UK Health Security Agency

Epidemiology Modelling Review Group: consensus statement on COVID-19

Date: 13 October 2021

Introduction

The UK Health Security Agency (UKHSA) Epidemiology Modelling Review Group (EMRG) shares this consensus statement on coronavirus (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. UKHSA's best estimate for R in England is between 0.9 and 1.1. R is estimated to be between 0.8 and 1.0 for Scotland, 0.8 and 1.1 for Wales, and 0.9 and 1.1 for Northern Ireland (Figure 1). These estimates are based on models[1] fit to data available up to 11 October 2021, including hospitalisations, deaths, testing, wastewater samples and longitudinal studies.

2. Combined estimates[2] show that the incidence[3] is between 31,000 and 69,000 new infections per day in England.

Incidence and prevalence

3. During its most recent week (ending 9 October), the ONS COVID-19 Infection Survey estimates[4] that an average of 890,000 people had COVID-19 in the community in England (95% credible interval 839,700 to 941,300). The survey does not include people in care homes, hospitals, or prisons. Estimates from across the 4 nations of the UK are:

- England 890,000 (95% credible interval 839,700 to 941,300)
- Scotland 66,600 (95% credible interval 53,900 to 80,900)
- Wales 66,200 (95% credible interval 54,400 to 79,300)
- Northern Ireland 15,100 (95% credible interval 9,700 to 21,700)

[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] These estimates can be subject to revision as further information is available and modelled.

Growth rate and reproduction number

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.[5]

4. EMRG's consensus estimates for the growth rates in the 4 nations are (90% credible interval):

- England is between -1% to +2% per day,
- Scotland is between -3% to 0% per day,
- Wales is between -3% to +1% per day, and
- Northern Ireland is between -2% to +1% per day

National estimates of growth rates are summarised in Figure 2.

5. 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.

6. UKHSA's best estimate for R in in England is between 0.9 and 1.1. R is estimated to be between 0.8 and 1.0 for Scotland, 0.8 and 1.1 for Wales, and 0.9 and 1.1 for Northern Ireland. UKHSA's agreed national and regional estimates are summarised in Table 1, Table 2, Figure 1 and Figure 3, and these are based on the latest data available up to 11 October 2021[6].

7. R is an indicator that lags changes in transmission by 2 to 3 weeks[7], due to the time required for changes to be seen in data streams.

8. This inherent lag means that recent fluctuations should not be expected to be consistent with these estimates, and estimates may not represent transmission trends now.

9. This week, UKHSA's estimates of the range of R includes values above and below one, for England and all English regions. There is uncertainty in the status of the epidemic in England and its future trends.

[5] Further Technical Information on the growth rate can be found in Plus Magazine: The growth rate of COVID-19 | plus.maths.org.
[6] Different models fit to different windows of time using different methodologies, hence not all models will fit up to this precise date.
[7] 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.

10. Estimates of R and the growth rates per day become less useful in determining the state of the epidemic when there is a high degree of immunity in the population. Particular care should be taken when interpreting these estimates.

11. Historical estimates of R, growth rate and doubling time may change in future as we gain a full understanding of the impact of the reported incident of incorrect negative results.

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

Nation	R	Daily growth rate	Doubling time[8]
England	0.9 to 1.1	-1% to +2%	Flat
Wales	0.8 to 1.1	-3% to +1%	-31 days to flat
Scotland	0.8 to 1.0	-3% to 0%	-23 days to flat
Northern Ireland	0.9 to 1.1	-2% to +1%	-37 days to flat

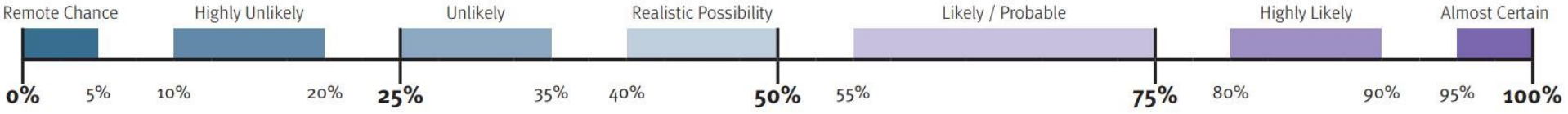
Table 2. Combined estimates of R values growth rates and doubling times in the NHS England regions (90% credible interval)

NHS England region	R	Daily growth rate	Doubling time[8]
London	0.9 to 1.1	-2% to +2%	Flat
East of England	0.9 to 1.2	-1% to +3%	32 days to flat
Midlands	0.9 to 1.1	-1% to +2%	38 days to flat
North East and Yorkshire	0.9 to 1.1	-1% to +1%	Flat
North West	0.9 to 1.1	-1% to +2%	Flat
South East	0.9 to 1.1	-1% to +2%	Flat
South West	0.9 to 1.1	-1% to +2%	39 days to flat

[8] 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

UKHSA takes responsibility for this consensus statement and its contents. However, 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 and University of Cambridge (9). 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 Modeling (14) for contributing model outputs. 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

