UK Health Security Agency

Epidemiology Modelling Review Group: consensus statement on COVID-19

Date: 1 September 2021

Introduction

The UK Health Security Agency (UKHSA) Epidemiology Modelling Review Group (EMRG) shares this consensus statement on COVID-19 with acknowledgment to SPI-M-O, who have developed and shared modelling methodologies and contribute model outputs to these combined estimates.

All probability statements are in line with the framework given in Annexe A.

Summary

1. The UKHSA's best estimate for R in England is between 0.9 and 1.1. R is estimated to be between 1.3 and 1.6 for Scotland, 1.2 and 1.4 for Wales, and 0.9 and 1.2 for Northern Ireland (Figure 1). These estimates are based on models[1] fitted to data available up to 27 August 2021, including hospitalisations, deaths, testing, wastewater samples and longitudinal studies.
2. Combined estimates[2] show that the incidence[3] is between 36,000 and 75,000 new infections per day in England.

Incidence and prevalence

3. During its most recent week (ending 28 August[4]), the ONS Covid infection survey estimates[5] that an average of 766,100 people had COVID-19 in the community in England (95% credible interval 714,400 to 821,800). The survey does not include people in care homes, hospitals, or prisons. Estimates from across the 4 nations of the UK are:
    - England 766,100 (95% credible interval 714,400 to 821,800)
    - Scotland 69,500 (95% credible interval 55,600 to 84,700)
    - Wales 28,100 (95% credible interval 20,000 to 38,400)
    - Northern Ireland 28,700 (95% credible interval 20,300 to 38,400)

Growth rate and reproduction number

4. For small daily changes, the growth rate is approximately the proportion by which the number of infections increases or decreases per day, that is, the speed at which an epidemic is growing or shrinking.[6]

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[1] Model estimates are required as quantities such as the Reproduction Number (R) are not directly observable. Instead, a variety of independently produced models are used to interpret the data and estimate R.
[2] Different nations and regions may use different sets of models for these estimates; hence caution should be applied in drawing direct comparisons. For example, fewer models produce estimates for Wales and Northern Ireland.
[3] The number of new infections per day.
[4] The reference week is different for England (21 to 27 August) compared to Wales, Northern Ireland and Scotland (22 to 28 August)
[5] These estimates can be subject to revision as further information is available and modelled.
[6] Further Technical Information on the growth rate can be found in Plus Magazine: The growth rate of COVID-19 | plus.maths.org.

5. EMRG's consensus estimates for the growth rates in the 4 nations are (90% credible interval):
    - England is between -2% to +2% per day,
    - Scotland is between +5% to +10% per day,
    - Wales is between +3% to +7% per day, and
    - Northern Ireland is between -2% to +3% per day

National and regional estimates of growth rates are summarised in Figure 1 and Figure 2.

6. The reproduction number (R) is the average number of secondary infections produced by a single infected individual; it is an average over time, geographies, viral variants, and communities.
7. UKHSA's best estimate for R in in England is between 0.9 and 1.1. R is estimated to be between 1.3 and 1.6 for Scotland, 1.2 and 1.4 for Wales, and 0.9 and 1.2 for Northern Ireland. UKHSA's agreed national estimates are summarised in Table 1 and Figure 1, and these are based on the latest data available up to 27 August 2021[7].
8. R is an indicator that lags by two to three weeks[8], due to the time required for changes to be seen in data streams. This inherent lag means that recent fluctuations and the effects of events or recent changes to interventions are not expected to be fully reflected in these estimates
9. In particular, Scotland has seen a significant increase in the number of new daily cases over the past two weeks and the associated R and growth rate estimates cannot fully reflect this; R in Scotland now is likely to be higher than that estimated here.

[7] Different models fit to different windows of time using different methodologies, hence not all models will fit up to this precise date.

[8] Different data-streams and different models are expected to be lagged in their estimates by different amounts when compared with the true underlying epidemiological situation. This is due to multiple lags such as reporting and delays in the infection processes. However, the consensus combination generally reflects a 2-week lag.

