



UK Health
Security
Agency

Epidemiology Modelling Review Group: consensus statement on COVID-19

Date: 26 January 2022

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 0.7 and 0.9. R is estimated to be between 0.5 and 1.0 for Wales, 0.7 and 0.9 for Scotland, and 0.8 and 1.1 for Northern Ireland ([Figure 1](#)). These estimates are based on models¹ fit to data available up to 24 January 2022 where feasible, including hospitalisations, deaths, testing, wastewater samples and longitudinal studies.
2. Changes to testing guidelines (suspension of confirmatory PCR testing)² has made trends in data streams used in this report less clear; some of the decline in case numbers may be due to changes in testing, to an uncertain degree.
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 estimates³ show that the incidence⁴ is between 122,000 and 220,000 new infections per day in England.

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 [Confirmatory PCR tests to be temporarily suspended for positive lateral flow test results - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/news/confirmatory-pcr-tests-to-be-temporarily-suspended-for-positive-lateral-flow-test-results)

³ 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.

⁴ The number of new infections per day.

Incidence and prevalence

5. During its most recent week (ending 22 January 2022), the ONS COVID-19 Infection Survey estimates⁵ that an average of 2,629,400 people had COVID-19 in the community in England (95% credible interval 2,542,500 to 2,716,500). The survey does not include people in care homes, hospitals or prisons. Estimates from across the 4 nations of the UK are:
- England 2,629,400 (95% credible interval 2,542,500 to 2,716,500)
 - Scotland 163,600 (95% credible interval 143,600 to 184,500)
 - Wales 99,500 (95% credible interval 83,300 to 117,100)
 - Northern Ireland 96,500 (95% credible interval 81,600 to 112,700)

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.⁶

6. The EMRG's consensus estimates for the growth rates in the 4 nations are (90% credible interval):
- England is between -6% to -2% per day
 - Wales is between -11% to 0% per day
 - Scotland is between -8% to -2% per day
 - Northern Ireland is between -5% to +3% 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 0.7 and 0.9. R is estimated to be between 0.5 and 1.0 for Wales, 0.7 and 0.9 for Scotland, and 0.8 and 1.1 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. Changes to testing guidelines (suspension of confirmatory PCR testing)⁷, have and continue to make trends in data streams less clear; changes in case numbers may be in part due to

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](https://plus.maths.org).

⁷ [Confirmatory PCR tests to be temporarily suspended for positive lateral flow test results - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

changes in testing, to an uncertain degree. There is variation in individual model estimates, particularly for Wales and Northern Ireland, reflecting uncertainty in trends.

10. 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. Therefore, while epidemic estimates for R and other metrics such as growth rate, use the latest data available up to 24 January 2022, where feasible⁹, the estimates reported here represent the epidemic situation as at 11 January 2022.
11. Early analysis suggests that the risk of being reinfected (having COVID more than once) is higher with Omicron than other variants¹⁰. However, in all nations (except Wales) if a person has had more than one positive SARS-CoV-2 test, they are only counted as one case, at present. This means that models using case data may underestimate transmission, further adding to uncertainty.
12. 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.
13. 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.
14. 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 incidence¹¹, and prevalence¹². When prevalence is very high, even if R is at, or below, 1, the absolute number of new cases will be very high.

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.

⁹ Different models fit to different windows of time using different methodologies, hence not all models will fit up to this precise date.

¹⁰ Commentary on this can be found in UKHSA variants technical briefing: [SARS-CoV-2 variants of concern and variants under investigation \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/106444/sars-cov-2-variants-of-concern-and-variants-under-investigation.pdf)

¹¹ The number of individuals who develop the disease within a specified time period

¹² 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 ¹³ |
|------------------|------------|-------------------|-----------------------------|
| England | 0.7 to 0.9 | -6% to -2% | -24 days to -13 days |
| Wales | 0.5 to 1.0 | -11% to 0% | -6 days to flat |
| Scotland | 0.7 to 0.9 | -8% to -2% | -32 days to -9 days |
| Northern Ireland | 0.8 to 1.1 | -5% to +3% | -14 days to 28 days |

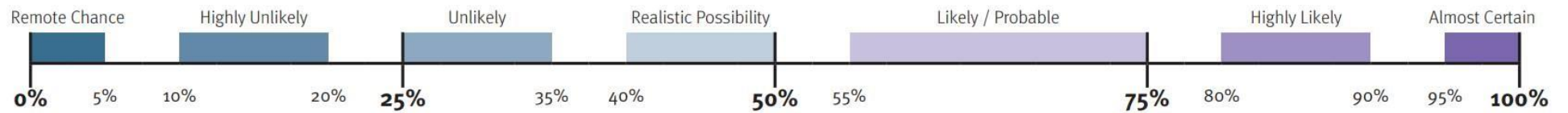
Table 2. Combined estimates of R values growth rates and doubling times in the NHS England regions (90% credible interval)

| NHS England region | R | Daily growth rate | Doubling time ¹³ |
|------------------------|------------|-------------------|-----------------------------|
| England | 0.7 to 0.9 | -6% to -2% | -24 days to -13 days |
| London | 0.6 to 0.9 | -8% to -3% | -19 days to -9 days |
| East of England | 0.7 to 1.0 | -6% to -1% | -12 days to flat |
| Midlands | 0.6 to 0.9 | -7% to -3% | -19 days to -9 days |
| North East & Yorkshire | 0.7 to 1.0 | -6% to -1% | -12 days to flat |
| North West | 0.5 to 0.8 | -10% to -5% | -14 days to -7 days |
| South East | 0.7 to 1.0 | -7% to -1% | -38 days to -10 days |
| South West | 0.7 to 1.0 | -5% to +1% | -14 days to flat |

