



UK Health
Security
Agency

Epidemiology Modelling Review Group: consensus statement on COVID-19

Date: 27 October 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. UKHSA's best estimate for R in England is between 1.1 and 1.3. R is estimated to be between 0.9 and 1.2 for Wales, 0.8 and 1.0 for Scotland, and 0.9 and 1.1 for Northern Ireland ([Figure 1](#)). These estimates are based on models¹ fit to data available up to 25 October 2021, including hospitalisations, deaths, testing, wastewater samples and longitudinal studies.
2. Combined estimates² show that the incidence³ is between 53,000 and 78,000 new infections per day in England.

Incidence and prevalence

3. During its most recent week (ending 23 October⁴), the ONS COVID-19 Infection Survey estimates⁵ that an average of 1,102,800 people had COVID-19 in the community in England (95% credible interval 1,043,900 to 1,161,200). The survey does not include people in care homes, hospitals or prisons. Estimates from across the 4 nations of the UK are:
 - England 1,102,800 (95% credible interval 1,043,900 to 1,161,200)
 - Scotland 71,500 (95% credible interval 58,900 to 85,200)
 - Wales 77,800 (95% credible interval 64,300 to 92,400)
 - Northern Ireland 23,900 (95% credible interval 17,000 to 32,300)

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 Due to availability of data, the reference week for Scotland (17 to 23 October 2021) is different compared to England and the other devolved administrations (16 to 22 October 2021).

⁵ 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.⁶

4. The EMRG's consensus estimates for the growth rates in the 4 nations are (90% credible interval):
 - England is between +1% to +3% per day,
 - Wales is between -1% to +2% per day,
 - Scotland is between -3% to 0% per day, and
 - Northern Ireland is between -3% to +2% 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 England is between 1.1 and 1.3. R is estimated to be between 0.9 and 1.2 for Wales, 0.8 and 1.0 for Scotland, and 0.9 and 1.1 for Northern Ireland. UKHSA's agreed national and regional R estimates are summarised in [Table 1](#), [Table 2](#), [Figure 1](#), and [Figure 3](#). These are based on the latest data available up to 25 October 2021⁷.
7. R is an indicator that lags changes in transmission by 2 to 3 weeks⁸, 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. 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.

⁶ Further Technical Information on the growth rate can be found in Plus Magazine: [The growth rate of COVID-19 | plus.maths.org](https://plus.maths.org).

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.

10. Estimates for the South West have been paused until we gain a full understanding of the impact of the reported incident of the incorrect negative PCR test results on estimates in this region. UKHSA is confident that R is above 1 in the South West and that the epidemic is growing in this region. Models that do not use case data also estimate an increase in R in this region, and that it is above 1.

11. We are now reporting estimates in all other English regions; this is following confidence that the impact of the incorrect negatives is unlikely to have materially impacted the estimates for regions outside of the South West.

12. Historical estimates of R, growth rate and doubling time may change in the 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 ⁹
England	1.1 to 1.3	+1% to +3%	23 days to flat
Wales	0.9 to 1.2	-1% to +2%	36 days to flat
Scotland	0.8 to 1.0	-3% to 0%	-29 days to flat
Northern Ireland	0.9 to 1.1	-3% to +2%	-30 days to flat

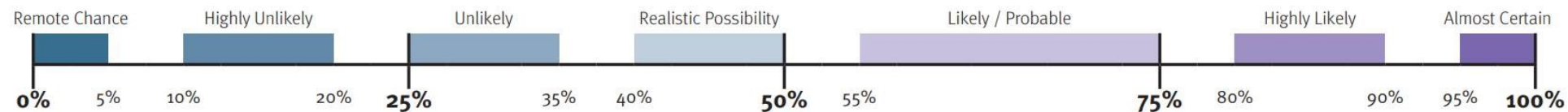
Table 2. Combined estimates of R values growth rates and doubling times in the NHS England regions (90% credible interval)

NHS England region	R	Daily growth rate	Doubling time ⁸
London	1.0 to 1.2	0% to +3%	27 days to flat
East of England	1.1 to 1.3	+2% to +5%	16 to 32 days
Midlands	1.0 to 1.2	0% to +3%	27 days to flat
North East and Yorkshire	1.0 to 1.2	0% to +3%	27 days to flat
North West	1.0 to 1.2	0% to +3%	27 days to flat
South East	1.1 to 1.4	+2% to +5%	14 to 29 days
South West	N/A	N/A	N/A

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

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.