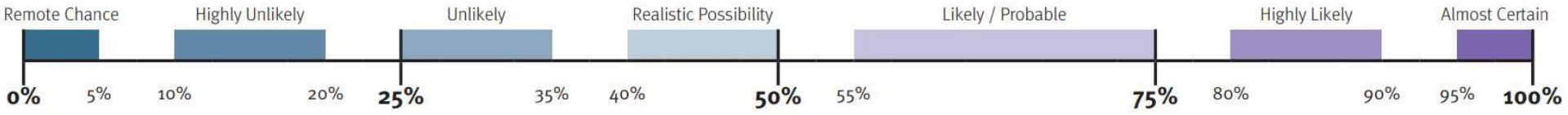
Table 1. Combined estimates of R values growth rates and doubling times in the 4 nations of the UK and NHS England regions (90% credible interval)

Nation	**R**	**Daily growth rate**	**Doubling time[9]**
England	0.9 to 1.1	-2% to +2%	37 days to flat
Wales	1.2 to 1.4	+3% to +7%	10 to 20 days
Scotland	1.3 to 1.6	+5% to +10%	7 to 13 days
Northern Ireland	0.9 to 1.2	-2% to +3%	30 days to flat
NHS England region	**R**	**Daily growth rate**	**Doubling time[8]**
London	0.8 to 1.1	-2% to +2%	37 days to flat
East of England	0.9 to 1.2	-2% to +3%	26 days to flat
Midlands	0.9 to 1.1	-2% to +3%	33 days to flat
North East and Yorkshire	0.9 to 1.1	-2% to +2%	-35 days to flat
North West	0.9 to 1.1	-2% to +3%	34 days to flat
South East	1.0 to 1.2	-1% to +4%	19 days to flat
South West	1.0 to 1.4	0% to +6%	11 days to flat

[9] Any estimates with a halving or doubling time of more than 40 days have been described as flat. Negative values of doubling time indicate a halving time (the time expected for cases to fall by 50%). Doubling time here is calculated using the growth rate.

Annexe A. PHIA framework of language for discussing probabilities

The Yardstick splits the probability scale into 7 ranges from remote chance (0 to 5% probability) to almost certain (95% to 100% probability).



Acknowledgements

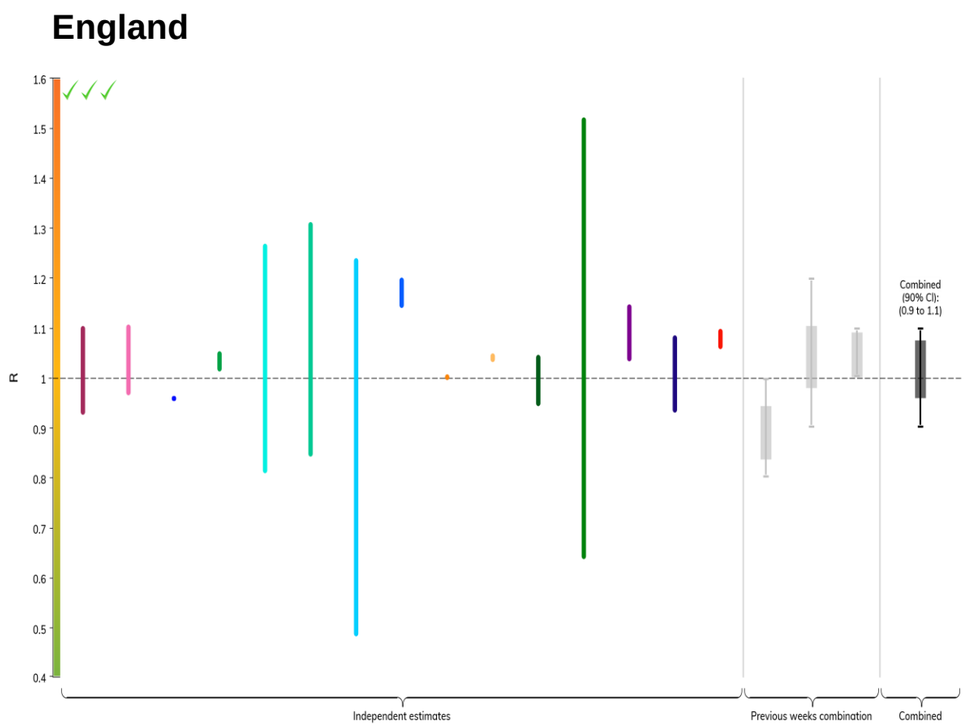
The UKHSA takes responsibility for this consensus statement and its contents. However, the UKHSA would like to acknowledge the work of SPI-M-O and academic partners in developing methodologies and sharing these, as well as continuing to contribute model outputs to the combined estimates. These estimates include contribution from LSHTM (1, 2), Imperial College London (3, 8), University of Warwick (4, 5), University of Exeter and University of Bristol (6), Lancaster University (7), University of Manchester, Public Health England and University of Cambridge (9). The UKHSA would also like to thank the European Bioinformatics Institute (10), University of Oxford (11, 12), University of Liverpool (13), and the Institute of Disease Modelling (14) for contributing model outputs. The UKHSA also acknowledges the work developing combination estimates from Defence and Science Technology Laboratory (15). UKHSA also thanks and acknowledges the support and collaboration of the SPI-M-O Secretariat and co-Chairs, as well as colleagues across the 4 nations.