¹³ 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

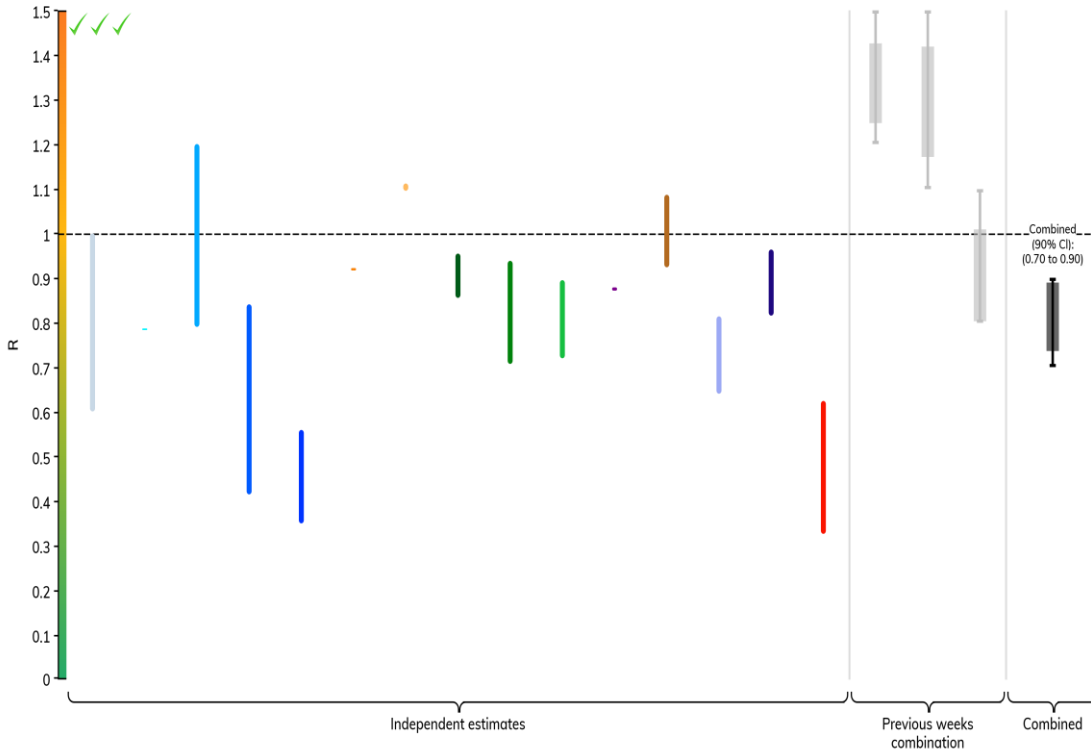
UKHSA takes responsibility for this consensus statement and its contents. However, UKHSA would like to acknowledge the work of SPI-M-O and academic partners in developing methodologies and sharing these, as well as continuing to contribute model outputs to the combined estimates. These estimates include 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 11 January 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.

England



Wales

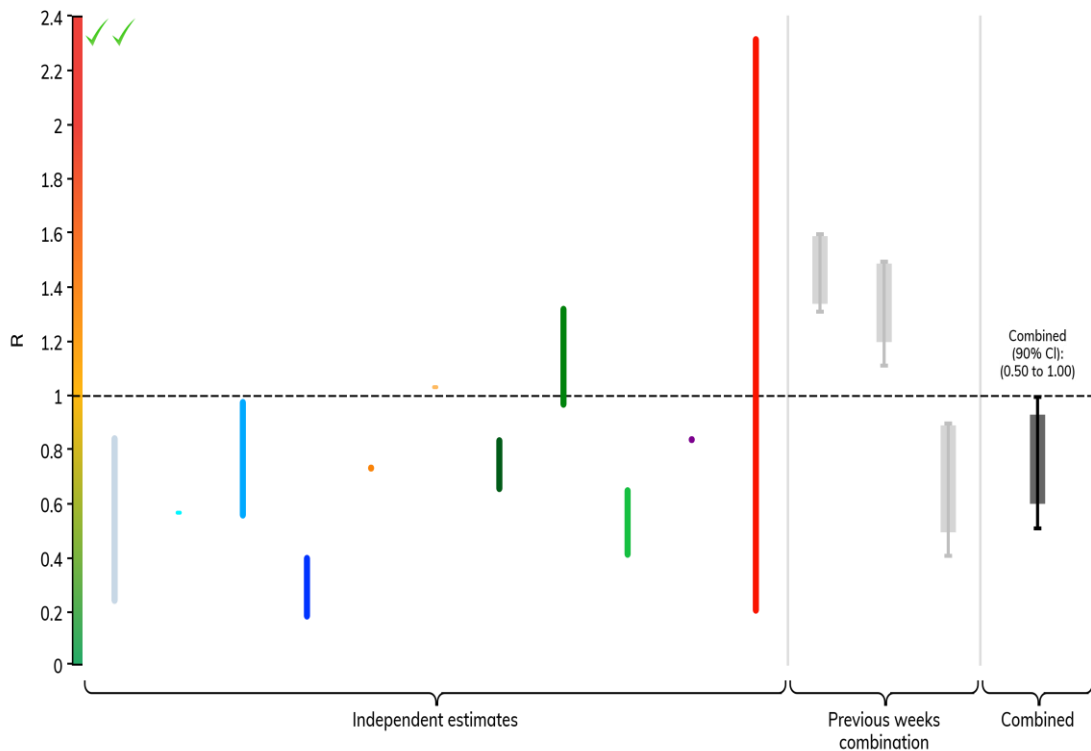
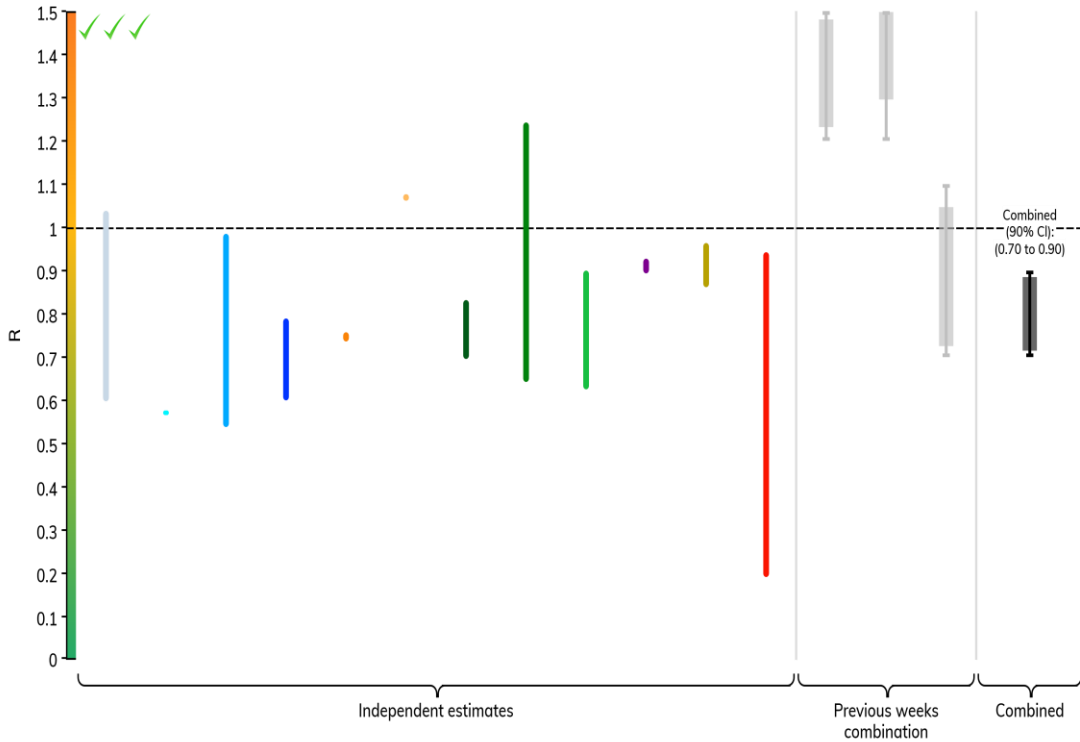


