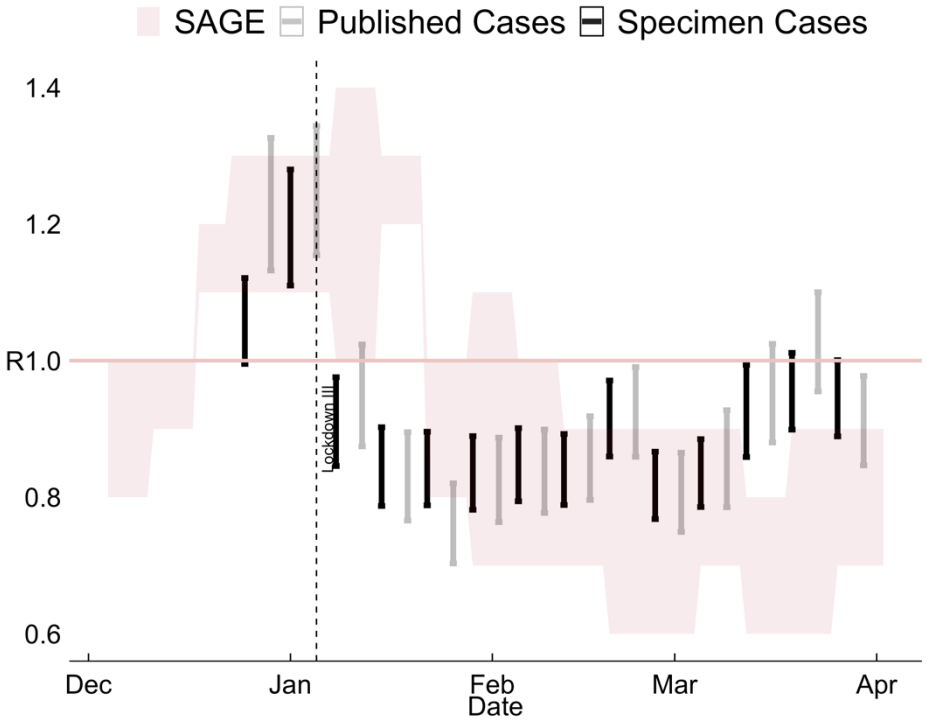
National Institute
NIESR Weekly Covid-19 Tracker No. 7
Thursday, 1st April 2021 niesr.ac.uk

Reproduction Number (R) and Forecasts of New Cases: R unchanged for now

Figure 1 - UK R – NIESR controlling for enhanced testing in schools and SAGE



Shaded pink area is SAGE upper and lower bounds (www.gov.uk/guidance/the-r-number-in-the-uk)
NIESR estimates of R show ± 1 standard deviation confidence intervals estimated on published and specimen cases. For specimen cases we discard the last 3 days data.

Main points

- We report estimates of the R number and forecasts for new cases of Covid-19, hospital admissions and deaths due to Covid-19 using publicly available data on 30th March 2021.
- Data on Covid-19 cases are reported by the government by 'specimen date' and by 'published date'. Specimen cases relate to the date when the sample was taken from the person being tested, while published cases relate to the first date when they are included in the published numbers. At the present time we

regard the specimen date data as a more reliable indicator of the trend in new cases. The model based on specimen dated observations has better captured the effect of the sharp increase in testing on the day that schools reopened.

- Figure 1 shows that the Reproduction number, R, which is the average number of secondary infections currently generated by an infected individual, estimated using the specimen date data until 26th March, **remained at 0.9 – 1.0.** This is again higher than SAGE's estimates. Our estimate was obtained after controlling for enhanced testing in schools that started when they reopened on the 8th of March. The model without any correction for enhanced testing in schools yields similar estimates as of now, as three weeks on, the effect of the discontinuous change in testing plays less of a role in recovering the underlying trend.
- Based on our model, by 12th April when non-essential retail is scheduled to reopen, we expect the trend value of daily cases to be around 3,800; admissions to be around 200, and deaths to stay below 50 (Figures 3-5). Our forecasts for cases and deaths are unchanged relative to last week, but our forecast for admissions is higher by 100.
- To the extent that each stage of re-opening increases transmission these numbers may increase. At the same time, expansion of the vaccination programme can be expected to reduce transmission. The trajectory that nets out these opposing trends will become evident in the weeks to come.
- Figure 6 shows the regional R number estimates. Currently, the North East has the lowest R number while Yorkshire and the Humber has the highest.