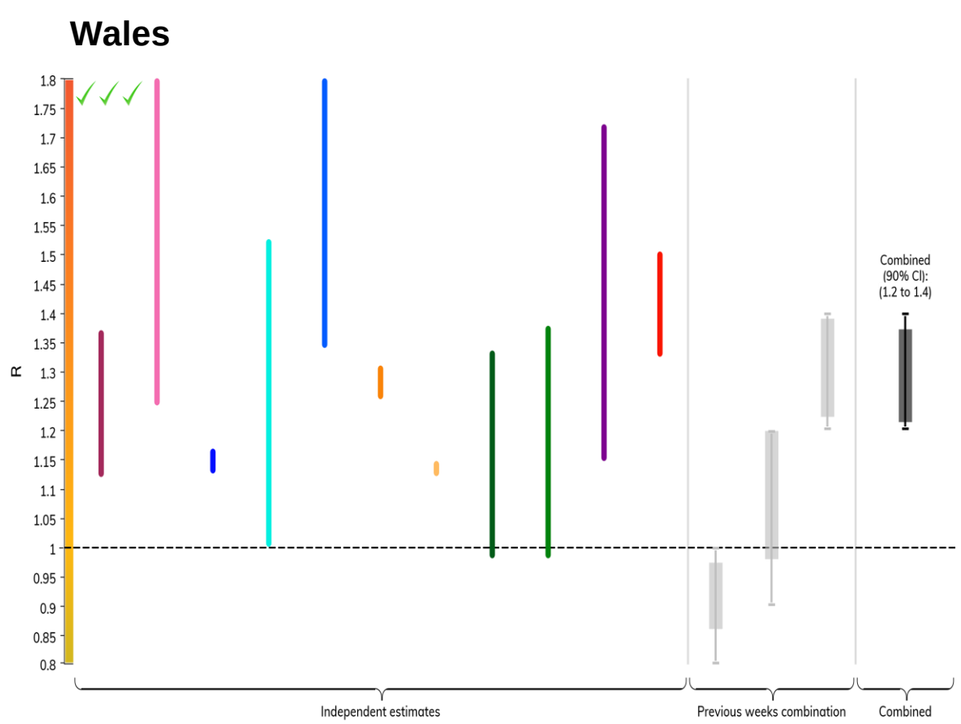
References

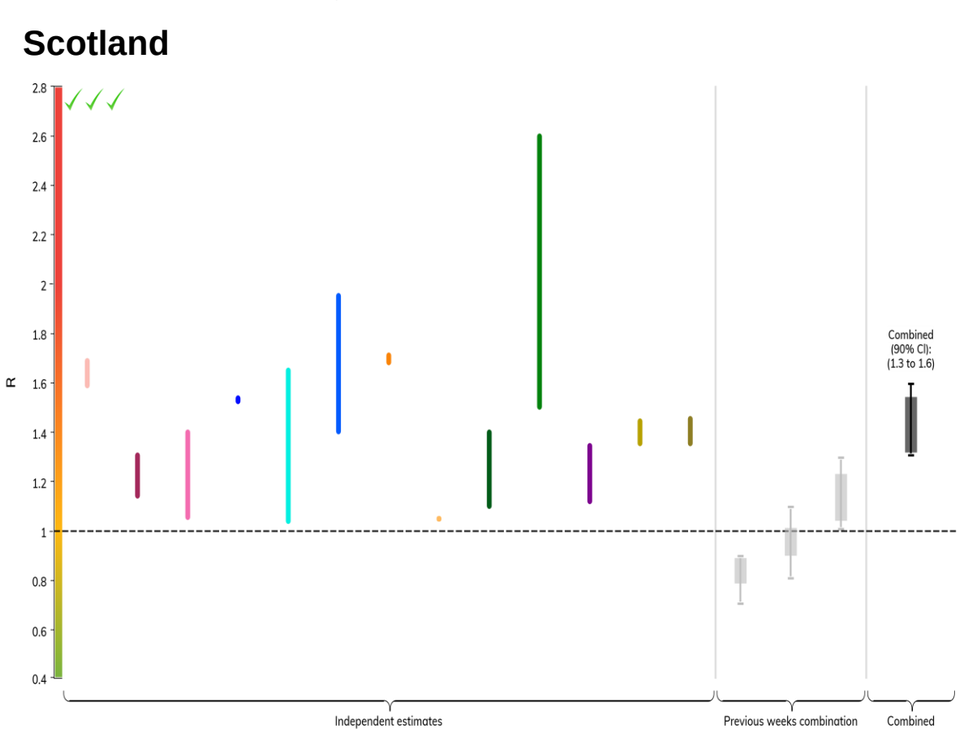
1. Abbott, Hellewell and others 'Estimating the time-varying reproduction number of SARS-CoV-2 using national and subnational case counts'. Wellcome Open Research, 8 December 2020
2. Sherratt and others. 'National and Subnational estimates for the United Kingdom'
3. Knock and others. 'Key epidemiological drivers and impact of interventions in the 2020 SARS-CoV-2 epidemic in England'. Science Translational Medicine, 14 July 2021
4. Keeling and others. 'Predictions of COVID-19 dynamics in the UK: Short-term forecasting and analysis of potential exit strategies. PLOS Computational Biology, 22 January 2021
5. Keeling and others. 'Fitting to the UK Covid-19 outbreak, short-term forecasts and estimating the reproductive number.' MedRxiv: 29 September 2020
6. Challen and others. 'Estimates of regional infectivity of COVID-19 in the United Kingdom following imposition of social distancing measures.' Philosophical Transactions of the Royal Society B: 31 May 2021
7. Jewell and others. 'Bayesian stochastic model-based forecasting for spatial COVID-19 risk in England Technical Concept Note.' Github: 22 September 2020
8. Cori and others. 'A New Framework and Software to Estimate Time-Varying Reproduction Numbers During Epidemics.' American Journal of Epidemiology: 1 November 2013