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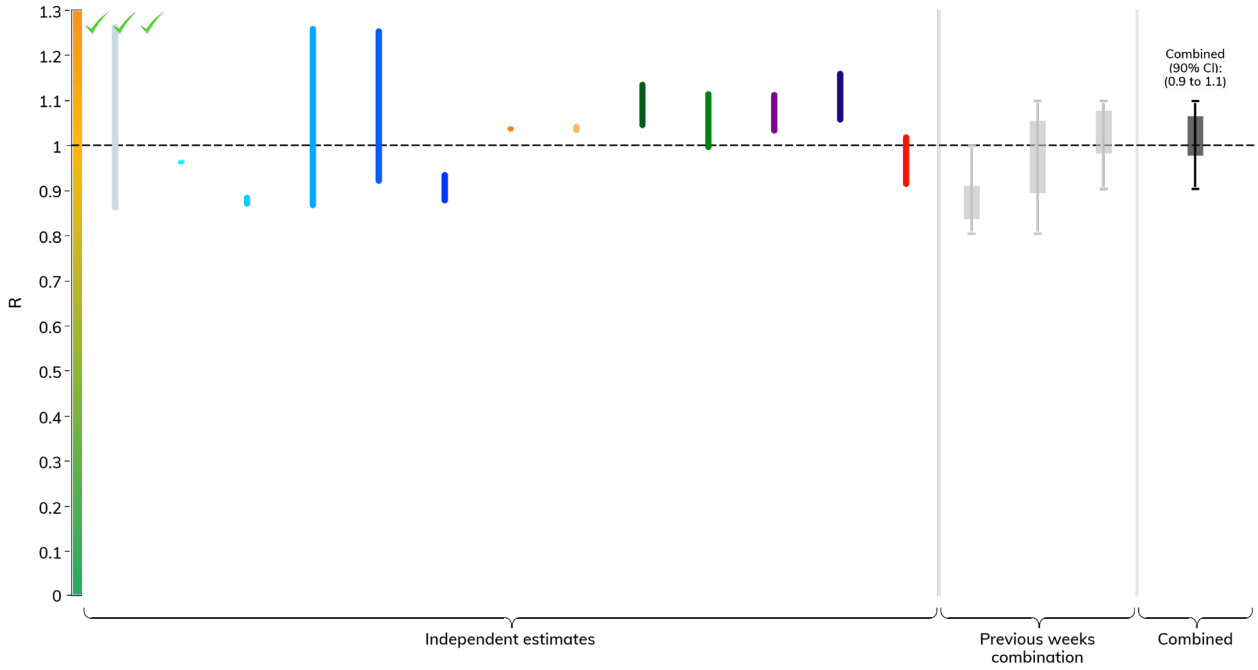
Figure 1a. Estimates of R in the 4 nations of the UK (90% credible intervals)
Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.