Figure 1b. Estimates of R in the 4 UK nations (90% credible intervals) as at 11 January 2022
 Bars represent different independent estimates. The grey shaded areas represent the combined numerical range and the black bars are the combined range after rounding outwards to one decimal place.

Scotland



Northern Ireland

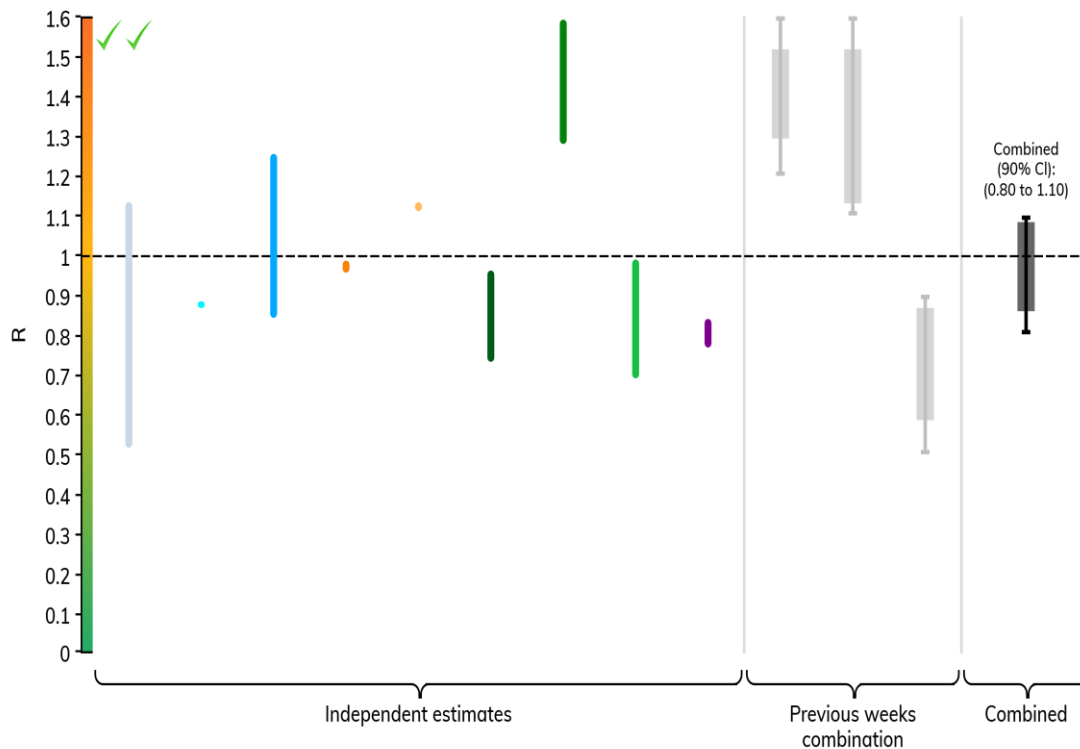
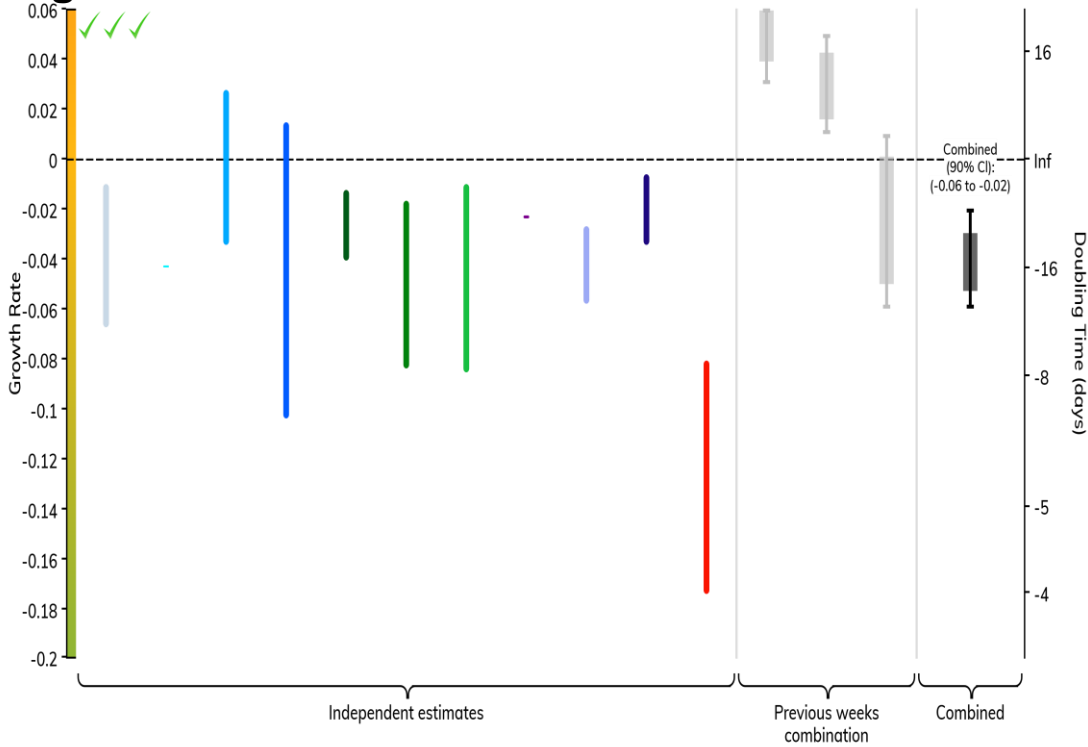