9. Birrell and others. 'Real-time Nowcasting and Forecasting of COVID-19 Dynamics in England: the first wave?' Philosophical Transactions of the Royal Society B: Biological Sciences, 31 May 2021
10. Vöhringer and others .Genomic reconstruction of the SARS-CoV-2 epidemic across England from September 2020 to May 2021. MedRxiv, 26 May 2021

11. Teh and others. ‘Efficient Bayesian Inference of Instantaneous Reproduction Numbers at Fine Spatial Scales, with an Application to Mapping and Nowcasting the Covid-19 Epidemic in British Local Authorities.’ LocalCovid.info: 19 April 2021
12. Panovska-Griffiths and others. Modelling the impact of reopening schools in early 2021 in the presence of the new SARS-CoV-2 variant amd with the roll out of vaccination against COVID-19. MedRxiv: 9 February 2021
13. Moore and Phillips. ‘Liverpool Covid Model: Model Overview.’ Github: 10 March 2021
14. Kerr and others. ‘Covasim: an agent-based model of COVID-19 dynamics and interventions.’ MedRxiv: 1 April 2021
15. Maishman and others. ‘Statistical methods used to combine the effective reproduction number, R(t), and other related measures of COVID-19 in the UK.’ arXiv preprint, 3 March 2021

Figure 1. Estimates of R in the 4 nations of the UK (90% credible intervals). Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to 1 decimal place