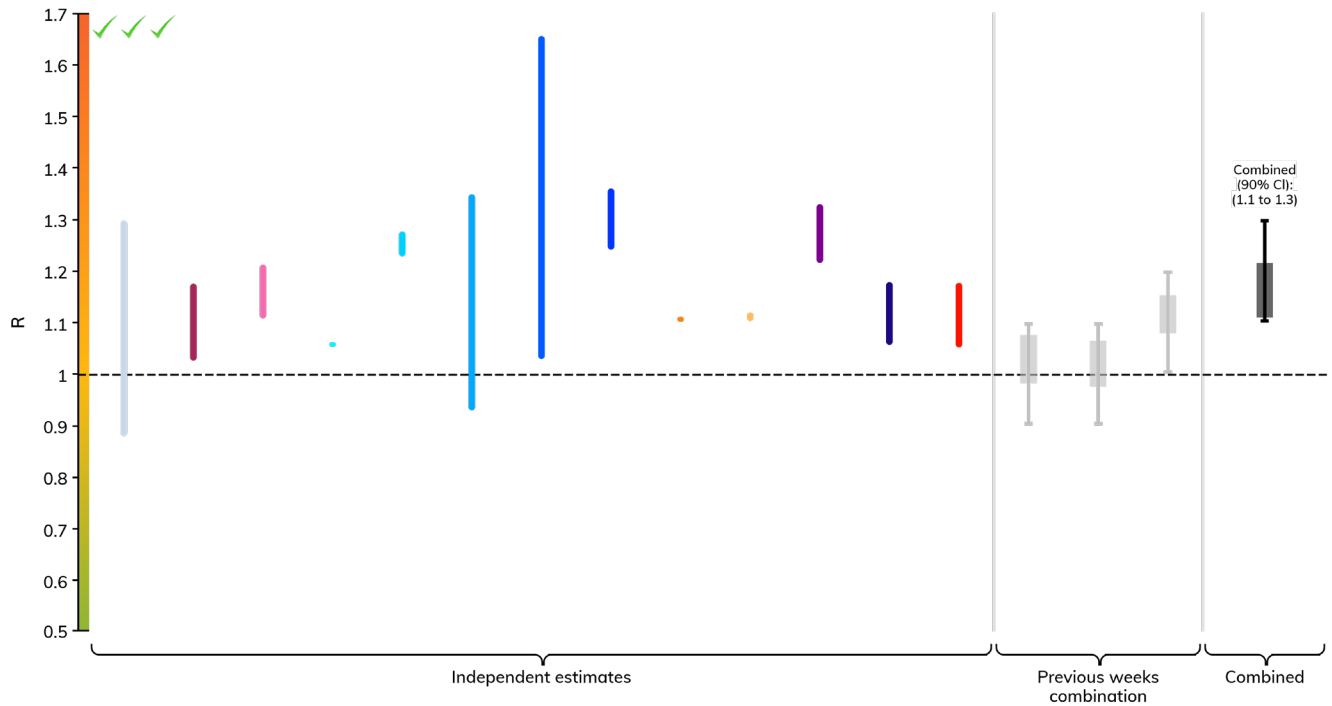
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Figure 1a. Estimates of R in the 4 nations of the UK (90% credible intervals)

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

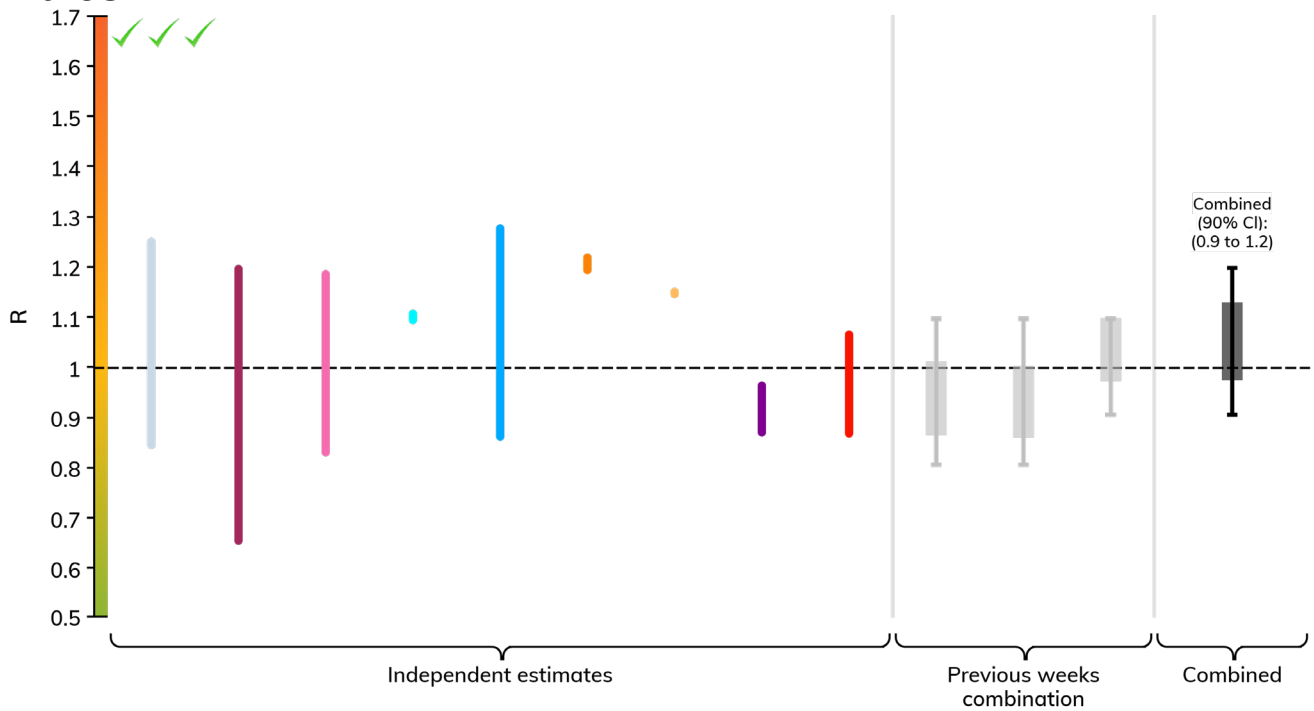
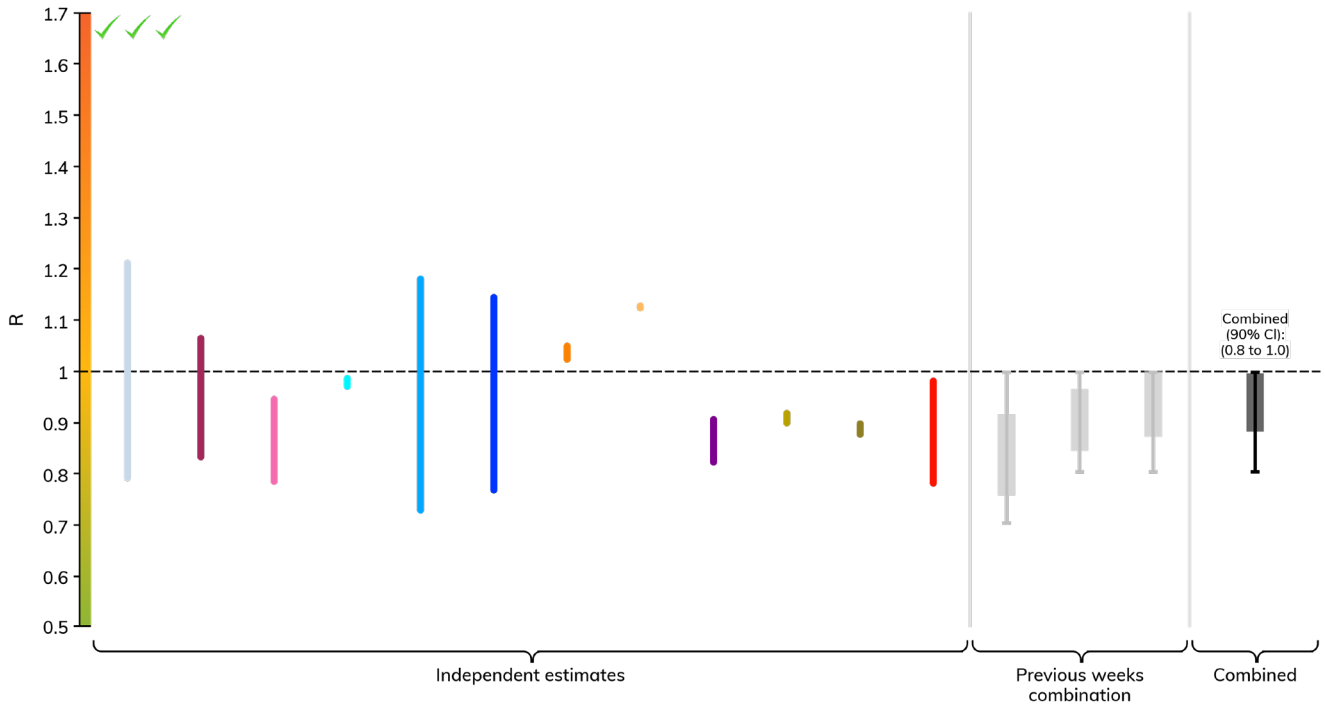


