

Update from SPI-M regional variation group - 2nd June 2021

Updates in these slides from Lancaster, Imperial, LSHTM and Warwick

Overall picture:

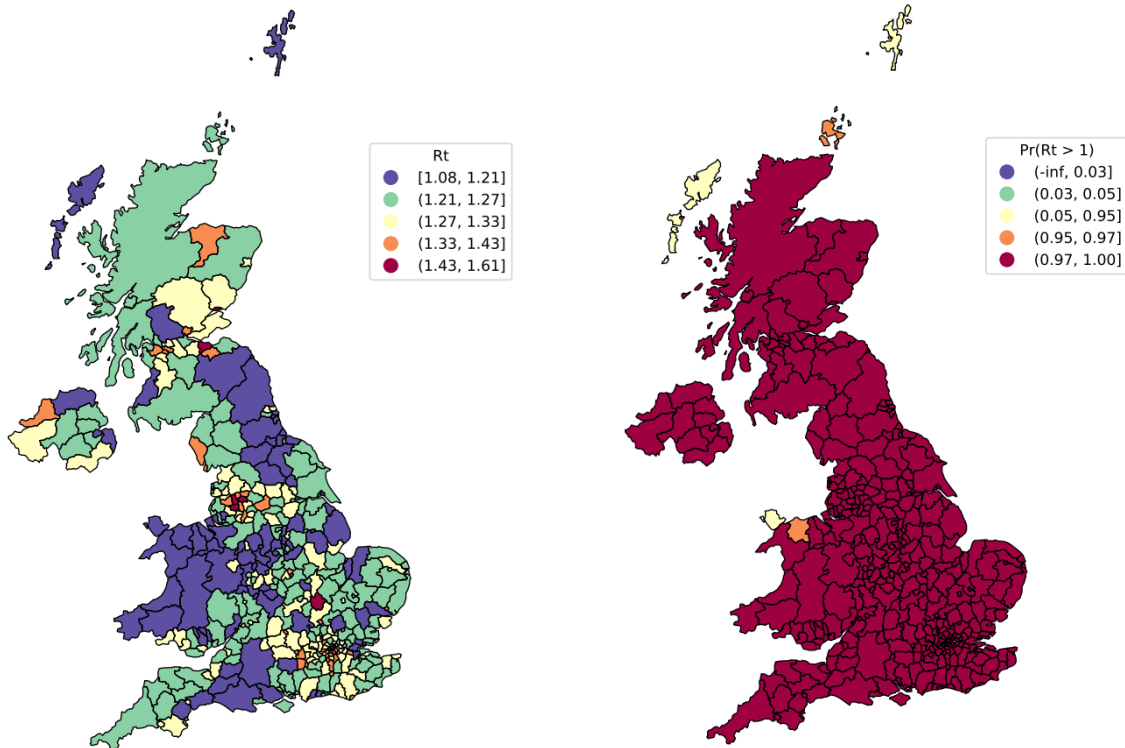
- Positive growth observed in more areas relative to last week:
 - Estimated R values from Lancaster are above 1 for almost all LADs.
 - This is more heterogeneous in the Imperial analyses, but cases have increased in most local authorities over the last two weeks.
 - Greater number of estimated R values by UTLA above 1 from LSHTM.
 - Distribution of growth rates across LTLAs has shifted upwards when considering both the absolute number and proportion of those testing positive in Warwick analyses, with positive mean growth rates.
- The cluster of most rapid growth in the North West is expanding in geographic size and becoming more clearly defined. This can be seen across all approaches, with Lancaster's exceedance analysis suggesting a travelling wave front.
- There is a clear and growing cluster in the central belt of Scotland in Lancaster and Imperial analyses. There is a potential indication of clustering in Berkshire across all approaches, but the exact extent of this is dependent on the specific approach.

Further detail:

- There are a number of other potential areas of interest, though the identified areas depend on the approach (e.g. Bedford, Leicester, Newcastle, Portsmouth).
- The estimated growth in Bolton is less of a high outlier compared to last week, with cases falling despite Bolton being situated within a growing cluster.
- In the Lancaster analyses, estimates of R from Pillar 1 data are generally below those from Pillar 2, but cases are still growing in urban centres. This is potentially an artefact of the geolocation of hospital testing.
- The pattern in London is more heterogeneous, with clear differences in the pattern of S-gene negative growth rate (see last slide from Warwick).

S-gene testing:

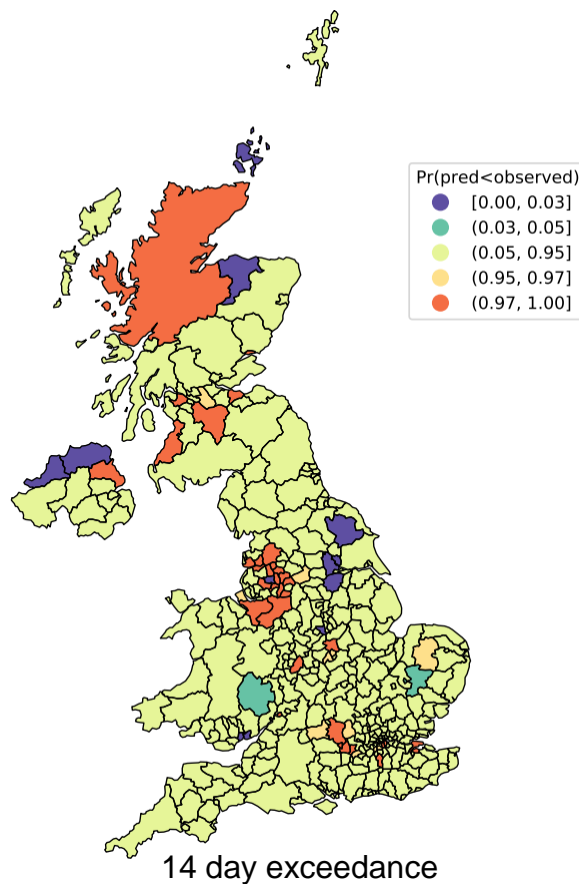
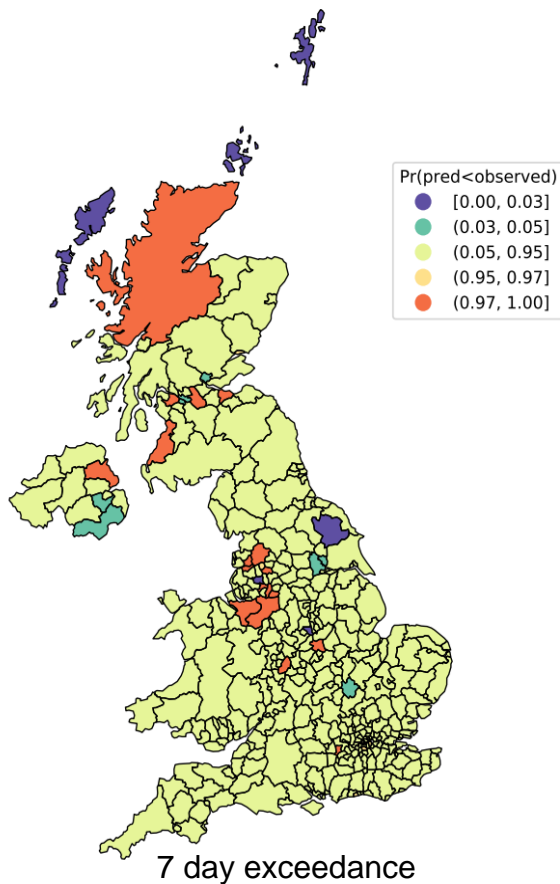
- Some locations are still dominated by cases with unknown S-gene status.
- There is a continued pattern of highest growth in cases appearing in areas where the proportion of S-gene positive cases is highest (see plots from LSHTM and Warwick).
- In Warwick analyses, the growth rate for S-gene positive cases appears higher than that for S-gene negative cases in the same locations over the same time period.

Mean posterior R_t $Pr(R_t > 1)$

Posterior estimates of time-varying effective reproduction number are derived by fitting a spatially-explicit SEIR model to COVID19 positive test data between 2021-02-26 and 2021-05-21.

Posterior estimates are summarised by mean and probability of exceeding 1.

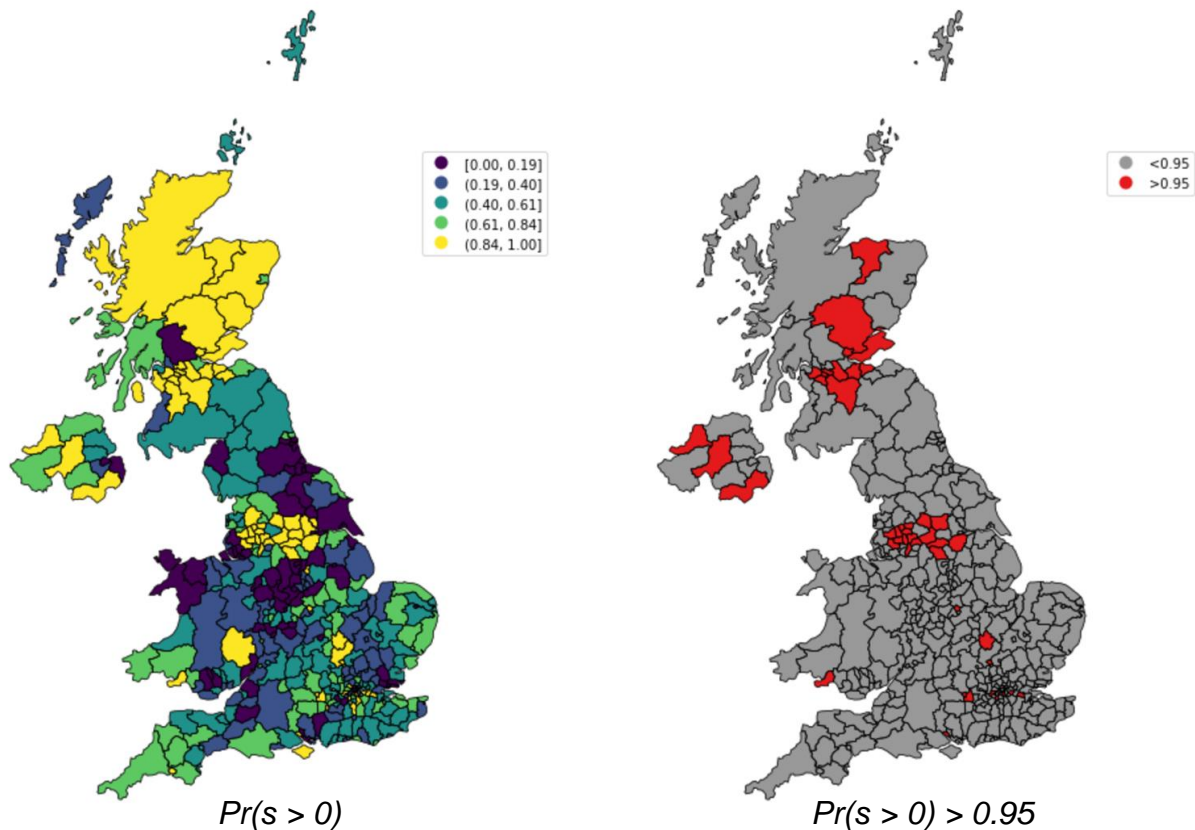
The extent of LADs with $Pr(R_t > 1) > 0.97$ had increased to cover most of the UK. The highest R_t LADs remain confined to the North West, Bedfordshire, Edinburgh, and London.