"Based on the latest data on new cases, our estimate of the R number for the UK lies in the range 0.9 – 1.0, unchanged from last week. This estimate is based on data up to 30th March 2021. Our model controls for increased testing in schools from 8th March, and finds that in the three weeks that followed increased transmissions have pushed the estimate of the R number ever closer to 1. That is, cases are still decreasing but at a slower rate than they were when schools reopened. Looking ahead, the key as to whether the R number moves above 1 and cases start to rise will be the trade-off between increases in transmission due to increased social interaction and any effect the continued rollout of the vaccine has on reducing transmissions. Reassuringly, hospital admissions and deaths due to Covid-19 continue their steady decline."

Dr Craig Thamotheram
Senior Economist - Macroeconomic Modelling and Forecasting

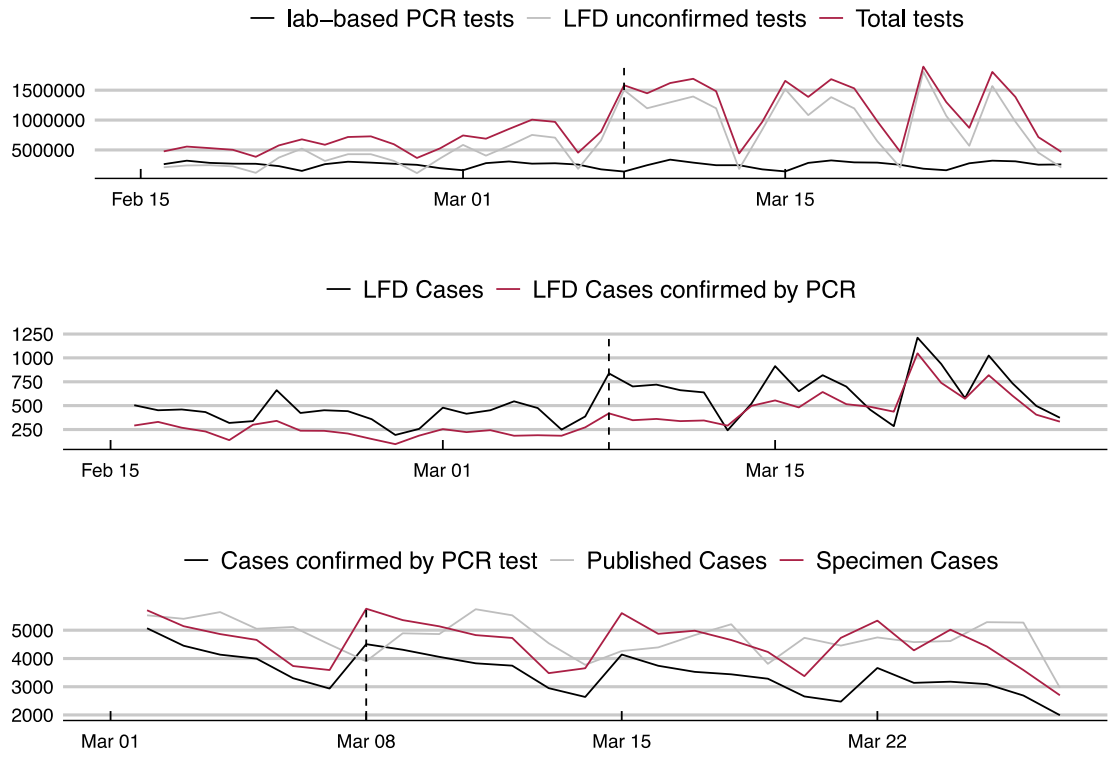
Results

From 10th March, data on cases identified by test type has been available for England. That is, the number of people with at least one positive COVID-19 test result is available by the type of test used in their first positive test. There are three types of tests:

1. Lab-based polymerase chain reaction (PCR).
2. Lateral flow device (LFD) confirmed by a PCR test taken within 3 days.
3. LFD that are unconfirmed by PCR.

