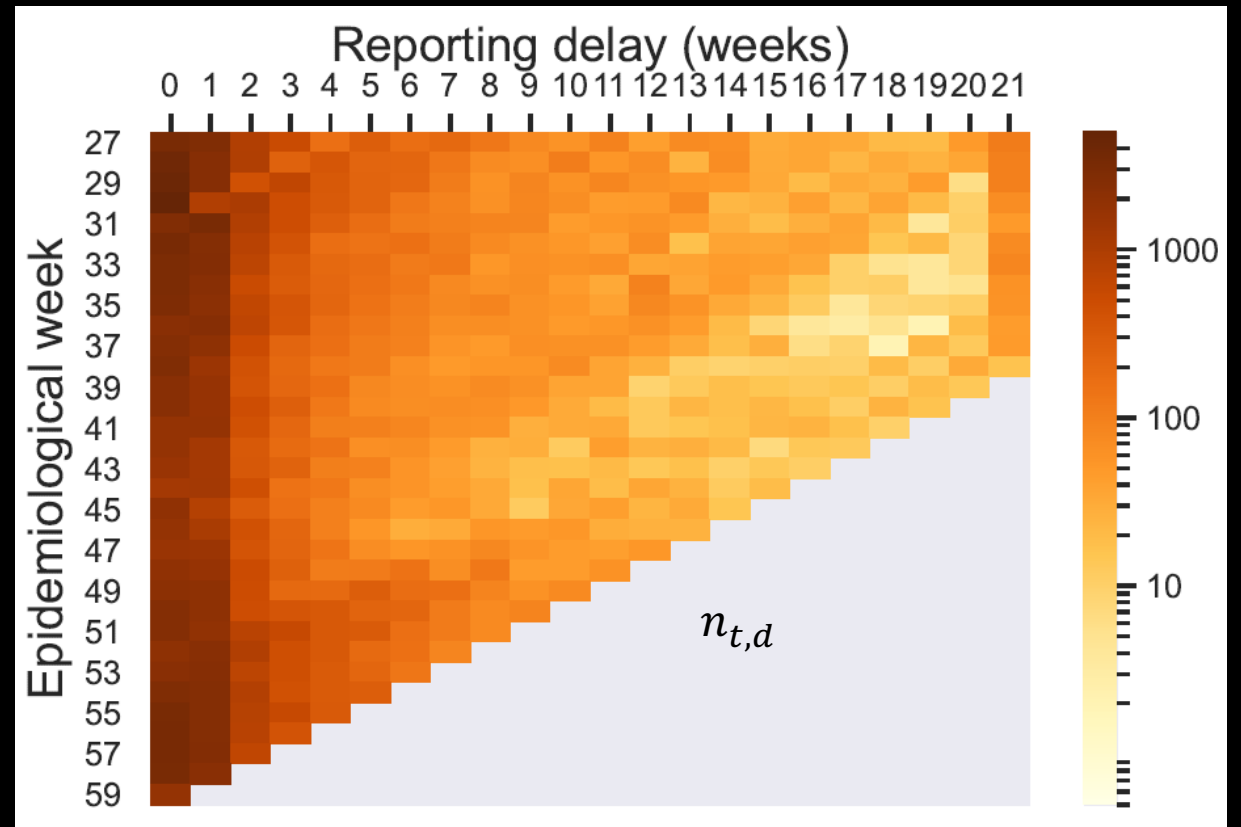
$$n_t = \sum_d n_{t,d}$$

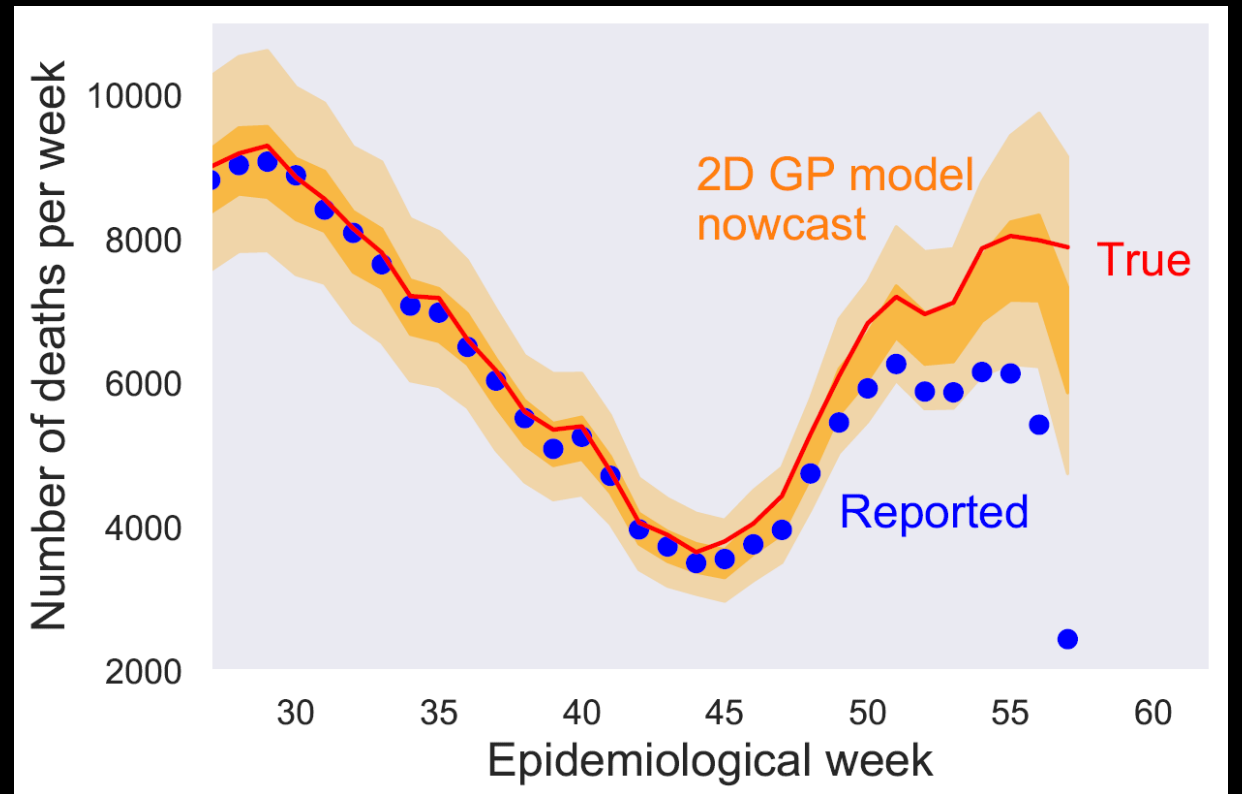
