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Rapid Investigation Team (RIT)

Preliminary investigation into COVID-19 exceedances in Leicester (June 2020).

29 June 2020

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Descriptive Epidemiology

This report presents a summary of the descriptive epidemiology of COVID-19 in Leicester.

1.1 Trend in case counts and rates

A total of 3,216 COVID-19 cases have been reported in Leicester equating to a rate of 90.54 cases per 10,000 population. In the last 14 days, 944 cases have been reported – 71 from Pillar 1 testing and 873 from Pillar 2.

Table 1.1 Number and rate per 10,000 population of confirmed cases in Leicester, East Midlands, and England (up to 24 June 2020)

| Pillar | Leicester | | East Midlands | | England | |
|----------|-----------|-------|---------------|-------|-----------|-------|
| | No. cases | Rate | No. cases | Rate | No. cases | Rate |
| Pillar 1 | 1028 | 28.94 | 9858 | 20.52 | 159694 | 28.53 |
| Pillar 2 | 2188 | 61.60 | 10175 | 21.18 | 80026 | 14.30 |
| Total | 3216 | 90.54 | 20033 | 41.70 | 239720 | 42.82 |

The epidemic curve is shown for the entire period until 24 June 2020 (figure 1) and for the 14-day period between 11 and 24 June 2020 inclusive (figure 2). This shows that cases reported in pillar 1 have declined from the peak in April and pillar 2 activity accounts for the majority of new cases reported since May 2020.

Figure 1.1 Epidemic curve of daily confirmed COVID-19 cases in Leicester, by specimen date, to 24 June 2020

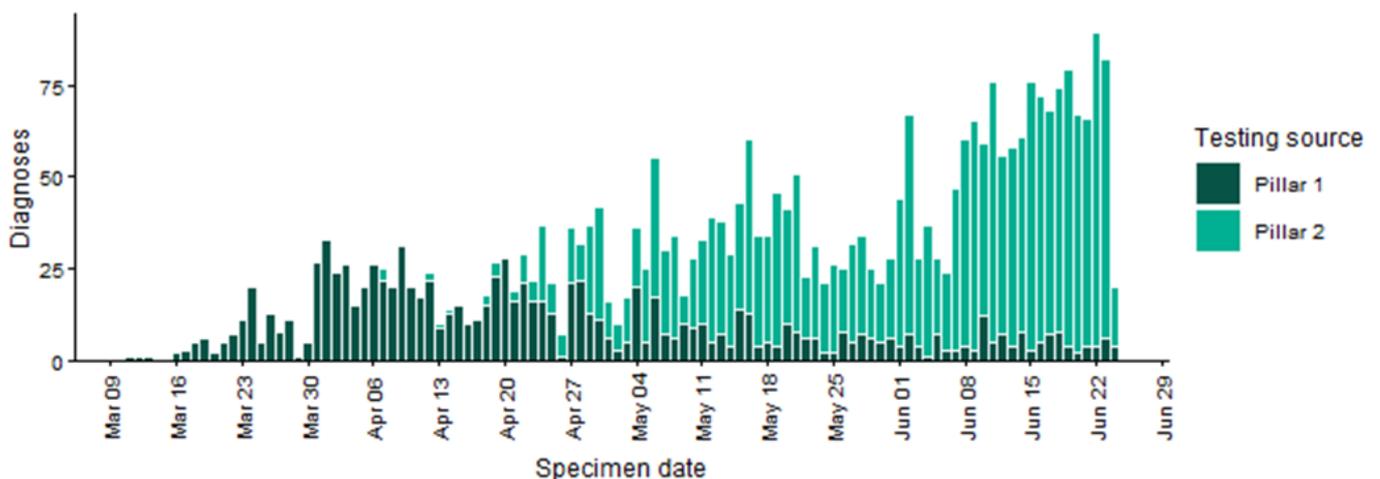
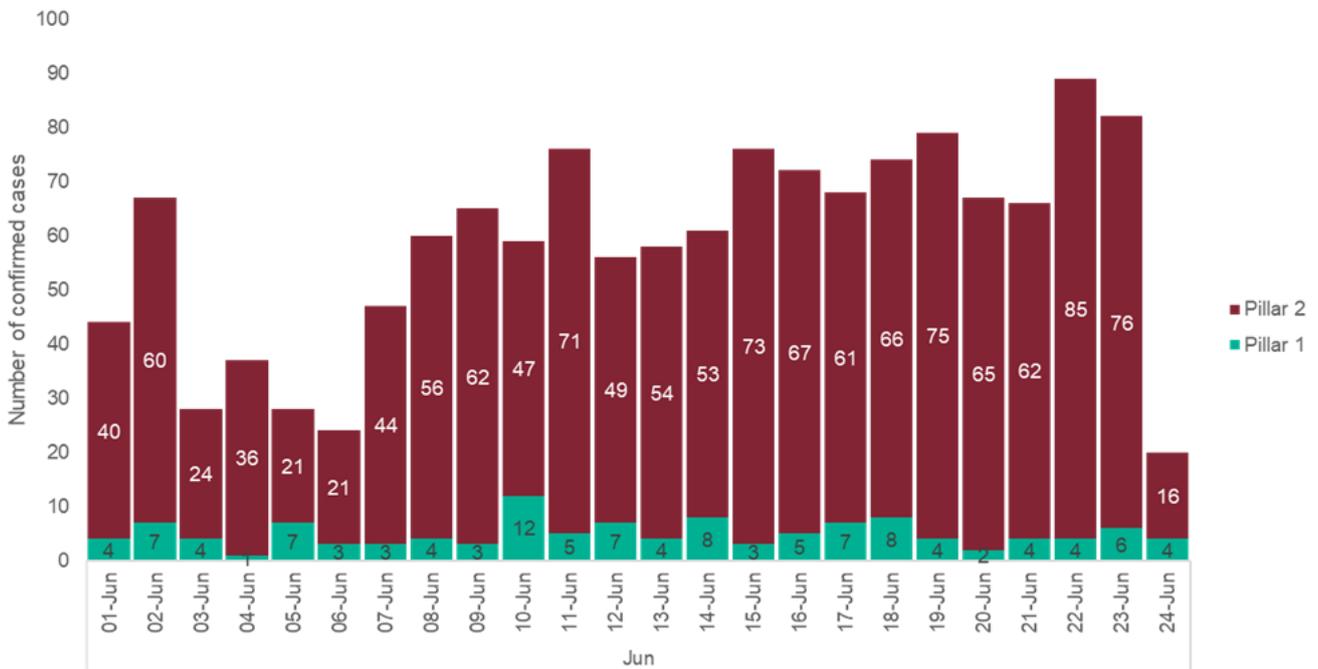


Figure 2. Epidemic curve of daily confirmed COVID-19 cases in Leicester, by specimen date, 11 June2020 to 24 June 2020



The table below shows the top 10 local authorities with the highest number of cases in them. This includes pillar 1 and pillar 2 COVID-19 cases combined, in the 10 days investigation period 13/06/2020 and 22/06/2020, inclusive.