Note, specimen cases are the sum of all three types of tests.

Figure 2 - England cases and tests by type



Vertical dashed line on 8th March. The test types are:
– lab–based polymerase chain reaction (PCR)
– lateral flow device (LFD) confirmed (this means the LFD result has been verified with a positive PCR result taken within 3 days)
– LFD unconfirmed (no positive PCR result taken within 3 days).

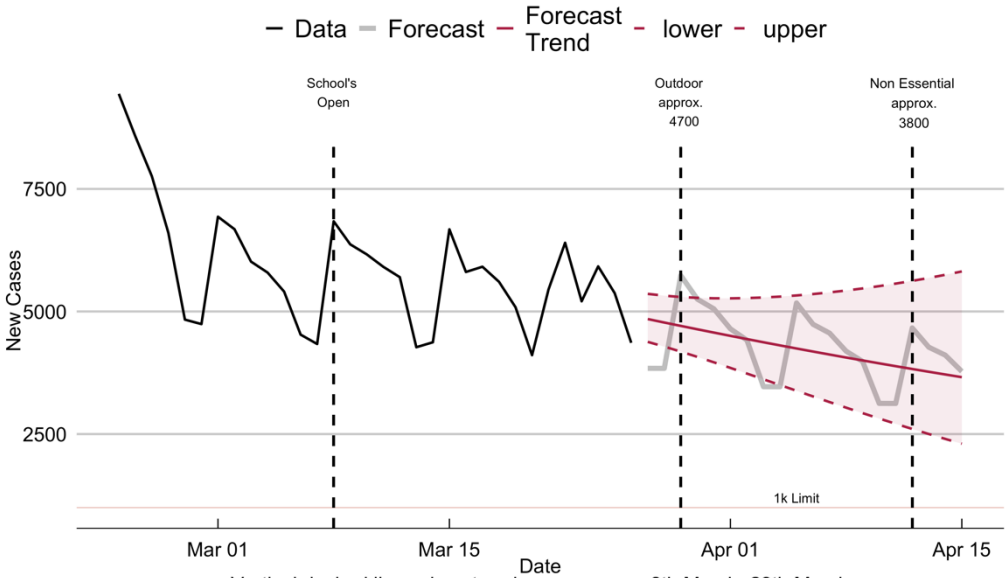
- The top panel of Figure 2 shows that the number of PCR tests remained approximately the same after schools reopened while the number of LFD tests increased significantly.

- The middle panel of Figure 2 shows that this translated into an increase in LFD cases on the 8th March.
- The bottom panel of Figure 2 shows that this fed through into published cases on the 9th March and specimen cases immediately, on the 8th March.

Figure 3 provides forecasts of daily cases of Covid-19 for the period till mid-April and highlights the underlying trend value of new cases to be expected on the key dates in the Government's roadmap: outdoor association on 29th March and non-essential retail reopening on 12th April. Projections include a correction for the increased testing due to the reopening of schools.

- Trend values of daily cases are forecast to be around 3,800 by 12th of April which is exactly the same forecast as last week.

Figure 3 - UK forecast of new COVID-19 cases



Vertical dashed lines show trend new cases on 8th March, 29th March and 12th April rounded to nearest 100.
Specimen case data available on 30 March 2021. The last 3 days data are discarded so the estimation sample ends on 26 March 2021.

Figure 4 provides forecasts of daily hospital admissions for Covid-19 until mid-April and highlights the underlying number of new admissions to be expected on the key dates in the Government's roadmap: non-essential retail reopening on the 12th April.

- Hospital admissions are forecast to be around 200 by the 12th of April which is up by 100 from last week.