Probability of cases in last 7 and 14 days being greater than expected (i.e. predicted) given temporal and spatial mean transmission rates.

Spatial clustering is evident around Glasgow, Manchester, West London and Berkshire (14 day period). Highland experienced a 3-fold increase in cases on 27th May, the last date of our analysis time window.

Compared to 25th May, we see evidence of an epidemic wave spreading outwards from Glasgow, Manchester, and London.



Here we plot summaries of a spatially-correlated random effect s placed on (log) transmission rate. This highlights regions with higher than average transmission over the last 84 day time window.

Posterior estimates are summarised as $Pr(s > 0)$ highlighting regions of higher than usual transmission rate (left).

We highlight regions (right) where $Pr(s > 0)$ is greater than 0.95, indicating regions where we have reasonable evidence for sustained above-average transmission rate.

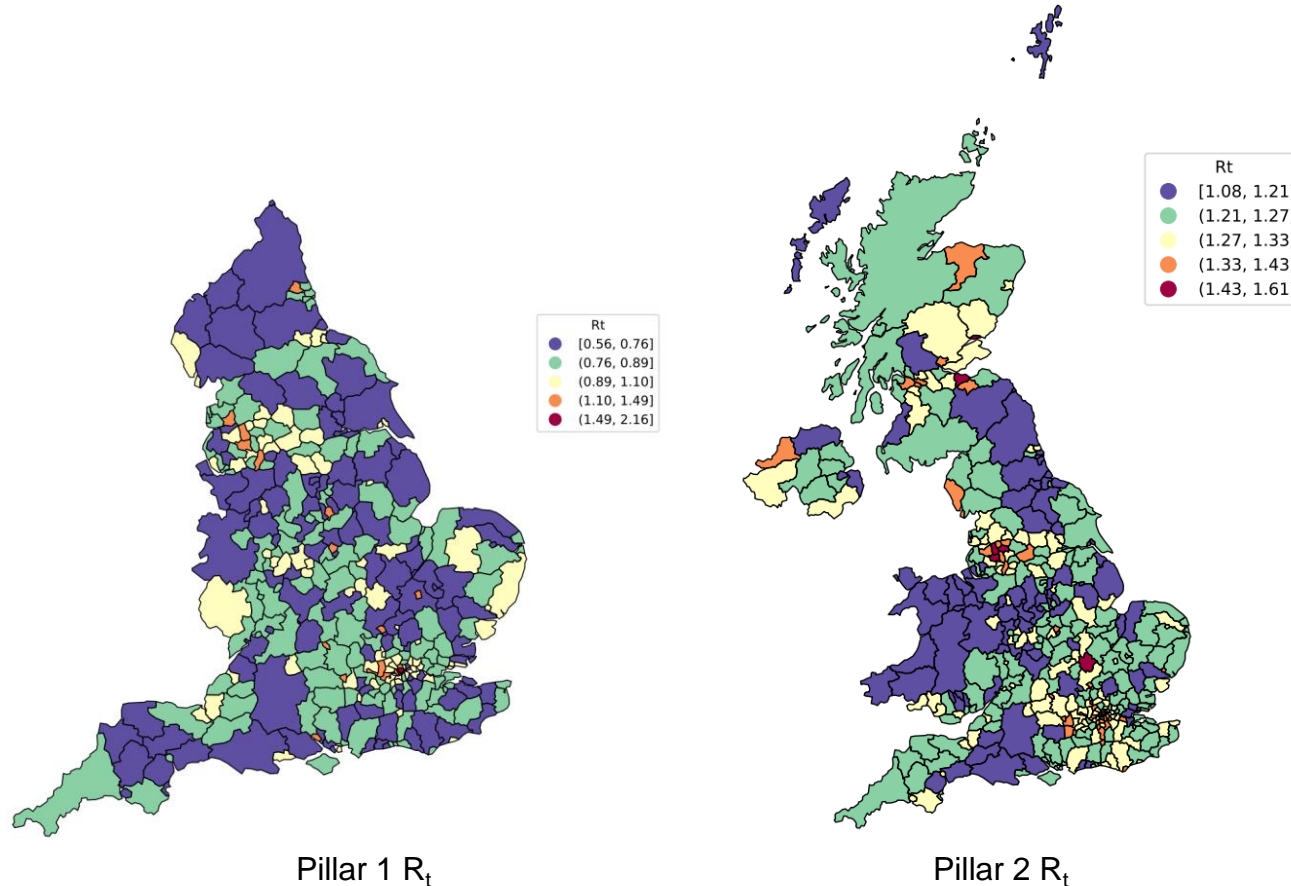
Little change of 25th May 2021.

Top 20 LADs sorted by expected number of positive test cases between 01 June 2021
and 08 June 2021.

LAD Code	LAD Name	Rt	Pr(Rt > 1)	Current cases per day	7 day cum. cases
E08000001	Bolton	1.54 (1.47, 1.62)	1.00	266 (230, 306)	1938 (1722, 2179)
S12000049	Glasgow City	1.38 (1.32, 1.44)	1.00	175 (145, 206)	1222 (1080, 1381)
E06000008	Blackburn with Darwen	1.57 (1.47, 1.67)	1.00	141 (115, 169)	1035 (883, 1210)
E08000003	Manchester	1.39 (1.33, 1.46)	1.00	117 (95, 141)	821 (714, 930)
E08000034	Kirklees	1.35 (1.29, 1.42)	1.00	108 (85, 132)	746 (634, 868)
S12000036	City of Edinburgh	1.44 (1.36, 1.53)	1.00	79 (60, 100)	567 (462, 685)
E08000025	Birmingham	1.27 (1.22, 1.33)	1.00	75 (56, 94)	508 (428, 598)
E08000035	Leeds	1.27 (1.22, 1.33)	1.00	67 (51, 86)	463 (390, 545)
E06000055	Bedford	1.49 (1.38, 1.60)	1.00	64 (47, 83)	460 (371, 560)
E06000016	Leicester	1.35 (1.27, 1.42)	1.00	58 (42, 75)	399 (333, 482)
E08000032	Bradford	1.30 (1.24, 1.36)	1.00	57 (41, 74)	390 (320, 459)
S12000038	Renfrewshire	1.37 (1.28, 1.46)	1.00	49 (34, 64)	342 (276, 421)
E08000006	Salford	1.30 (1.22, 1.39)	1.00	49 (35, 64)	341 (272, 418)
E08000010	Wigan	1.29 (1.22, 1.37)	1.00	48 (34, 63)	337 (270, 406)
S12000050	North Lanarkshire	1.29 (1.23, 1.36)	1.00	46 (32, 60)	318 (260, 382)
S12000029	South Lanarkshire	1.26 (1.19, 1.34)	1.00	46 (33, 63)	318 (257, 388)
E08000002	Bury	1.37 (1.28, 1.46)	1.00	42 (29, 56)	299 (240, 369)
E07000125	Rossendale	1.49 (1.36, 1.62)	1.00	41 (28, 56)	298 (228, 371)
E08000007	Stockport	1.32 (1.23, 1.41)	1.00	36 (24, 49)	253 (194, 313)
E08000005	Rochdale	1.29 (1.21, 1.38)	1.00	36 (24, 50)	252 (197, 313)

Remarks

- Values shown as $x(y, z)$ represent posterior mean and 95% credibility intervals.
- “7 day cum. cases” gives the expected total number of cases between 01 June 2021 and 08 June 2021.



Comparing mean posterior Rt metrics between Pillar 1 (England only) and Pillar 2 shows a marked difference in spatial pattern.

Pillar 1 metrics are predominantly below 1, apart from urban centres. Pillar 2 is predominantly above 1 in the majority of places (see also [Slide 2](#)).

Hospital testing (Pillar 1) may be geolocating tests to the hospital in which they were performed, rather than the residence of the test subject.

NB. Different colour scales between the maps!