England



Wales

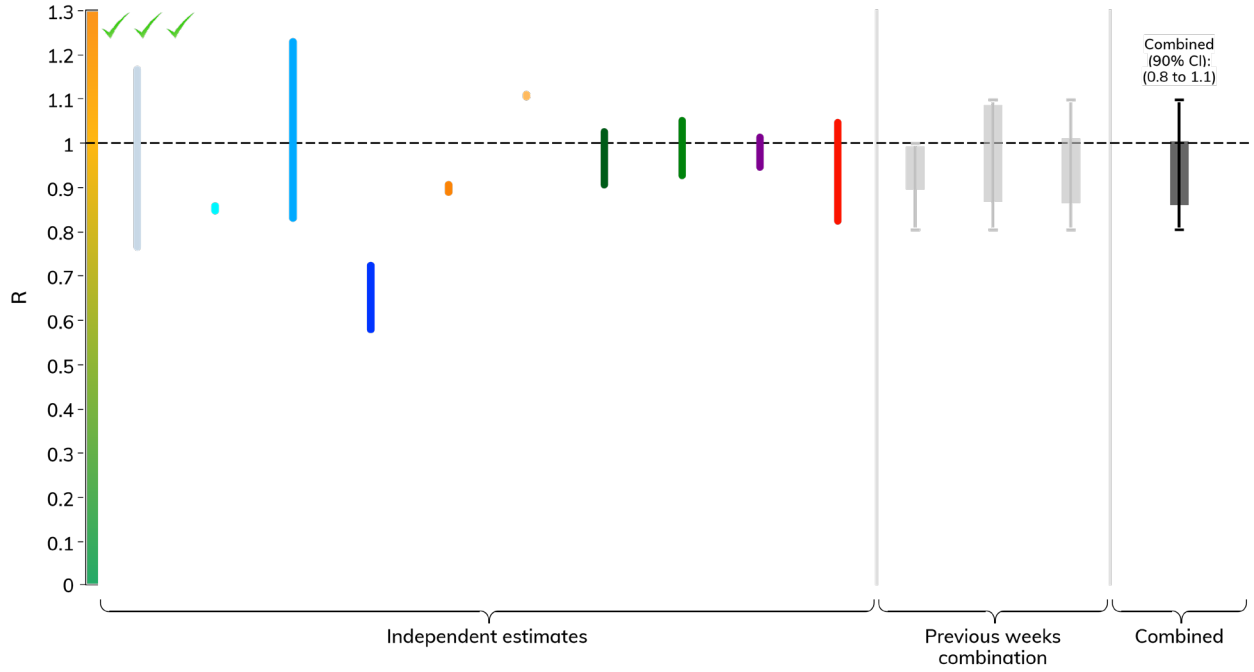
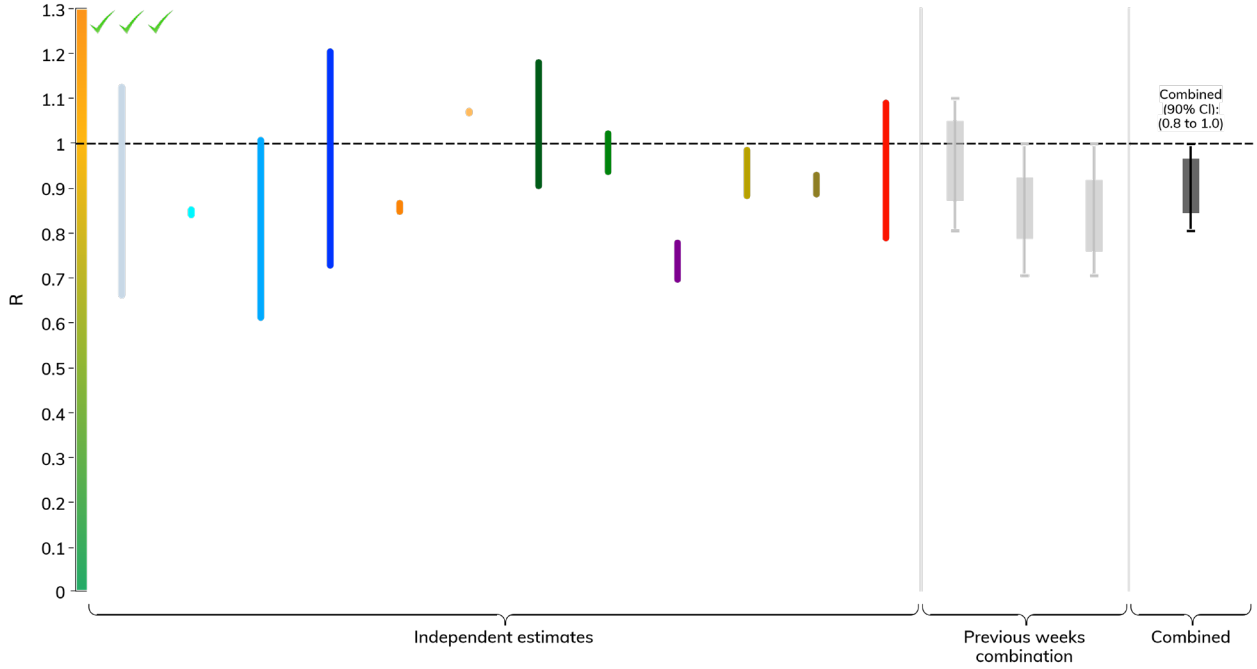


Figure 1b. Estimates of R in the 4 nations of the UK (90% credible intervals)
Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.