Figure 1b. Estimates of R in the 4 nations of the UK (90% credible intervals)

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

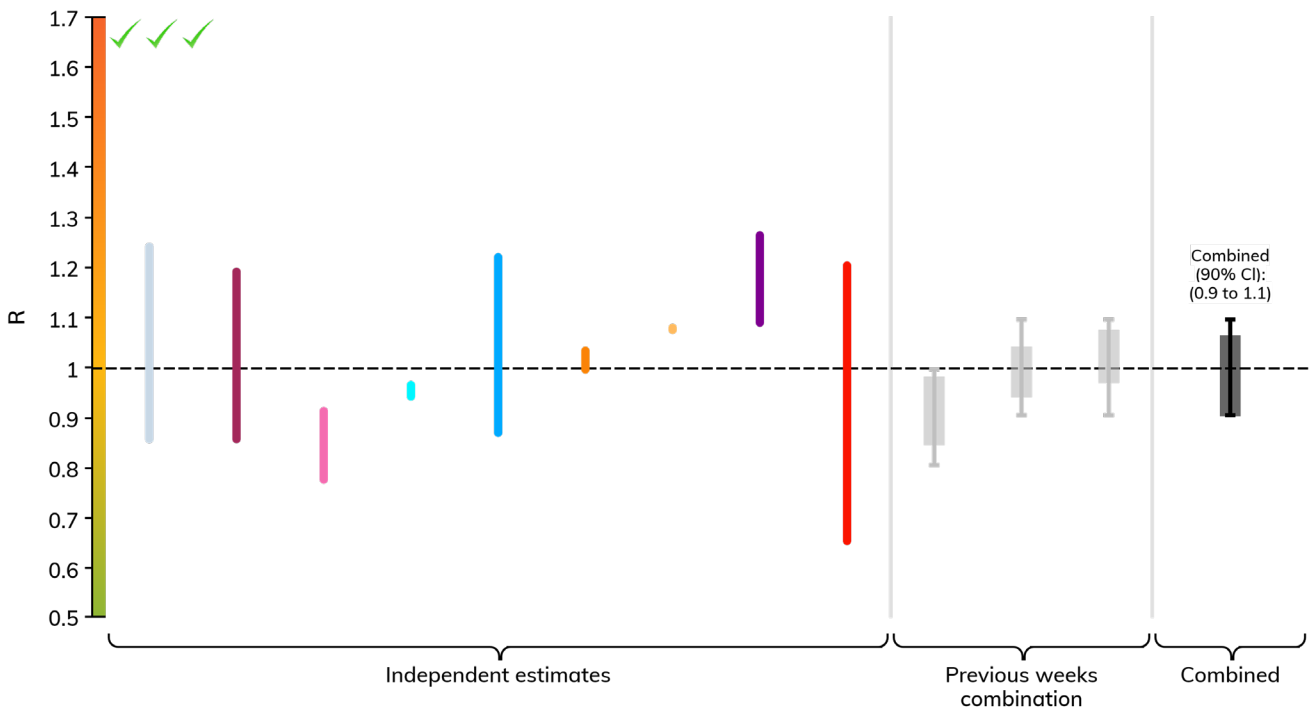
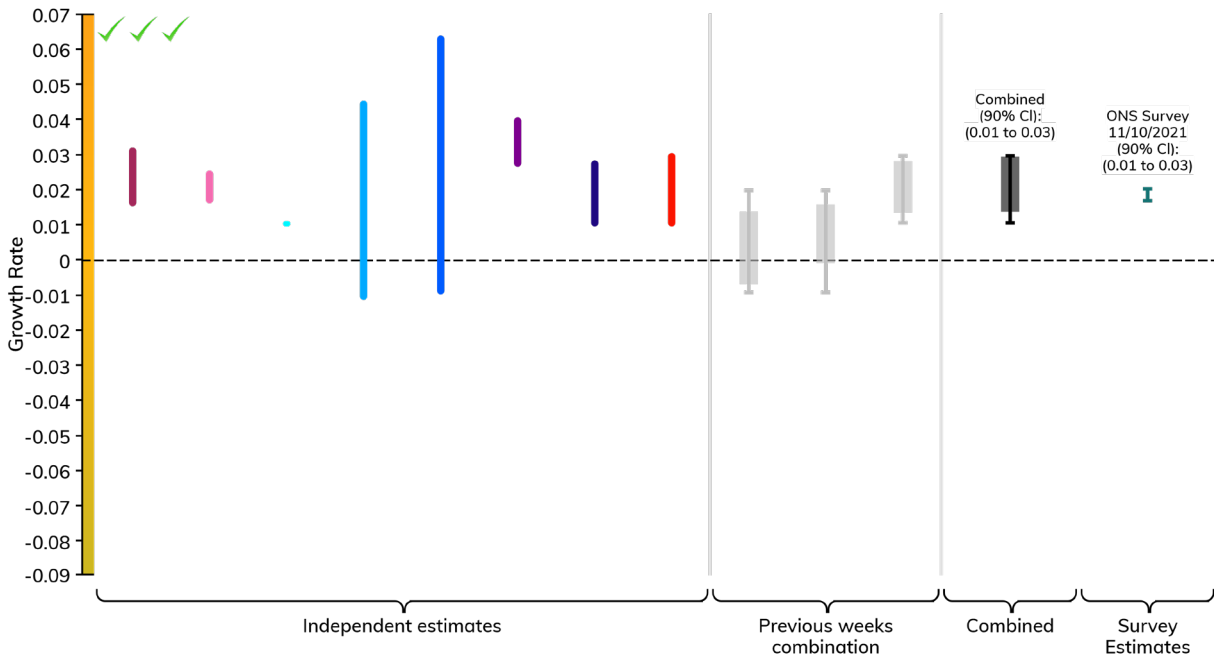