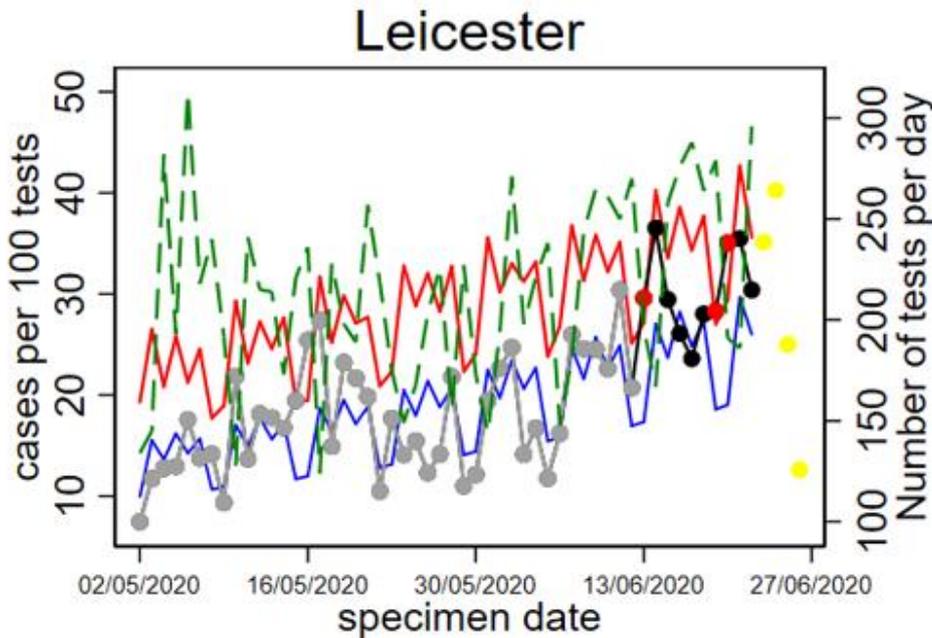
Table 1.2. Top 10 local authorities by case count between 13 June and 22 June 2020

| PHEC | LTLA name | Observed | Expected | IRR | lower 95% CL | upper 95% CL |
|----------------------|-----------------------|----------|----------|-------|--------------|--------------|
| East Midlands | Leicester | 711 | 582 | 1.055 | 1.033 | 1.077 |
| Yorkshire and Humber | Bradford | 493 | 379 | 1.018 | 0.996 | 1.04 |
| Yorkshire and Humber | Sheffield | 196 | 164 | 0.983 | 0.953 | 1.014 |
| Yorkshire and Humber | Leeds | 191 | 77 | 1.104 | 1.063 | 1.147 |
| Yorkshire and Humber | Barnsley | 187 | 72 | 1.055 | 1.014 | 1.098 |
| Yorkshire and Humber | Kirklees | 181 | 74 | 1.06 | 1.016 | 1.105 |
| West Midlands | Birmingham | 151 | 73 | 1.017 | 0.983 | 1.053 |
| East of England | Luton | 98 | 35 | 0.974 | 0.924 | 1.028 |
| North West | Blackburn with Darwen | 60 | 49 | 1.047 | 0.993 | 1.105 |
| North West | Liverpool | 49 | 40 | 1.004 | 0.939 | 1.074 |

The observed cases is the sum of the number of laboratory confirmed COVID-19 cases over the 10-day investigation period. The expected rate is the sum of the expected number of laboratory confirmed COVID-19 cases over the 10-day investigation period derived from the model used in the exceedance algorithm. Incident Rate Ratio (IRR) is the estimate of the relative change each day in the number of laboratory confirmed COVID-19 from the model (with 95% confidence limits). The results reported are derived from the time-series of laboratory confirmed cases, and the total number of laboratory tests for SARS-CoV-2, by specimen date and earliest test date, respectively, for each lower tier local authority. Due to delays in laboratory reporting into PHE, the most recent 4 days are deemed too incomplete to use and therefore have been ignored.

The time-series plots for Leicester based on cases per 100 tests and number of tests per day is presented below. In contrast to a decreasing trend noted in the vast majority of other UTLAs in East Midlands and England, a gradual increasing trend has been noted in Leicester in the last few weeks.

Figure 1.3. Time series plot of cases per 100 tests and number of tests per day, Leicester and other UTLs



The red line is the 99% threshold, the blue line is the expected or average number of cases per 100 tests each day which is predicted from the regression model. The grey line and points are the observed number of cases per 100 tests in the baseline period, i.e. the 6 weeks of data that are used in the exceedance algorithms regression model. The black line and points are the observed number of cases per 100 tests in the 10-day investigation period. The yellow points are the observed number of cases per 100 tests in the last 4 which are subject reporting delay so ignored. The green dashed line is the total number of tests (pillar 1 and pillar 2 tests combined) each day in the LTLA. A rough estimate of the number of cases each day can be obtained by multiplying the observed cases per 100 tests each day by the number of tests each day, and dividing by 100.

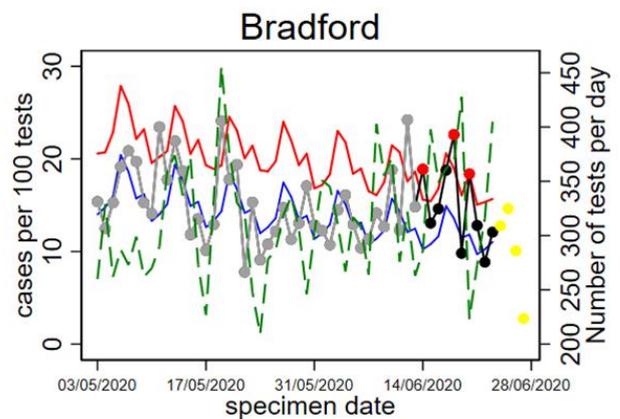
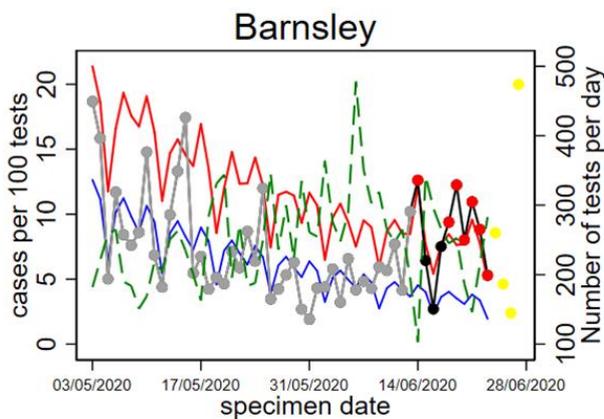


