Note added for release (1)

Short-term forecasts from SPI-M-O. This was considered at SAGE 47 on 16 July 2020.

It should be viewed in context: these short-term forecasts represent SPI-M-O's best predictions based on the data and evidence available at the time of writing. Therefore, some of the information in this paper may have been superseded and the author's opinion or conclusion may since have developed.

Separate forecasts are produced using different models and approaches by the modelling groups represented at SPI-M-O. These individual forecasts are then combined to form a consensus forecast which is subsequently shared with the Scientific Advisory Group for Emergencies (SAGE).

The short-term forecasts are produced by transmission models of the epidemic process. These models are fit to trends in the past data, and therefore do not predict the impact changes to social distancing measures will have on the number of COVID-19 deaths or hospitalisations - unless the impact of any changes have already started to be reflected in the data by the time the forecasts were produced.

It isn't possible to produce accurate forecasts when case numbers fall to very low levels. Furthermore, where data series are inconsistent, for example if ICU bed occupancy is decreasing much faster than general bed occupancy, the models may not always fit well to the data. If case numbers drop to very low levels in a region or the forecasts do not fit well to the data, then these forecasts are excluded from the slides circulated to SAGE.

Data limitations mean some of the forecasts aren't informed by past data. Where this is the case these forecasts need to be treated with caution and represent SPI-M-O's best assessment using the available data from other parts of the UK.

These documents are released as pre-print publications that have provided the government with rapid evidence during an emergency. These documents have not been peer-reviewed and there is no restriction on authors submitting and publishing this evidence in peer-reviewed journals.

Note added for release (2)

Forecasts of hospital and community deaths by date of death are produced for England, Scotland, Wales, Northern Ireland and NHSE regions. However, some forecasts were excluded from the slides circulated to SAGE due to low numbers and/or poor fit to past data.

SPI-M have paused reporting on hospital metrics for the time being. If numbers start increasing, and it is required, this can be started again.

Not all of the models produce forecasts each week or for every metric.

A description of the hospital and community death measures used in the short-term forecasts between SAGE 23 and 46 is listed below, together with caveats for each source. These are additional to the existing caveats on the individual forecast slides, and should be taken into account. Please note that the coverage and definitions of these data streams have changed over time, reflecting improved understanding of the disease and epidemic.

Metric	Nation	Definition and additional caveats
Hospital and community deaths by date of death	**England** (SAGE 23-51)	PHE line list of deaths, by date of death Deaths of people with laboratory-confirmed COVID-19. This does not include deaths of people where COVID-19 is suspected, but not laboratory confirmed - but is a more timely measure. Please note that this data was prior to the change in definition on 12 August, and this measure relates to deaths of people with laboratory-confirmed COVID-19 with no time restriction imposed. Recent data points at the time of forecast will be more uncertain due to reporting delays. More information on this change can be found in the PHE data series on deaths in people with COVID-19: technical summary.
	Scotland (SAGE 27-51)	Public Health Scotland deaths line list Daily number of COVID-19 deaths, defined as individuals who die within 28 days of their first laboratory confirmed report of COVID-19 infection, and are registered with National Records of Scotland
	Wales (SAGE 27-51)	Public Health Wales deaths line list, field "Suspected COVID-19 deaths in lab confirmed cases" This relates to deaths of hospitalised patients in Welsh Hospitals or care home residents where COVID-19 has been confirmed with a positive laboratory test and the clinician suspects this was a causative factor in the death
	Northern Ireland (SAGE 44-51)	NI Department of Health Sitrep, field "deaths by date of death (historic figures updated retrospectively as at the date the overall spreadsheet is updated)" Deaths reported to the PHA where the deceased has had a positive test for COVID-19 and died within 28 days, whether or not COVID-19 was the cause of death

SPI-M Short term forecasts

As of the 14th of July, 2020

Models

- *Faculty/NHSX/NHSEI*: statistical Bayesian hierarchical model fitted individually to ICU and hospital admissions data to produce forecasts at the trust level
- *Imperial Stochastic Compartmental*: fitted to multiple data streams
- *LSHTM EpiSoon*: renewal-equation based model fitted to multiple data streams; combined with a time series model to forecast trends in transmission
- *LSHTM Transmission*: age-specific regional stochastic SEIR model fitted to multiple data streams
- *Manch/Oxf/Lanc*: deterministic SEIR model fitted to new cases in hospital, fitted via MCMC/MLE.
- *PHE/Cambridge*: deterministic transmission model combined with a disease reporting model, fitted to deaths by date; two variants
- *Warwick*: age-structured SEIR model fitted to multiple data streams

None of the models separate out transmission routes in the community, hospitals or other settings. Presented numbers are of overall cases.

