

Note added for publication

This paper contains agreed SAGE estimates for the reproduction number (R) in the UK, as published by SAGE at the time.

It also contains estimates of R for nations and regions of the UK. Please note that these are estimates from individual modelling groups, and not agreed consensus estimates from SAGE.

R is an average value that can vary in different parts of the country, communities, and subsections of the population. It cannot be measured directly so there is always some uncertainty around its exact value. Regional estimates are subject to greater uncertainty given the lower number of cases and increased variation.

Different modelling groups use different data sources to estimate R using complex mathematical models that simulate the spread of infections. Some may even use all these sources of information to adjust their models to better reflect the real-world situation. There is uncertainty in all these data sources, which is why R estimates can vary between different models, and why we do not rely on one model; evidence is considered, discussed and R is presented as a range.

Given wide uncertainty ranges, it should not be concluded from estimates in this paper that R is higher or lower in different regions or nations.

SPI-M-O: Consensus Statement on COVID-19

Date: 20th May 2020

SIGNED OFF BY CHAIRS ON BEHALF OF MEMBERS

Summary

1. SPI-M-O's best estimate is that the overall reproduction number, R_t , in the UK is between 0.7 and 1.0. While it is highly likely to be under 1, it could be close to it.
2. Any changes in transmission that may have occurred in the past two weeks will not yet be reflected in clinical data, nor therefore in SPI-M-O's estimates of R_t .
3. There is little evidence of any variation in R_t in different UK nations or English regions, although there is greater uncertainty in estimates at this scale as the numbers of cases and deaths are smaller.
4. Incidence remains uncertain, with modelling estimates ranging from 10,000-60,000 new infections per day, in line with evidence from the ONS swabbing survey, the results of which imply a range of around 12,000 – 30,000. This range is higher than in previous weeks because SPI-M-O have considered a wider range of models, not because SPI-M-O think that the number of infections has increased. Uncertainty in this range is primarily due to differing assumptions on the proportion of infections that are asymptomatic; as further community surveys of swabbing and serological data become available, this uncertainty is expected to reduce.

Reproduction number

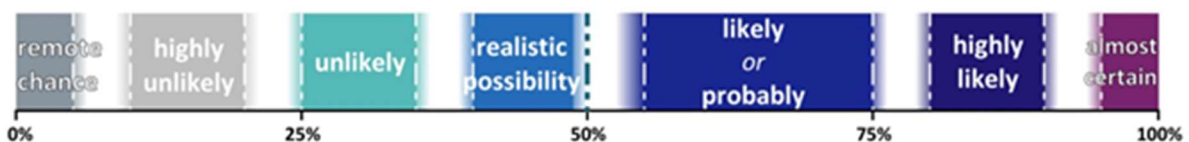
5. The reproduction number is the average number of secondary infections produced by a single infected individual. R_t is an average over time, geographies and communities. Whilst it varies in different parts of the of the population, teasing apart transmission within and between these parts increases uncertainty.
6. There are three settings which are particularly relevant to the current situation: the community, care homes, and hospitals. These are not independent; infection can be spread between hospitals and care homes, from these settings back into the community, and vice versa. These cannot be captured though estimating R_t separately for care homes and hospitals. **SPI-M-O recommends that the situation in particular settings is not monitored using R_t , but rather in terms of how the number of cases and deaths in them is changing and, where possible, epidemiological investigation of how the three epidemics interact.**
7. Estimates of R_t are dependent on differences in modelling methodology, the choice of data source used, the time frame considered, and will always carry some level of uncertainty. SPI-M-O's approach is for different modelling groups to independently estimate R_t to reflect this inherent uncertainty and to agree a consensus.
8. Any changes in R_t that may have occurred since social distancing measures were changed last week will not yet be reflected in the clinical data, nor therefore in SPI-M-O's estimates of R_t .
9. There is an inherent lag over which R_t can be estimated, and the uncertainty in its value will increase as the number of infections drop, or when it is evaluated over smaller regions.
10. SPI-M-O's best estimate is that the overall reproduction number in the UK is between 0.7 and 1.0. While it is highly likely to be under 1, it could be close to it.
11. It is the consensus view of SPI-M-O that the overall reproduction number has increased slightly in the past few weeks. This is because the number of cases in the community has decreased more quickly than the number in or seeded from care homes or hospitals. As a result, hospital or care home cases now represent a higher proportion of total cases. This means that the rate at which the overall epidemic is shrinking has slowed.
12. **Because the epidemics in different settings are interlinked, it is not the case that the larger drop in infections in the community implies that we have a "greater room for manoeuvre" whilst keeping R_t below 1.**

13. SPI-M modelling groups' estimates of R_t in different regions and nations of the UK vary. They are summarised in **Table 1** and **Figure 1** in Annex 2. **There is little evidence of regional variation in R_t .** Because the number of cases and deaths is smaller on a subnational level, there is greater uncertainty in our estimates of R_t . It is likely that R_t is less than one in all UK nations and regions.