Table 1.3. 7-day infection rate per 100k: Top 10

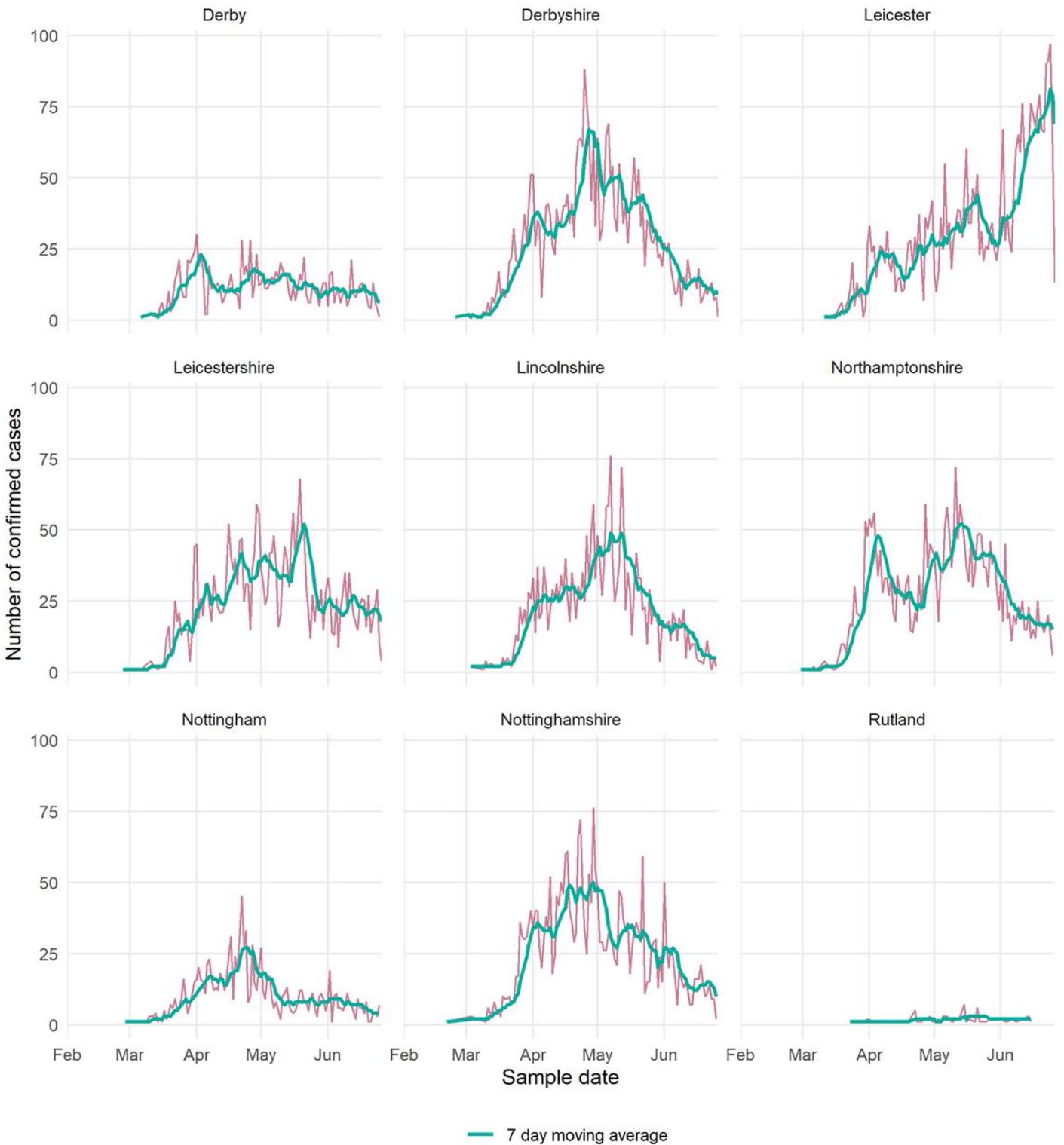
| Rank | UTLA name | Prior 7-day rate per 100,000 (June 14 to 20 2020) | 7-day rate per 100,000 (June 21-27 2020) | Difference in rate from prior week* | |
|------|-----------------------|---|--|-------------------------------------|---|
| 1 | Leicester | 140.2 | 135.7 | -4.5 | = |
| 2 | Bradford | 72.8 | 42.8 | -30 | ↓ |
| 3 | Barnsley | 53.8 | 34.7 | -19.1 | ↓ |
| 4 | Rochdale | 49.5 | 31.4 | -18.1 | ↓ |
| 5 | Oldham | 44.1 | 28.4 | -15.7 | ↓ |
| 6 | Blackburn with Darwen | 27.5 | 23.5 | -4.0 | ↓ |
| 7 | Rotherham | 34.8 | 22.3 | -12.5 | ↓ |
| 8 | Bedford | 42.5 | 21.6 | -20.9 | ↓ |
| 9 | Doncaster | 17.4 | 21.6 | 4.2 | ↑ |
| 10 | Bolton | 15.1 | 21.4 | 6.3 | ↑ |
| | England | 10.7 | 6.7 | -4.0 | ↓ |

*Green or red arrows mark more than 10% relative change in rate

When the 7 day infection rate of the top 10 UTLA is examined then Leicester city is three times higher than the next highest UTLA

The figure below (1.4) showing the trend of cases across local authorities in East Midlands shows the increasing trend in Leicester in contrast to other areas.

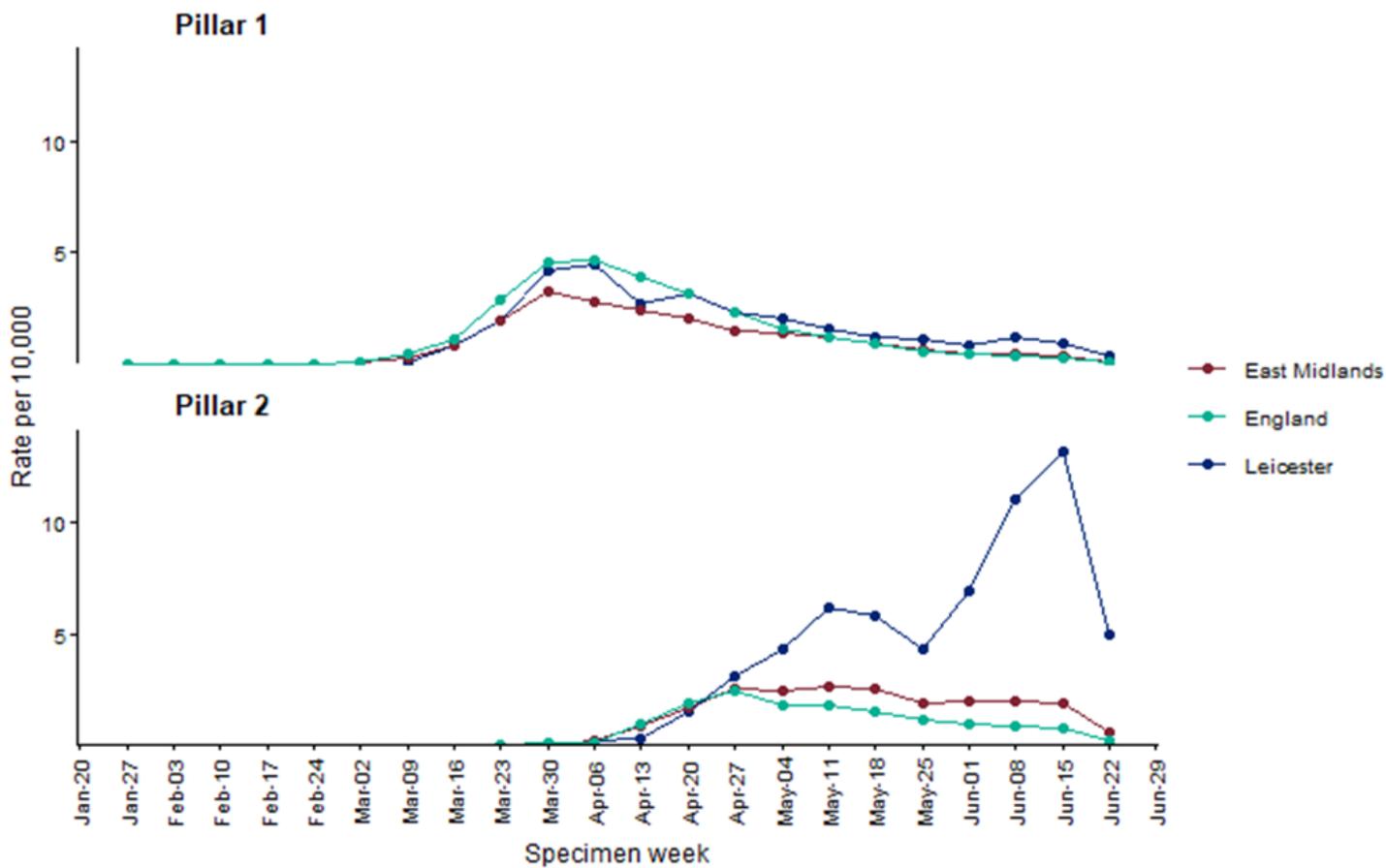
Figure 1.4: Laboratory-confirmed COVID-19 cases and 7 day moving average in East Midlands by local authority and report date