Figure 4 – UK forecast of daily Covid-19 hospital admissions

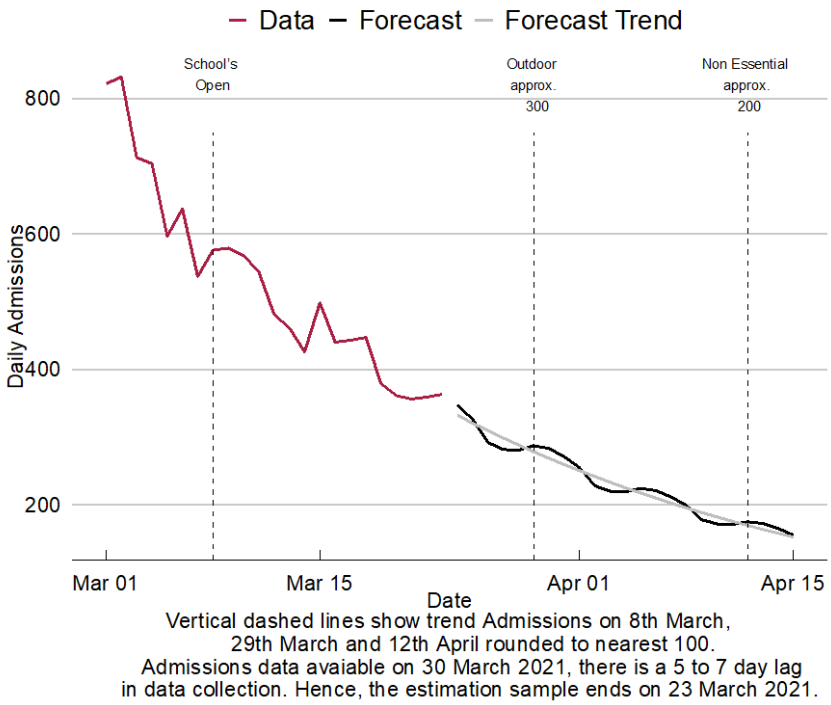
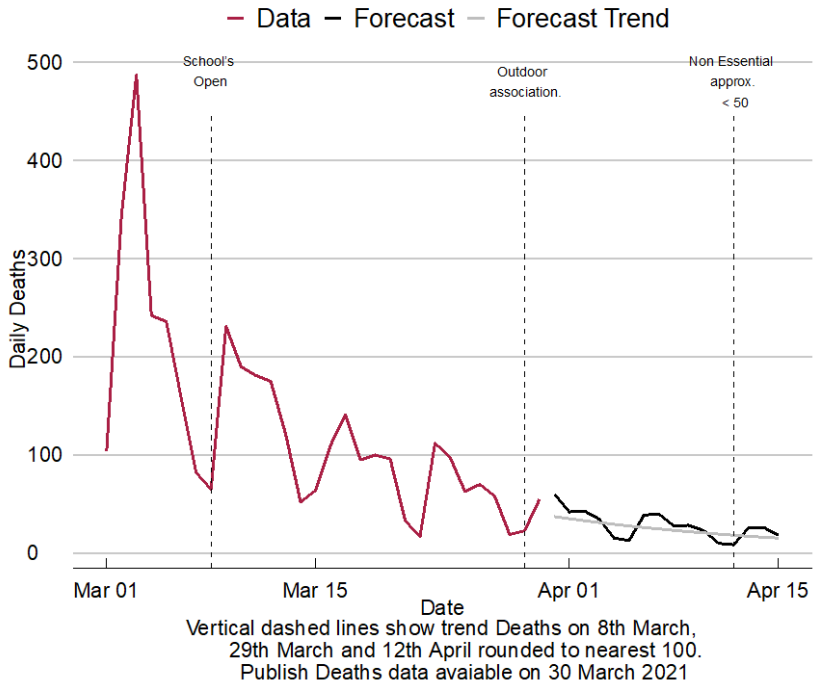


Figure 5 provides forecasts of daily deaths due to Covid-19 till mid-April and highlights the underlying number of daily deaths to be expected on the key remaining date in the Government's roadmap: non-essential retail reopening on 12th April.