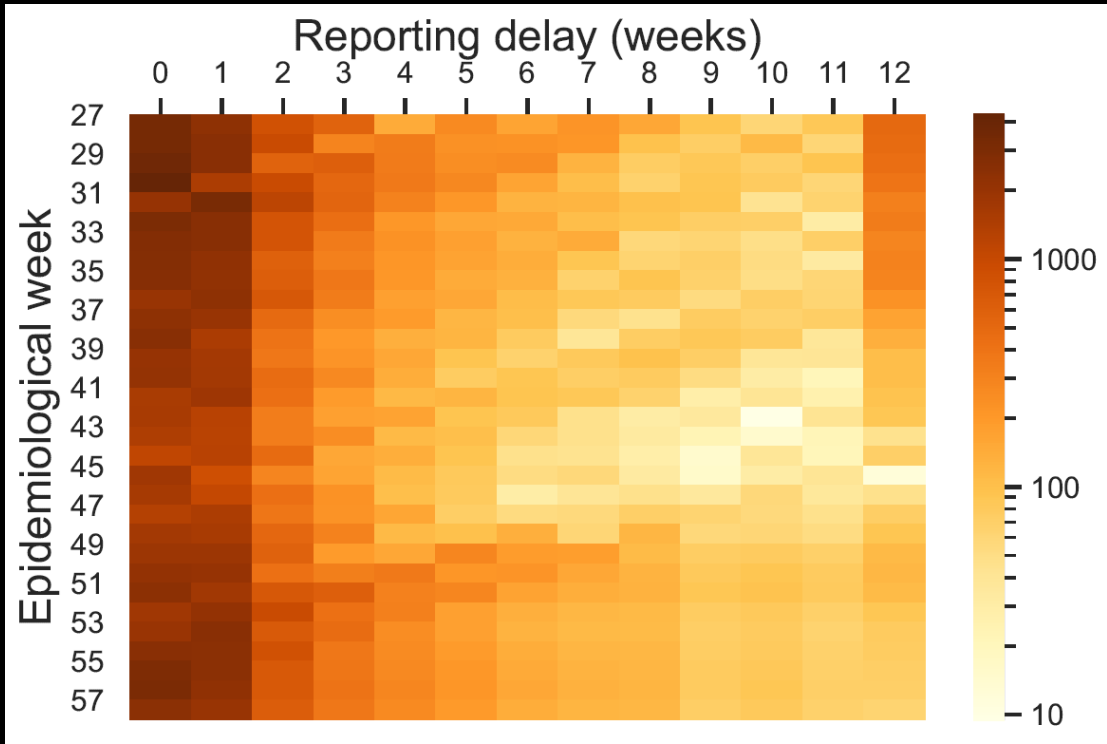
$$n_{t,d} \sim NB(\lambda_{t,d}, r)$$