Includes both Pillar 1 and Pillar 2 data. Excludes cases with unassigned upper tier local authority

The figure below shows that the rate per 100,000 population of confirmed cases is higher in Leicester compared to East Midlands and England in recent weeks.

Figure 1.5. Rate per 10,000 population of weekly confirmed cases in Leicester, East Midlands, and England (up to 24 June 2020)



The table below shows the rates of cases per 100,000 population. It shows that the rate seen in June 2020 is much higher compared to similar LAs. While Leicester also had the highest rate for all cases until 24 June, other LAs appear to have achieved better control of infection rates by June 2020 whereas rates in Leicester remain high.

Table 1.4. Number of cases by local authority, epicell data, all cases and June 2020, mid-2019 ONS population

| Local Authority | 1-24 June 2020 | | All cases | |
|-----------------------------|----------------|------------------------------|-----------|------------------------------|
| | Total | Cases per 100,000 population | Total | Cases per 100,000 population |
| Leicester | 1,490 | 420.6 | 3,303 | 932.5 |
| Nottingham | 148 | 44.5 | 1,139 | 342.1 |
| Coventry | 71 | 19.1 | 1,309 | 352.3 |
| Luton | 215 | 100.9 | 1,329 | 623.8 |
| Sandwell | 138 | 42.0 | 1,608 | 489.6 |
| Wolverhampton | 107 | 40.6 | 1,355 | 514.5 |
| Salford | 113 | 43.7 | 1,280 | 494.5 |
| Oldham | 345 | 145.5 | 1,764 | 744.0 |
| Blackburn with Darwen | 157 | 104.9 | 954 | 637.3 |
| Derby | 225 | 87.4 | 1,237 | 480.8 |
| Rochdale | 338 | 152.0 | 1,454 | 653.7 |
| Bradford | 1,137 | 210.6 | 3,889 | 720.5 |
| Liverpool | 121 | 24.3 | 2,372 | 476.3 |
| Southampton | 66 | 26.1 | 911 | 360.8 |
| Kingston upon Hull, City of | 183 | 70.4 | 1,523 | 586.3 |
| Newcastle upon Tyne | 73 | 24.1 | 1,510 | 498.6 |

NOTE: the above table is ordered according to how close each LA is to Leicester with those at the top being most similar and those at the bottom least similar.

1.2 Age/sex distribution

The age-sex pyramid of cases confirmed in pillar 1 and 2 testing is shown below. The proportion of male to female cases is similar (49% Female).

Figure 1.6. Population pyramid for confirmed cases in past 14 days in Pillar 1 (June 11 2020 to June 24 2020) and prior (March 11 2020 to June 10 2020)