Figure 2a. Estimates of the growth rate in the 4 UK nations, including 90% credible intervals as at 11 January 2022

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.

England



Wales

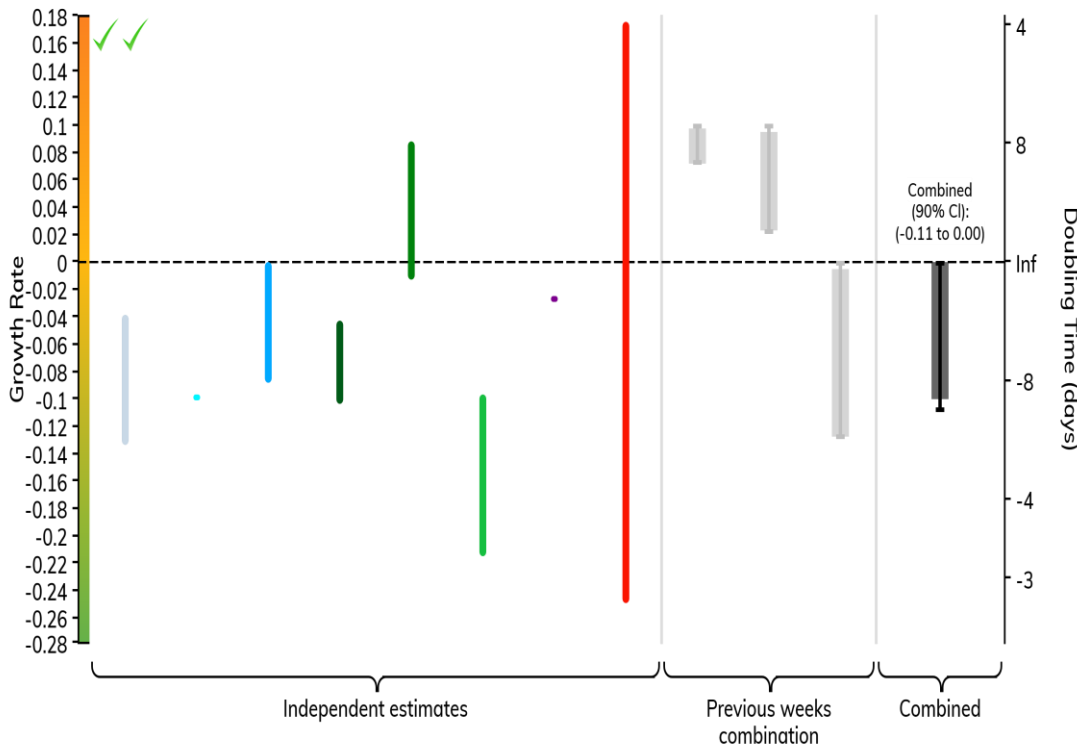
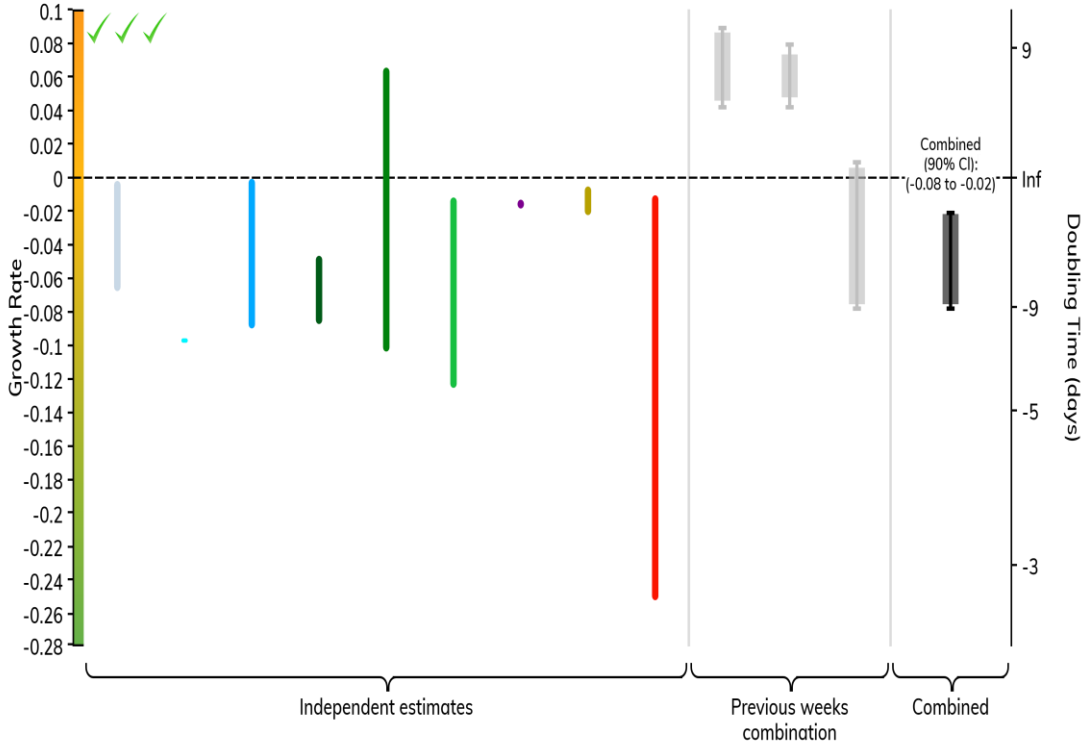