Figure 2a. Estimates of the growth rate in NHS England nations, including 90% credible intervals

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

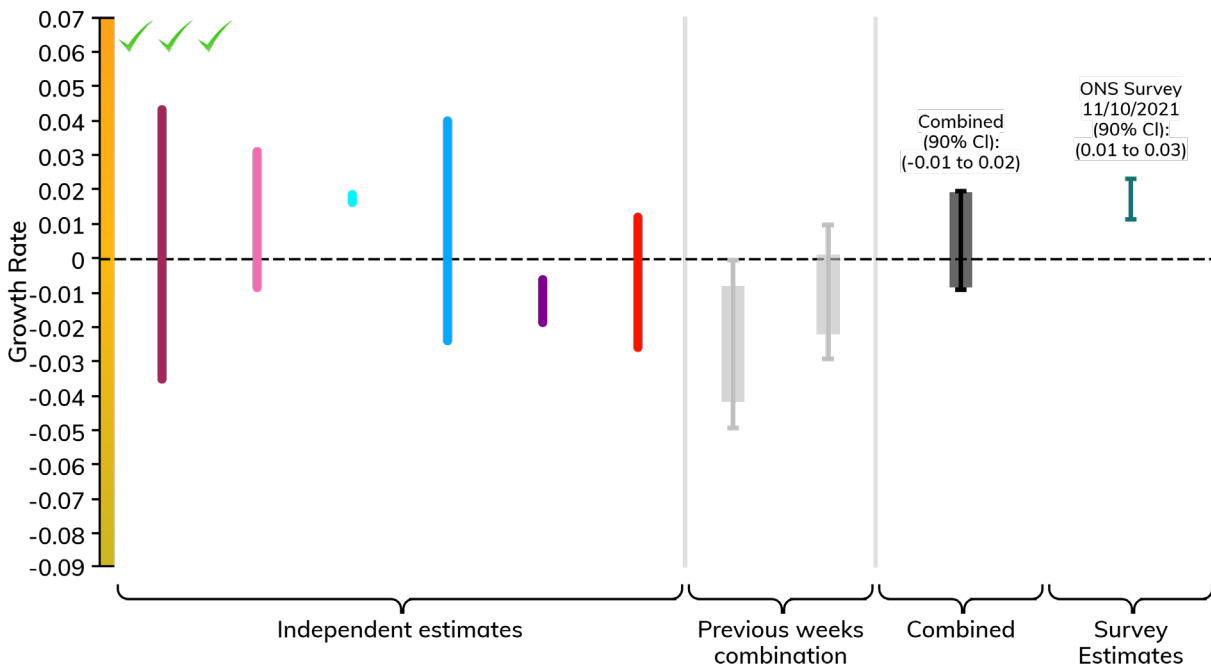
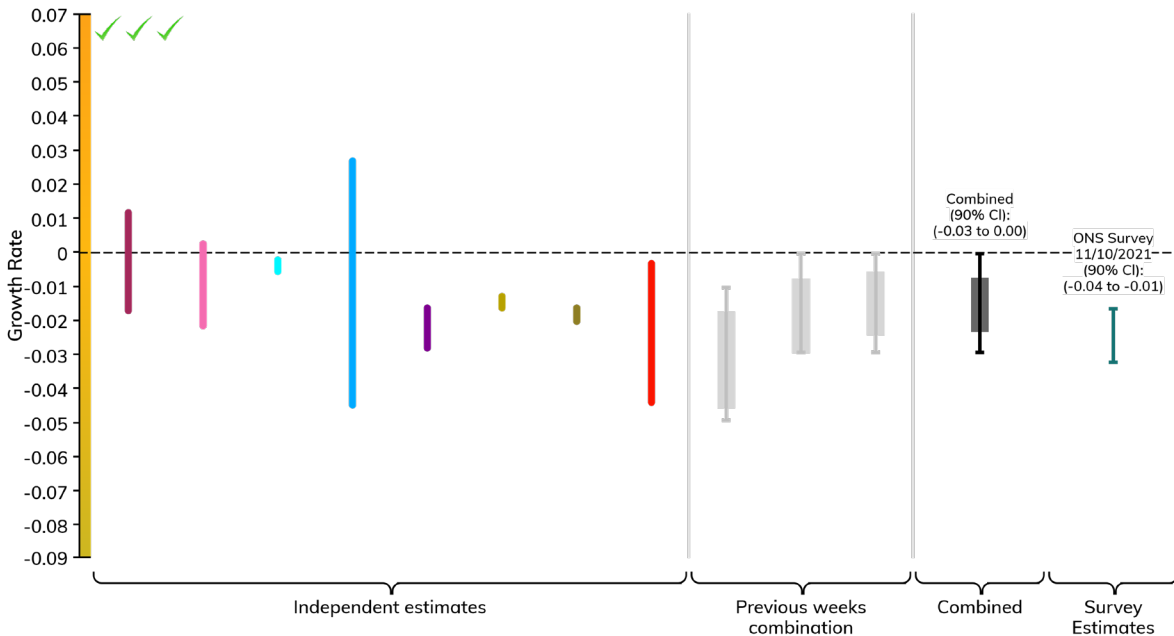