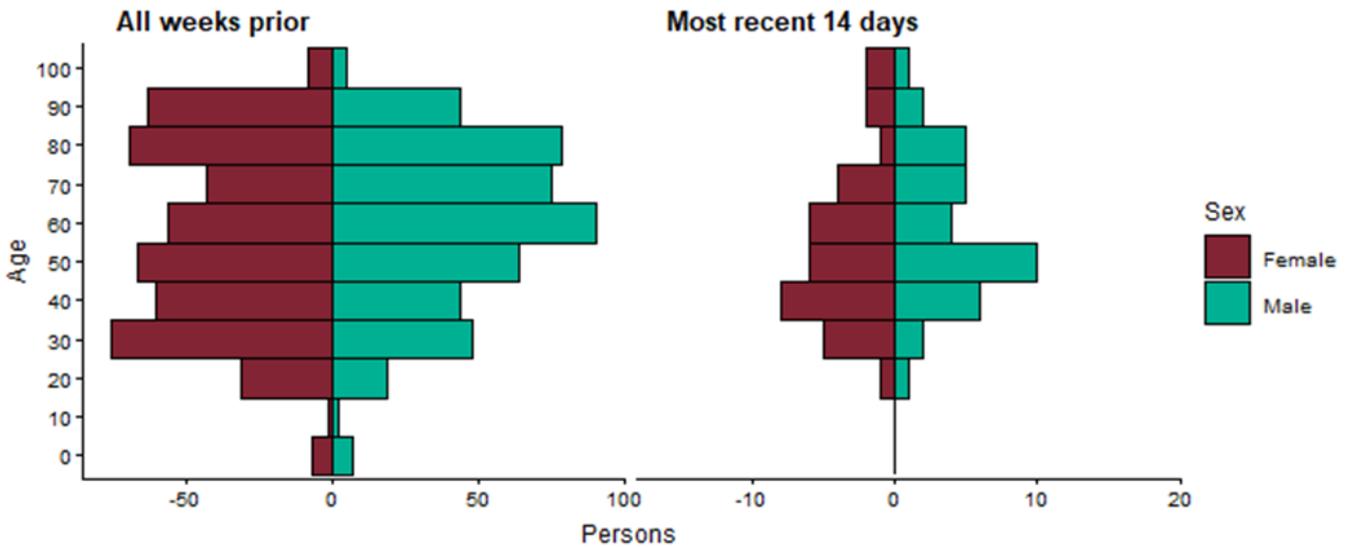
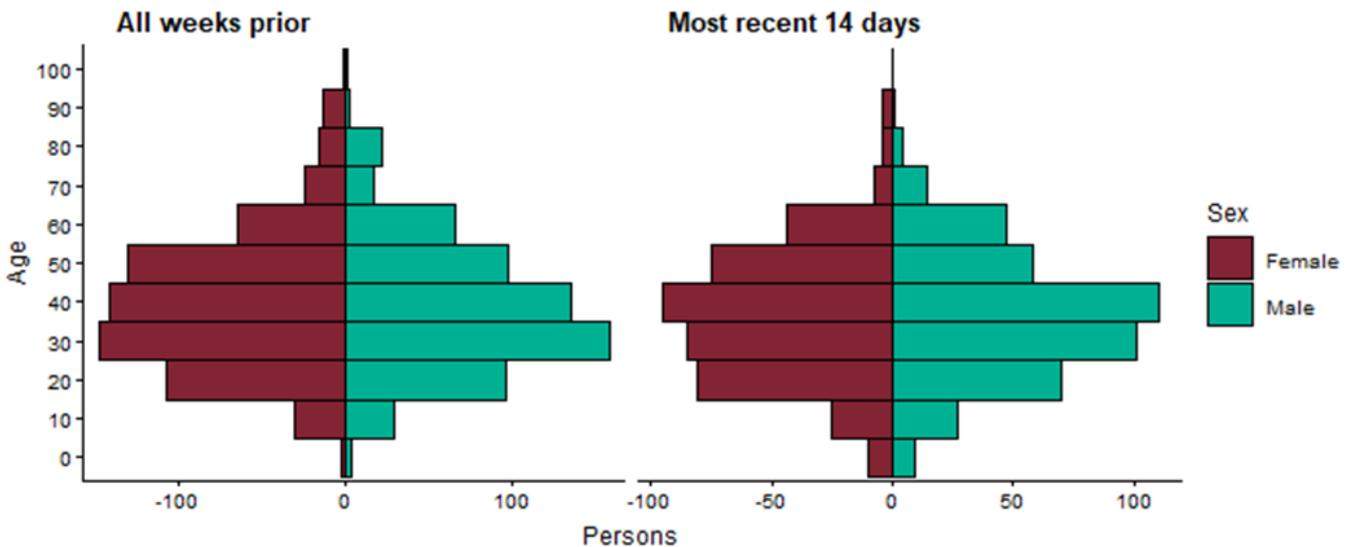
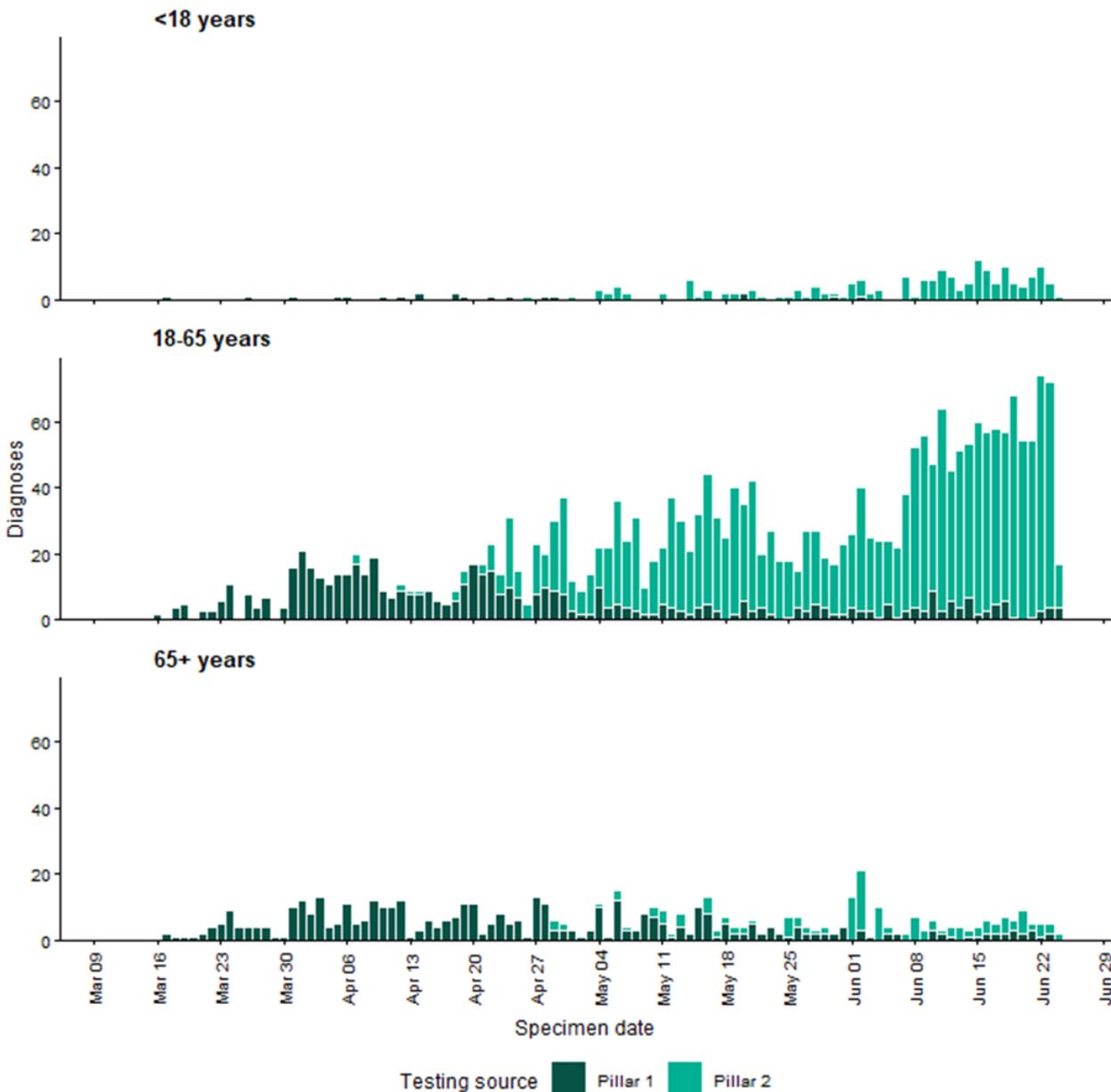


Figure 1.7. Population pyramid for confirmed cases in past 14 days in Pillar 2 (11 June 2020 to 24 June 2020) and prior (March 11 2020 to June 10 2020)



The majority of cases confirmed in the recent 14 days are aged 18 to 65 years. The number of cases in those aged 65 years and over has been stable whereas cases reported in those under 18 years of age have been slowly increasing in the last 4 weeks.

Figure 1.8. Epidemic curve of daily confirmed COVID-19 cases over time in Leicester by age group (March 11 2020 to June 24 2020)



The median age is 39 years (range 0 to 98). Cases are younger in Leicester compared with CIPFA nearest neighbours.

