



UK Health
Security
Agency

Epidemiology Modelling Review Group: consensus statement on COVID-19

Date: 7 December 2022

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 1.2. R is estimated to be between 0.8 and 1.0 for Wales, 0.9 and 1.1 for Scotland, and 0.8 and 1.0 for Northern Ireland ([Figure 1](#)). These estimates are based on models¹ fit to data available up to 01 December 2022 where feasible, including hospitalisations, deaths, testing, wastewater samples and longitudinal studies.
2. Models used in combination to provide R and growth rate estimates are adjusted when required, for example when changes to testing guidance^{2,3,4,5} alter data streams. Care should be taken when comparing consensus estimates over time.
3. Estimates lag changes in transmission by 2 to 3 weeks, due to the time required to see changes in data streams. It is an average over time, geographies, viral variants, and communities.
4. Combined estimates⁶ show that the incidence⁷ is between 72,000 and 115,000 new infections per day in England. This may be an over-estimate, due to the mix of models present in this combination estimate.
5. Following a detailed review, the next publication of the 'Epidemiology Modelling Review Group: consensus statement on COVID-19' on 6 January will be the last. COVID-19 incidence data will continue to be accessible from the ONS Coronavirus (COVID-19)

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. The combination of models able to be included can change between weeks and therefore care should be taken when drawing week-on-week comparisons.

² [Changes to COVID-19 testing in England from 1 April - GOV.UK \(www.gov.uk\)](#)

³ [Changes to testing and care homes as we all learn to live safely with coronavirus | GOV.WALES](#)

⁴ [Test-Trace-Transition-Plan.pdf \(health-ni.gov.uk\)](#)

⁵ [Coronavirus \(COVID-19\): Test and Protect - transition plan - gov.scot \(www.gov.scot\)](#)

⁶ 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.

⁷ The number of new infections per day.

Infection Survey ([Coronavirus \(COVID-19\) Infection Survey, UK Statistical bulletins - Office for National Statistics](#)). All UKHSA data publications will be kept under constant review. For feedback email emrg@ukhsa.gov.uk

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. However, at very high growth rates, this relationship does not hold.⁸

6. 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 -3% to +1% per day
 - Scotland is between -2% to +1% per day
 - Northern Ireland is between -4% to 0% per day

National estimates of growth rates are summarised in [Figure 2](#).

7. 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.
8. UKHSA's best estimate for R in England is between 0.9 and 1.2. R is estimated to be between 0.8 and 1.0 for Wales, 0.9 and 1.1 for Scotland, and 0.8 and 1.0 for Northern Ireland. UKHSA's agreed national and regional R estimates are summarised in [Table 1](#), [Table 2](#) and individual model estimates are illustrated in [Figure 1](#), and [Figure 3](#).
9. Models used in combination to provide R and growth rate estimates are adjusted when required, for example when changes to testing guidance^{9,10,11,12} alter data streams. Care should be taken when comparing consensus estimates over time.
10. R is an indicator that lags changes in transmission by 2 to 3 weeks,¹³ due to the time required for changes to be seen in data streams. Therefore, while epidemic estimates for R and other metrics such as growth rate, use the latest data available up to 1 December 2022,

⁸ 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).

⁹ [Changes to COVID-19 testing in England from 1 April - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

¹⁰ [Changes to testing and care homes as we all learn to live safely with coronavirus | GOV.WALES](https://www.gov.wales)

¹¹ [Test-Trace-Transition-Plan.pdf \(health-ni.gov.uk\)](https://www.health-ni.gov.uk)

¹² [Coronavirus \(COVID-19\): Test and Protect - transition plan - gov.scot \(www.gov.scot\)](https://www.gov.scot)

¹³ 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.

where feasible,¹⁴ the estimates reported here represent the epidemic situation as at 22 November 2022.

11. 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 to the circulating variant in the population. Particular care should be taken when interpreting these estimates.
12. In addition, changes in population immunity can impact data streams, with alterations to the relationship between cases and health outcomes, such as hospital admissions. These relationships will continue to change depending on the degree of immune protection to variant(s) in circulation.
13. R and growth rate estimates indicate the magnitude of growth or decay of the epidemic. However, these indicators should be considered alongside other measures of the epidemic, such as incidence,¹⁵ and prevalence.¹⁶ When prevalence is high, if R is at, above or below 1, the absolute number of new cases will be very high.

¹⁴ Different models fit to different windows of time using different methodologies, hence not all models will fit up to this precise date.

¹⁵ The number of individuals who develop the disease within a specified time period

¹⁶ The proportion of the population with the disease at a given point in time

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 ¹⁷
England	0.9 to 1.2	-1% to +3%	34 days to flat
Wales	0.8 to 1.0	-3% to +1%	-24 days to flat
Scotland	0.9 to 1.1	-2% to +1%	Flat
Northern Ireland	0.8 to 1.0	-4% to 0%	-17 days to flat

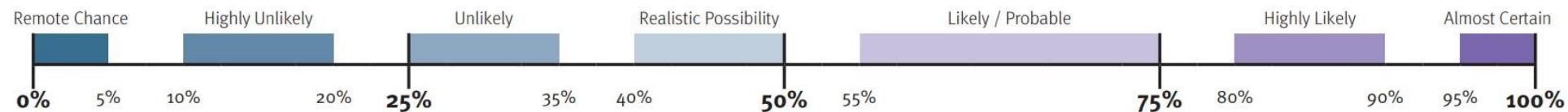
Table 2. Combined estimates of R values growth rates and doubling times in the NHS England regions (90% credible interval)

NHS England region	R	Daily growth rate	Doubling time ¹⁸
England	0.9 to 1.2	-1% to +3%	34 days to flat
London	0.9 to 1.1	-1% to +2%	Flat
East of England	0.9 to 1.1	-1% to +2%	Flat
Midlands	0.9 to 1.1	-1% to +2%	Flat
North East & Yorkshire	0.9 to 1.1	-1% to +2%	Flat
North West	0.9 to 1.2	-1% to +3%	28 days to flat
South East	1.0 to 1.2	0% to +3%	27 days to flat
South West	0.9 to 1.2	-1% to +2%	35 days to flat

¹⁷ 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 UK nations (90% credible intervals) as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