Figure 2b. Estimates of the growth rate in NHS England nations, including 90% credible intervals

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

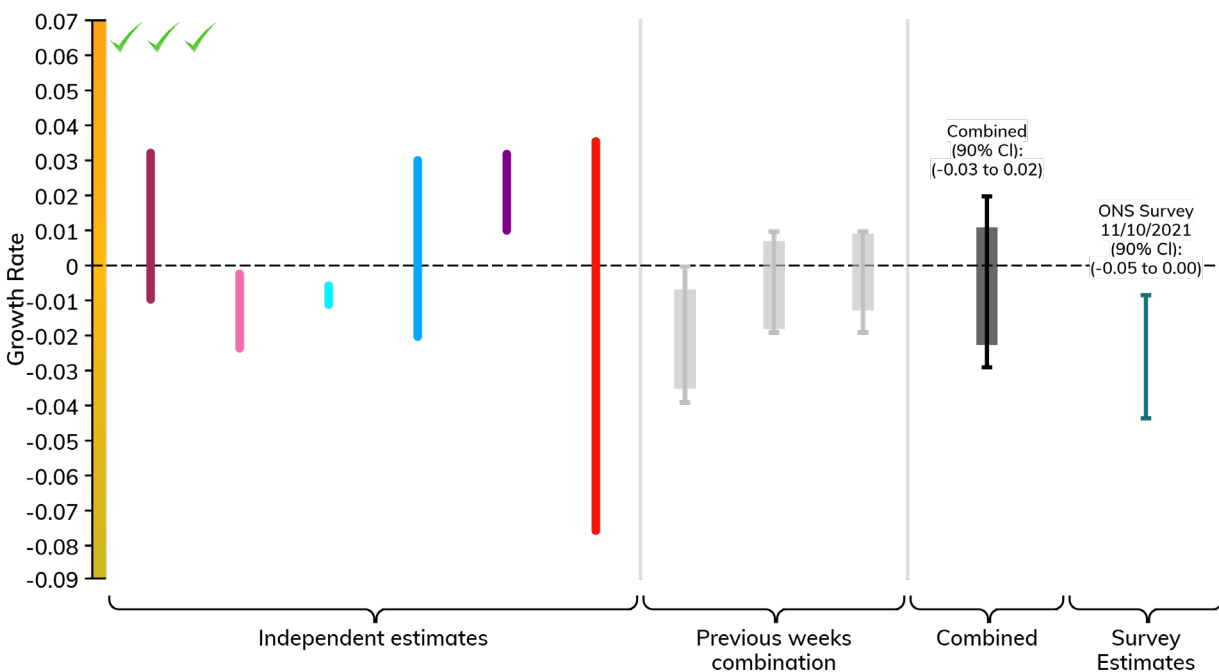
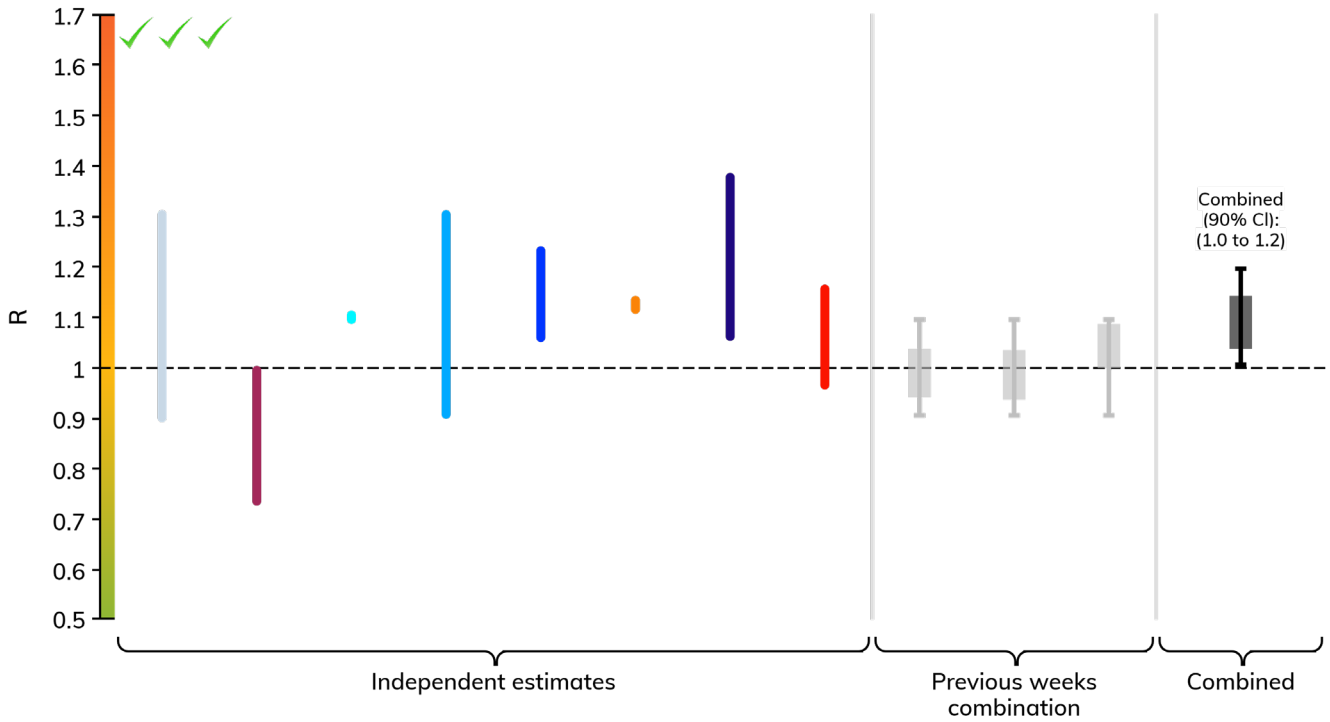