$$\log(\lambda_{t,d}) \sim GP(0, k)$$

Or

$$\log(\lambda_{t,d}) \sim GP(0, k_{\text{long}}(t, d) + k_{\text{short}}(t, d))$$

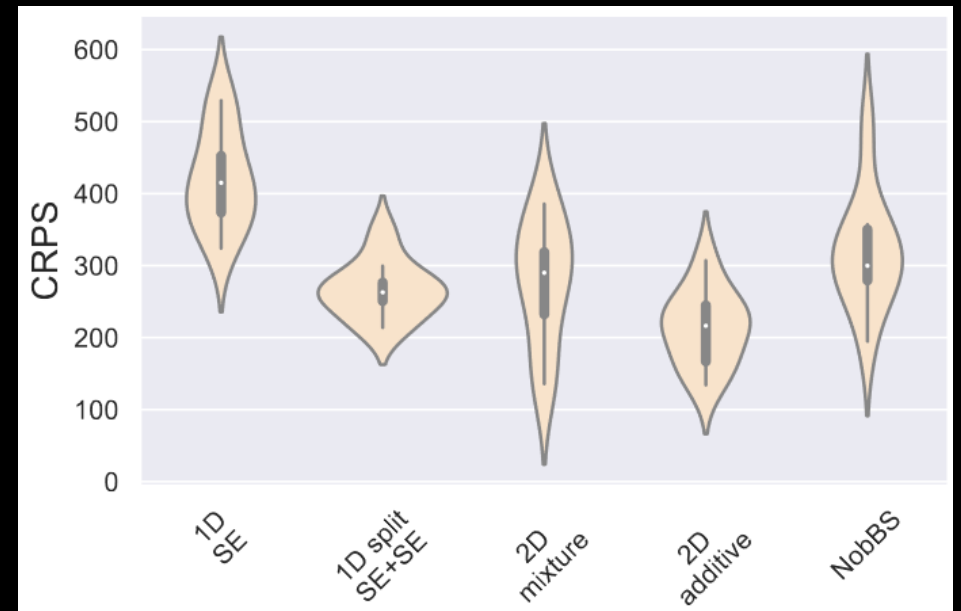
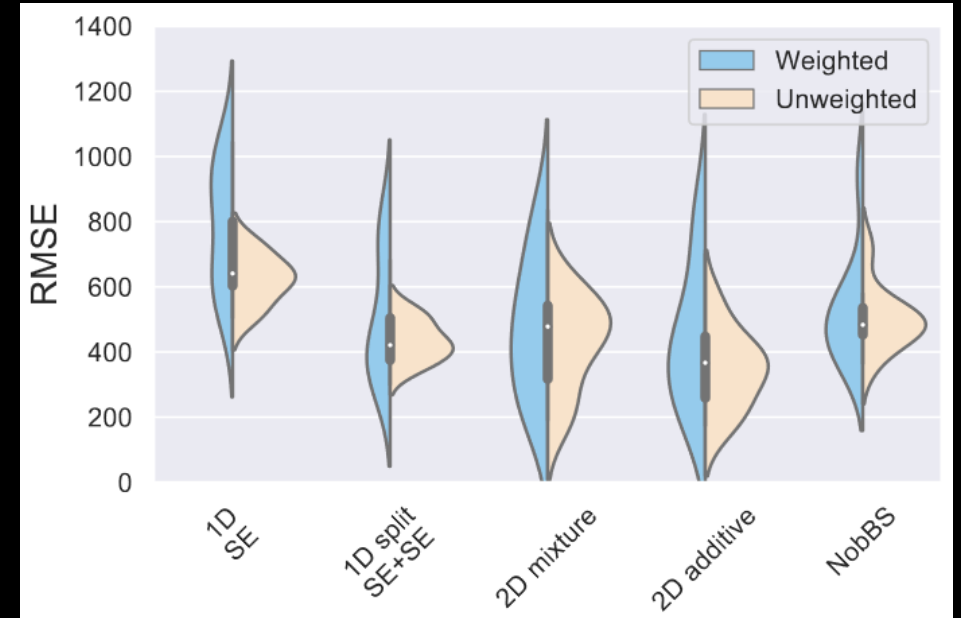
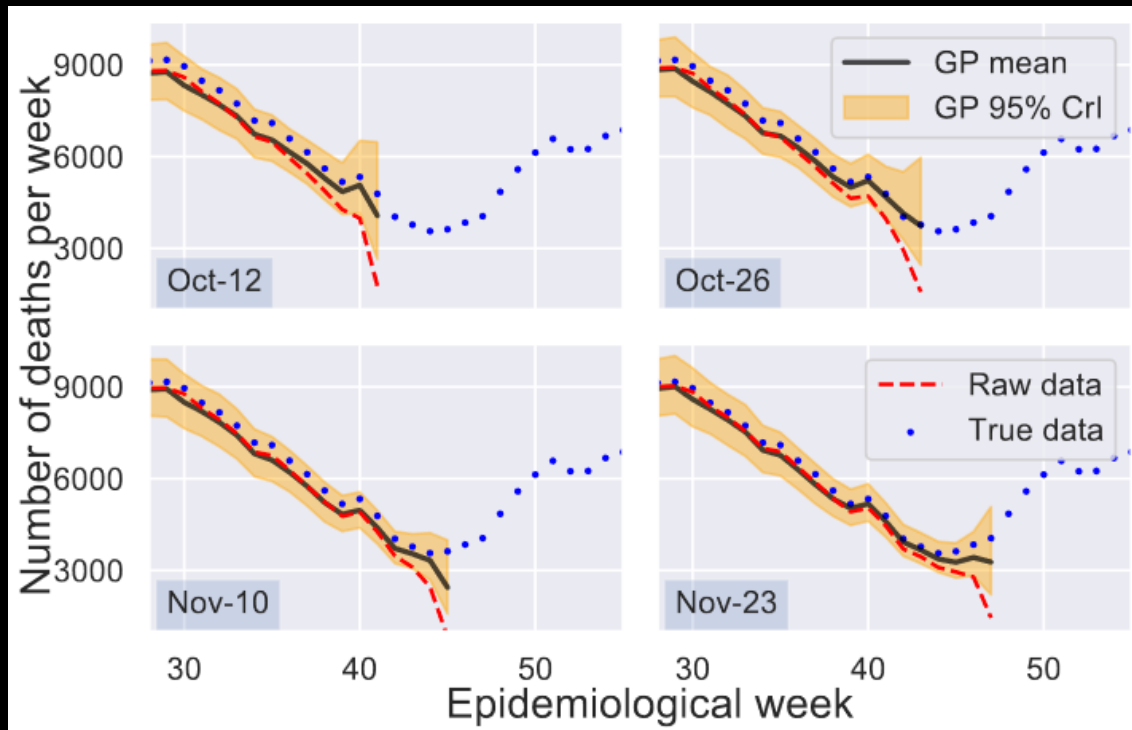