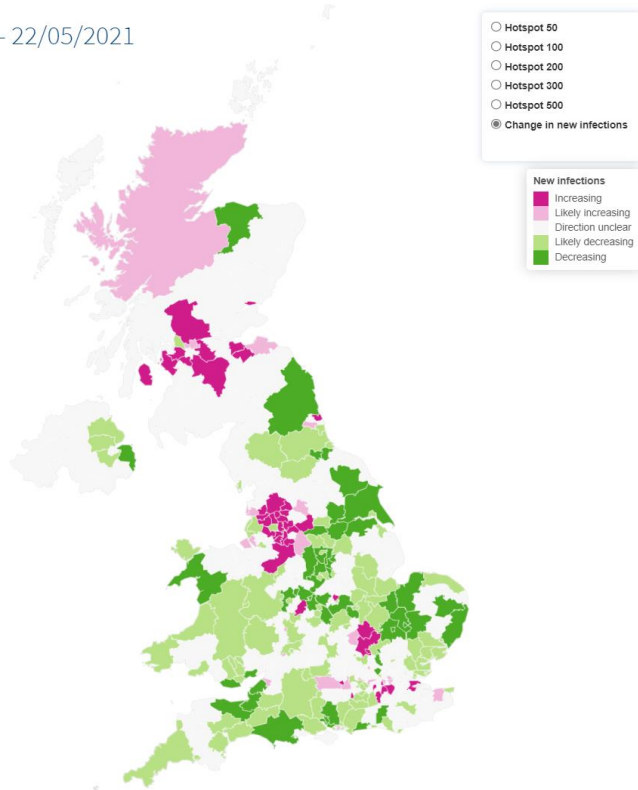
Imperial

Last updated 1/6/21

P(more than 100 weekly cases per 100k) two weeks in the future

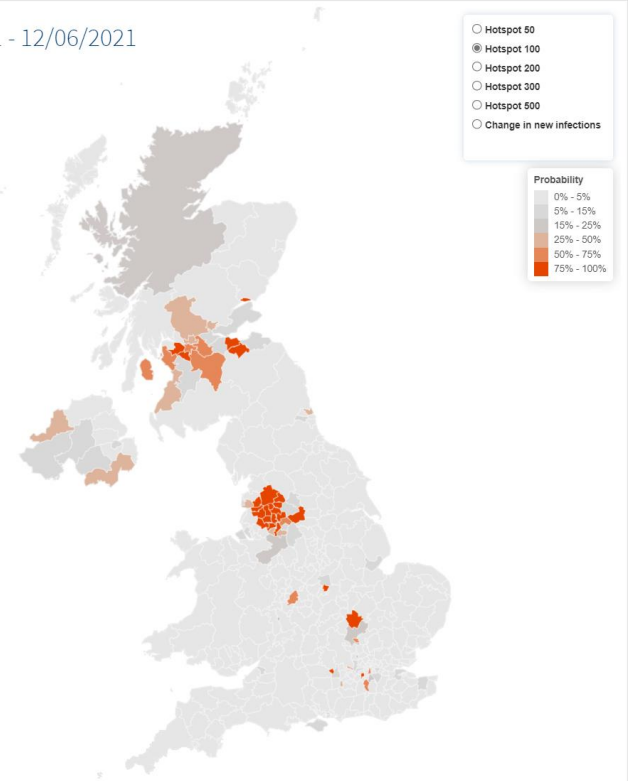
$P(R_t > 1)$

16/05/2021 - 22/05/2021



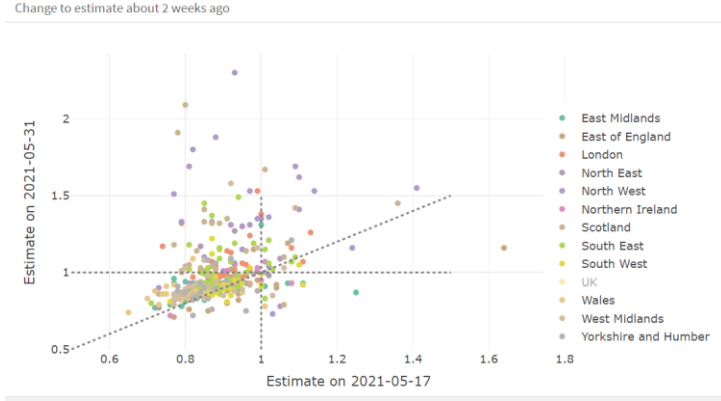
06/06/2021 - 12/06/2021

+
-

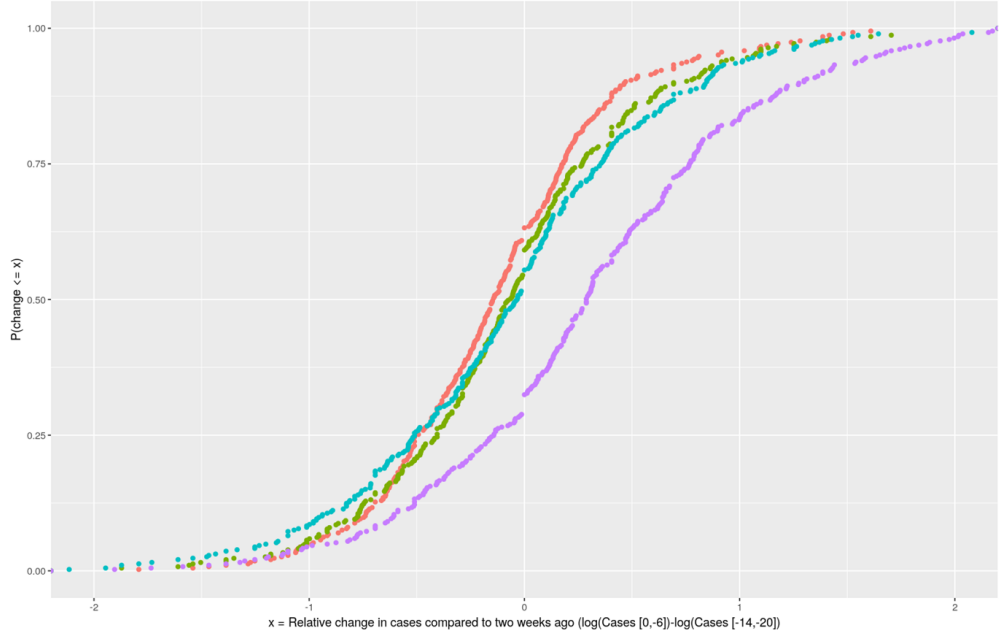


Projected

Change in R over last two weeks

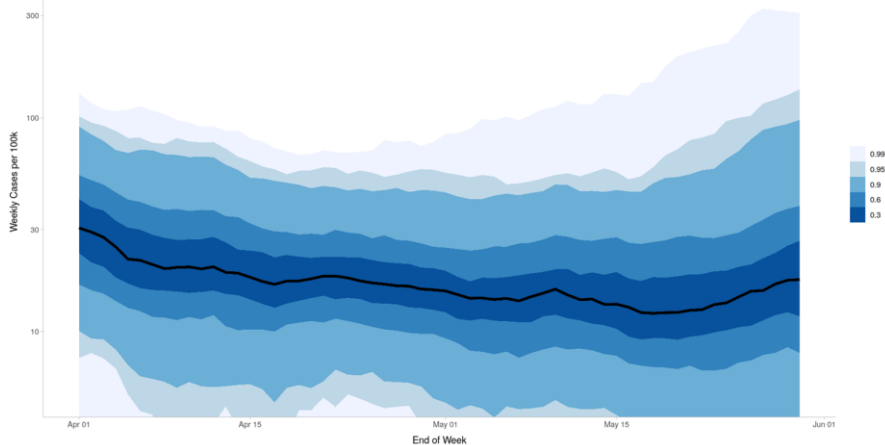


Relative change in cases over two weeks



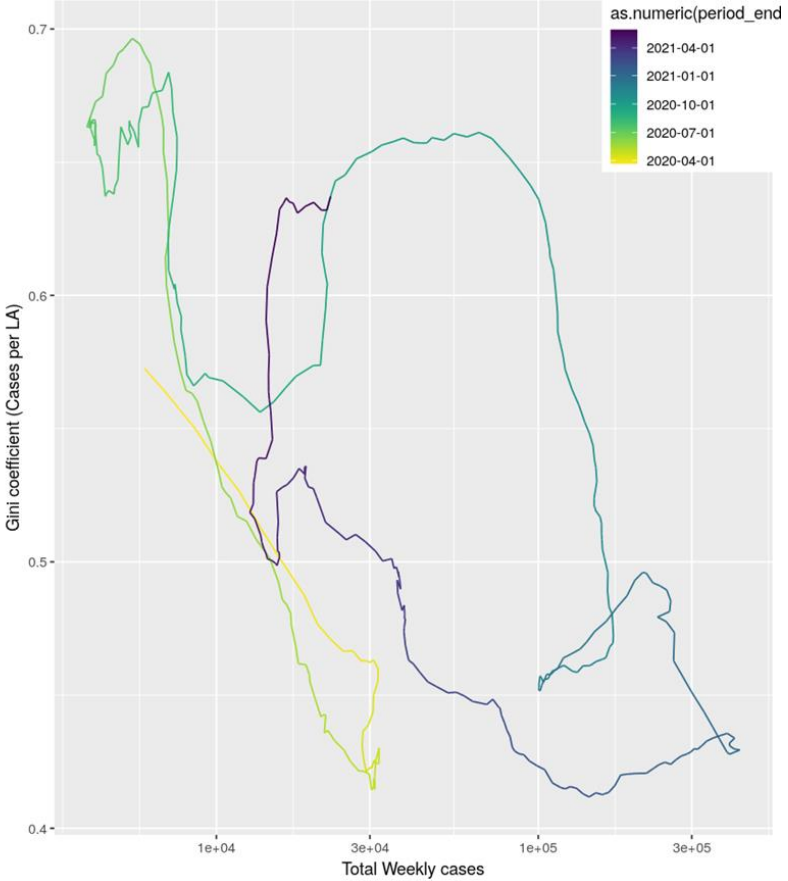
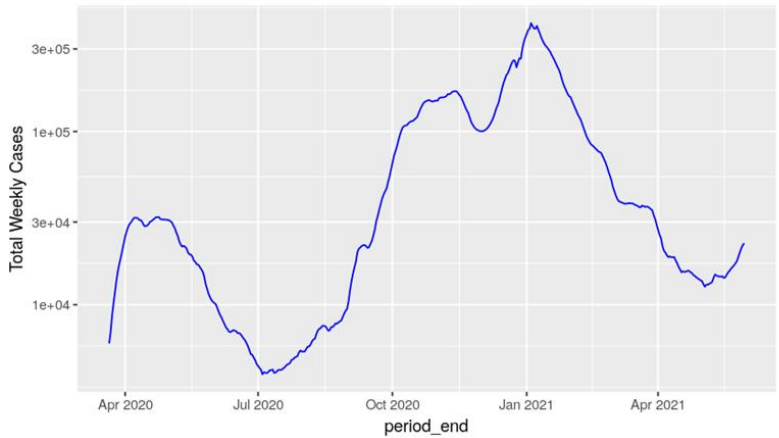
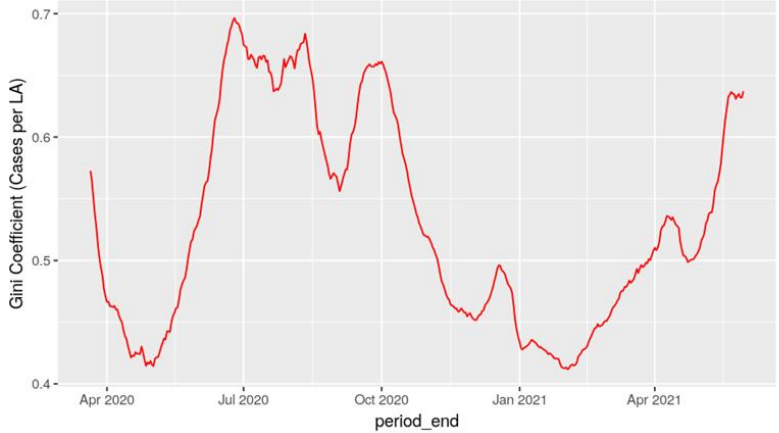
The week ending 2021-05-30 is the first week since reopening started in which the majority of LAs have recorded an increase in cases - previously the majority always had a decrease