Figure 3a. Estimates of R in the NHS England regions, including 90% credible intervals
 Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.

London



East of England

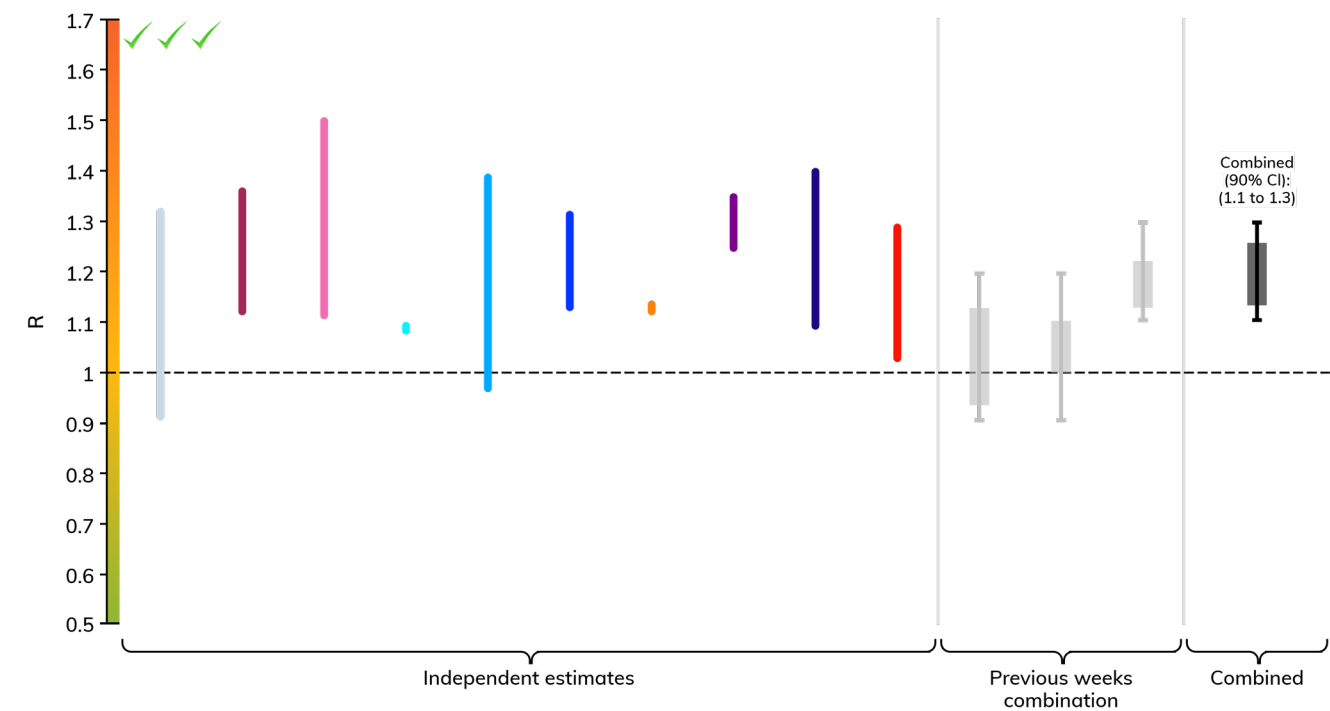
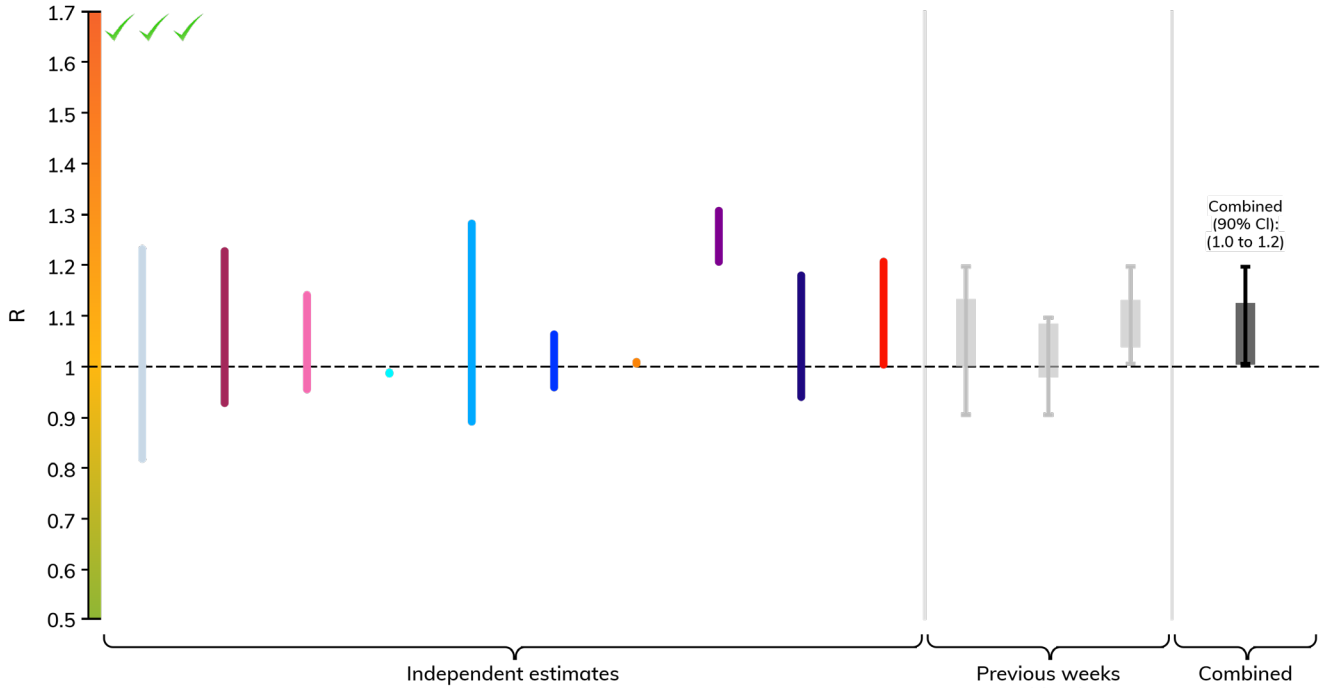