Forecasts

- *Hospital and community deaths: number of deaths with confirmed COVID-19, by date of death.*

Note added for release:

The description for the Manch/Oxf/Lanc model should read "deterministic SEIR model fitted via MLE/MCMC to daily hospital admissions, hospital prevalence, ICU prevalence, and daily hospital deaths"

General notes

- Forecasts are produced by individual models and combined. Models are combined by fitting a normal distribution to each individual predictive distribution and aggregating them in a normal mixture distribution with equal weights.

- Several modelling groups produce forecasts for England, Scotland, Wales and Northern Ireland. As a result it has been possible to extend the coverage of the forecasts to all four nations for most metrics. However, it is not always possible to produce forecasts for every metric for all four nations.

- Each group fits their model to trends in the historical data. If the alterations to social distancing measures announced by the Government and devolved administrations have not had an impact on hospital or death data by the time the forecasts are made, then the forecasts will not include the possible impact of these changes on each of the metrics.

- SPI-M have paused reporting on hospital metrics for the time being. If numbers start increasing, and it is required, this can be started again.

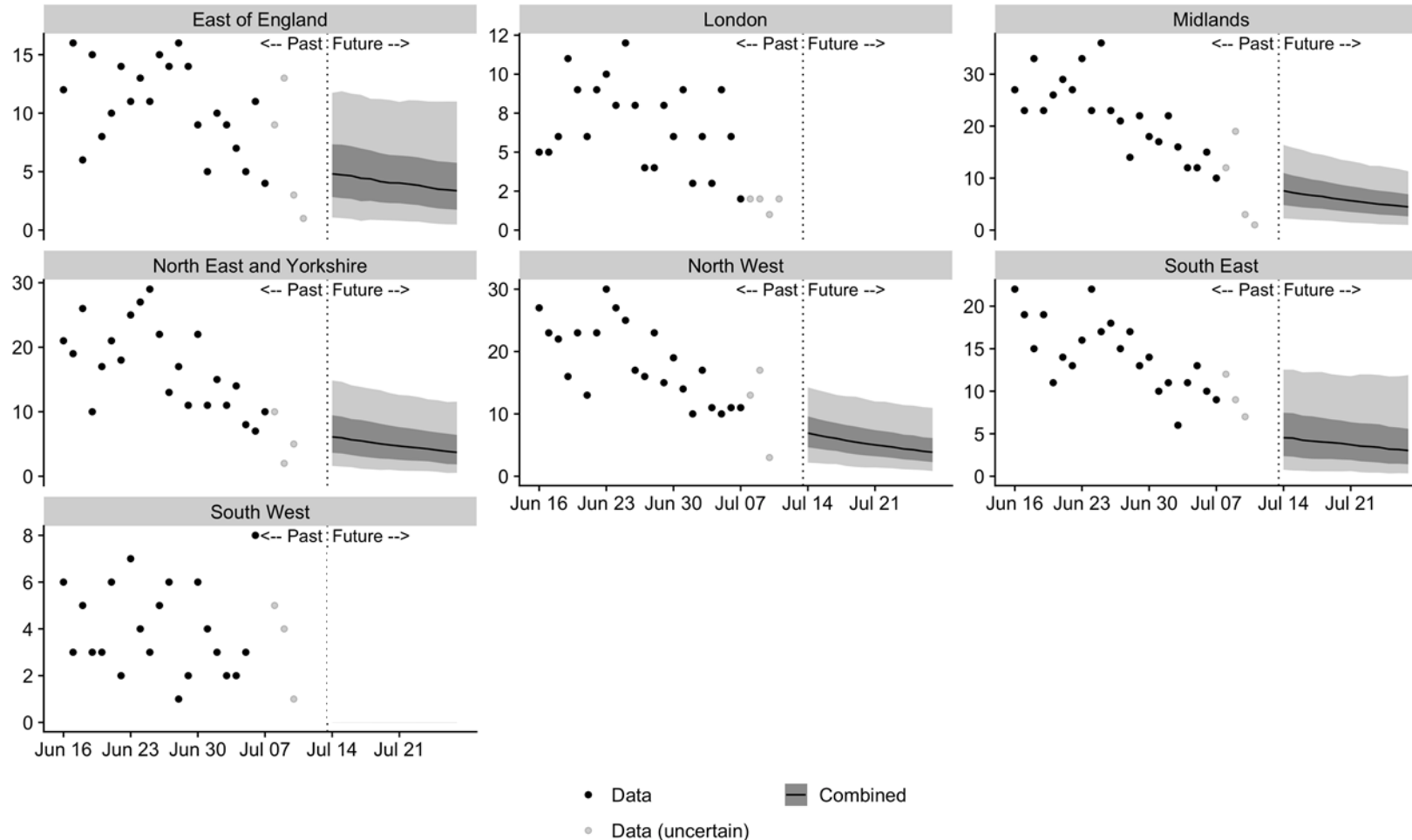# Hospital and community deaths (by date of death)
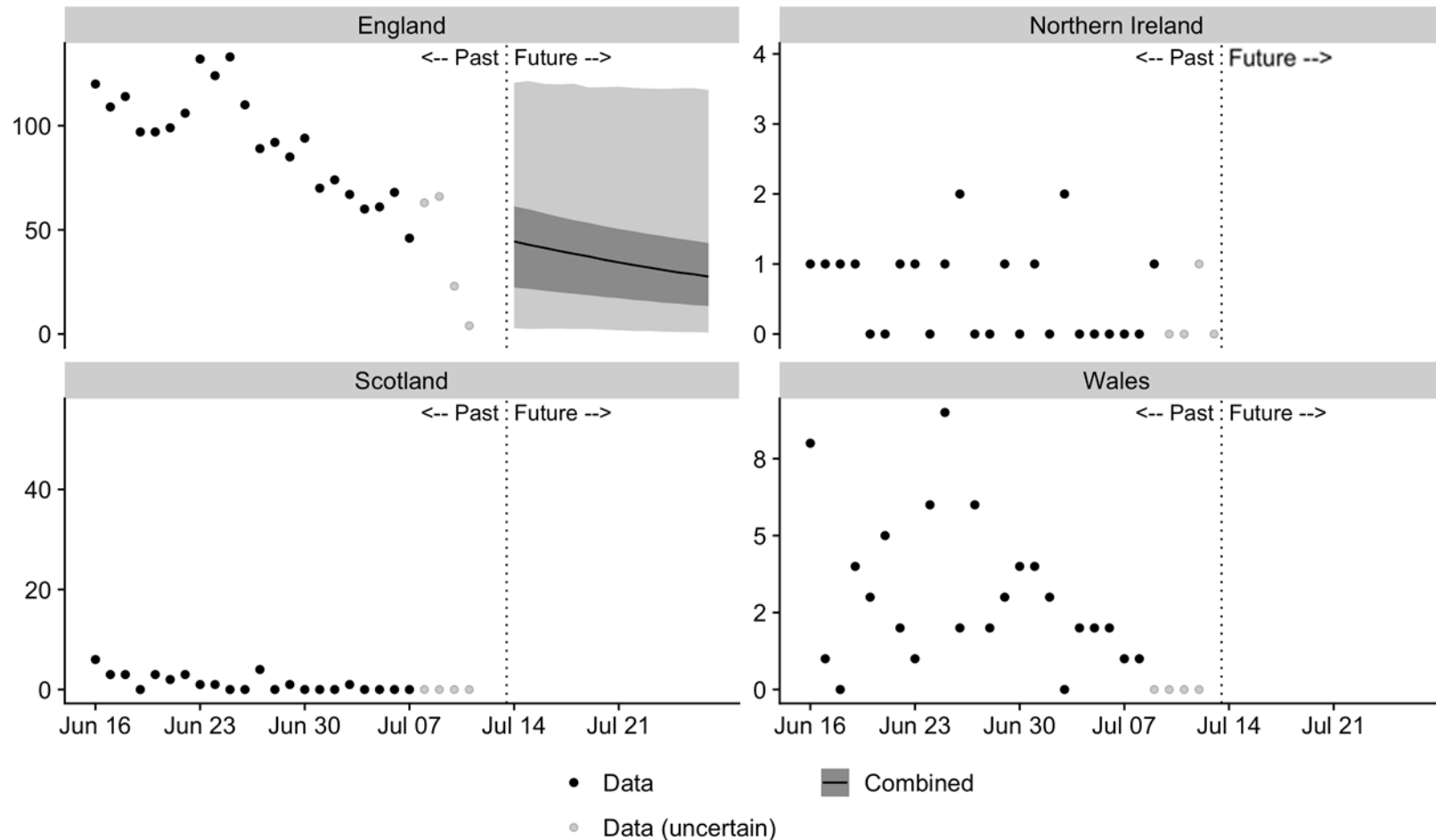
Combined forecasts

Note: The four most recent data points are coloured in grey to reflect uncertainty due to reporting delays. This is based on line lists of deaths and only covers deaths with a positive test. The forecasts for Northern Ireland, Scotland and Wales have been excluded. The models aren't able to produce accurate forecasts when the number of deaths falls to very low levels. SPI-M's central forecast is for the number of deaths in Northern Ireland, Scotland and Wales to remain low. Shaded area: 50% and 90% confidence.

Regional forecasts

Hospital and community deaths (by date of death)

Combined forecasts

Note: The four most recent data points are coloured in grey to reflect uncertainty due to reporting delays. This is based on the PHE line list of deaths and only covers deaths with a positive test. The forecasts for the South West and London have been excluded. The models aren't able to produce accurate forecasts when the number of deaths falls to very low levels. SPI-M's central forecast is for the number of deaths in the South West and London to remain low. Shaded areas represent 50% and 90% confidence.