England

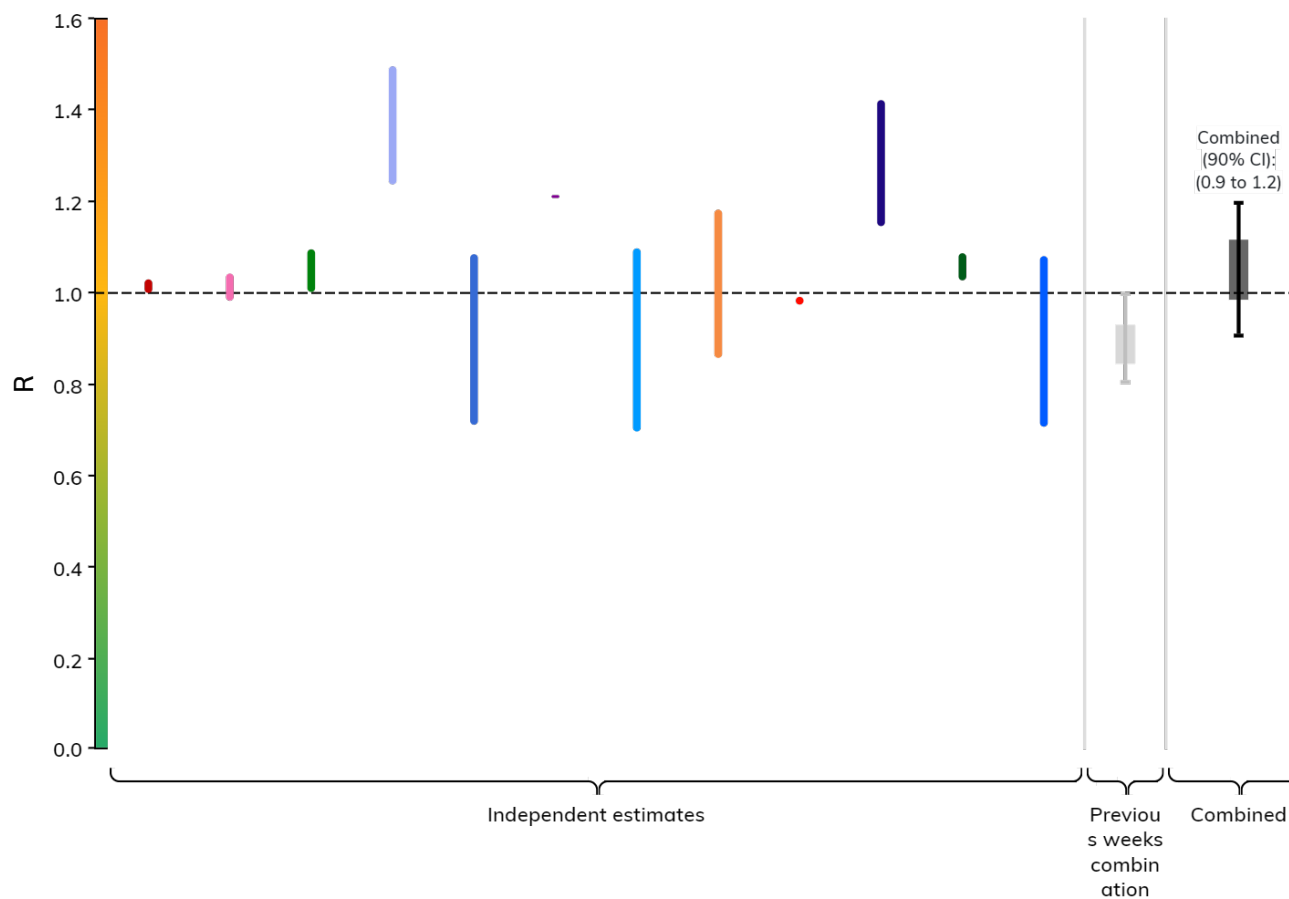


Figure 1b. Estimates of R in the 4 UK nations (90% credible intervals) as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

Wales

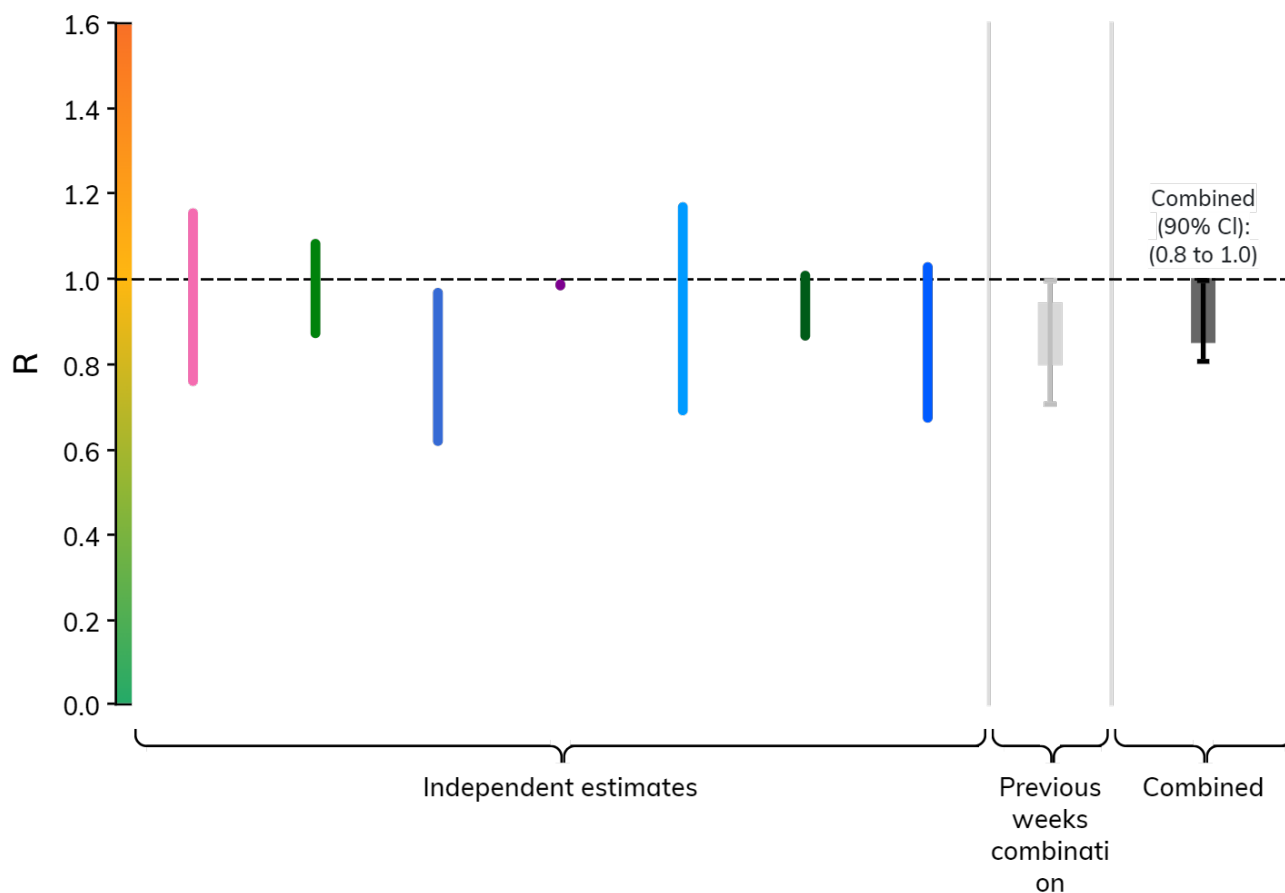


Figure 1c. Estimates of R in the 4 UK nations (90% credible intervals) as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