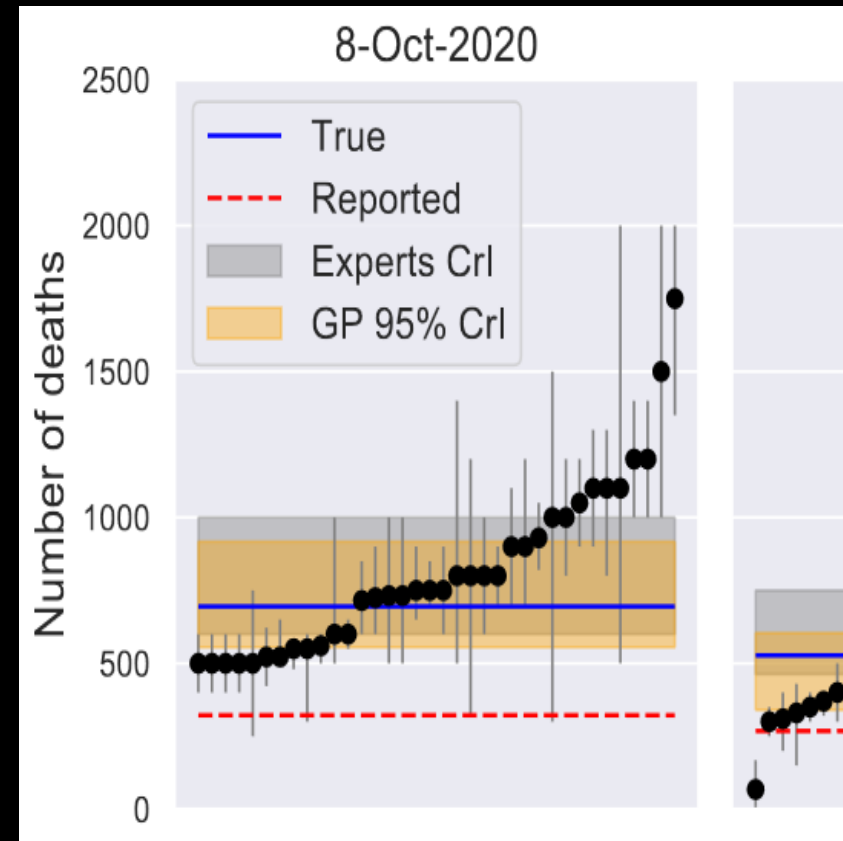
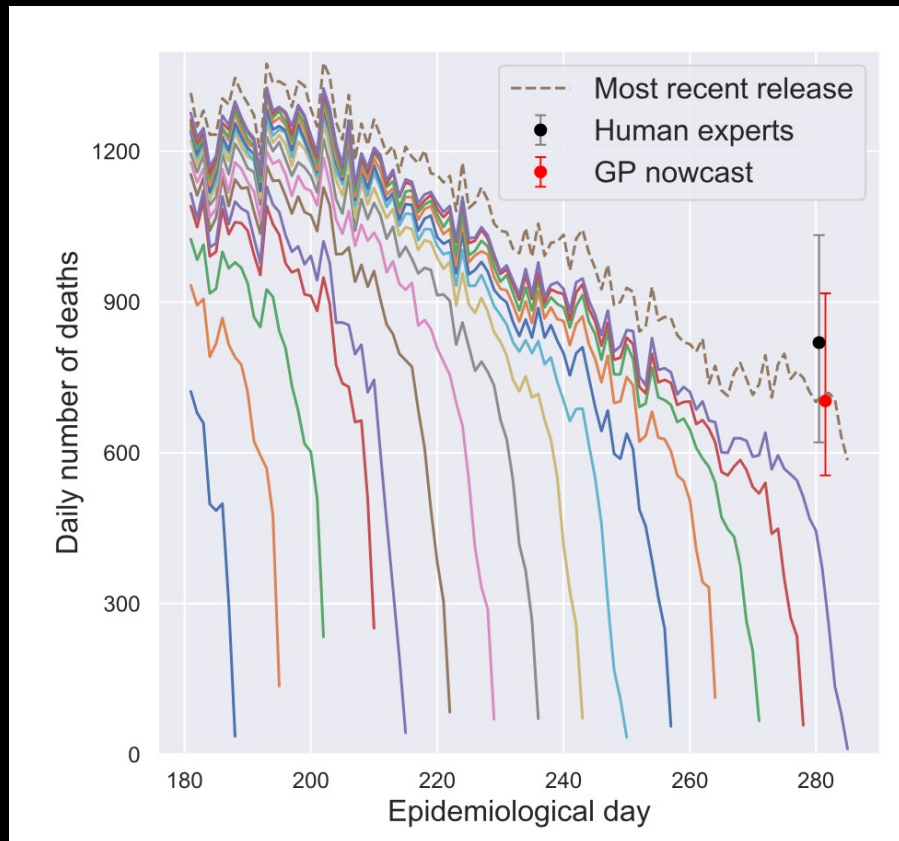
# Testing the accuracy