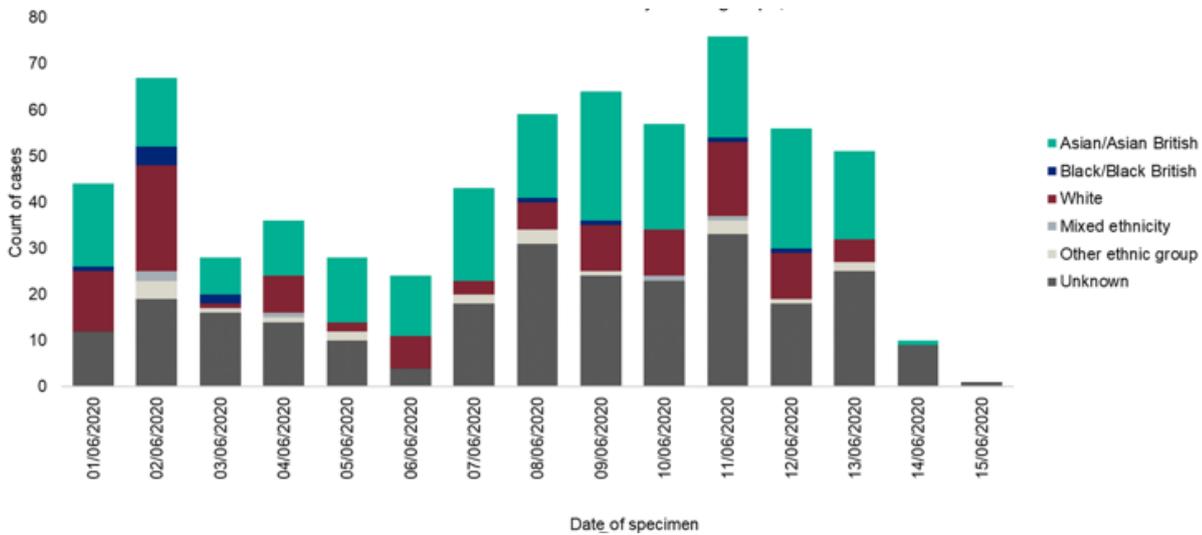
Table 1.5. Age profile of cases reported in June 2020 in Leicester compared to CIPFA nearest neighbours

| Local Authority | Mean age of cases | Median age of cases | Range of ages | Number female | Number male |
|--------------------|-------------------|---------------------|---------------|----------------|--------------|
| Leicester | 40.5 | 39 | 0 - 98 | 530 (50.9%) | 511 (49.1%) |
| Nearest neighbours | 49.8 | 47 | 0-106 | 10,202 (57.9%) | 7425 (42.1%) |

1.2 Ethnicity

Ethnicity of cases reported in Leicester in June 2020 is shown below, likely reflects the ethnicity profile of the population.

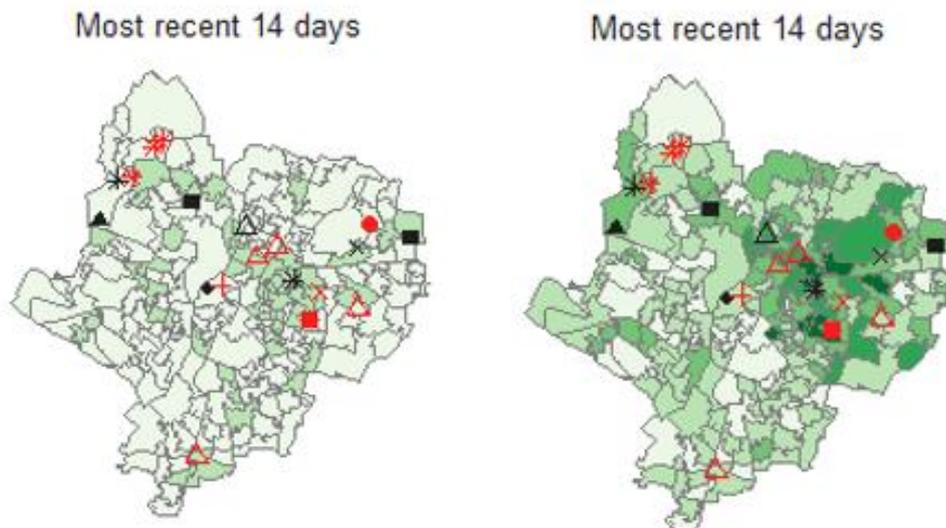
Figure 1.9. Ethnicity of cases reported in June 2020 in Leicester

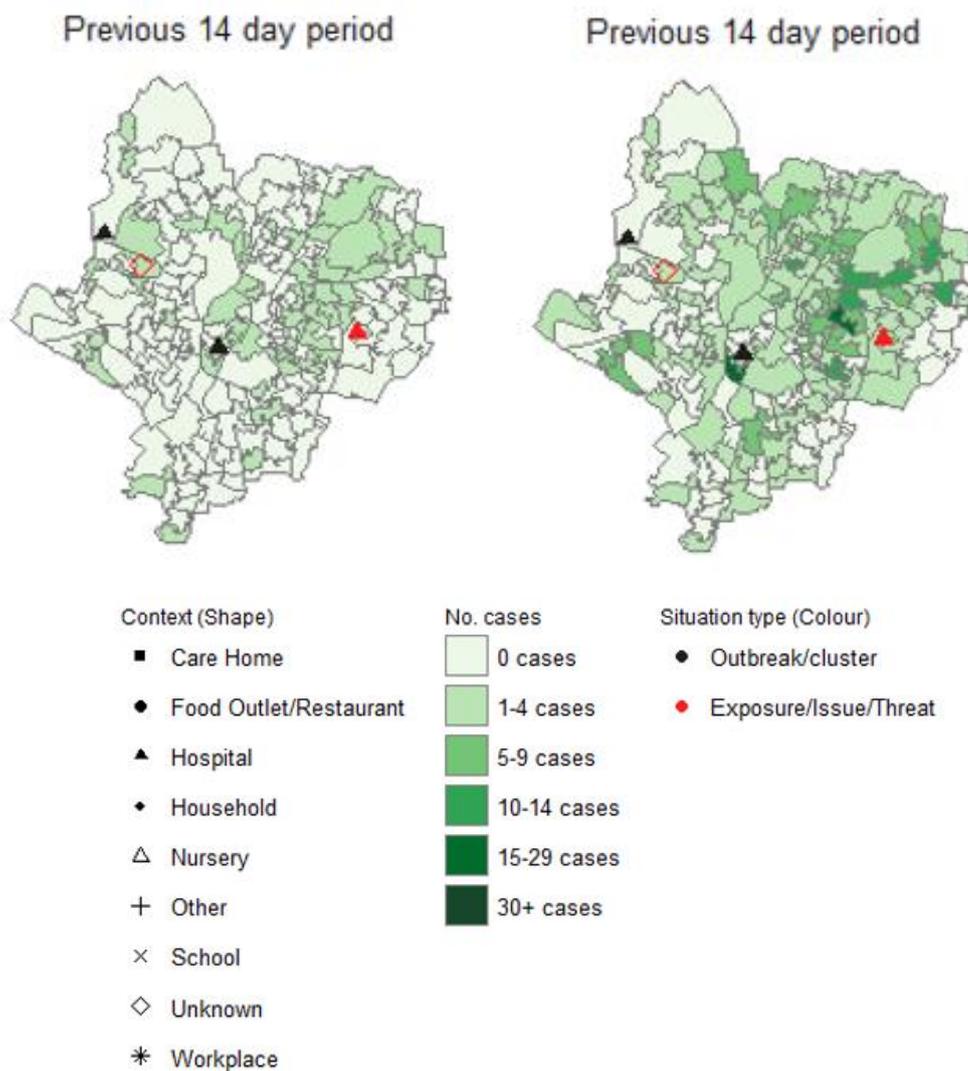


1.3 Location of residence of cases

The map below shows the location of cases resident in Leicester for the last 28 days. As noted earlier, cases diagnosed in pillar 2 account for the majority of cases in last 14 days.