Scotland

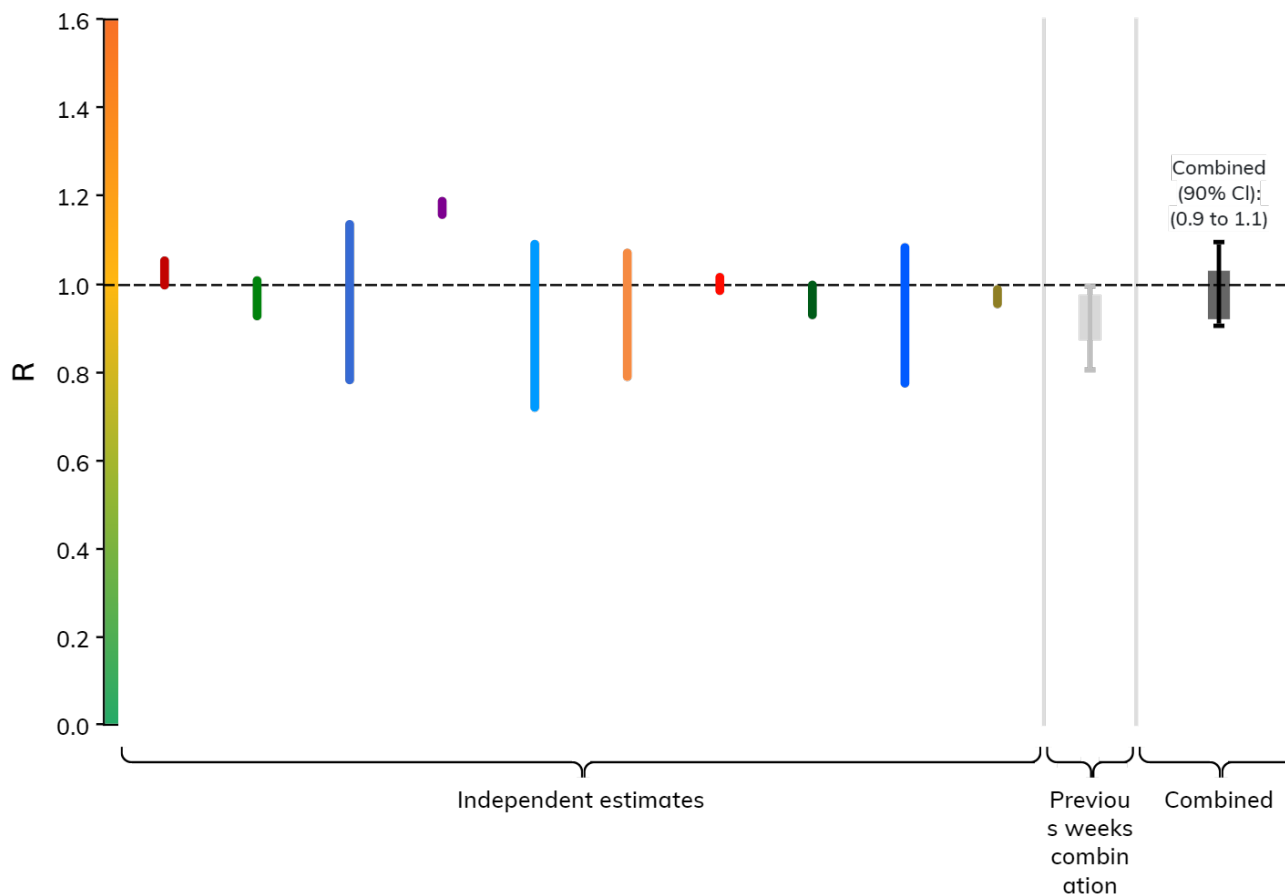


Figure 1d. Estimates of R in the 4 UK nations (90% credible intervals) as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

Northern Ireland

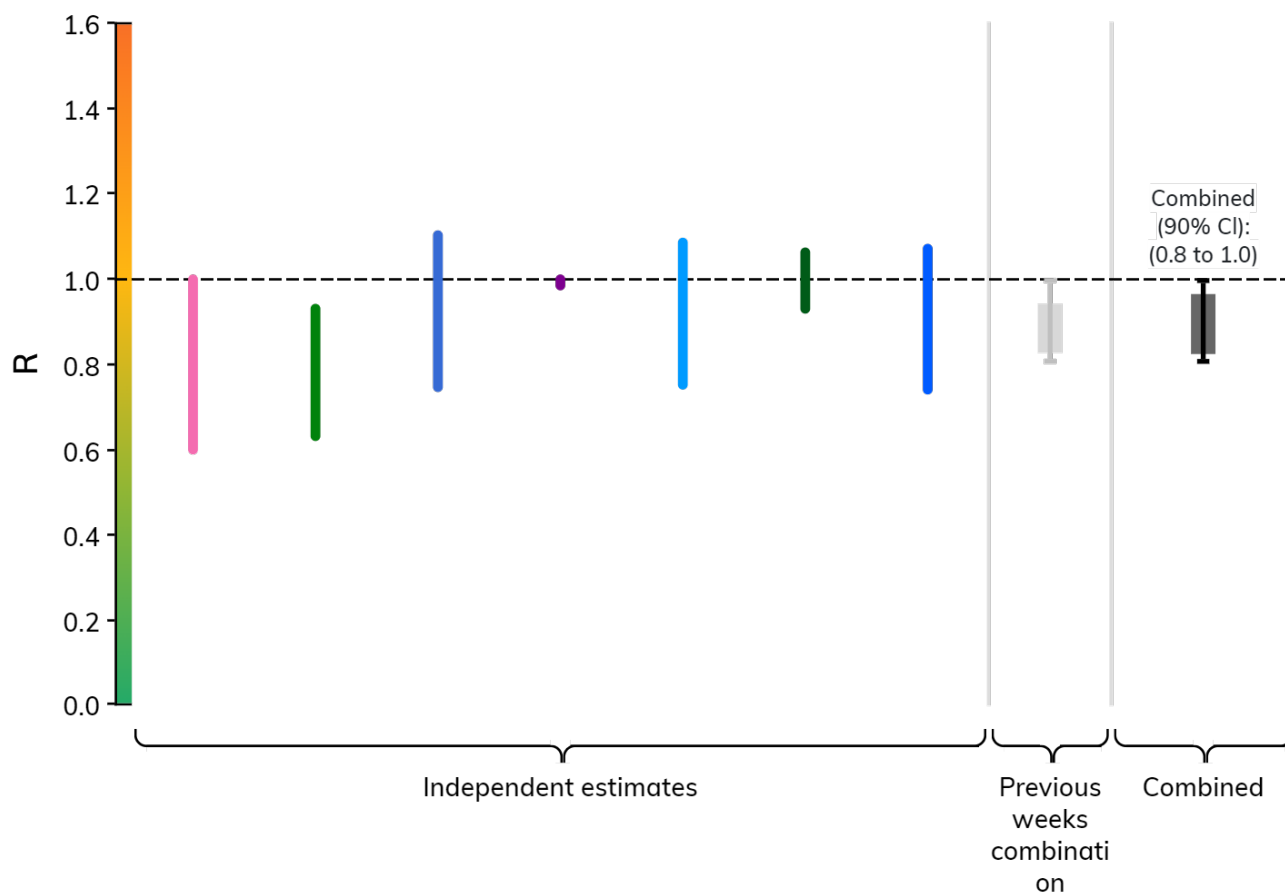


Figure 2a. Estimates of the growth rate in the 4 UK nations, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