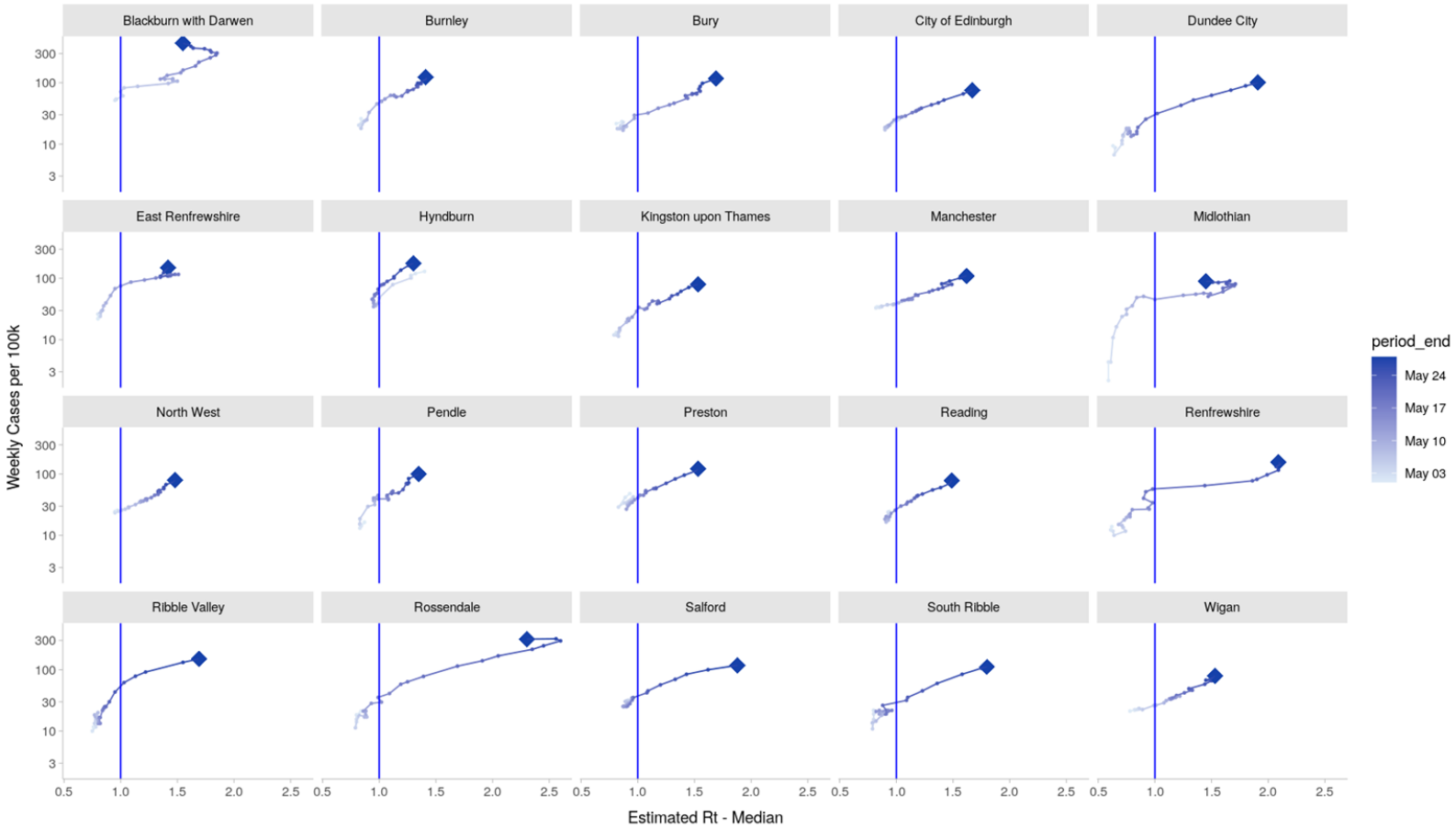
Distribution of weekly cases per LA over time



Imperial

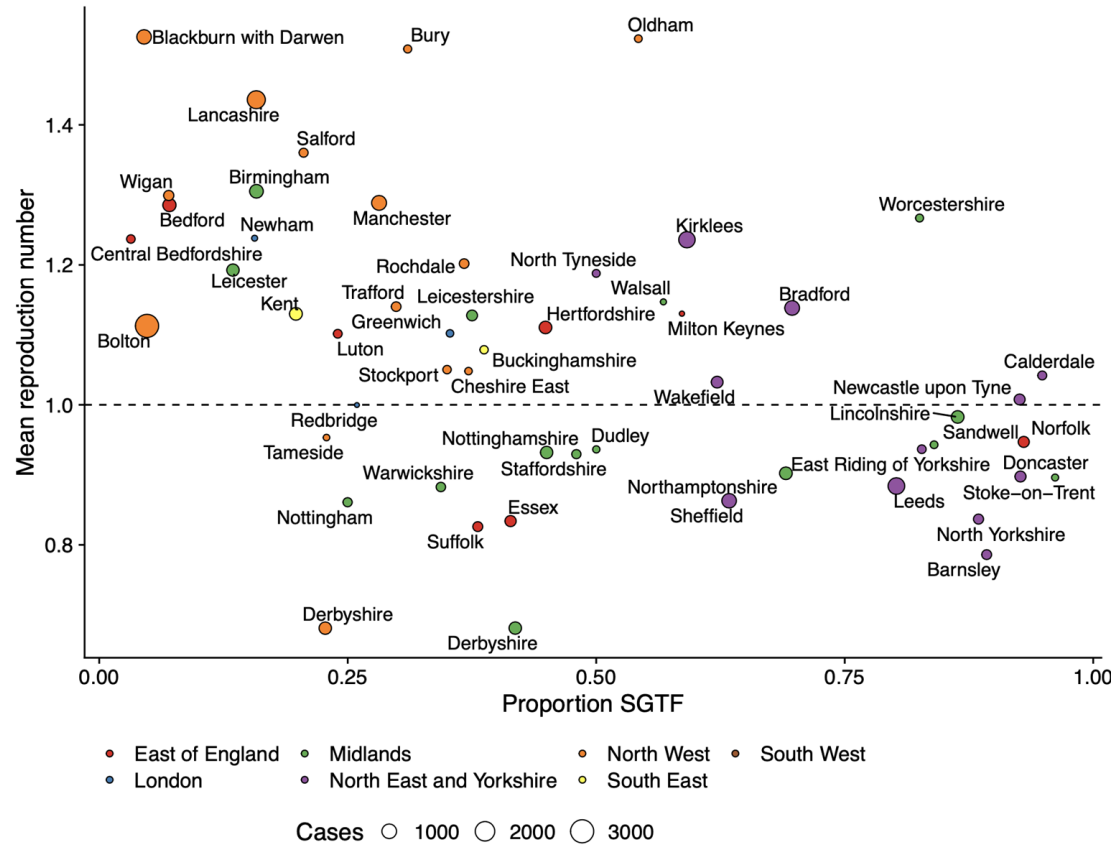
Last updated 1/6/21





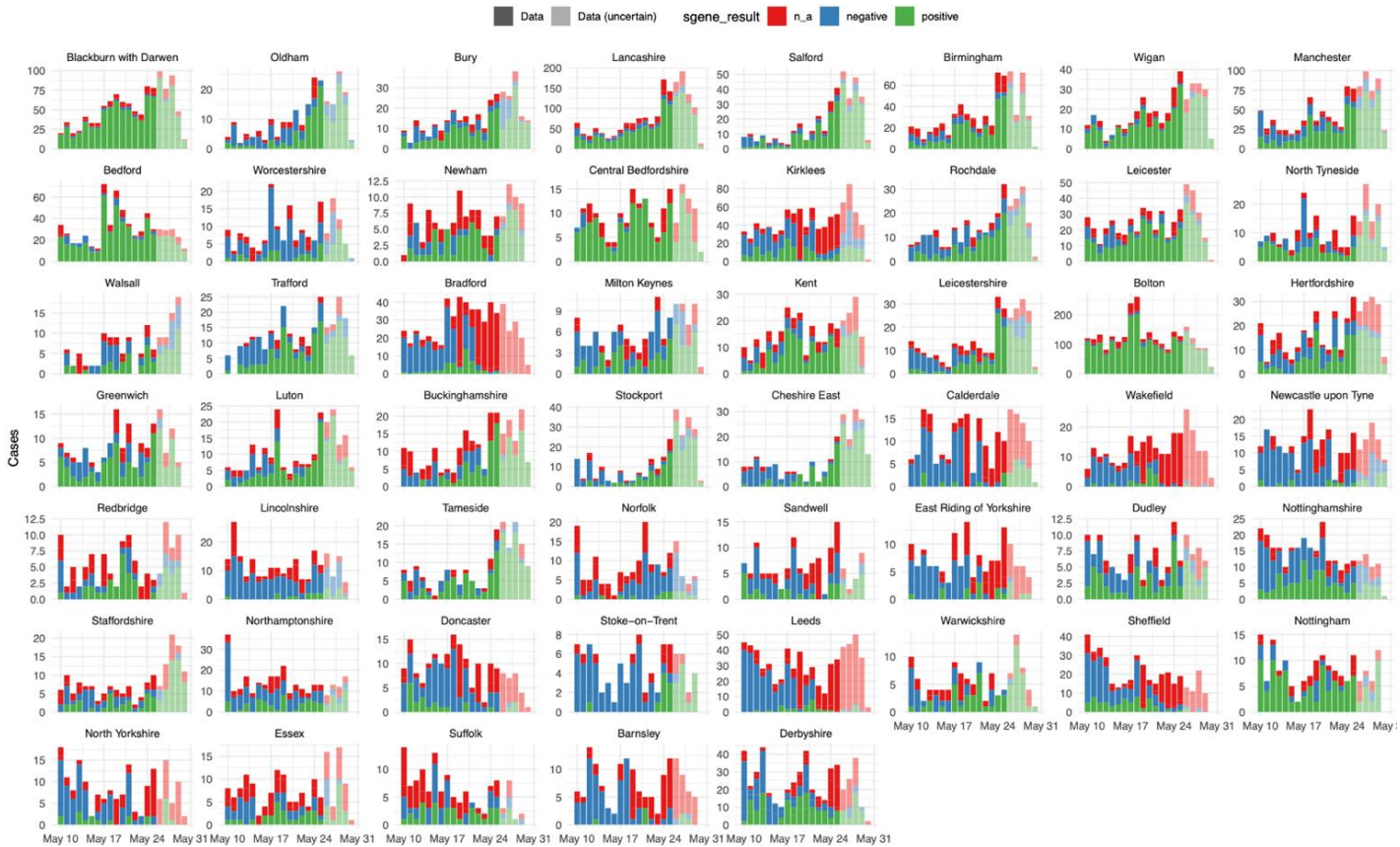
LSHTM: Rt vs s-gene positivity

Size of ULTA marker corresponds to number of cases in the last 4 weeks.