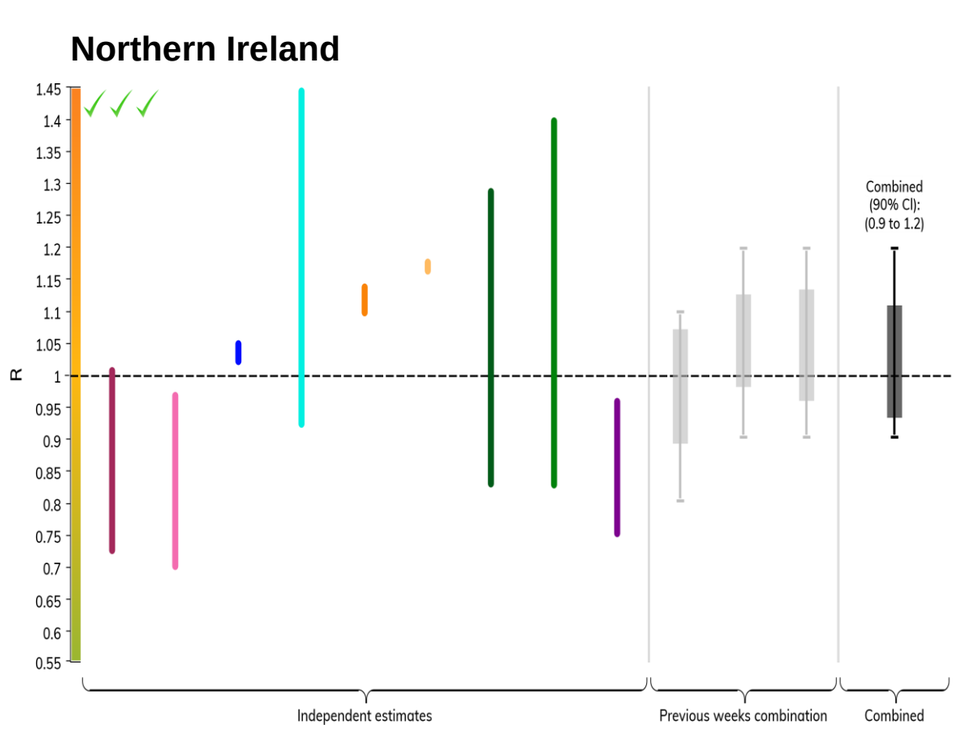