Scotland



Northern Ireland

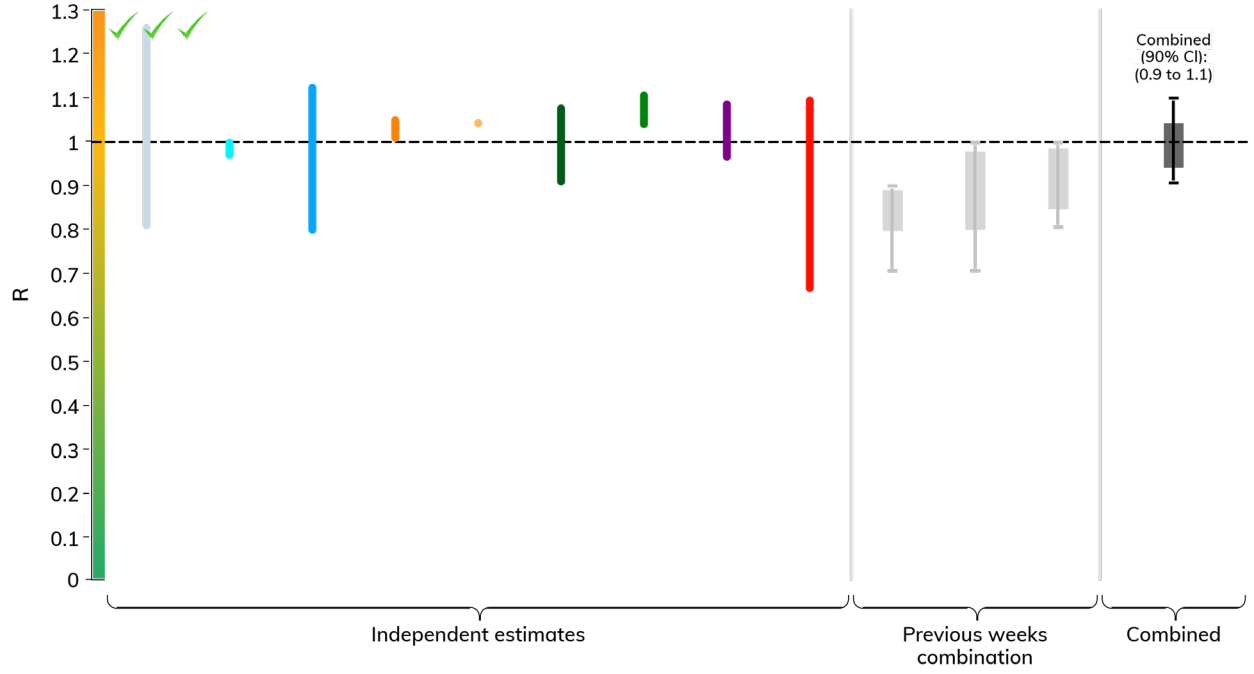
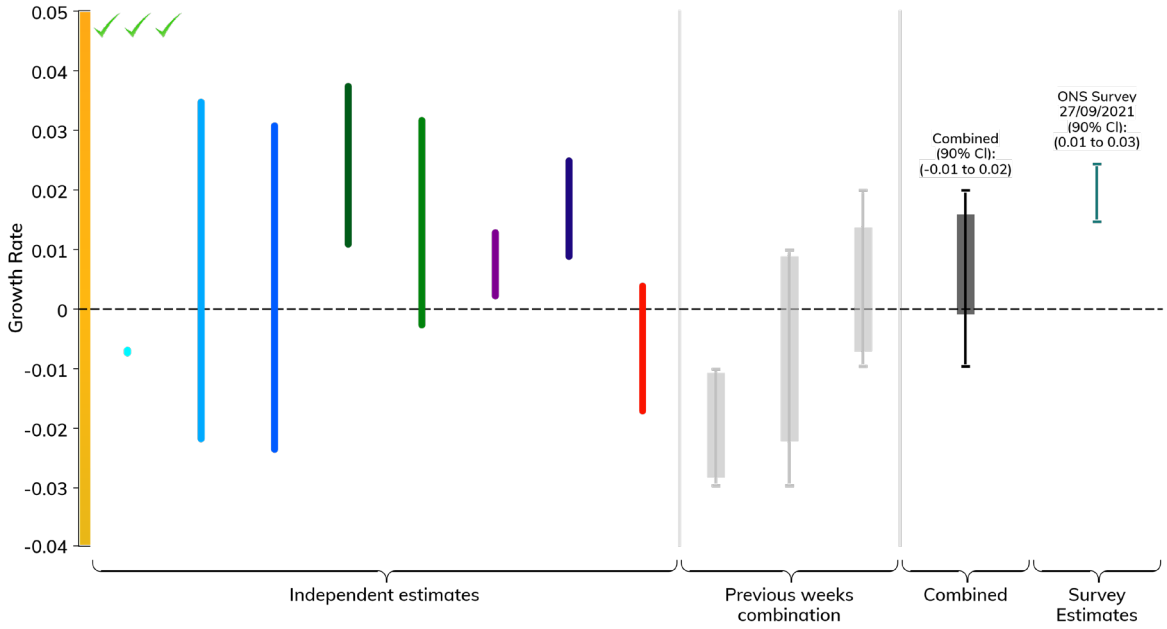


Figure 2a. Estimates of the growth rate in NHS England nations, including 90% credible intervals

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 per cent.