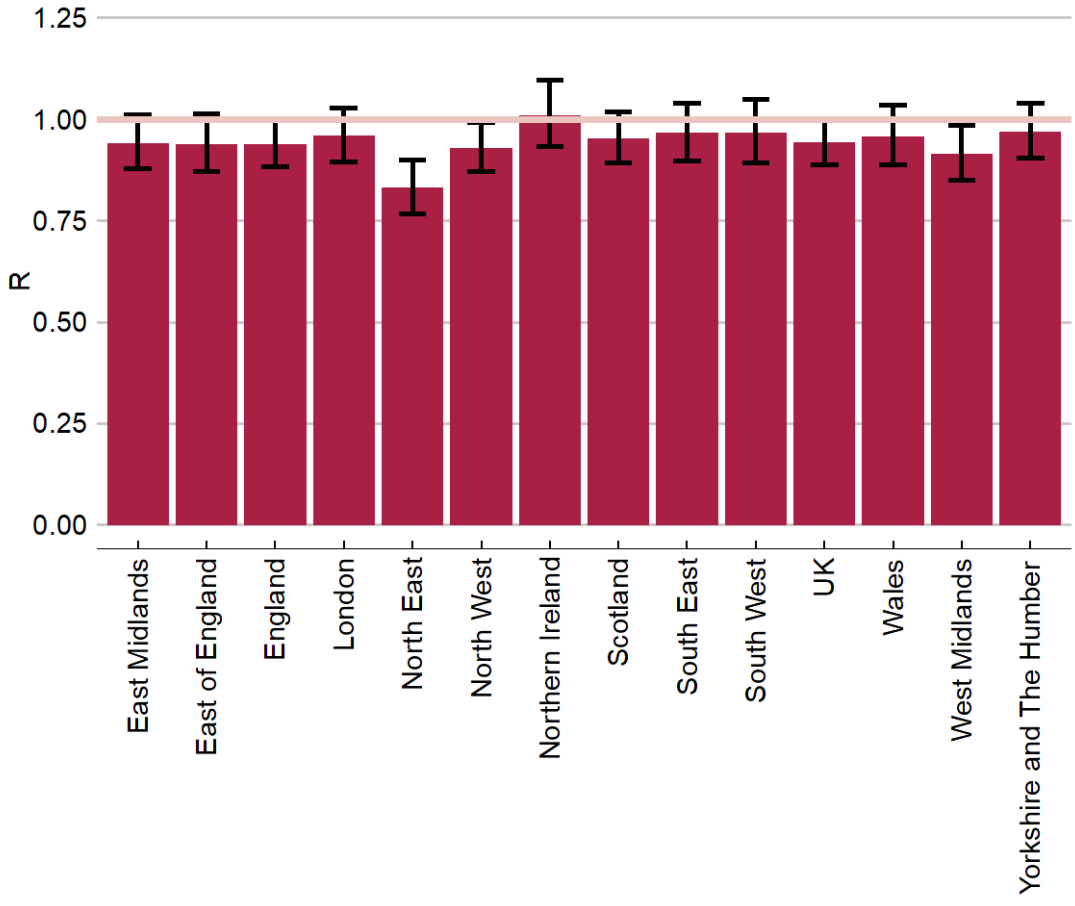
- By 12th April when non-essential retail is expected to restart, daily deaths are forecast to be below 50 which is unchanged from last week.

Figure 5 – UK forecast of daily Covid-19 deaths



- Figure 6 provides regional R number estimates based on specimen date data series released on 30th March 2021, controlling for increased testing due to schools reopening. We discard the last 3 days data due to data revisions in that time window. Thus, at the end of our estimation sample on the 26th March 2021, regional R number estimates have increased with all now lying above 0.9.
- Among nations of the UK, Northern Ireland has the largest R number (1.01) and England has the lowest (0.94).
- Among regions of England, Yorkshire and Humber has the highest R number (0.97) and the North East has the lowest (0.83).

Figure 6 - UK Regional R



Bar chart shows point estimates of R and the ± 1 standard deviation confidence intervals

Background

NIESR aims to set out projections of the future path of the Covid-19 epidemic in the United Kingdom, its constituent nations and the regions of England, based on current policies.