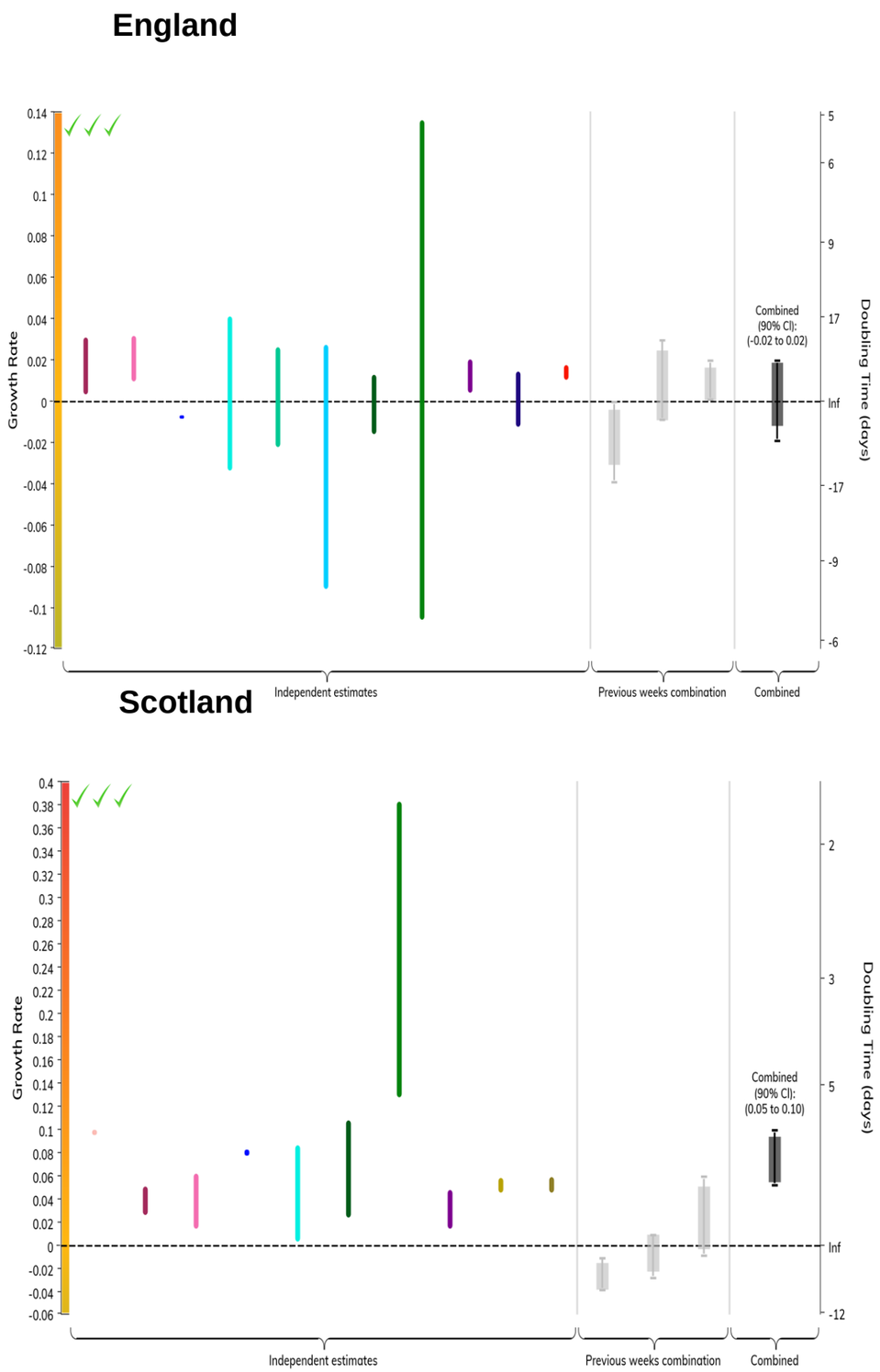