England



Wales

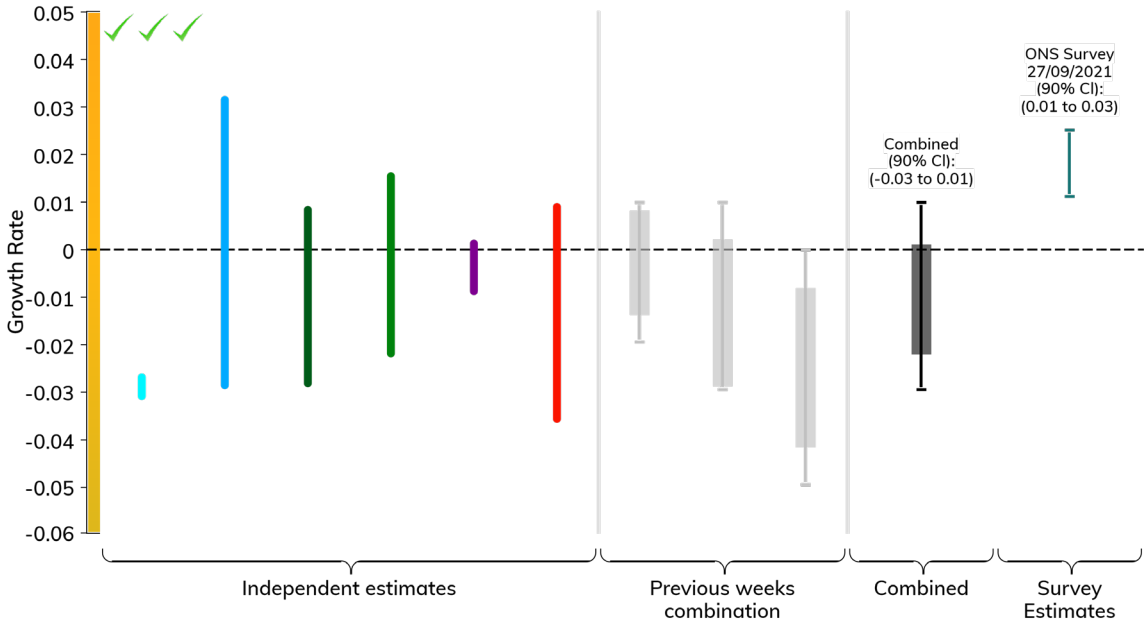
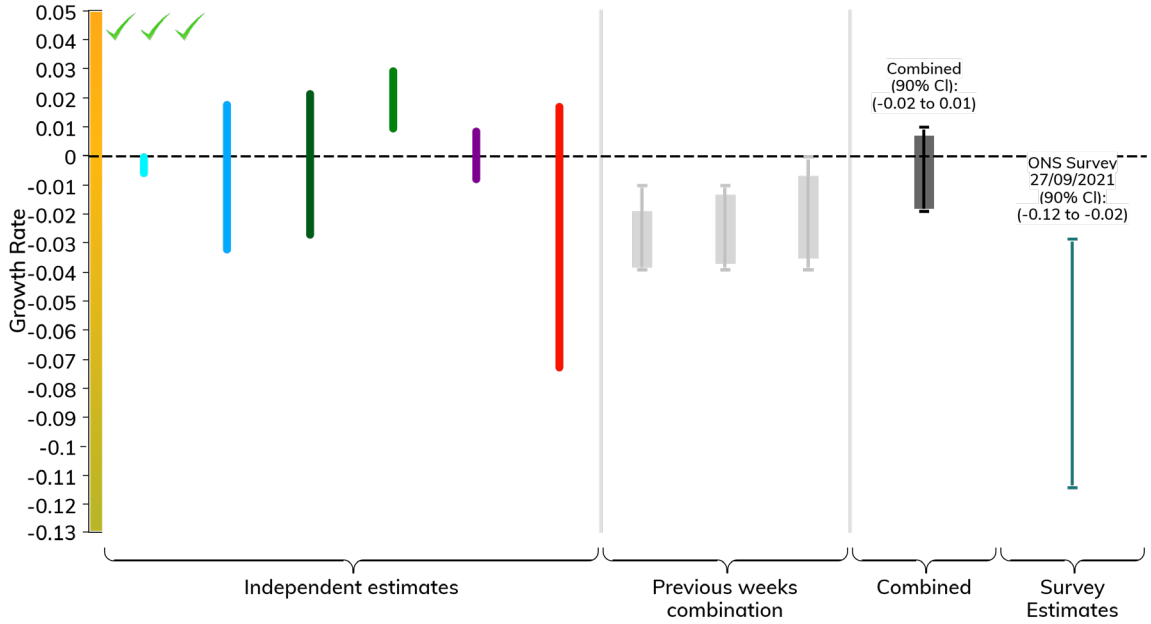


Figure 2b. Estimates of the growth rate in NHS England nations, including 90% credible intervals

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 per cent.

Scotland



Northern Ireland

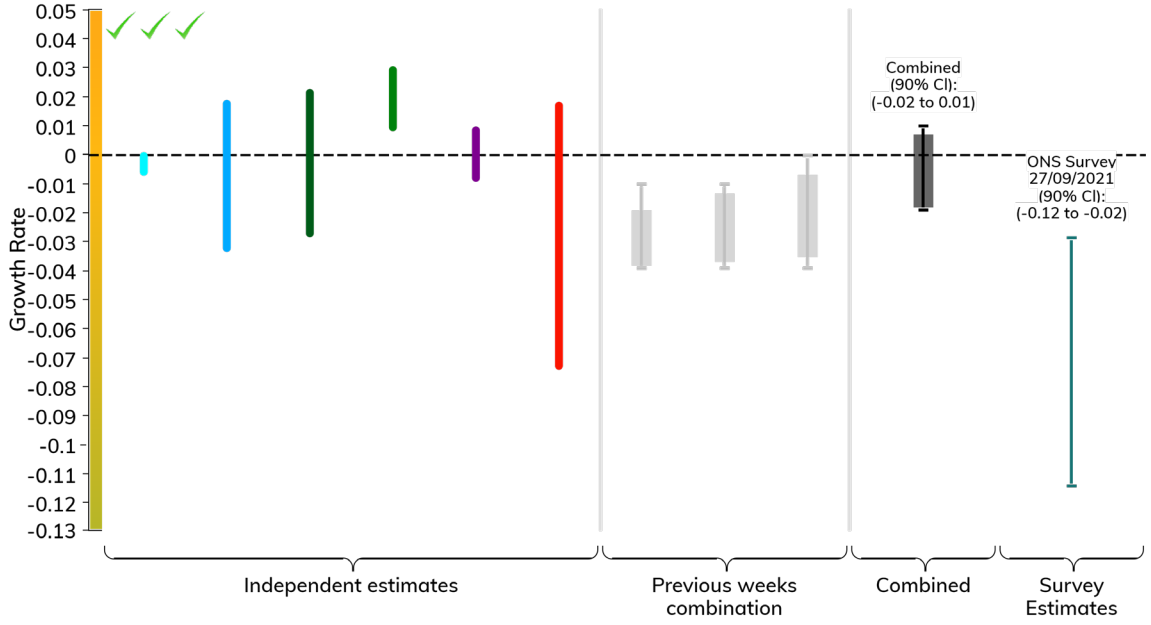


Figure 3a. Estimates of R in the NHS England regions, including 90% credible intervals
Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.