England

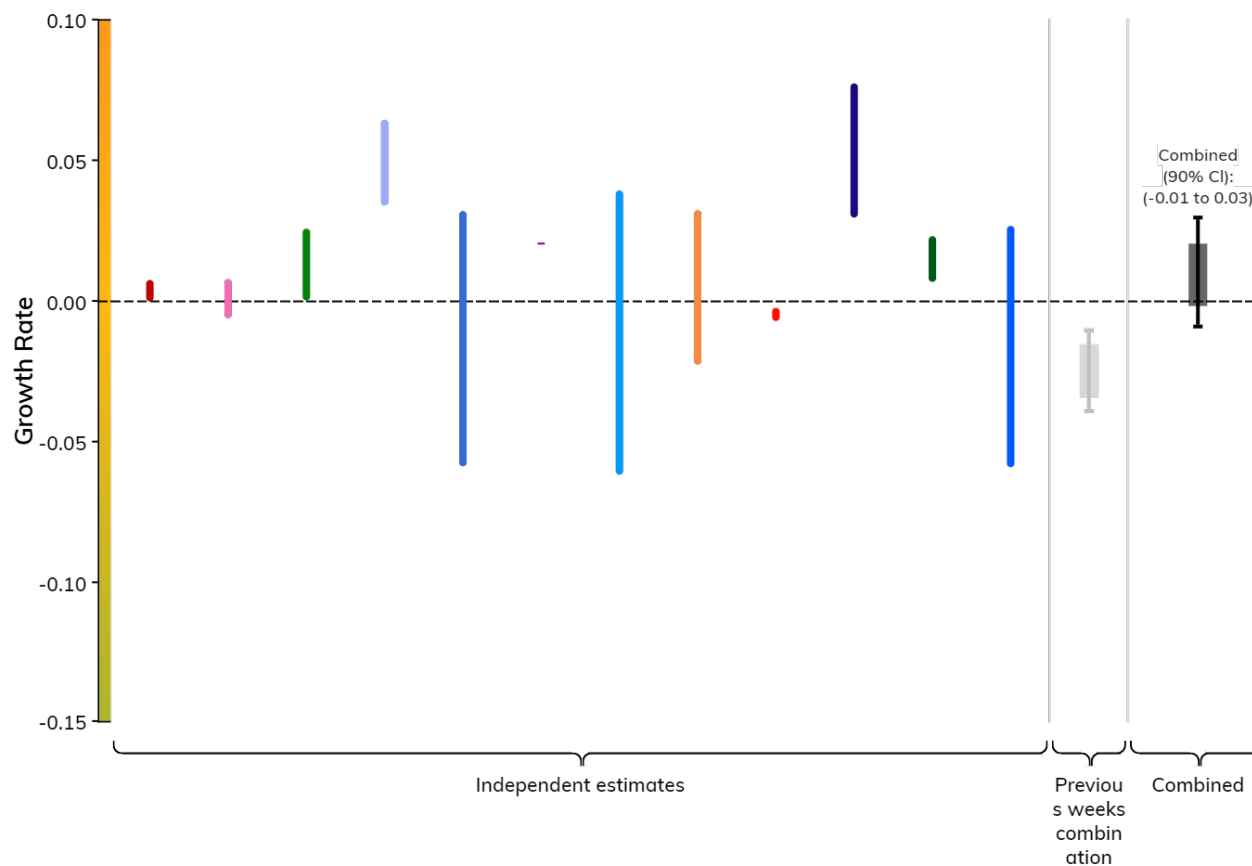


Figure 2b. Estimates of the growth rate in the 4 UK nations, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

Wales

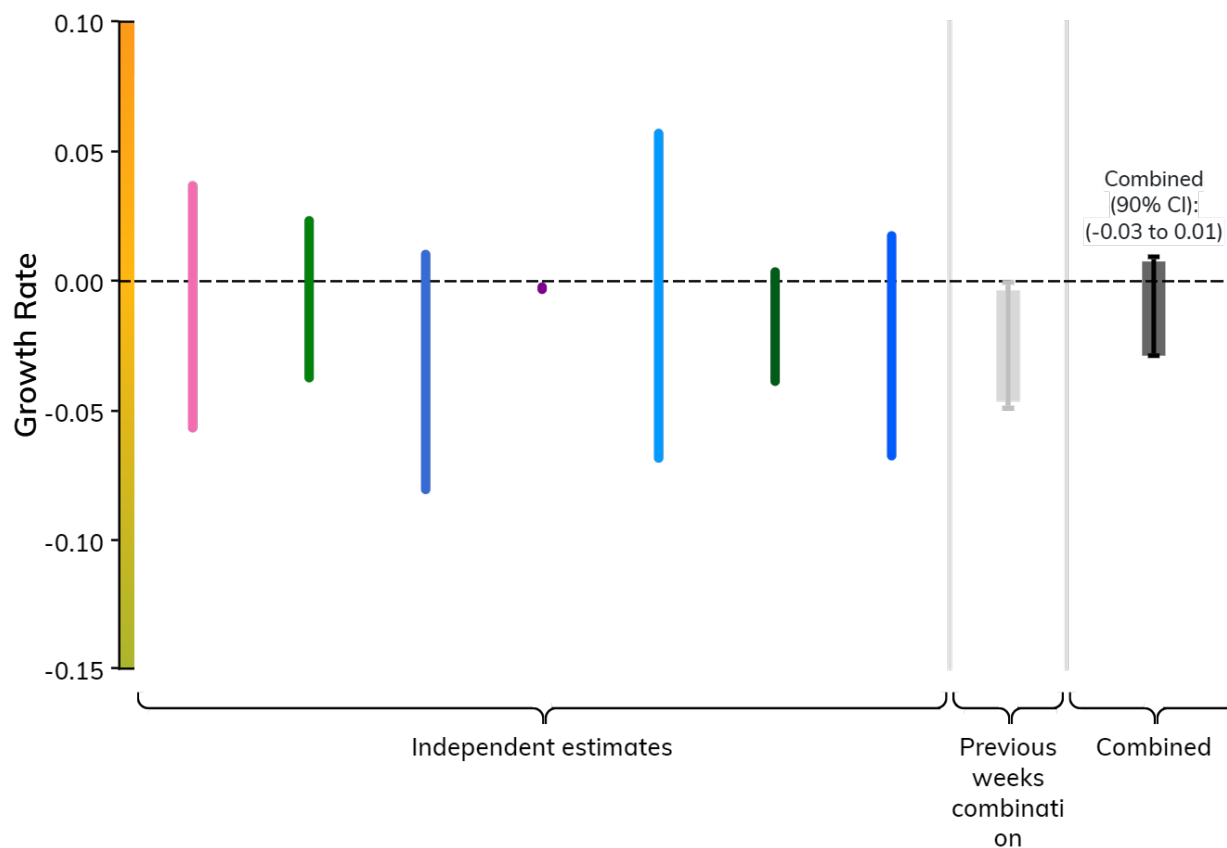


Figure 2c. Estimates of the growth rate in the 4 UK nations, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

Scotland

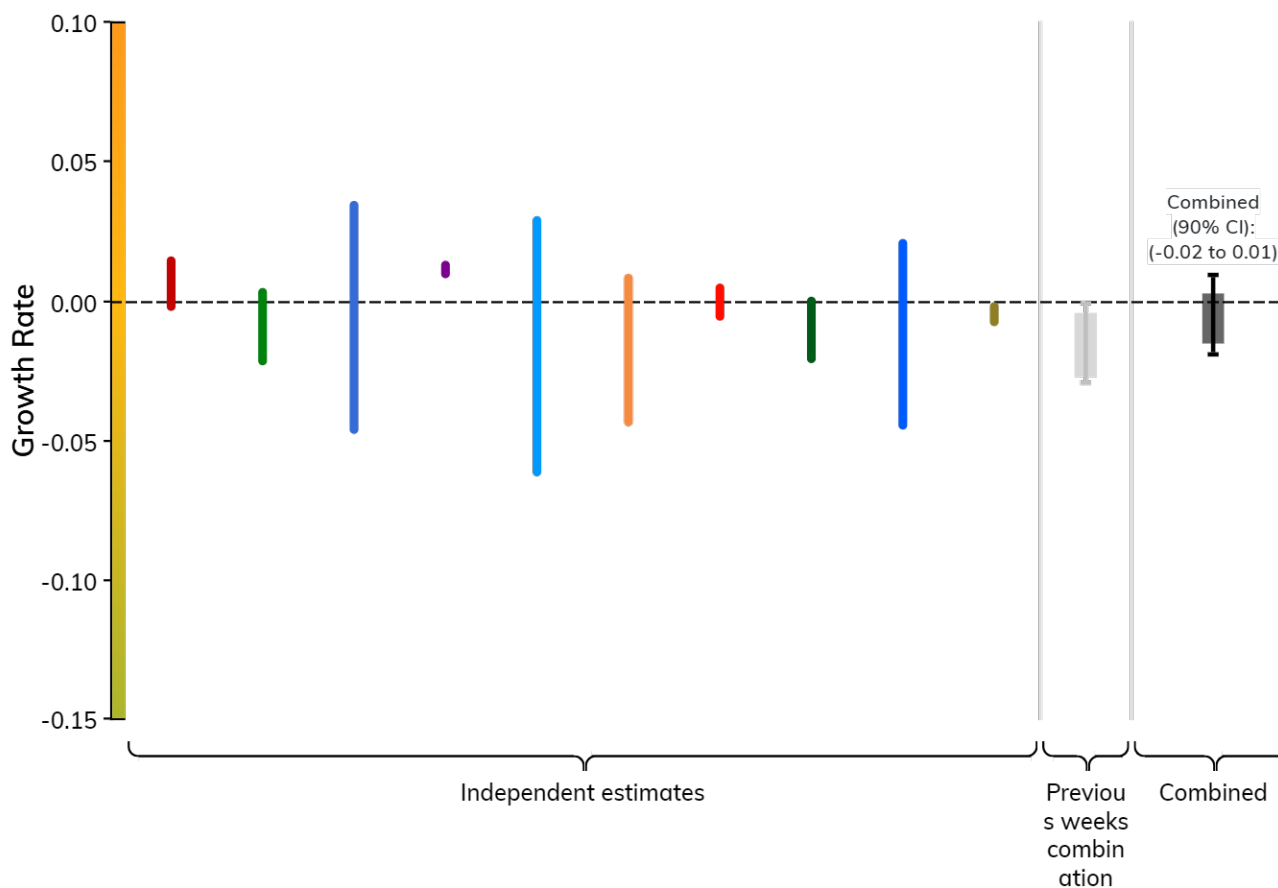


Figure 2d. Estimates of the growth rate in the 4 UK nations, including 90% credible intervals as at 22 November 2022