Figure 2. Estimates of the growth rate in NHS England regions, including 90% credible intervals. Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to the nearest percent



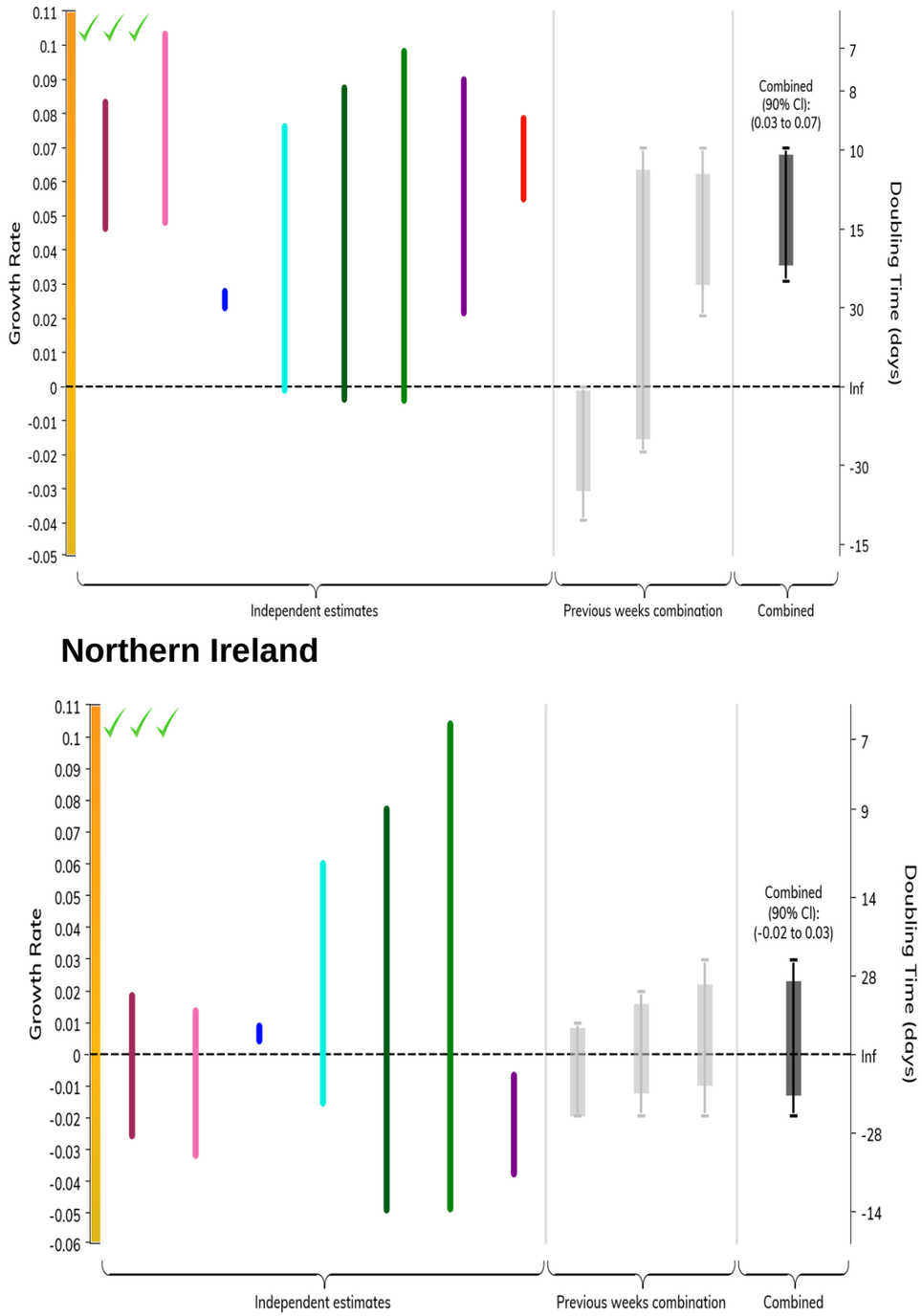
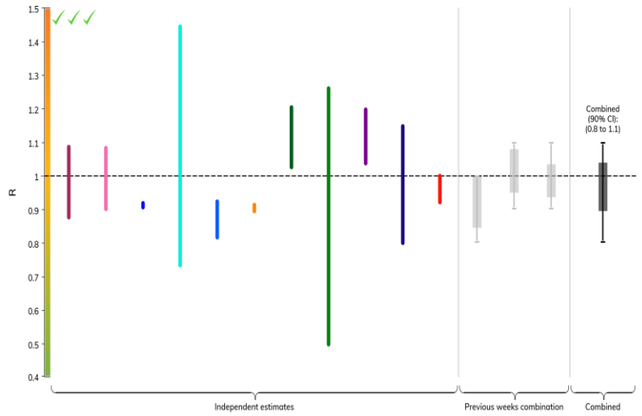
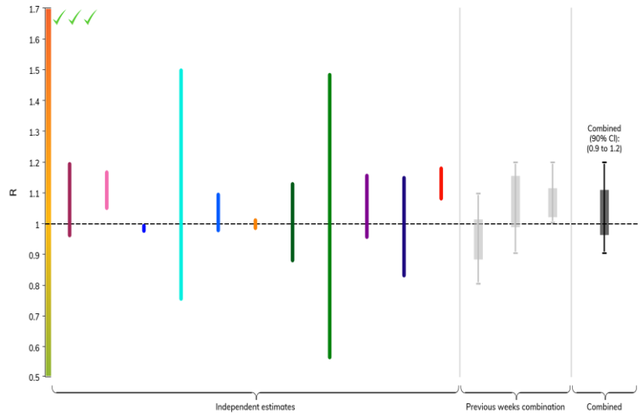


Figure 3. Estimates of R in the NHS England regions, including 90% credible intervals. Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to 1 decimal place