Figure 2b. Estimates of the growth rate in the 4 UK nations, including 90% credible intervals as at 11 January 2022

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.

Scotland



Northern Ireland

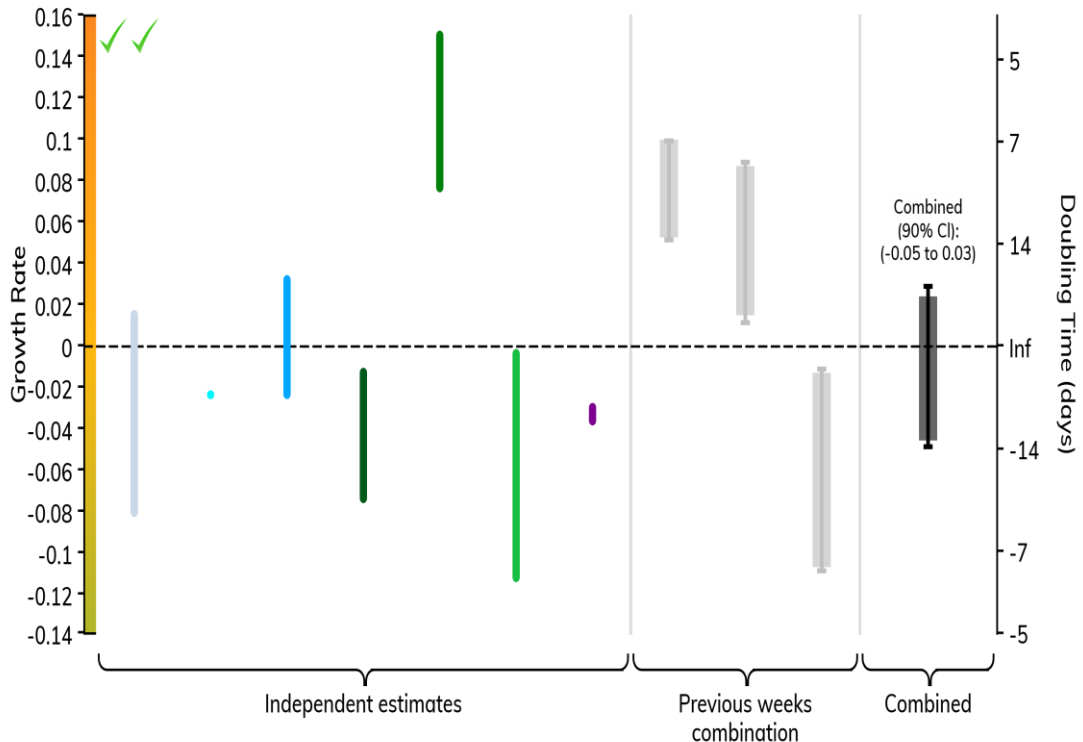
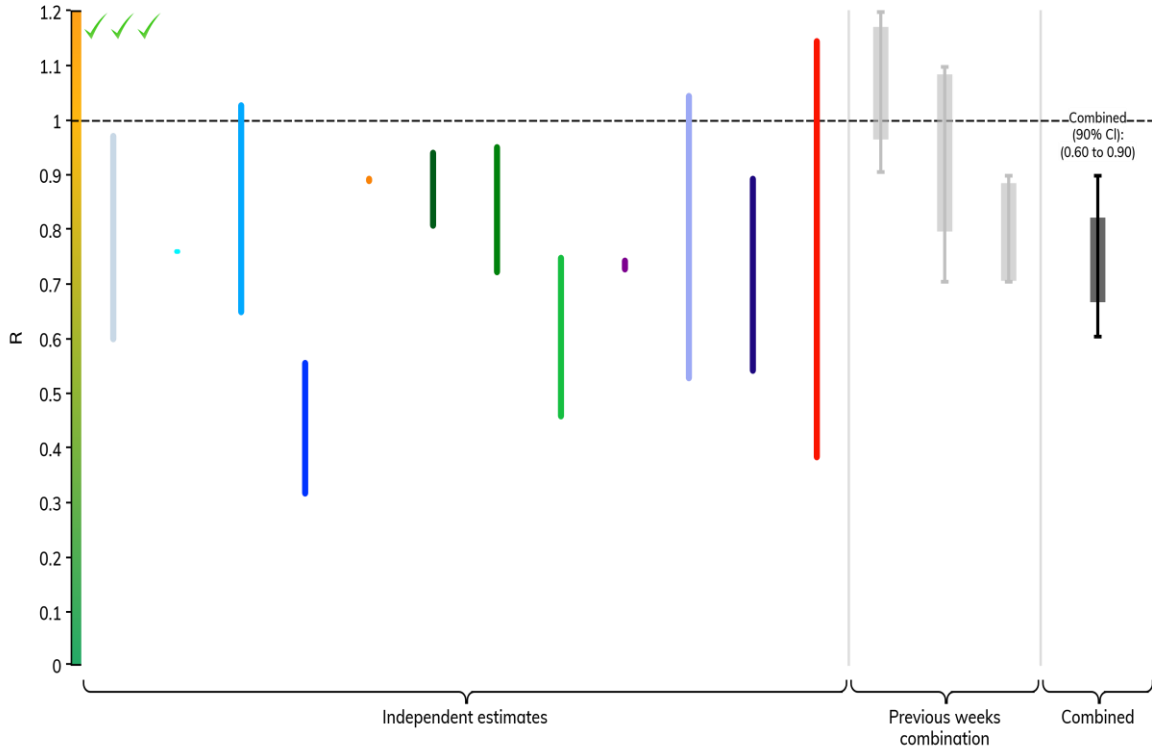


Figure 3a. Estimates of R in the NHS England regions, including 90% credible intervals as at 11 January 2022

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.