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Northern Ireland

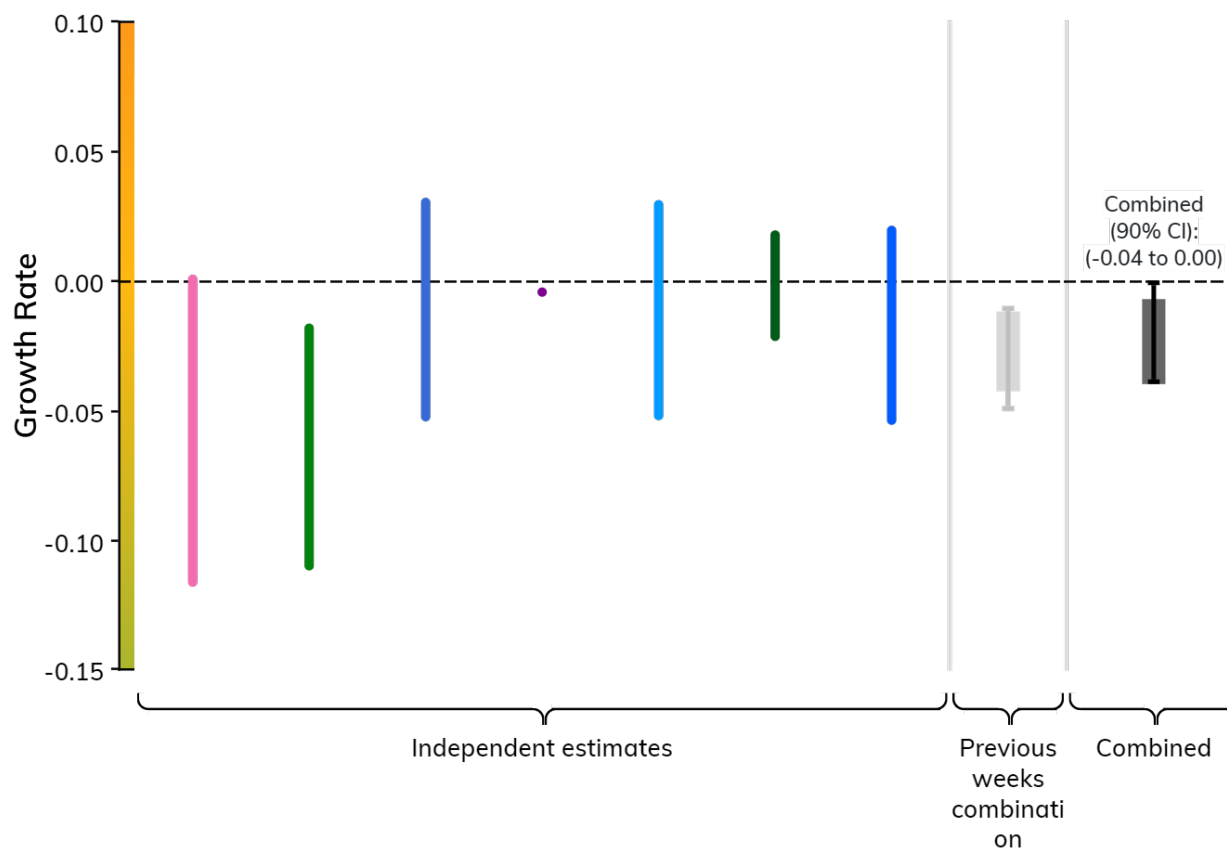


Figure 3a. Estimates of R in the NHS England regions, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

London

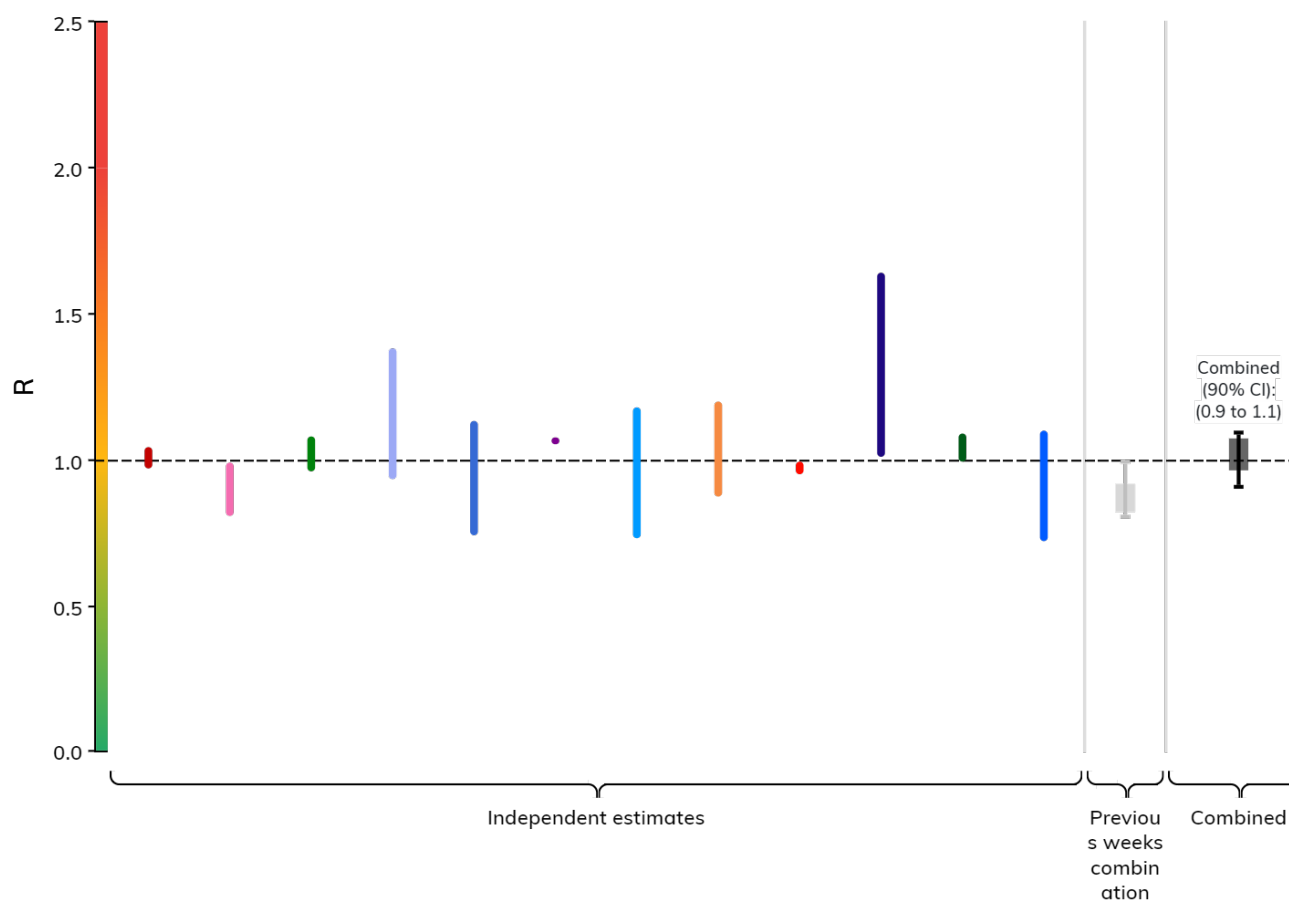


Figure 3b. Estimates of R in the NHS England regions, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