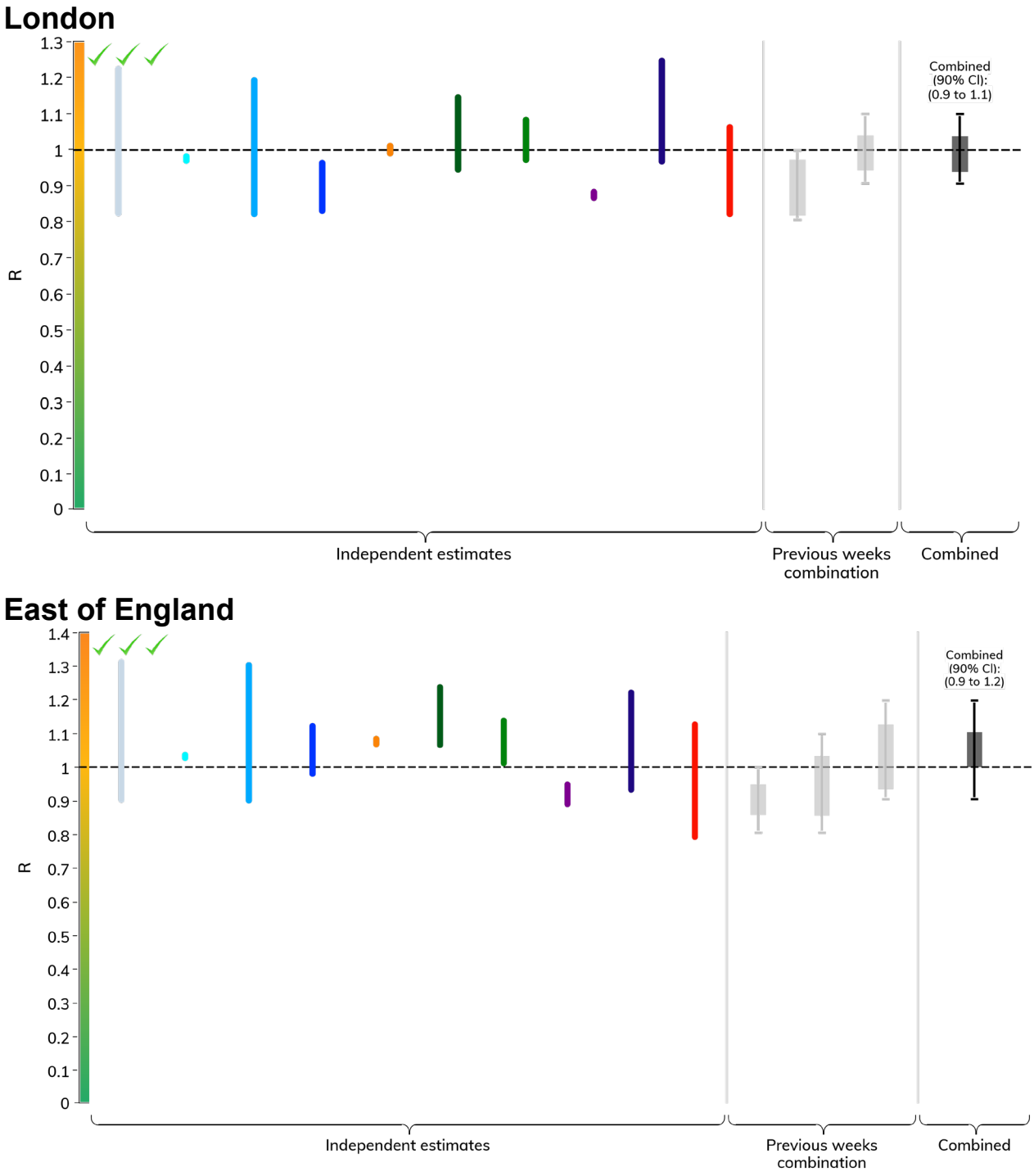


Figure 3b. Estimates of R in the NHS England regions, including 90% credible intervals
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