London



East of England

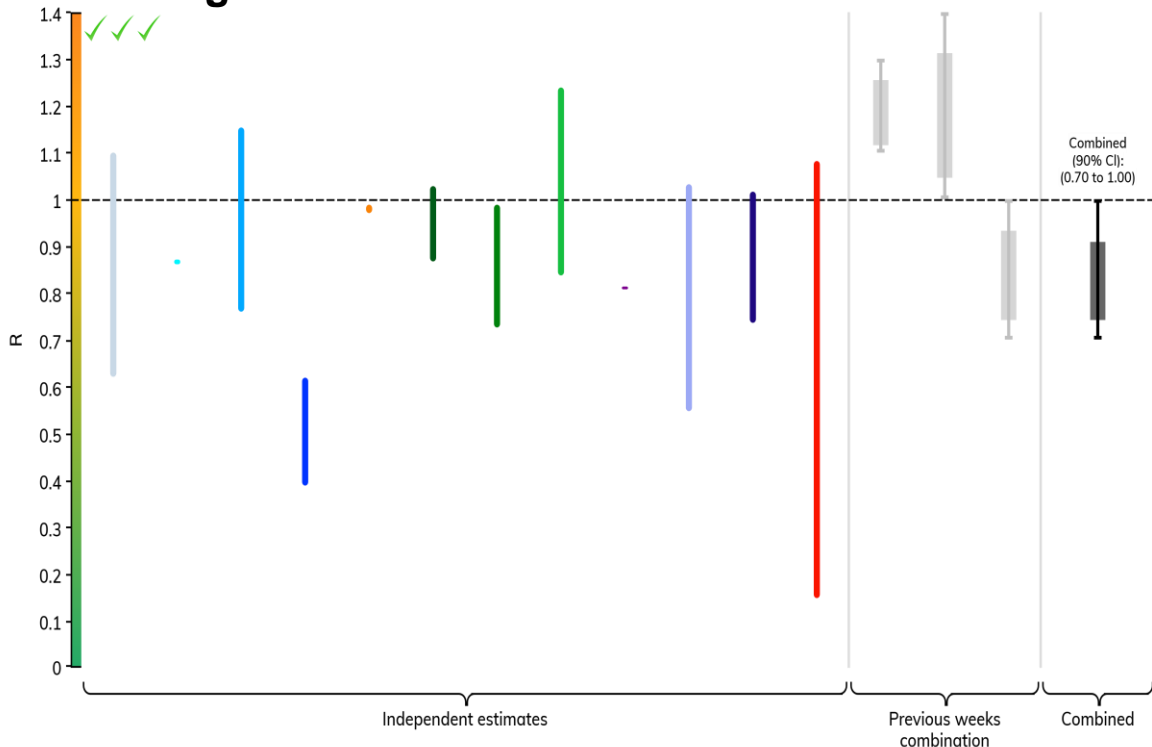
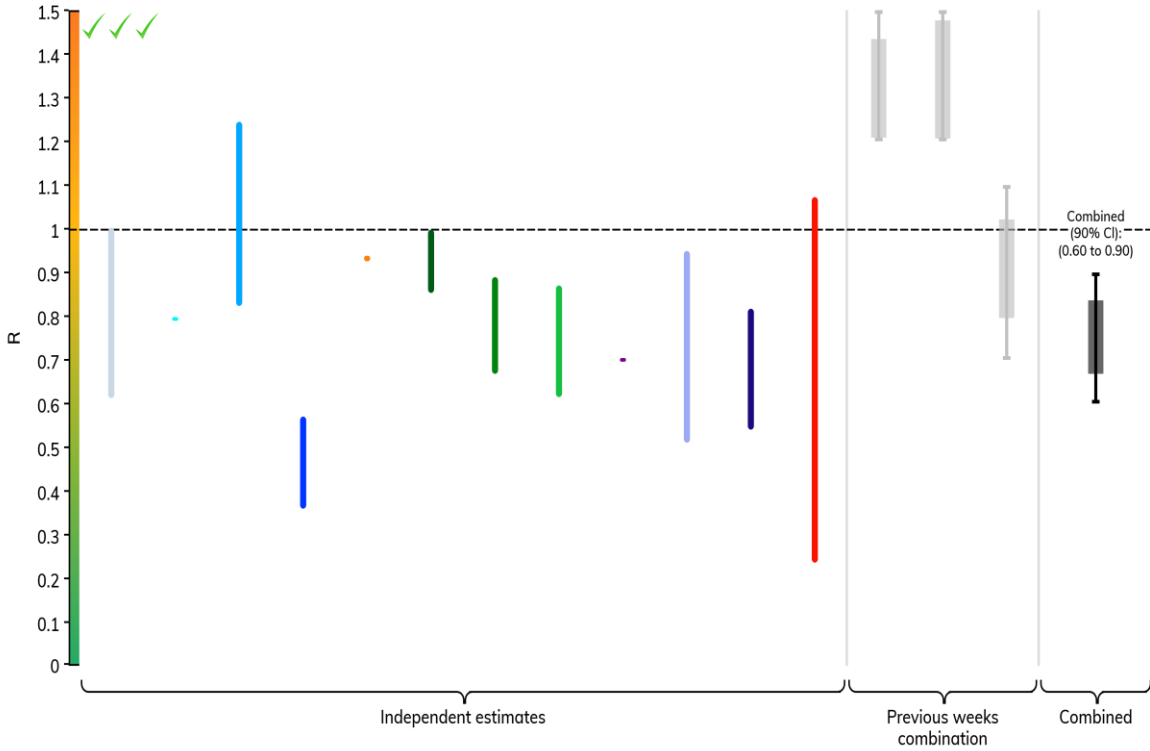


Figure 3b. Estimates of R in the NHS England regions, including 90% credible intervals as at 11 January 2022

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.