Figure 1.10. Map of new cases reported from Pillar 1 (left) and Pillar 2 (right) in Leicester in recent 14 days (June 11 2020 to June 24 2020) and prior 14 days (May 28 2020 to June 10 2020), overlaid with outbreak/cluster information from HPZone



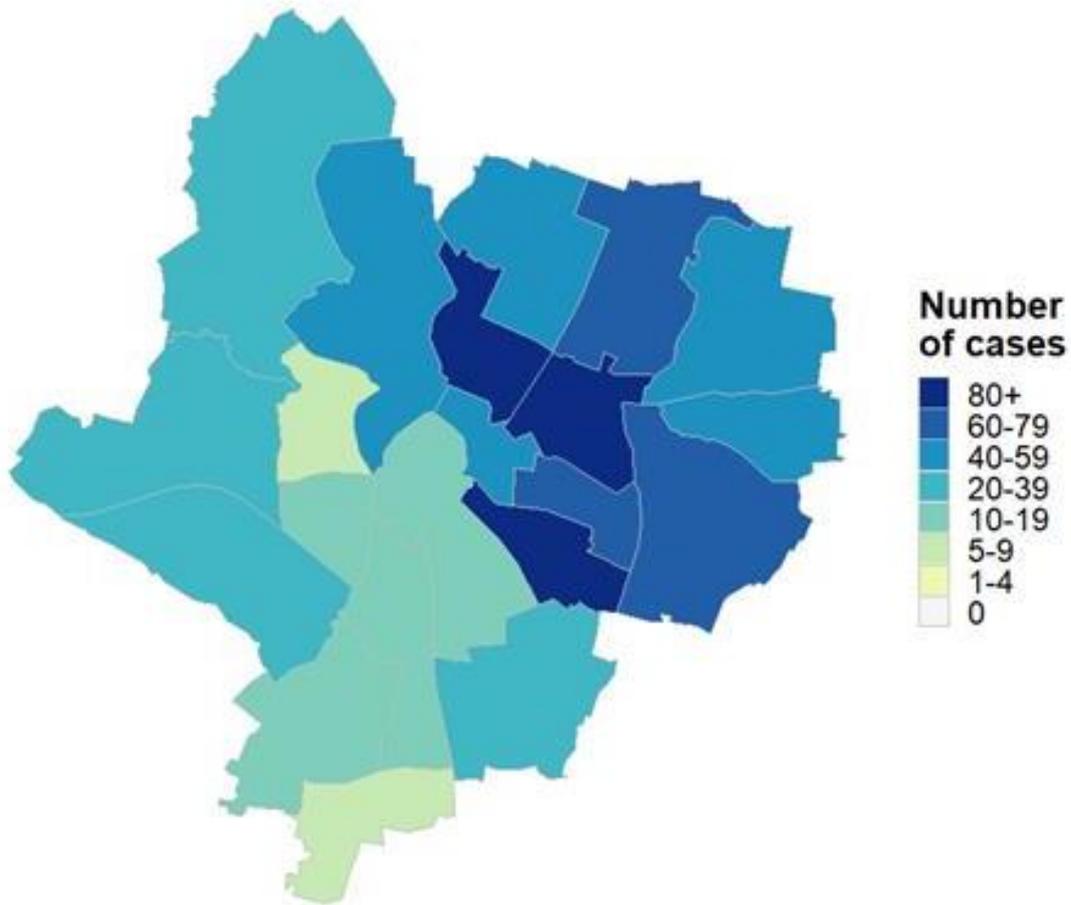


Analysis of case counts by wards shows that the North East areas of Leicester has the most cases reported in the recent 2 weeks.

Table 1.6 Number and proportion of cases reported between 11 and 25 June 2020 in the top 10 wards in Leicester

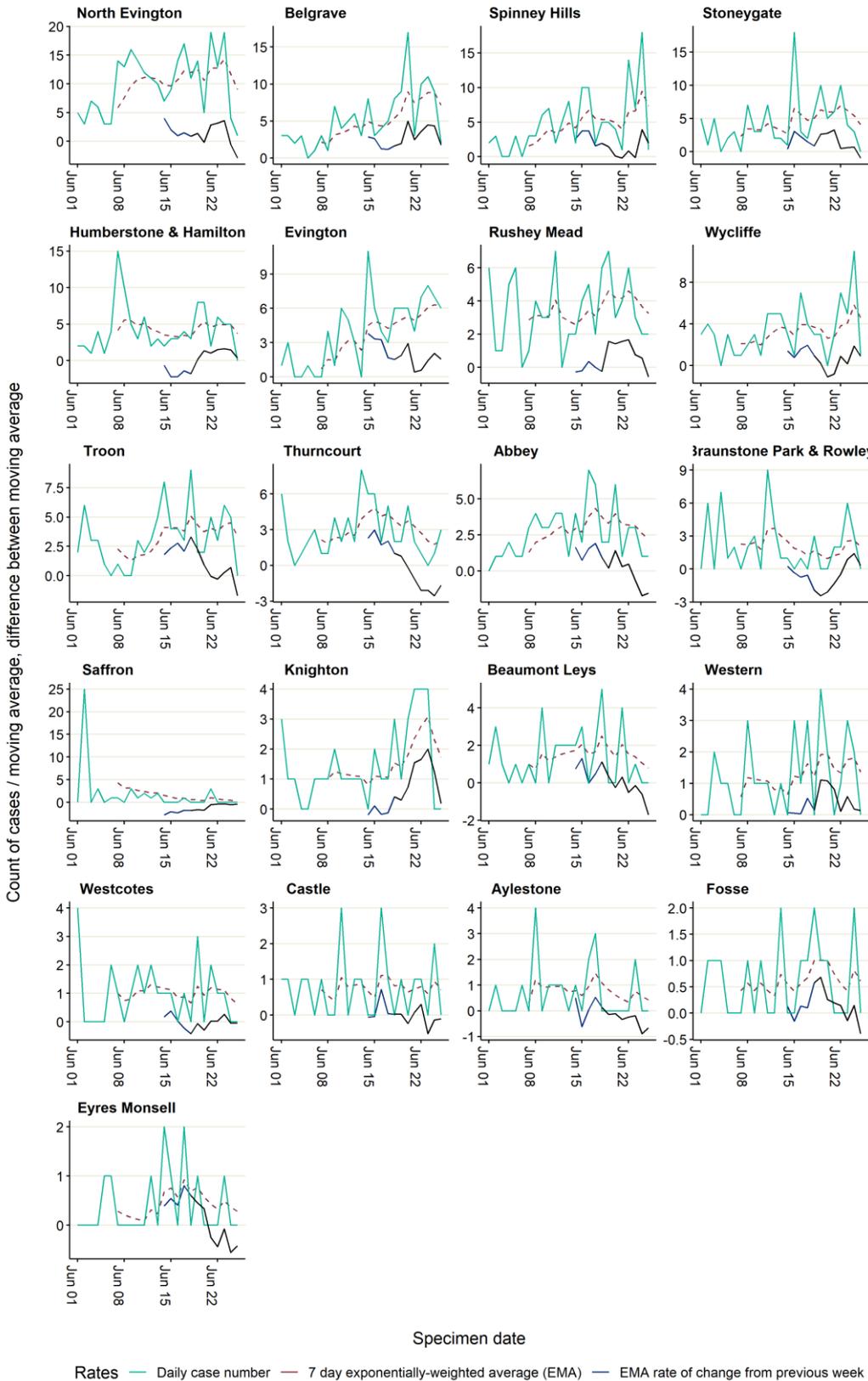
| Ward | Number | % of Total |
|-----------------------------------|--------|------------|
| North Evington | 161 | 16.7 |
| Belgrave | 97 | 10.1 |
| <u>Stoneygate</u> | 82 | 8.5 |
| Spinney Hills | 79 | 8.2 |
| Evington | 73 | 7.6 |
| Troon | 61 | 6.3 |
| Wycliffe | 56 | 5.8 |
| <u>Humberstone & Hamilton</u> | 53 | 5.5 |
| <u>Rushey Mead</u> | 53 | 5.5 |
| Abbey | 43 | 4.5 |