East of England

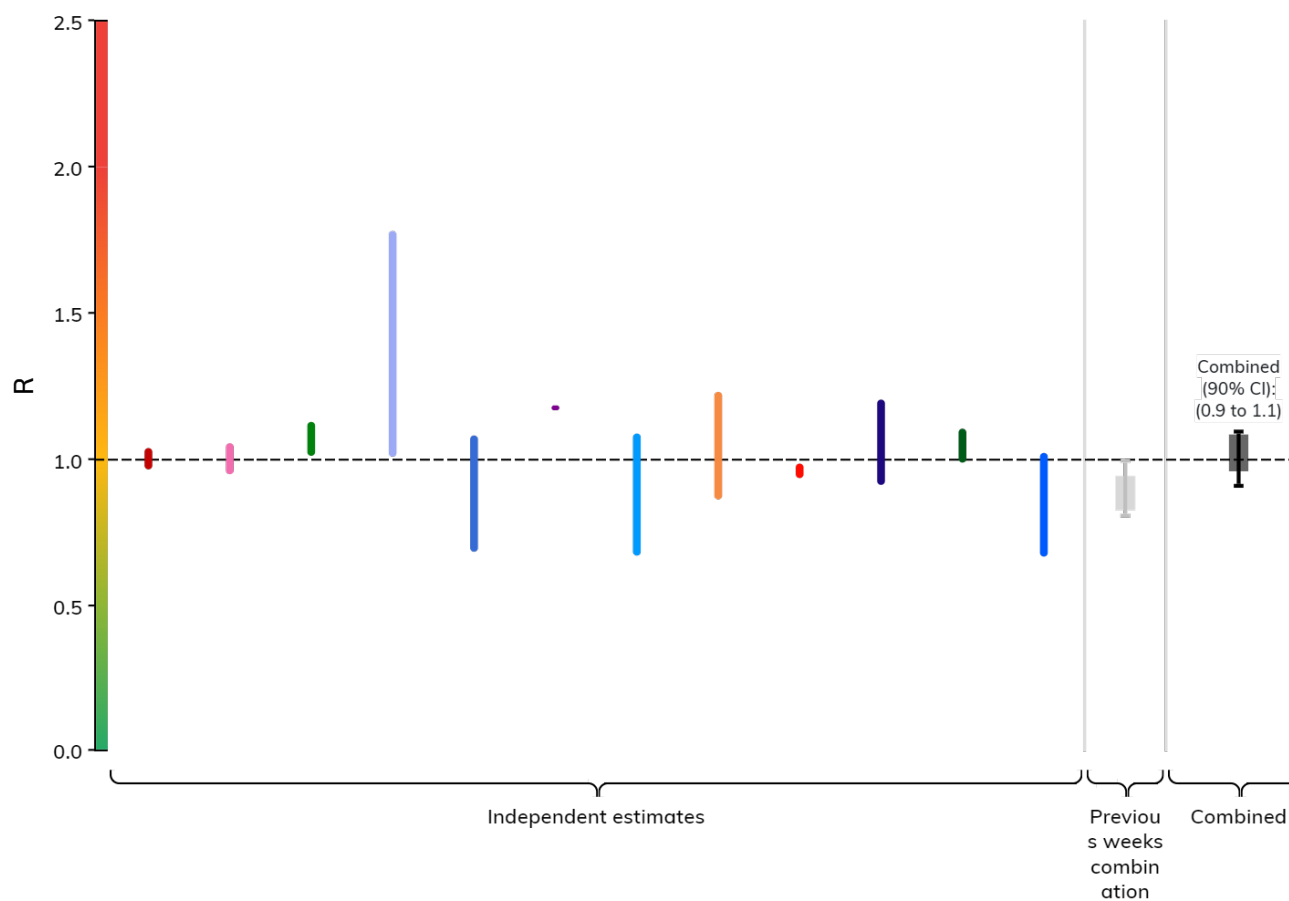


Figure 3c. Estimates of R in the NHS England regions, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

Midlands

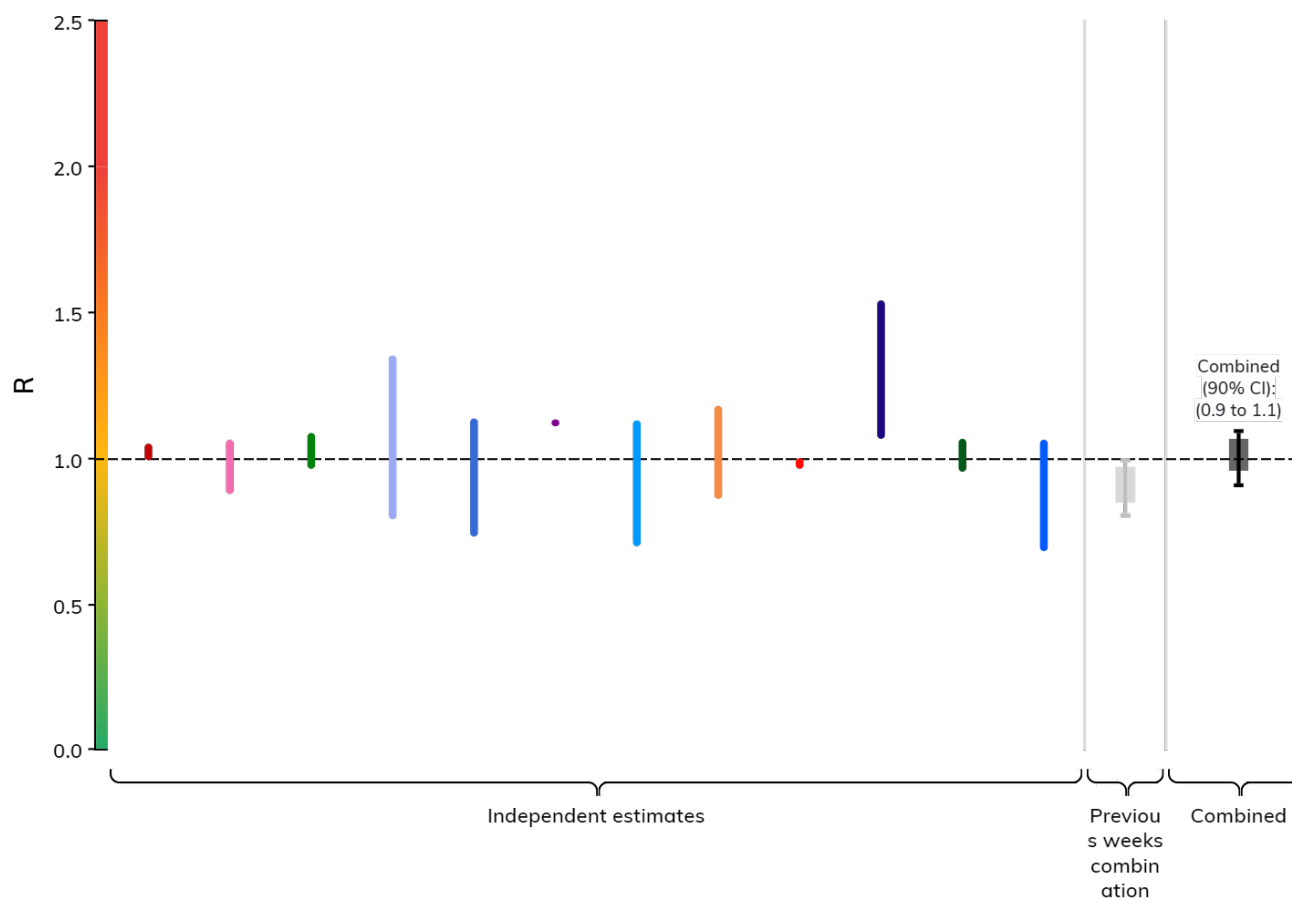


Figure 3d. Estimates of R in the NHS England regions, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