Midlands



North East and Yorkshire

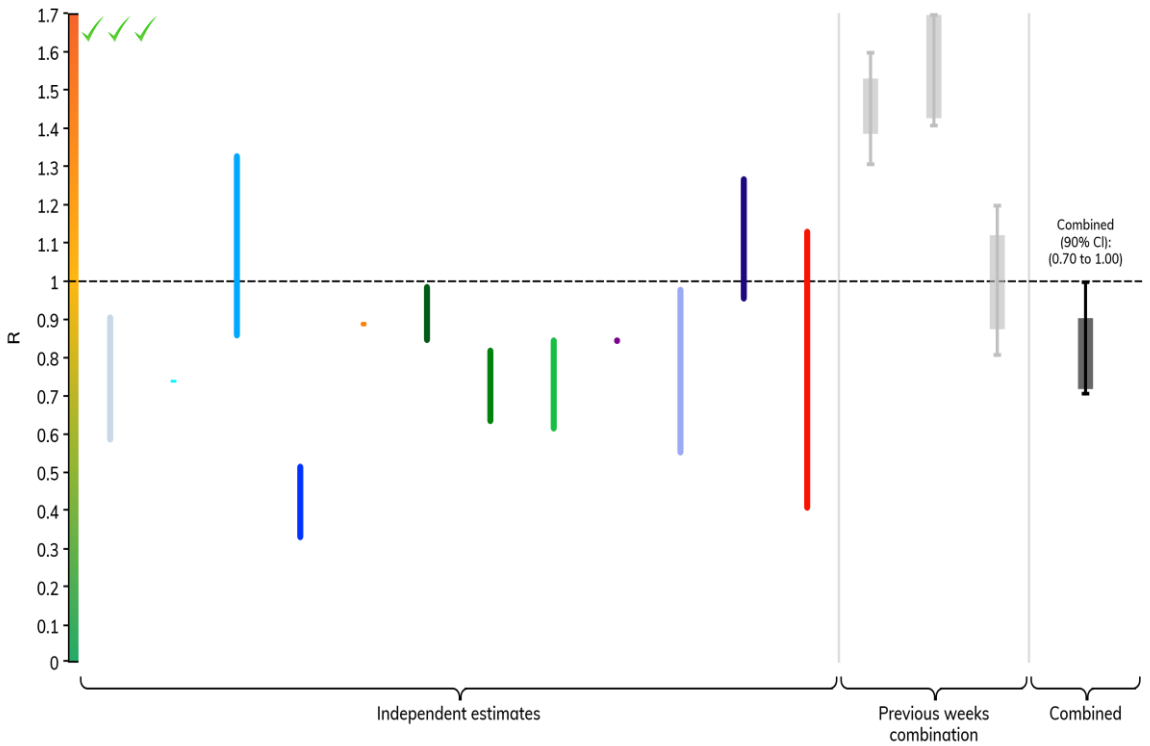
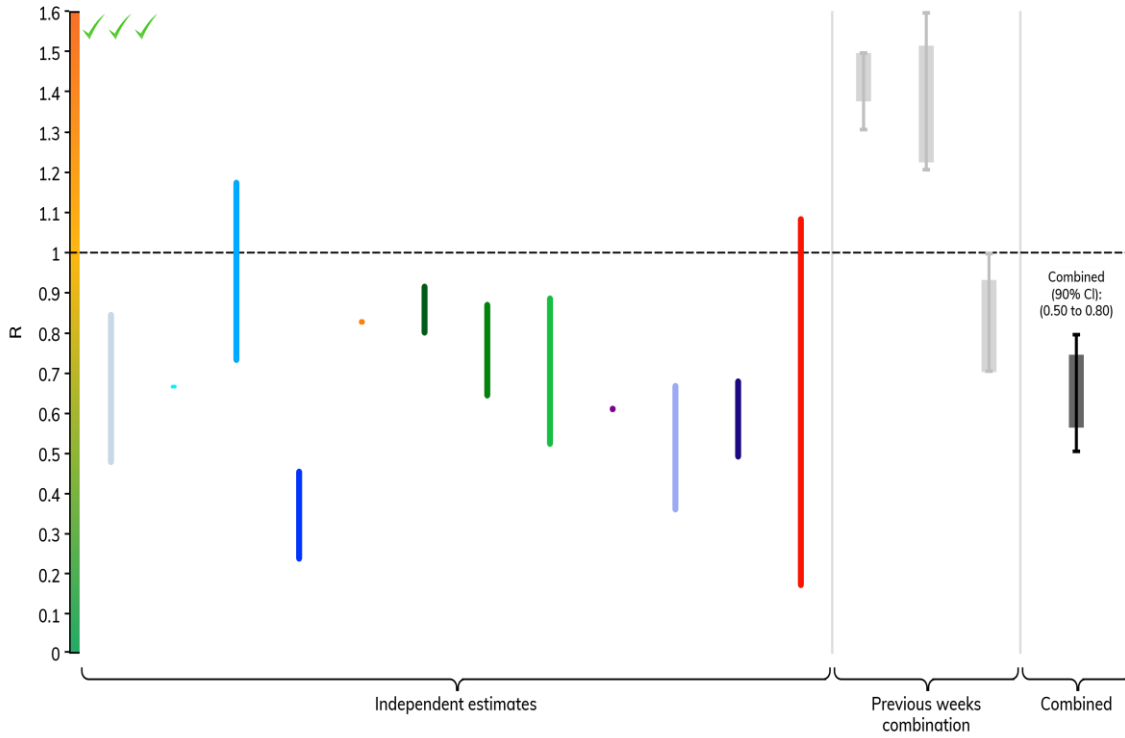


Figure 3c. Estimates of R in the NHS England regions, including 90% credible intervals as at 11 January 2022

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.