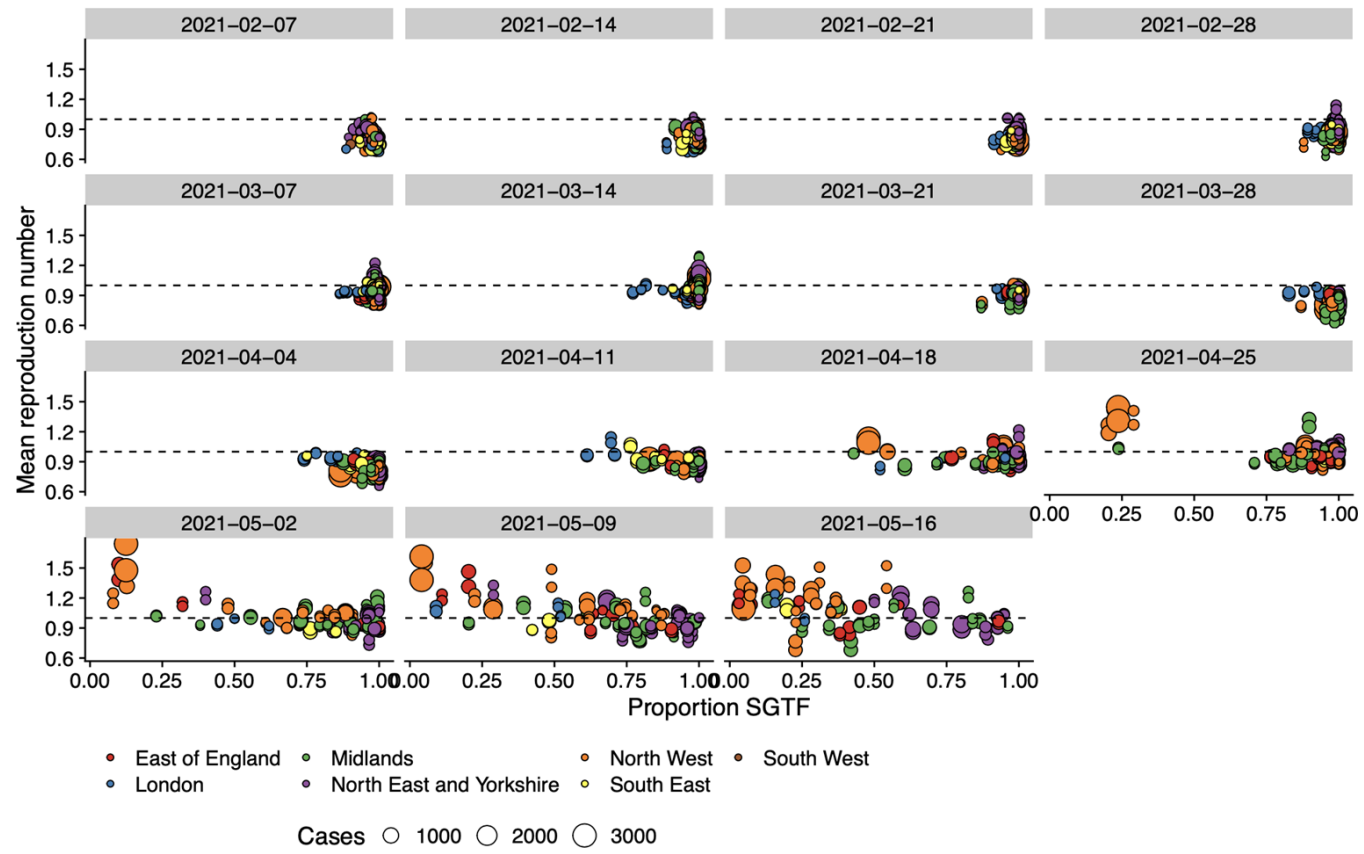
LSHTM: recent case numbers

Ordered by R from top left to bottom right

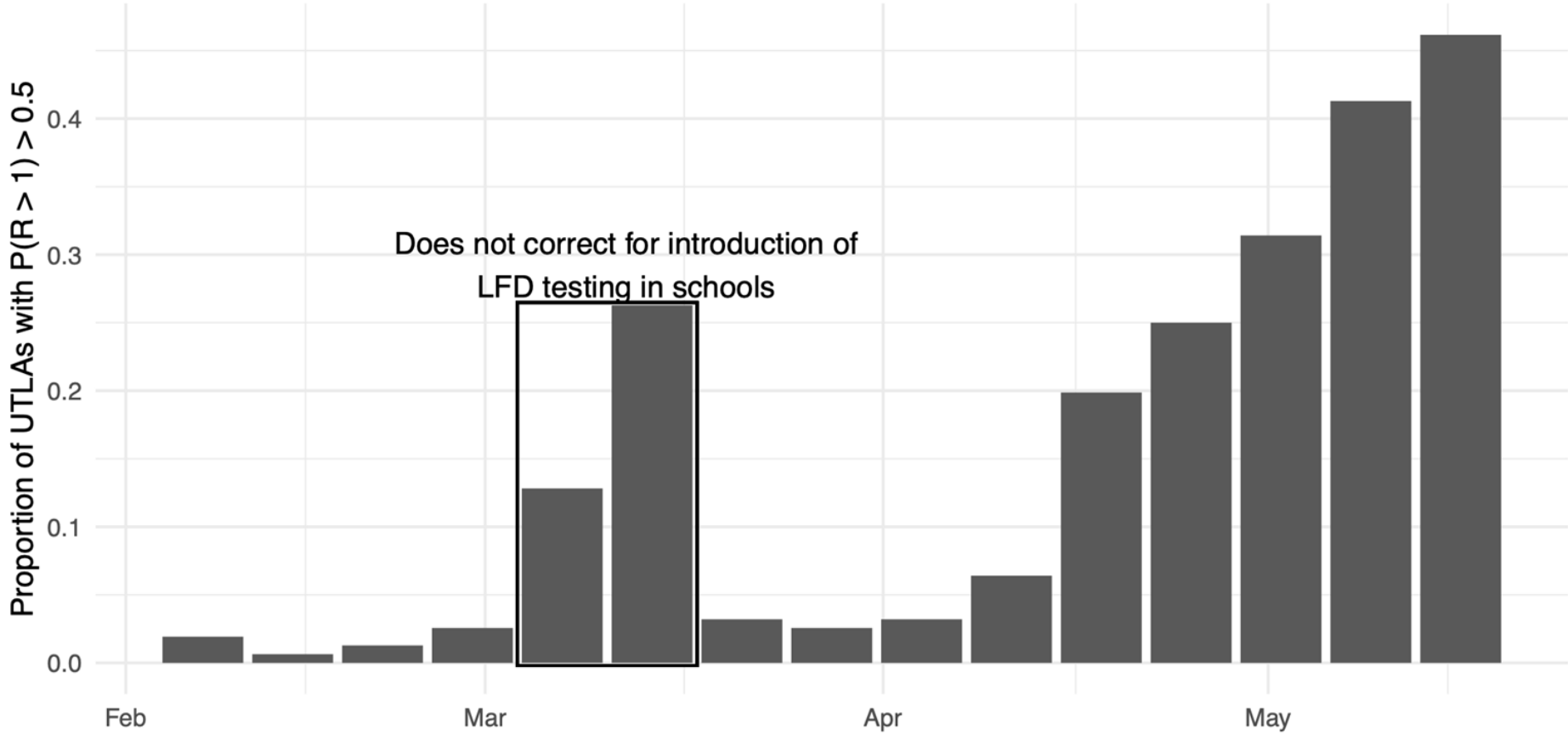


LSHTM: Rt vs s-gene positivity over time

Size of ULTA marker corresponds to number of cases in the last 4 weeks.

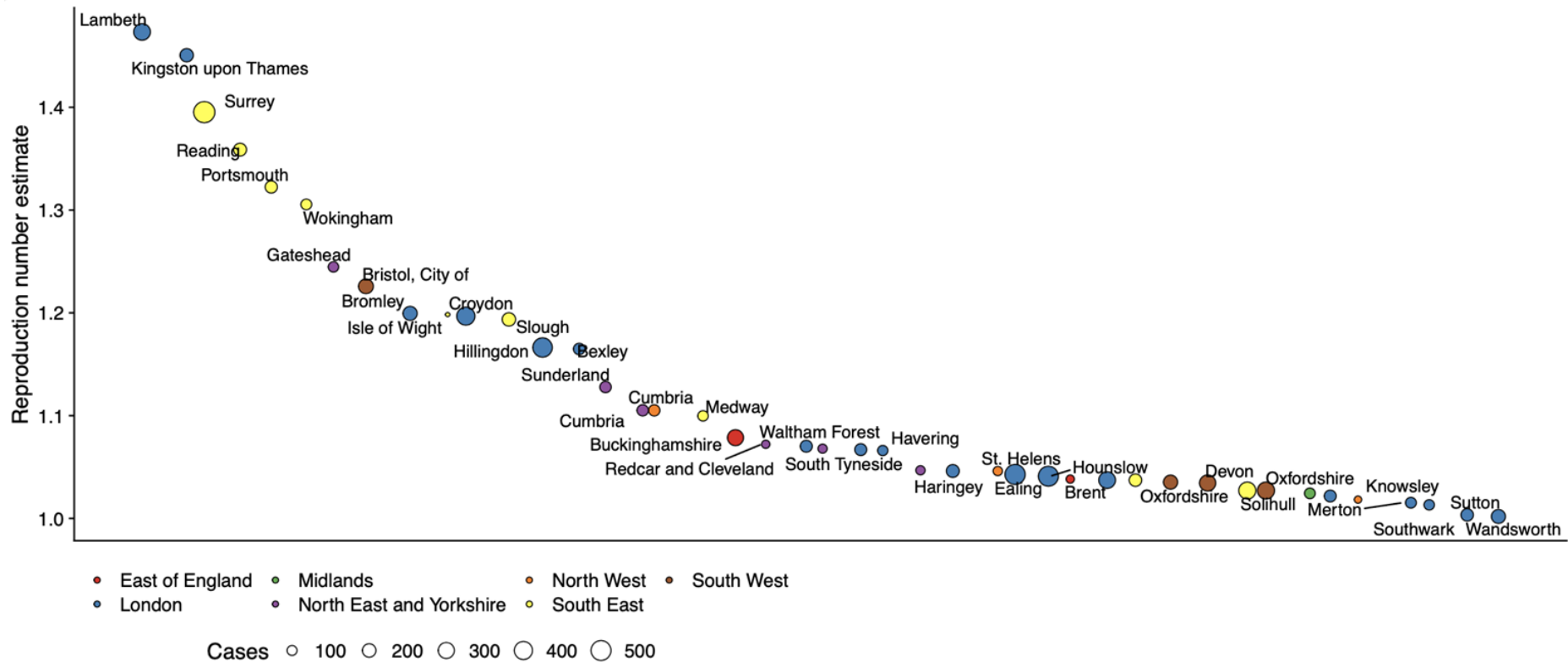


LSHTM: Proportion of UTLAs with $P(R > 1) > 0.5$ over time



LSHTM: UTLAs without sufficient TaqPath coverage

Size of ULTA marker corresponds to number of cases in the last 4 weeks. Only UTLAs with central estimate $R > 1$ shown.