NIESR will be producing weekly updates on Thursdays, projecting new cases and estimating the R number using a class of time series models developed by Prof. Andrew Harvey and Dr. Paul Kattuman of Cambridge University; see Harvey and Kattuman (2020a). The models generate forecasts by extracting changing trends from historical data. They are relatively simple and transparent, and their specifications can be assessed by standard statistical test procedures. The advantage of the time series approach is that it can adapt very quickly to the most recent information and hence produce timely estimates. This flexibility enables the effects of changes in policy, virus mutations and human behaviour to be tracked. The models are data driven and so are different from the structural models used by epidemiologists which rely on assumptions about transmission and behaviour; see Avery et al (2020).

A description of the methods used to produce these estimates and an evaluation of their forecasting performance can be found in Harvey, Kattuman, and Thamotheram (2021).

Data

Data: COVID-19 confirmed cases and deaths data are sourced from https://coronavirus.data.gov.uk

On 27 March 2021, 850 historic cases were removed due to a laboratory processing error. This affected specimen date data between 23 and 25 March in local authorities primarily in the North East and Yorkshire. The cumulative total number of people tested positive was revised down on 27 March 2021. Historic published date totals have not been changed. The downward correction on 27th March is mixed with the positive upward revisions of cases as more test results are returned over time making it impossible to date these corrections accurately. Thus, we cannot back out on which day these corrections were made. For published data, we choose to remove 300, 300 and 250 cases on 24, 25 and 26th of March respectively.

Caveat

The model relies on historical data and does not incorporate future outlined changes in the underlying environment. Thus, it is important to read the forecasts in this context. For example, the current forecasts make no assumptions about the effect of reopening non-essential retail on increasing transmissions. On the other hand, the effect of the vaccine program will be in the opposite direction.

Authors

Professor Andrew Harvey is Emeritus Professor of Econometrics at the University of Cambridge and a Fellow of Corpus Christi College. He has published over 100 articles and is the author of four books: *The Econometric Analysis of Time Series* (1981), *Time Series Models* (1981), *Forecasting. Structural Time Series Models and the Kalman Filter* (1989) and *Dynamic models for Volatility and Heavy Tails* (2013). He is a Fellow of the British Academy and the Econometric Society.

Dr Paul Kattuman is a reader in Economics at Cambridge University. He has been a Senior Research Fellow at the University of Cambridge Department of Applied Economics, and a lecturer in economics at Durham. He has held Visiting Professorships at Université Paris 12 and Paris-Est Créteil and was appointed Grupo Santander Visiting Professor at Universidad Complutense de Madrid. He was visiting Faculty Scholar at the Kennedy School of Government, and at the Department of Statistics, both at Harvard University.

Dr Craig Thamotheram is a Senior Economist at NIESR. Prior to joining NIESR, he studied Engineering at Imperial and obtained a PhD in Economics at Warwick. He has work experience as a post-doc in macro and financial econometrics.

Bibliography

Avery, C., W. Bossert, A. Clark, G. Ellison, and S. F. Ellison (2020). An economist's guide to epidemiology models of infectious disease. *Journal of Economic Perspectives* 34(4), 79–104.

Harvey, A. and P. Kattuman (2020a). Time series models based on growth curves with applications to forecasting coronavirus. *Harvard Data Science Review*, Special issue 1 - COVID -19. https://hdsr.mitpress.mit.edu/ pub/ozgjx0yn

Harvey, A. and P. Kattuman (2020b). A farewell to r: Time series models for tracking and forecasting epidemics. *CEPR working paper*, 51, 7th October. https://cepr.org/content/covid-economics

Harvey, A., P. Kattuman, and C. Thamotheram (2021). Tracking the mutant: forecasting and nowcasting COVID-19 in the UK in 2021. *National Institute Economic Review*. Forthcoming.

Notes for editors

For further information and to arrange interviews please contact the NIESR Press Office: press@niesr.ac.uk or Luca Pieri on l.pieri@niesr.ac.uk / 07930 544 631

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