

# Draft for discussion

## Short-term Forecasting: Proposed Process for discussion

SPI-M, 6<sup>th</sup> April 2020

This paper proposes a process for producing short-term forecasts for Covid-19, ensuring modelling efforts are aligned and that one version of the truth can be shared across government. This process is proposed for the agreement of SAGE, Cabinet Office and NHS colleagues.

These forecasts will provide real time insights into how the epidemic is progressing and help to inform wider NHS modelling, scientific understanding and policy development.

Modelling work will be co-ordinated by SPI-M's Short-term Forecasting Working Group. The working group is a sub group of SPI-M and its membership includes colleagues in NHSX / Faculty AI, as well as academic and Public Health England modelling groups. Several members of the working group also sit on SAGE and its membership will be extended to NHSE&I analysts.

The modelling groups will each produce their own short-term forecasts for the metrics of interest, drawing primarily from the NHSX database. These will be combined by DSTL using their Crystal Cast software. The software aims to bring disparate models, data streams and predictions together to form a single combined viewpoint. To that end, Crystal Cast provides a technically rigorous treatment of the within and across model uncertainty, performs statistical combinations of different epidemiological forecasts and uses machine learning to place greater weight on outputs which have been the most accurate in the past.

### Metrics to forecast

Modelling groups will forecast how several key Covid-19 metrics and indicators of pressure on the healthcare system will change over a 14-day time horizon. The proposed metrics are outlined in table 1 below for agreement with SAGE, NHSE&I, NHSX, and Cabinet Office. These will be regularly reviewed as other data streams become available.

**Table 1: Forecast metrics**

<b>Metric</b>	<b>Definition</b>
ICU occupancy	The number of people in ICU each day that have been confirmed with Covid-19.
Non-ICU bed occupancy	The number of people in hospital that have been confirmed with Covid-19
New deaths in hospitals	The number of deaths in hospitals with a positive Covid-19 test by date of report.
New deaths in hospitals and the community	The number of deaths in hospital and the community due to Covid-19 by the date of death.
New hospital bed admissions	The number of people requiring admission to hospital with Covid-19.

Upper and lower bounds, corresponding to the 95% confidence intervals, will be presented alongside central estimates.

Two different datasets report the number of Covid-19 deaths. The first contains information on the number of deaths which have occurred in hospital and when the date they were reported. The second reports the total number of deaths in both hospitals and the community and the date they occurred. The models can be fit to either of these datasets and output either metric.

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The Short-term Forecasting Working Group have agreed that, without serological testing, it is not possible to forecast new infections with any degree of certainty. An indicative estimate of the cumulative number of infections can be provided, based on an agreed assumption about asymptomatic infections but this would in practice be calibrated using other metrics.

### Assumptions on length of stay in hospital

All the forecasts are highly sensitive to the modelled length of stay in hospital. These assumptions should be agreed by the Short-term Forecasting Working Group, including input from NHSE analysts. These assumptions will be regularly reviewed as new data becomes available.

### Geography

The required data is currently being drawn from NHSE&I daily sitreps and PHE reported deaths, which only cover patients in England. As a result, initial forecasts are only available for the key metrics in England.

As UK-wide data becomes available and integrated into NHSX's database the forecasts will be expanded to cover the whole of the UK, and we will be able to drill down to a more local level as required.

NHSE&I are currently using modelling forecasts of incidence from Imperial College London (one of the groups supporting this short-term forecasting work) to produce local forecasts of NHS operational requirements. We will continue to work with NHSE&I to ensure these forecasts are aligned as far as possible.

### Outputs

Once up and running, the results from each modelling group will be combined by DSTL using machine learning to form a consensus forecast.

The forecasts, using their Crystal Cast data visualisation tool, can then be provided to the Cabinet Office for monitoring. Outputs will also be available as a spreadsheet and could be fed back into the NHSX database for wider use.

### Frequency

Forecasts will be produced three times a week (Monday, Wednesday and Friday), with modelling results being submitted by midnight the previous the day (Sunday, Tuesday and Thursday).

### Sign off process

The overall process and specification should be collectively agreed by Cabinet Office, DHSC, NHSE&I, NHSX, DAs and SAGE. Any significant changes to the process will be discussed by the working group initially, before being signed off by these groups.

Within this agreed process standard forecast updates will be signed-off by the working group who will also provide in-depth quality assurance and methodological scrutiny. Consensus views of any epidemiological insights that arise will also be provided.

A standing agenda item will also be added to a weekly SPI-M meeting, to provide members with an opportunity to review and assure the forecasts. NHSE, NHSX and Faculty AI colleagues will also be invited to these sessions. Forecasts will be shared to SAGE for further oversight.

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## Annex 1: Short-term forecasting process overview