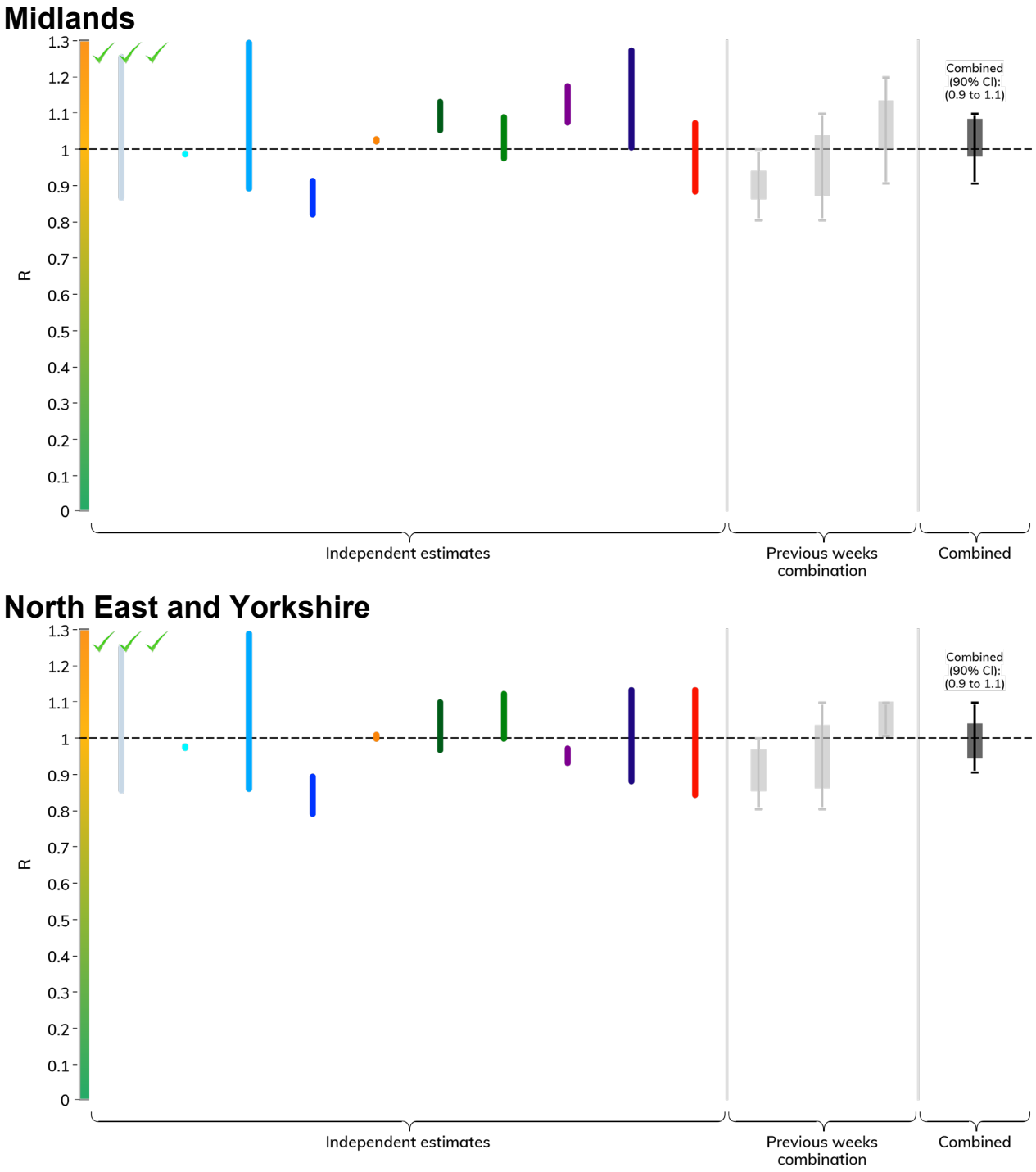


Figure 3c. Estimates of R in the NHS England regions, including 90% credible intervals
Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.