## Different models



# Testing the accuracy

## Human experts



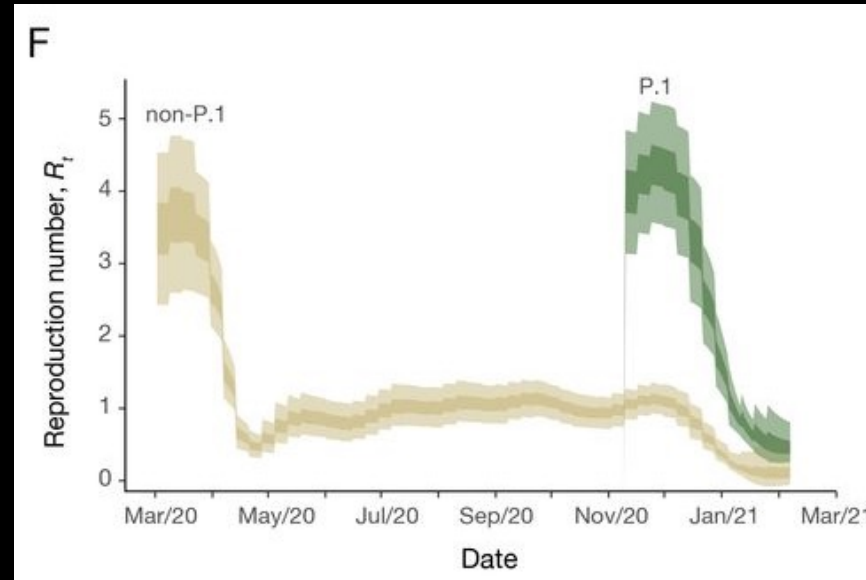
# Application to Brazil pandemic

## Brazil's 'rapid and violent' Covid variant devastates Latin America

Expert says global leaders must not ignore Brazil, which is 'brewing variants left, right and centre'



▲ Relatives pray during the funeral of a 57-year-old Covid victim at a cemetery in Manaus, Brazil. Analysis suggests the P.1 variant originated in or near the city. Photograph: Michael Dantas/AFP/Getty Images



### RESEARCH ARTICLE

## Genomics and epidemiology of the P.1 SARS-CoV-2 lineage in Manaus, Brazil

Nuno R. Faria<sup>1,2,3,\*†</sup>, Thomas A. Mellan<sup>1,†</sup>, Charles Whittaker<sup>1,†</sup>, Ingra M. Claro<sup>2,4,†</sup>, Darlan da S. Candido<sup>2,3,†</sup>, Swapnil Mishr...

+ See all authors and affiliations

Science 14 Apr 2021:  
eabh2644  
DOI: 10.1126/science.abh2644

# Summary

- New nowcasting framework based on latent Gaussian processes
- Disease-agnostic method, fully data-driven
- Can be used for a real-time monitoring of the epidemic
- Benchmark with the existing state-of-the-art and human experts
  
- Limitations: relies on historical data and regular data updates

# Thank you!

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Hawryluk et al. (2021). Gaussian process nowcasting: application to COVID-19 mortality reporting.

Proceedings of the Thirty-Seventh Conference on Uncertainty in Artificial Intelligence, PLMR



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