North East and Yorkshire

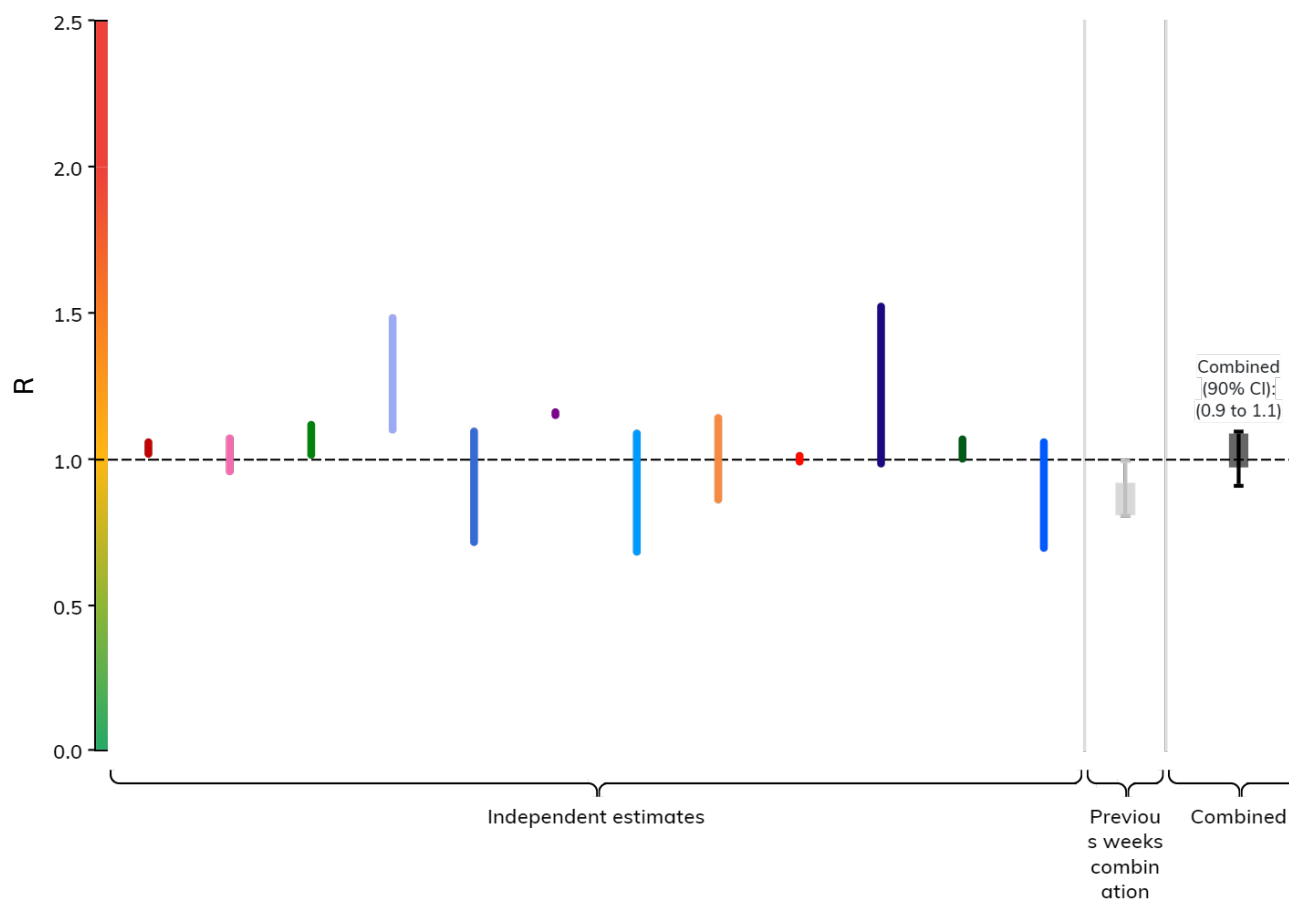


Figure 3e. Estimates of R in the NHS England regions, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

North West

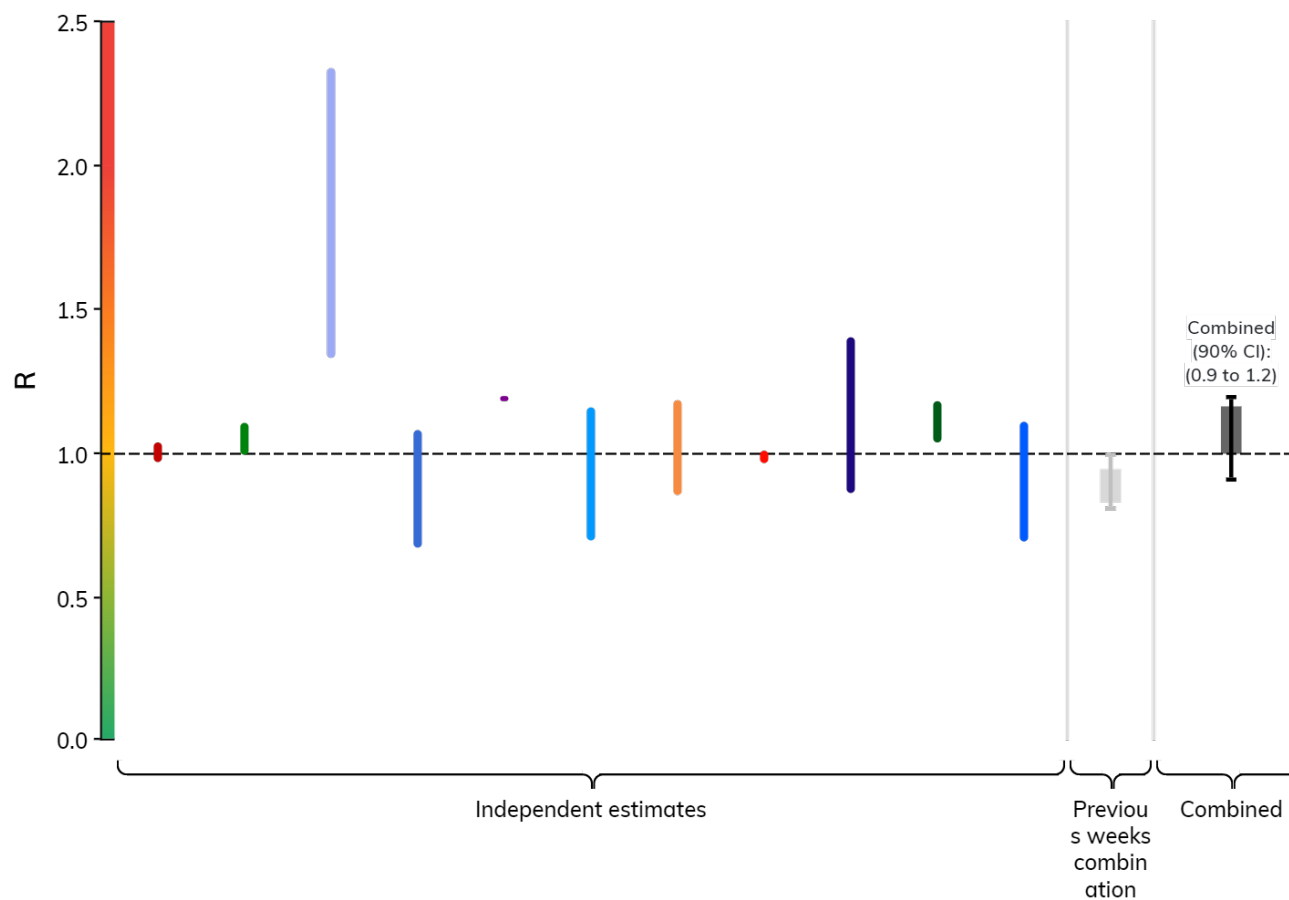


Figure 3f. Estimates of R in the NHS England regions, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