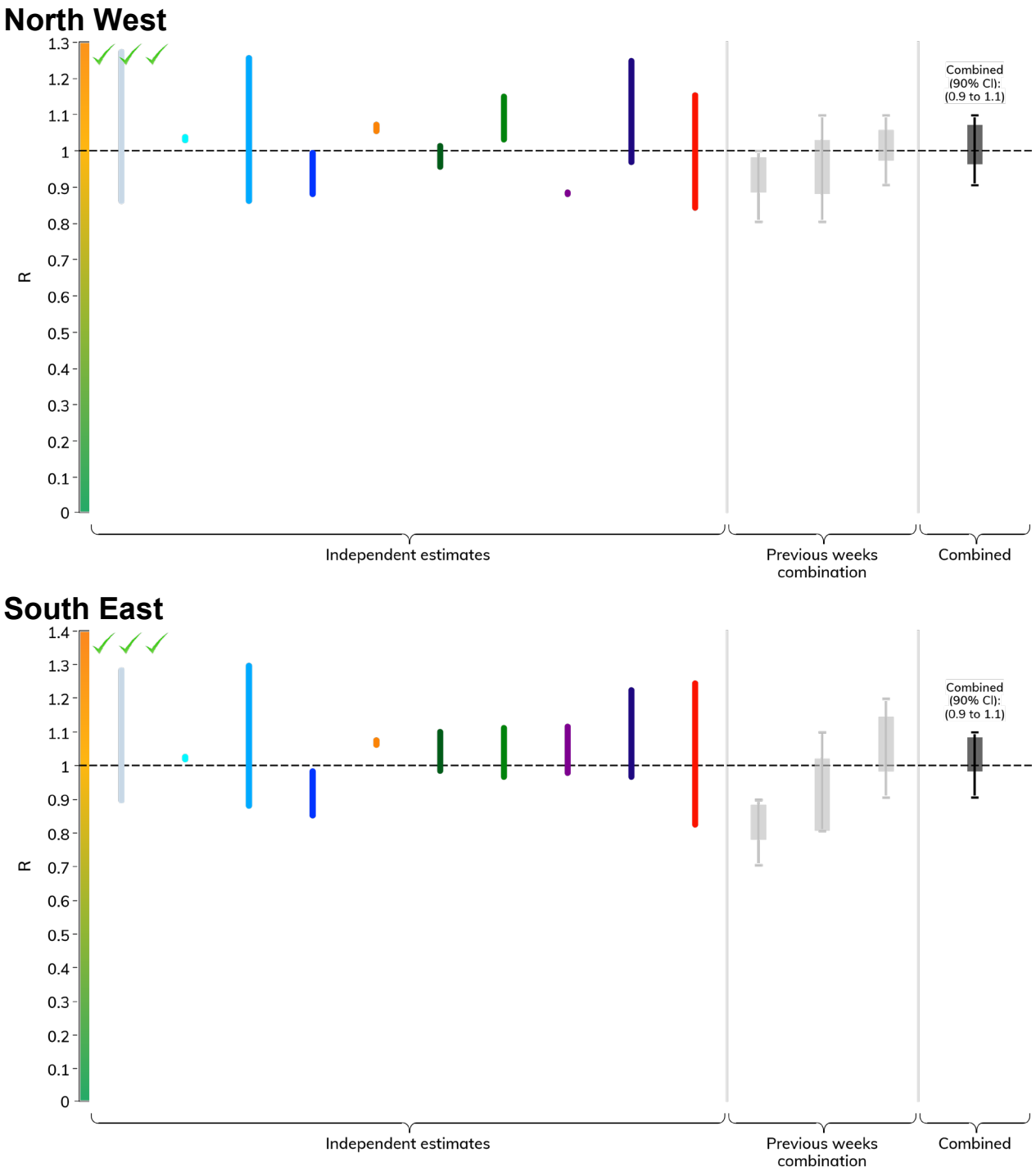
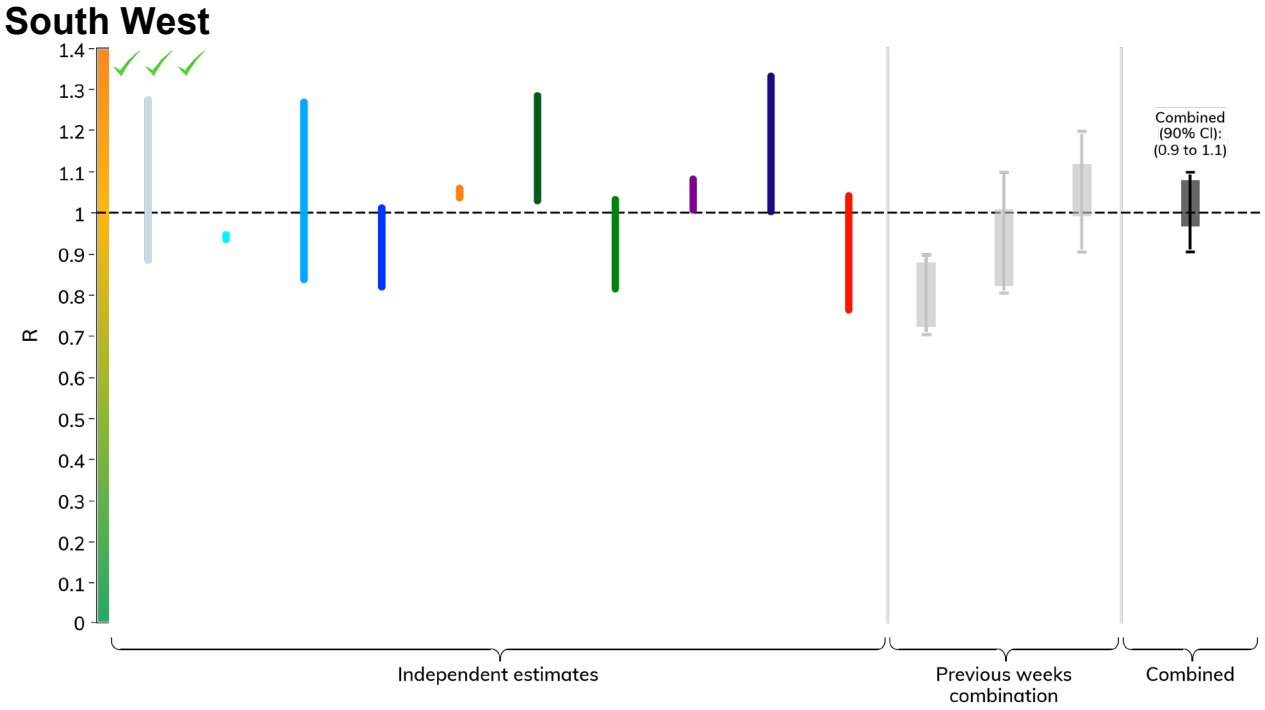


Figure 3d. Estimates of R in the NHS England regions, including 90% credible intervals
Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.



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