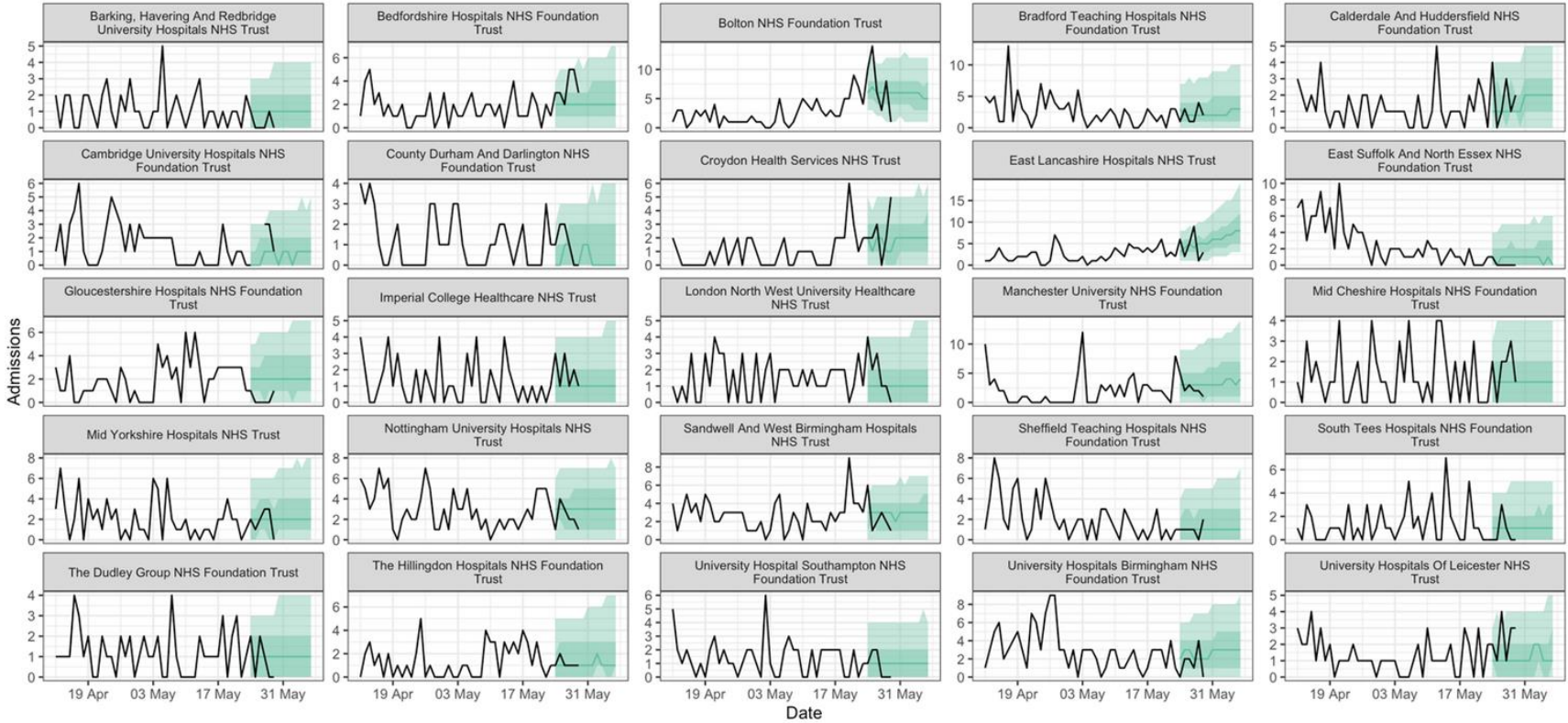
LSHTM: recent cases (insufficient TaqPath coverage)



LSHTM: Hospitalisations

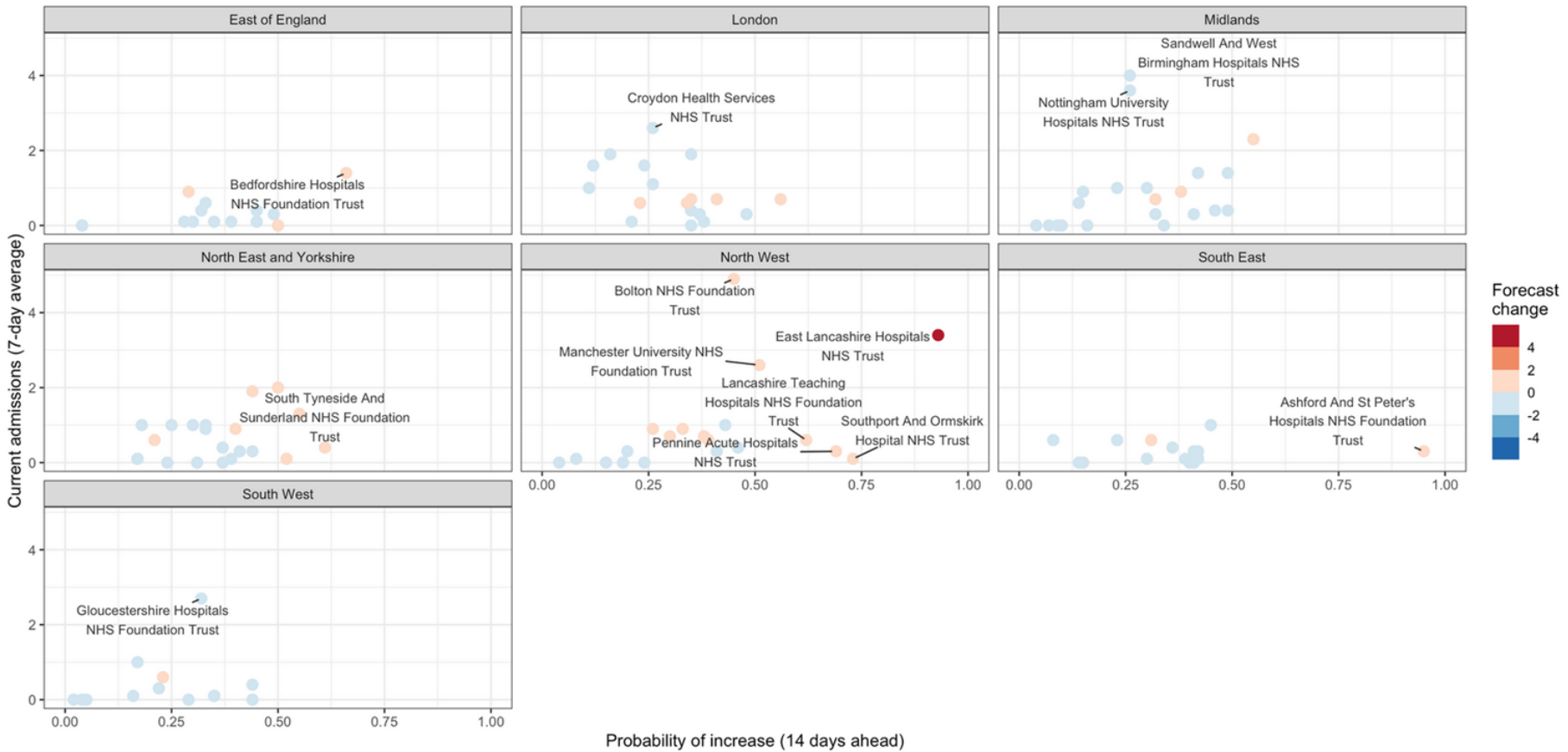
Forecasts from 23 May 2021

Top 25 Trusts with most admissions in last 28 days



LSHTM: Hospitalisations

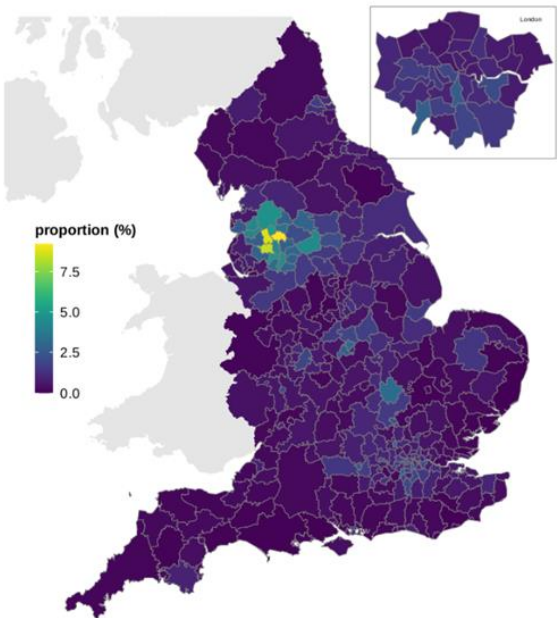
Forecasts from 23 May 2021



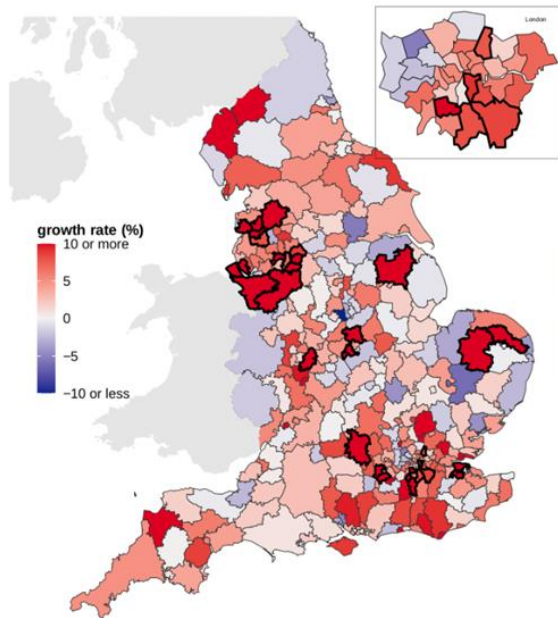
Warwick

We use the proportion of positive Pillar 2 samples as our measure of choice, with a beta-binomial distribution and a Gaussian Process (GP) to fit to the underlying data. Growth rates are calculated from the local gradient of the GP. To remove the fine-scale fluctuations in the GP, we compute the growth rates over a 6-day window.

