Rapid Design and Implementation of a Data-Driven Forecast of ICU Strain from COVID-19 for Early Surge Planning in England

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SCAN ME

INTRODUCTION

- Creating ICU "surge capacity" was essential for the COVID-19 pandemic.
- We created a short-range forecast in late-March to guide these preparations in England.
- The design, construction, testing, implementation, documentation, dissemination and peer-review of a computer model is typically a lengthy process.
- However, we were able to build a working tool within a week.

OBJECTIVES

To develop and implement a region-specific, short-range ICU demand forecast based on case data from the commissioning regions in England as rapidly as possible.

METHODS

- We modelled the likely increases in regional ICU bed demand over 14-days.
- Daily COVID-19 cases were extrapolated from cumulative data using log-linear regression.
- We used Monte Carlo simulations to obtain bed occupancy predictions.
- We developed a web application to publish updated predictions daily (Figure 1), with a manuscript on medRvix [1] and code [2].

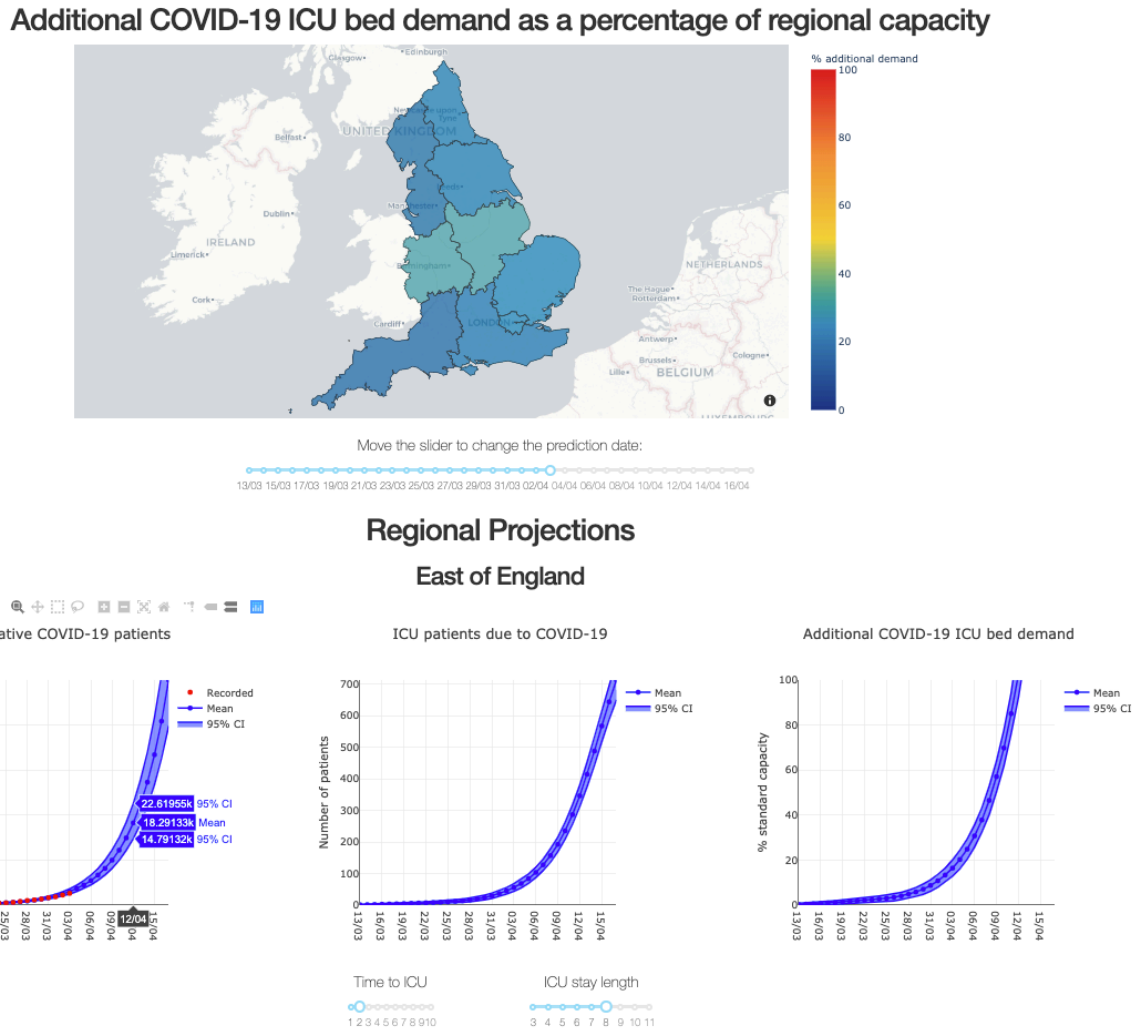

Figure 1: Our interactive web application. The user can alter the model assumptions as well as interact with the plots for more detail.

RESULTS

- We delivered an interactive web application along with explanatory notes and versioned code in 7 days.
- Community feedback allowed for a crowd-sourced review of manuscript and code.
- Users could explore the effect of changing various modelling assumptions interactively at a regional level.
- We accurately predicted that surge capacity would be required from the end of March in London.

CONCLUSIONS

We were able to leverage software development techniques to deliver a working application on a timescale which was still actionable in the preparatory phase for COVID-19 in England. Our approach demonstrates that data-driven approaches to emergency healthcare planning can be highly agile.

REFERENCES

[1] J Deasy, E Rocheteau, K Kohler, DJ Stubbs, P Barbiero, P Liò, A Ercole. Forecasting ultra-early intensive care strain from COVID-19 in England. MedRxiv 2020 DOI: 10.1101/2020.03.19.20039057
[2] J Deasy, E Rocheteau, K Kohler, DJ Stubbs, P Barbiero, P Liò, A Ercole. GitHub 2020 DOI: 10.5281/zenodo.3726134