South East

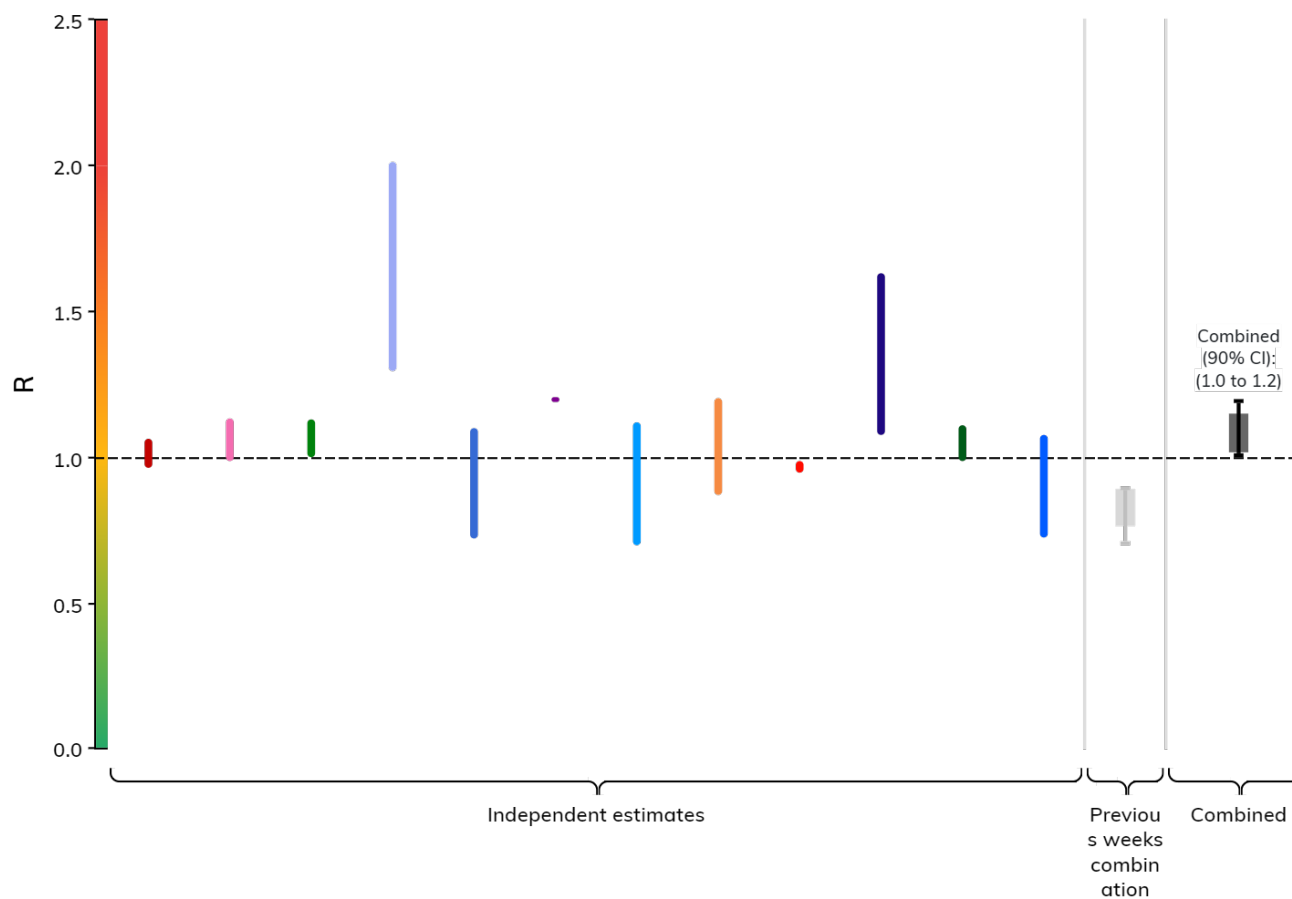
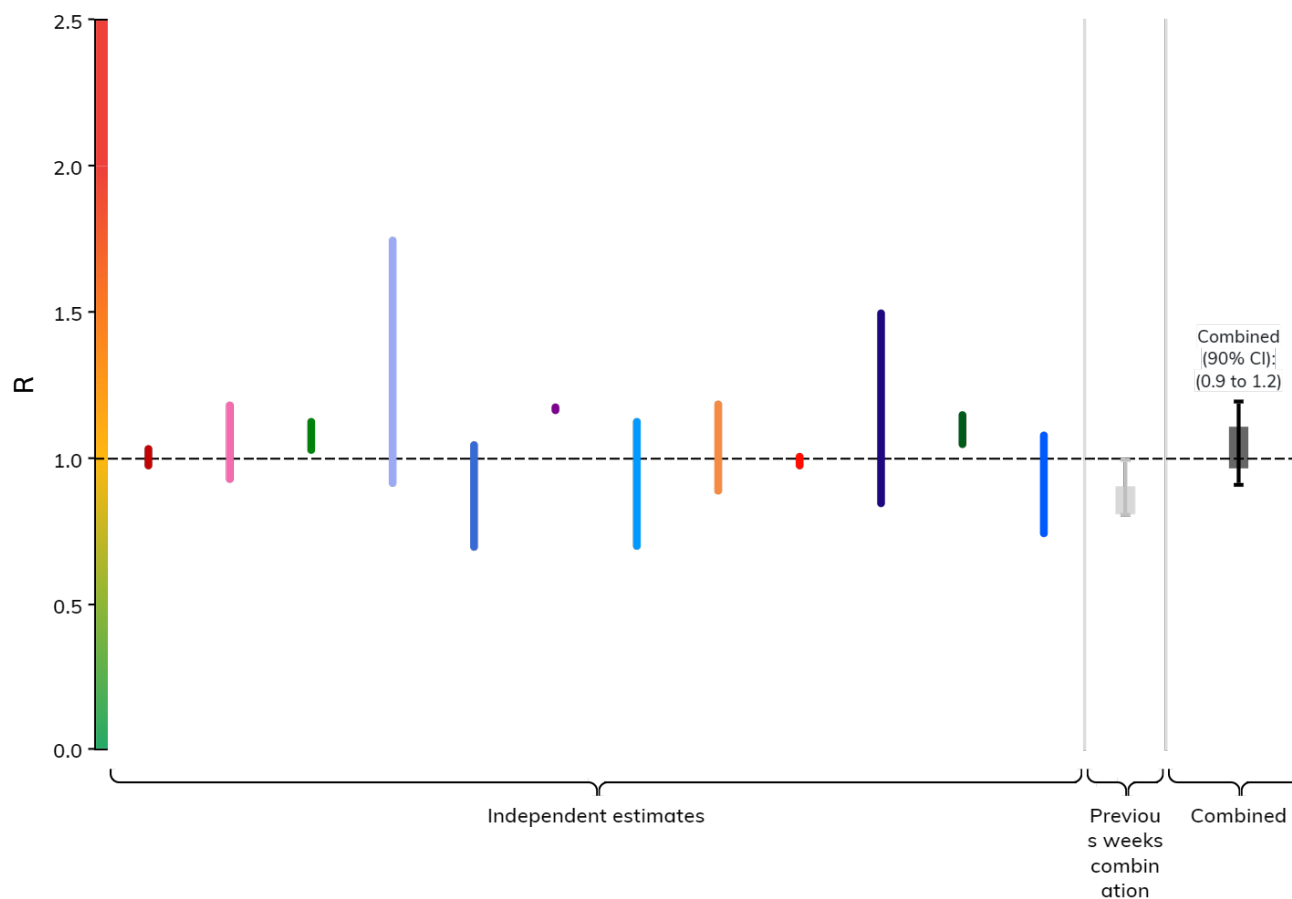


Figure 3g. Estimates of R in the NHS England regions, including 90% credible intervals as at 22 November 2022

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. Previous weeks' combination reflects estimate at 8 November 2022.

South West



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