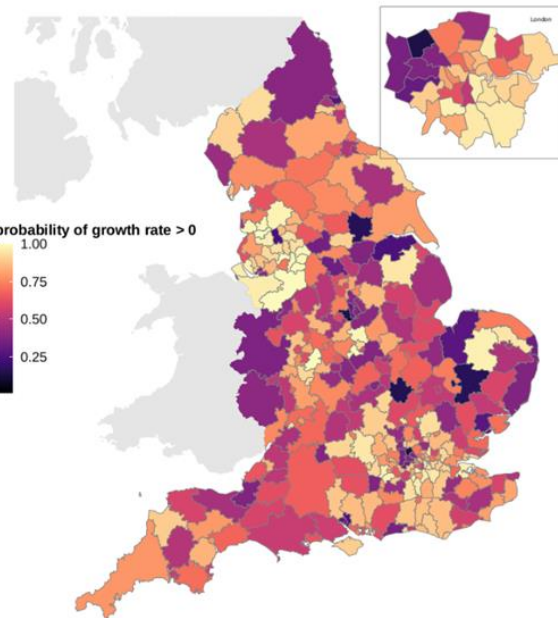
Proportion Pillar 2 testing positive
Tue. 25 May (2021)



Growth rate – proportion testing positive
Tue. 25 May (2021)



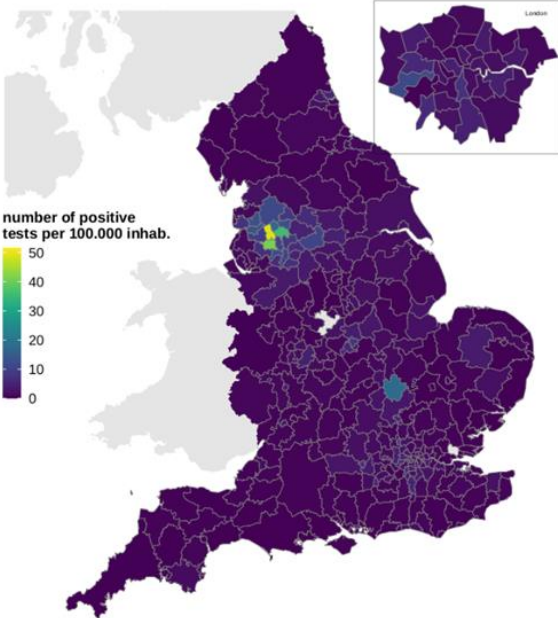
Probability growth rate > 0 – proportion testing positive
Tue. 25 May (2021)



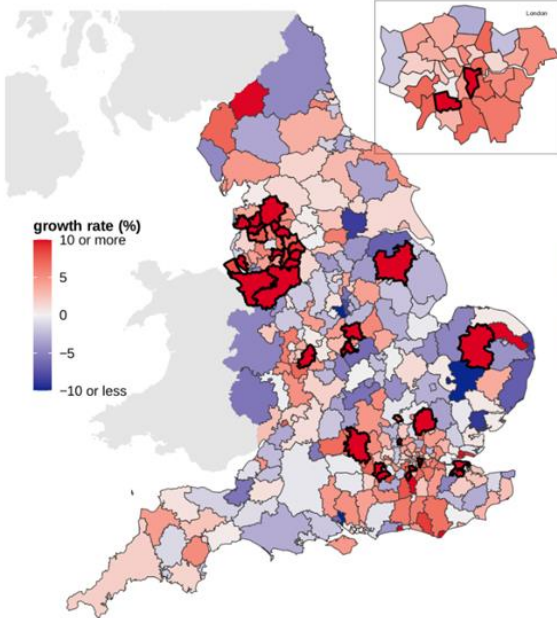
Warwick

We use the number of positive Pillar 2 samples as our measure of choice, with a negative-binomial distribution and a Gaussian Process (GP) to fit to the underlying data. Growth rates are calculated from the local gradient of the GP. To remove the fine-scale fluctuations in the GP, we compute the growth rates over a 7-day window.

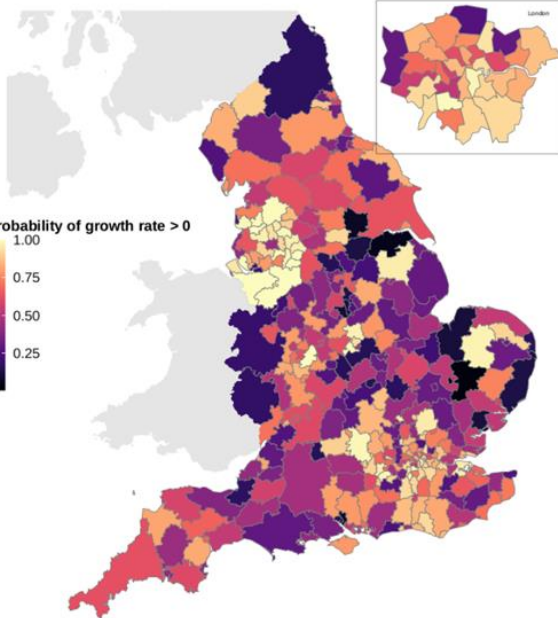
Pillar 2 testing positive
Tue. 25 May (2021)



Growth rate – positive tests
Tue. 25 May (2021)



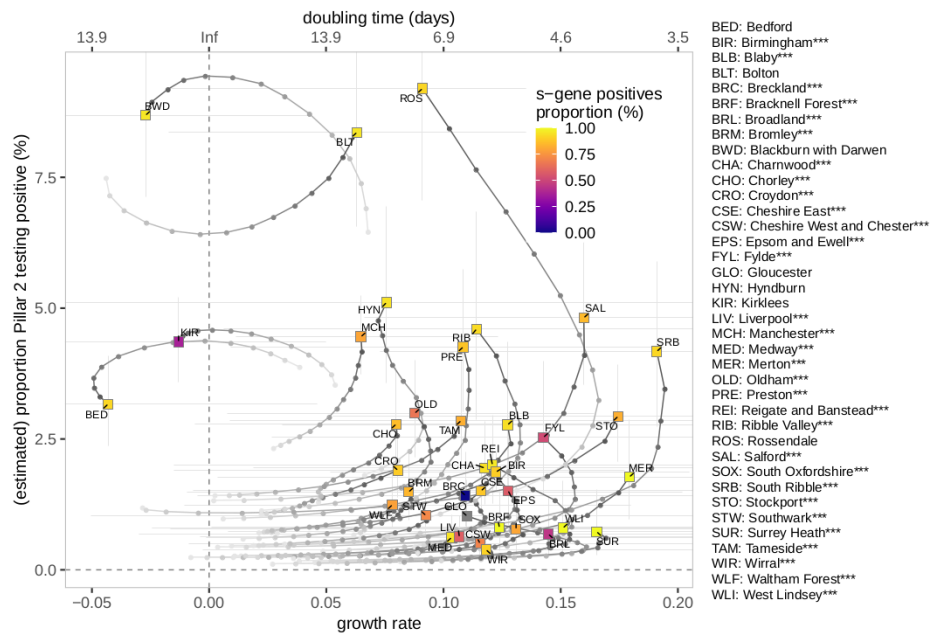
Probability growth rate > 0 – positive tests
Tue. 25 May (2021)



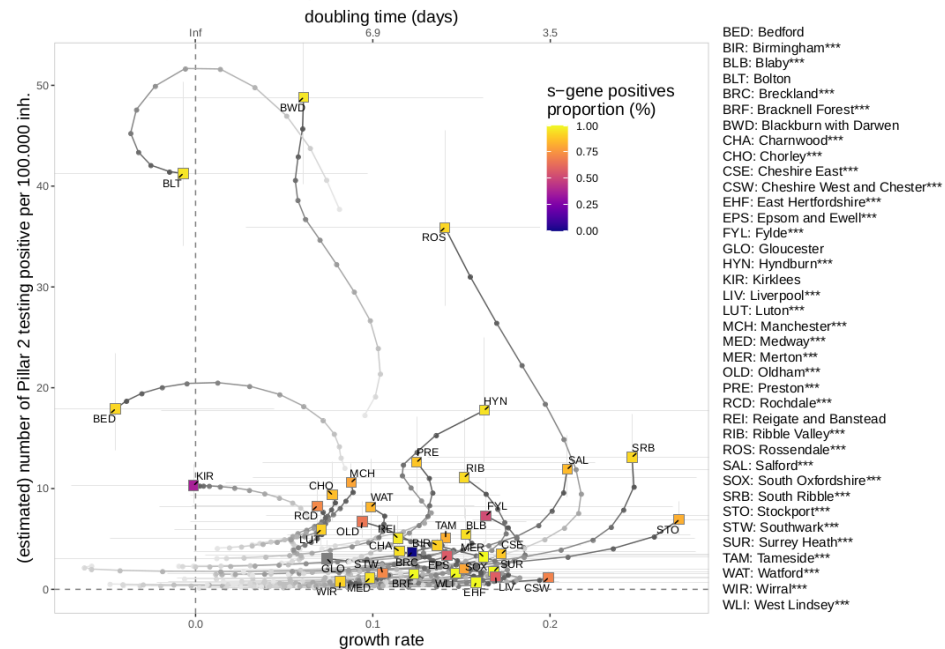
Changes between 12 May 2021 - 25 May 2021

*LTAs with growth rate (or number of positives) above the 0.99 quantile of all LTAs growth rate (or number of positives)

Proportion Pillar 2 testing positive (estimated mean) vs. Growth Rate
On Tue. 25 May 2021 and the 14 previous days

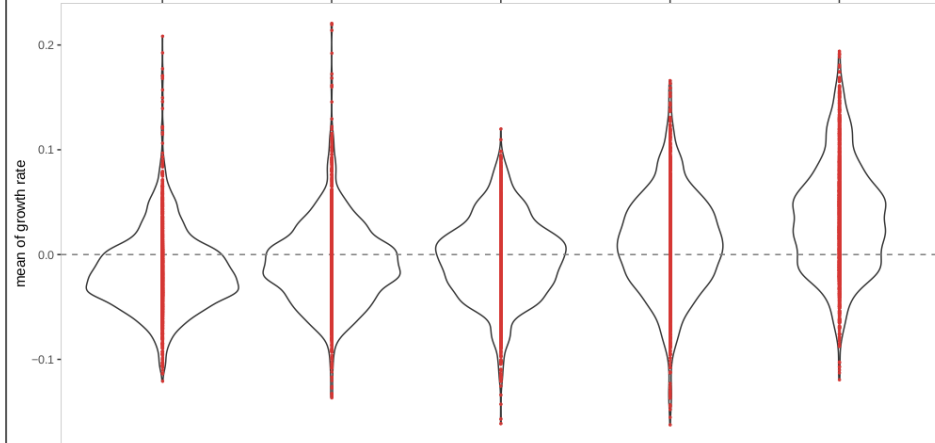


Number of Pillar 2 testing positive (estimated mean) vs. Growth Rate
On Tue. 25 May 2021 and the 14 previous days



Distribution of mean growth rate of all LTLAs per week
(estimated using the proportion of Pillar 2 testing positive)