Figure 3b. Estimates of R in the NHS England regions, including 90% credible intervals
 Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.

Midlands



North East and Yorkshire

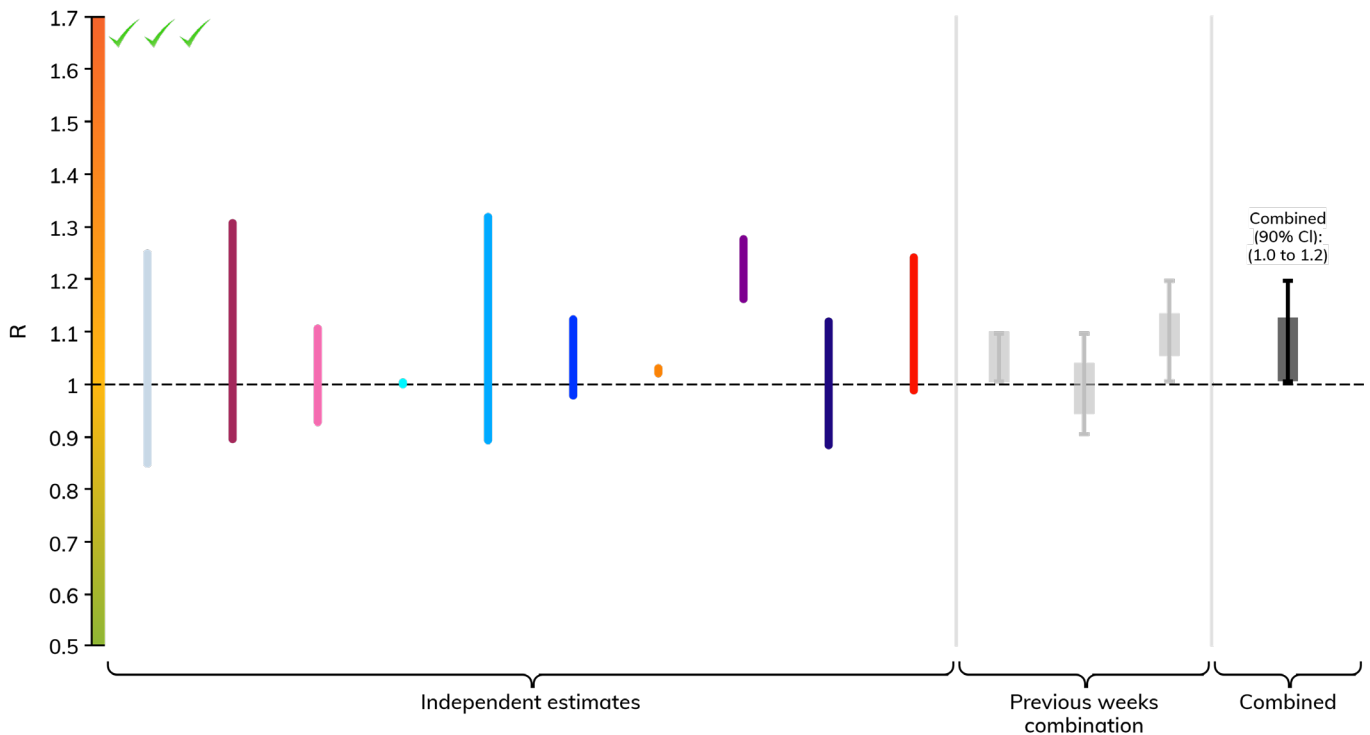
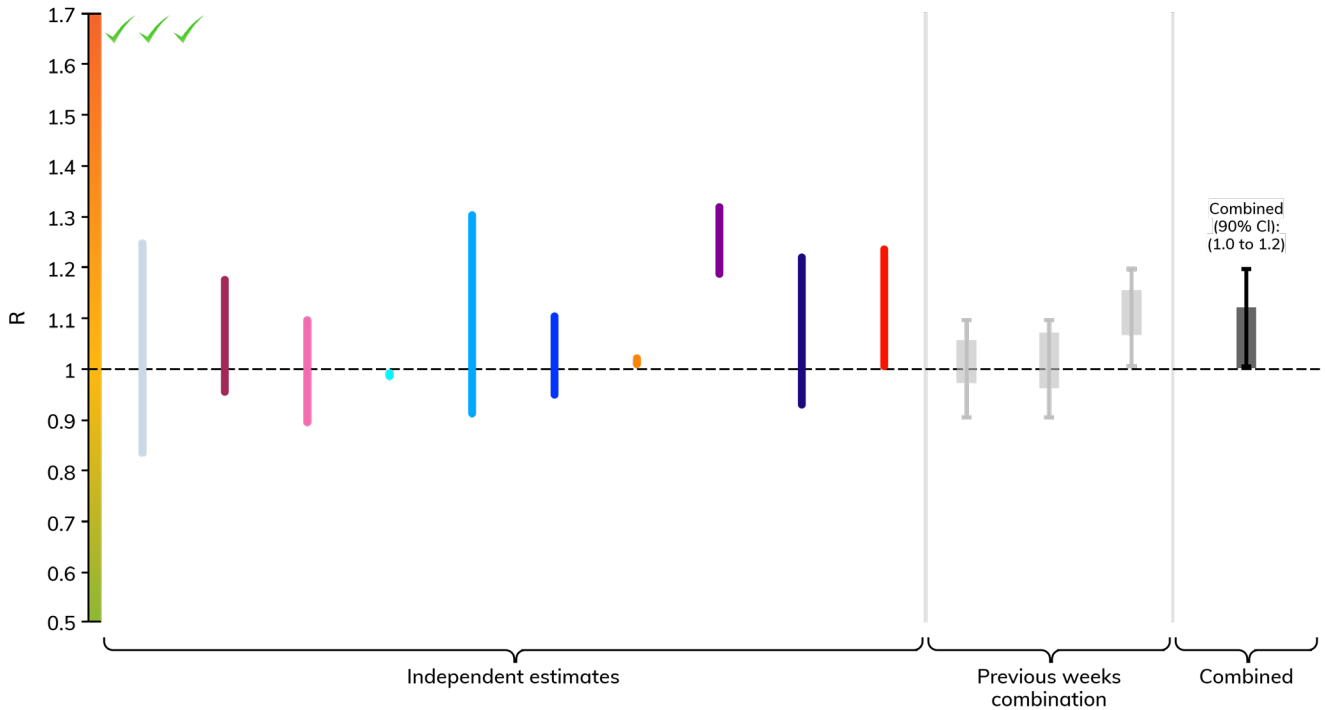