North West



South East

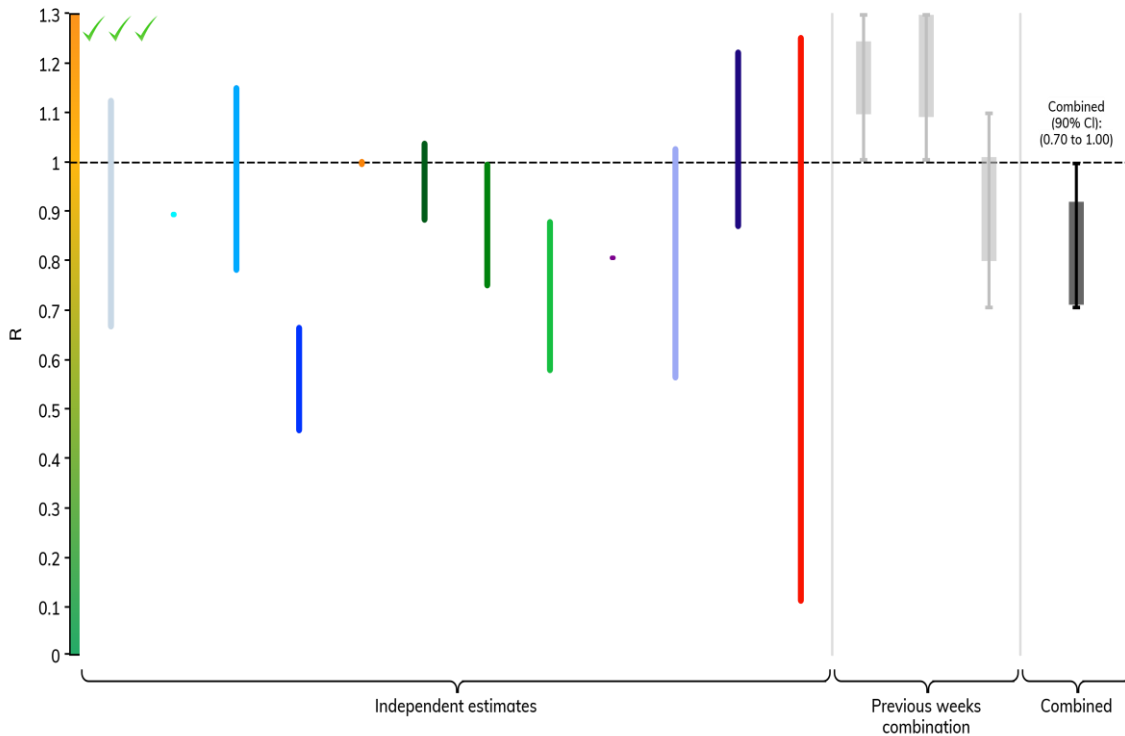
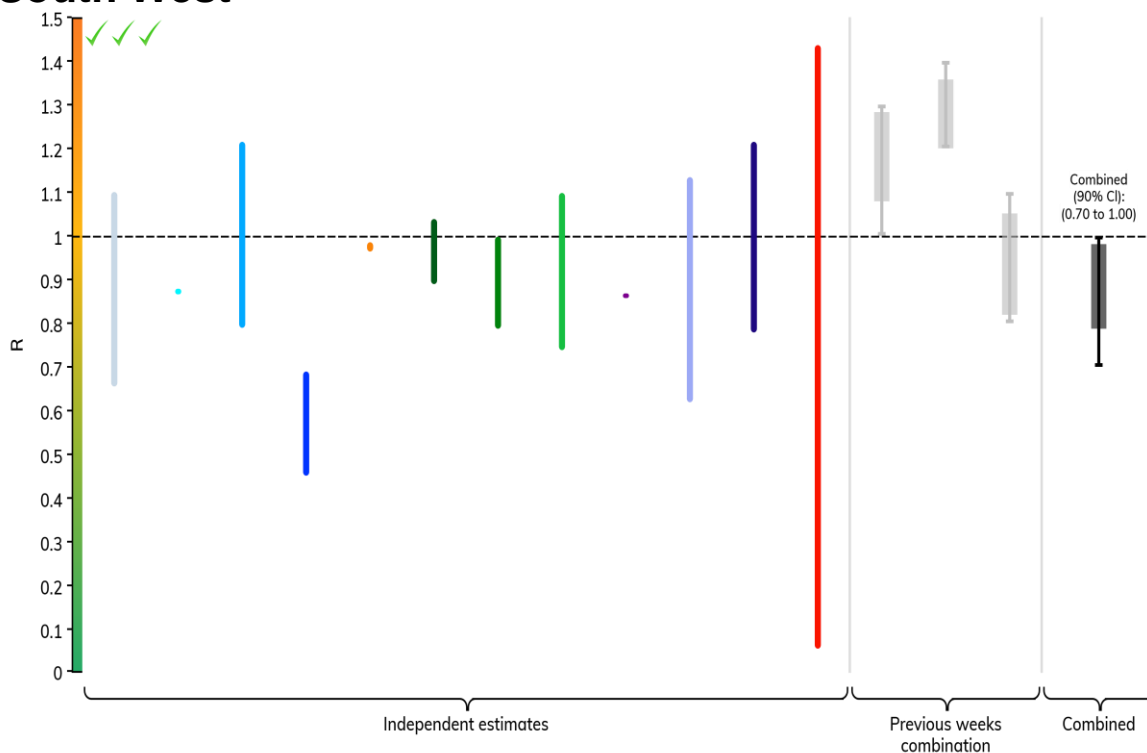


Figure 3d. Estimates of R in the NHS England regions, including 90% credible intervals as at 11 January 2022

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.

South West



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