Prevalence and incidence of COVID-19

14. The current number of new infections per day remains uncertain. Data from an ONS swabbing survey between 4th and 17th May suggests that an average of 137,000 people in England (confidence interval 85,000 to 208,000) would have swabbed positive with SARS-CoV-2 during that time, with no clear evidence of trend during that period.
15. Central estimates from different members of SPI-M-O for the incidence of infection (including those with no symptoms) range from 10,000-60,000 new infections per day. This range is higher than in previous weeks because different modellers have submitted estimates, not because SPI-M-O think that the number of infections has increased. If people are swab positive for around 7 days, the results of the ONS survey would imply that there were around 12,000 – 30,000 new infections per day during the period in question.
16. If R_t remains under 1, the number of new infections will continue to drop slowly.
17. As additional community swabbing and serological testing is carried out, our understanding of prevalence and incidence of COVID-19 in the population will improve, and help resolve some of the uncertainty in estimating R_t .

Annex 1: SAGE framework of language for discussing probabilities



Annex 2: Different groups' estimates of reproduction number

Table 1: SPI-M groups estimates of median R_t by region / nation including (95% confidence intervals). All rounded to the nearest 0.05.

Nation / Region	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
East of England	0.95 (0.80 – 1.10)	0.80 (0.75 – 0.82)	0.60 (0.55 – 0.70)	0.75 (0.70 – 0.77)	0.75 (0.70 – 0.75)	0.70 (0.55 – 0.85)
London	0.90 (0.75 – 1.10)	0.85 (0.80 – 0.88)	0.60 (0.50 – 0.70)	0.70 (0.60 – 0.70)	0.45 (0.40 – 0.45)	0.85 (0.65 – 1.00)
Midlands	0.95 (0.80 – 1.05)	0.90 (0.90 – 0.90)	0.80 (0.75 – 0.85)	0.70 (0.70 – 0.75)	0.70 (0.70 – 0.70)	0.70 (0.55 – 0.90)
North East and Yorkshire	0.90 (0.80 – 1.05)	0.90 (0.90 – 0.95)	0.70 (0.60 – 0.80)	0.80 (0.75 – 0.80)	0.80 (0.80 – 0.80)	0.65 (0.50 – 0.85)
North West	0.95 (0.85 – 1.10)	0.90 (0.90 – 0.90)	0.80 (0.70 – 0.85)	0.75 (0.70 – 0.75)	0.75 (0.70 – 0.75)	0.70 (0.50 – 0.85)
South East	0.90 (0.75 – 1.05)	0.80 (0.75 – 0.80)	0.75 (0.70 – 0.85)	0.75 (0.70 – 0.75)	0.75 (0.70 – 0.75)	0.70 (0.55 – 0.85)
South West	0.95 (0.75 – 1.25)	0.75 (0.75 – 0.80)	0.65 (0.55 – 0.75)	0.70 (0.65 – 0.75)	0.80 (0.75 – 0.80)	0.65 (0.50 – 0.80)
England	0.90 (0.85 – 0.95)	0.85 (0.85 – 0.90)	0.70 (0.65 – 0.80)	0.75 (0.70 – 0.75)	0.75 (0.75 – 0.75)	0.75 (0.55 – 0.90)
Scotland	0.95 (0.75 – 1.15)	0.90 (0.85 – 0.90)	0.85 (0.75 – 0.90)	0.80 (0.80 – 0.85)		0.70 (0.50 – 0.85)
Wales	0.95 (0.70 – 1.30)	0.90 (0.90 – 0.95)	0.85 (0.80 – 0.90)	0.75 (0.70 – 0.80)		0.70 (0.55 – 0.90)
Northern Ireland		1.15 (1.00 – 1.30)	0.80 (0.75 – 0.90)	0.90 (0.90 – 0.90)		0.70 (0.55 – 0.90)
UK	0.90 (0.85 – 0.95)		0.75 (0.70 – 0.80)	0.75 (0.75 – 0.75)		0.75 (0.60 – 0.90)

Figure 1: SPI-M groups estimates of median R_t by region / nation, including 95% confidence intervals (smaller dots), where colours represent different modelling groups.