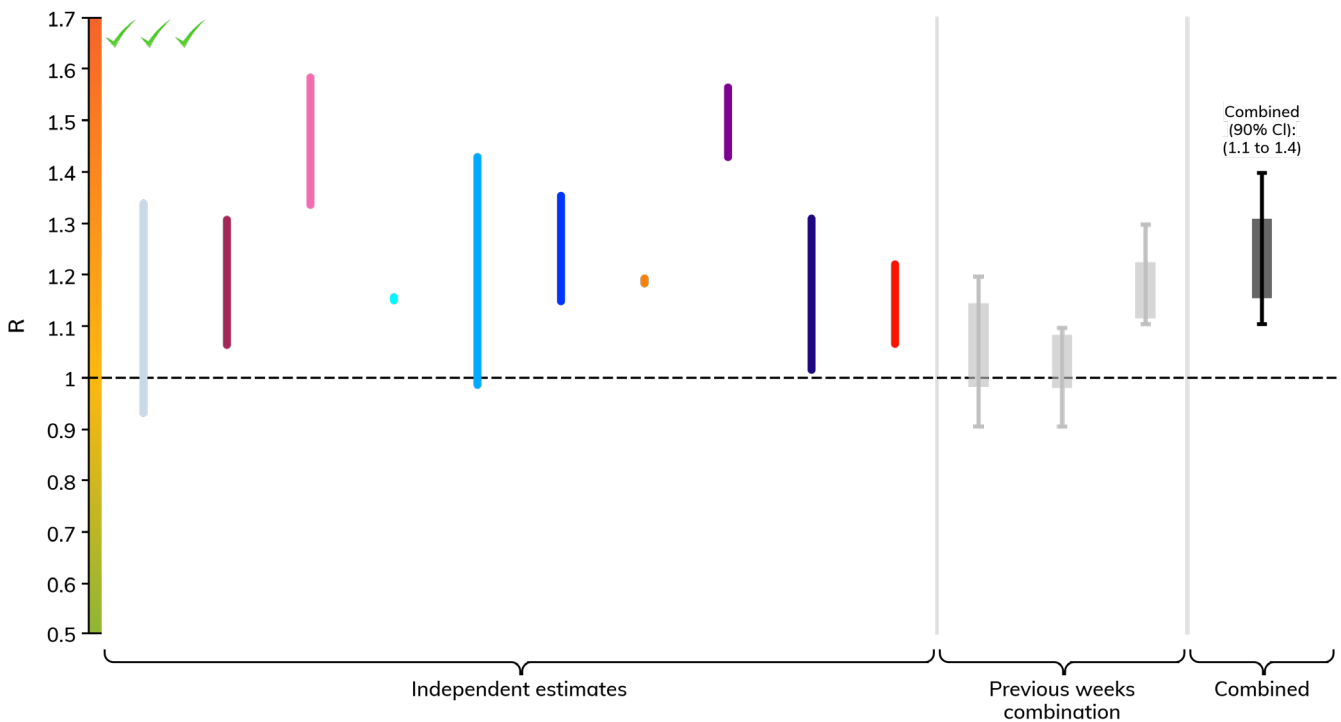


Figure 3c. Estimates of R in the NHS England regions, including 90% credible intervals
 Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.

North West



South East



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