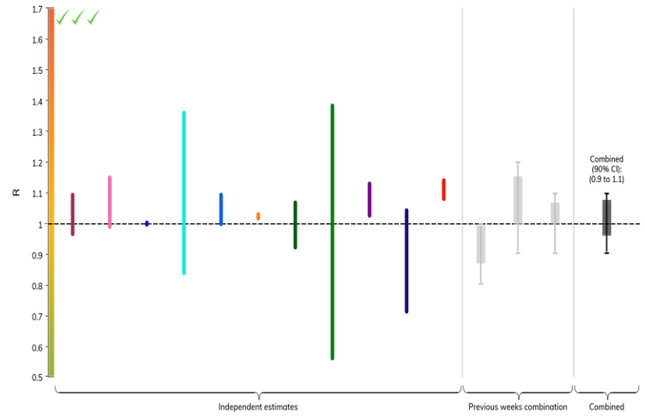
London



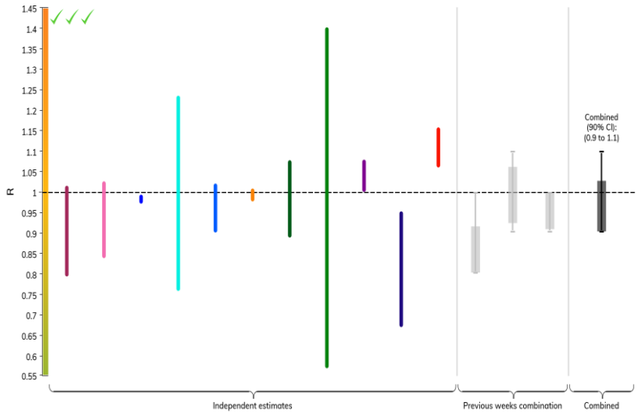
East of England



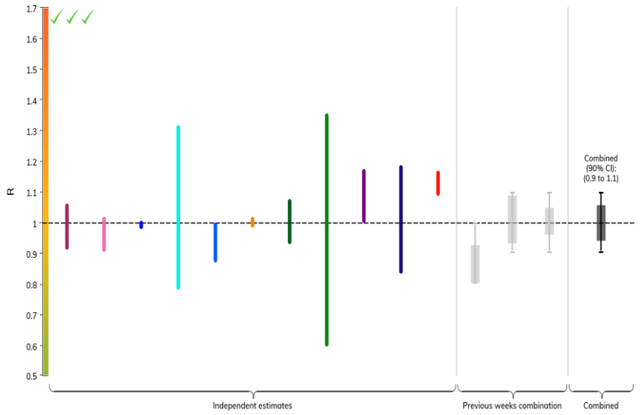
Midlands



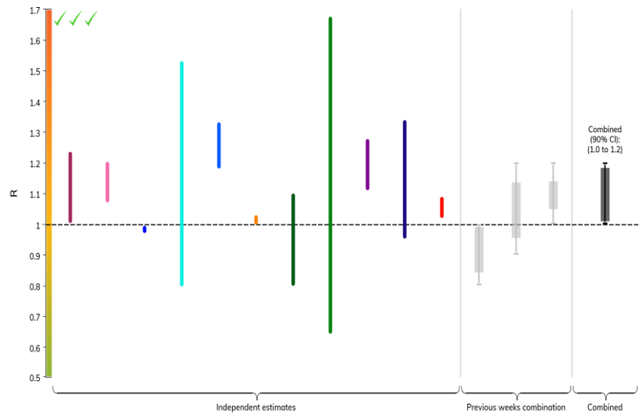
North East and Yorkshire



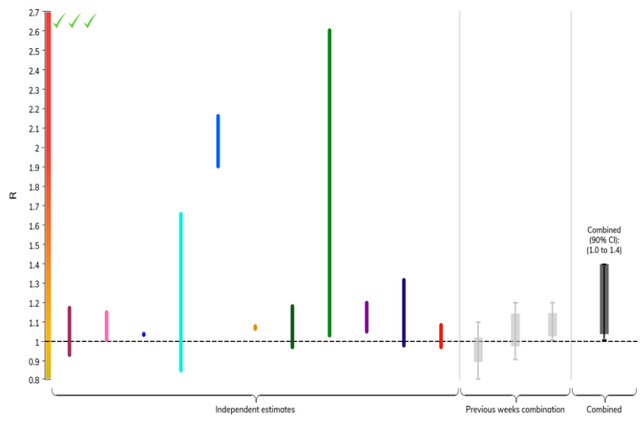
North West



South East



South West



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