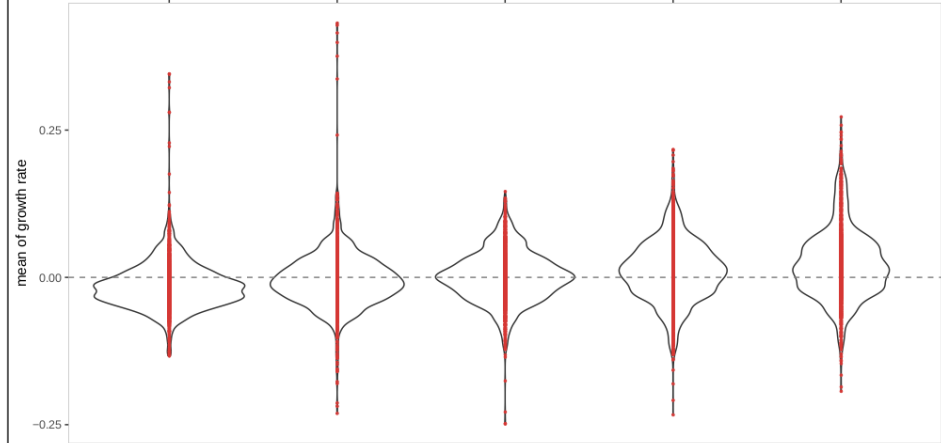
Week from Wed. 21 Apr 2021 to Tue. 27 Apr 2021 Week from Wed. 28 Apr 2021 to Tue. 04 May 2021 Week from Wed. 05 May 2021 to Tue. 11 May 2021 Week from Wed. 12 May 2021 to Tue. 18 May 2021 Week from Wed. 19 May 2021 to Tue. 25 May 2021



(*each dot corresponds to a LTLA in one day)

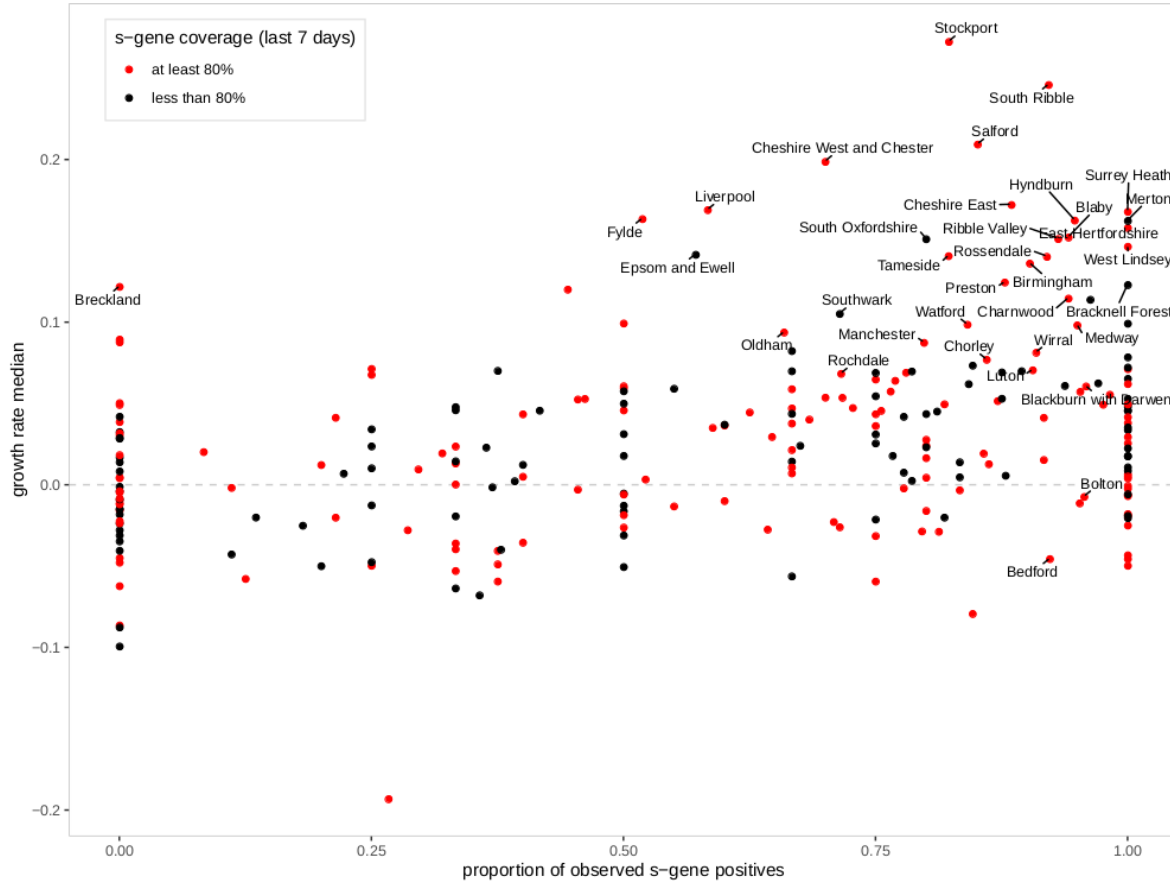
Distribution of mean growth rate of all LTLAs per week
(estimated using the number of Pillar 2 testing positive per 100,000 inh.)

Week from Wed. 21 Apr 2021 to Tue. 27 Apr 2021 Week from Wed. 28 Apr 2021 to Tue. 04 May 2021 Week from Wed. 05 May 2021 to Tue. 11 May 2021 Week from Wed. 12 May 2021 to Tue. 18 May 2021 Week from Wed. 19 May 2021 to Tue. 25 May 2021



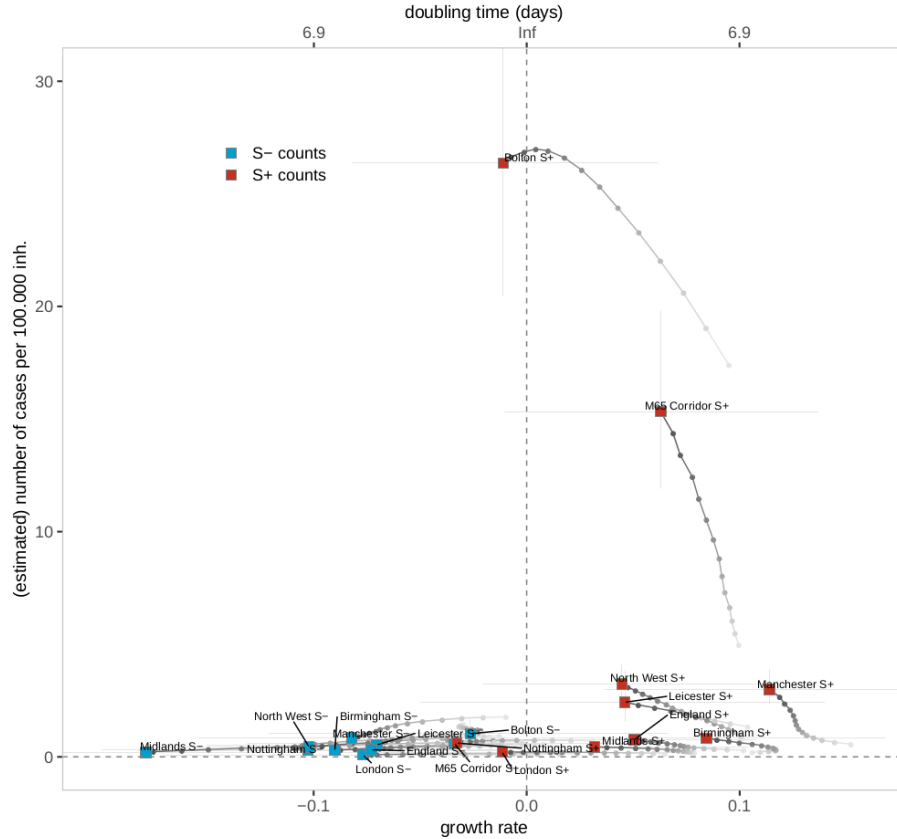
(*each dot corresponds to a LTLA in one day)

Proportion of observed s-gene positives vs. growth rate of number of Pillar 2 testing positive per 100.000 inh.
On Tue. 25 May 2021 and the 14 previous days

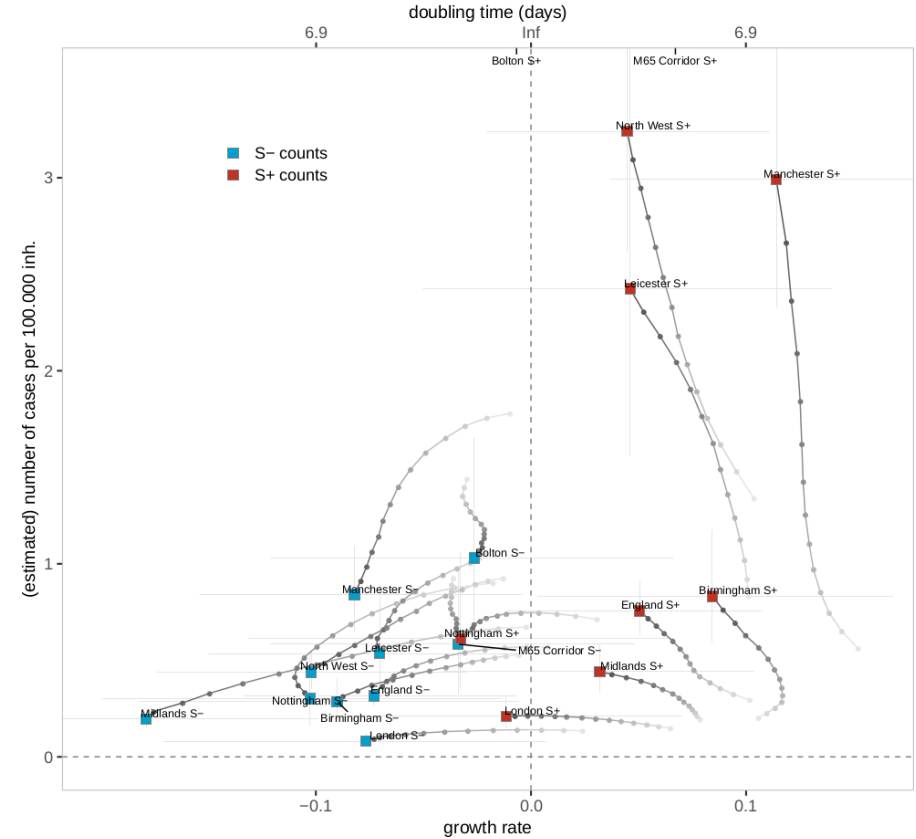


Growth rate and number of cases per LTLA and S+/- counts (left: all, right: zoom)

Number of symptomatic cases (estimated mean) vs. growth rate (estimated mean)
On Fri. 21 May 2021 and the 14 previous days



Number of symptomatic cases (estimated mean) vs. growth rate (estimated mean)
On Fri. 21 May 2021 and the 14 previous days



Growth rate comparison for:

- x-axis: growth rate of s-gene deletions between 01 Sep 2020 - 25 Mar 2021
- y-axis: growth rate of s-gene positives between 26 Mar 2021 - 20 May 2020
- dotted line: $x=y$

Approach:

The proportion of s-gene positives per LTLA were fitted using two logistic functions (one for i. 01 Sep 2020 - 25 Mar 2021 and another one for ii. 26 Mar 2021 - 20 May 2020)