Figure 1.11. Location of cases reported between 11 and 25 June by ward in Leicester



The figure below shows the trend of cases in wards in Leicester in June 2020

Figure 1.12. Trend of cases in wards in Leicester, June 2020



The facet panel below shows the number of cases and positivity by wards in Leicester for cases to 25 June 2020 using SGSS/USD data. Areas with high positivity include Belgrave, Evington, Spinney Hills, North Evington, Stoneygate and Wycliffe. This is a provisional finding and needs further analysis

1.4 Incidents reported to local Health Protection Team

East Midlands has reported 37 situations of interest in the last 3 weeks; with 22 related to Leicester postcodes. This is more than double the nearest region; with the majority of regions reporting less than 10 situations of interest in the last 4 weeks. Many of these incidents are related to food factories/outlets. The HPT have supported detailed risk assessments with the companies involved and enhanced communications and actions have been put in place. There are 4 situations where shops and supermarkets are reporting staff with COVID-19.

It is important to note that the care homes are much less affected than late March/ early April suggesting that the measures introduced are protecting these settings.

1.5 Backward contact tracing

A current study on the utility of backward contact tracing is being piloted across England. Leicester city residents have been included in the pilot. Against an intended sample of 50 cases, only 11 cases in the city had successfully completed the study until 24 June 2020. Preliminary analysis of the 11 cases did not identify any events with multiple households attending. Most of the cases did not report leaving home, other than for visiting supermarkets.

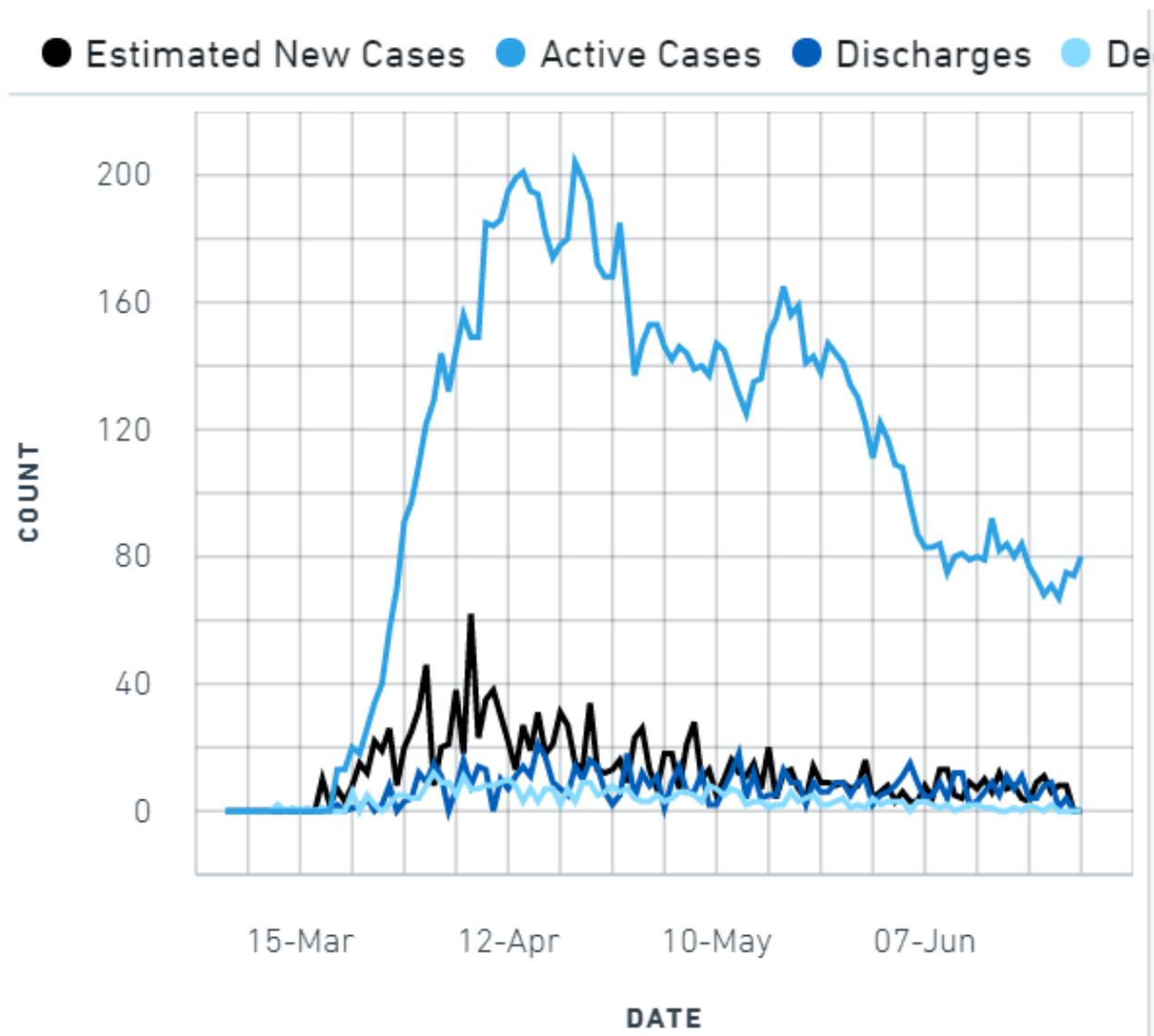
1.6 Impact on Hospitals

The Leicester Hospitals are contained with the Leicester, Leicestershire and Rutland STP. University Hospitals of Leicester NHS Trust (UHL) has 4 sites around Leicester. One of these sites reported an outbreak on one ward where 5 patients who were screened as COVID negative on admission were subsequently detected as COVID positive following planned screens on day 5 of admission (i.e. likely incubating on admission). All other patients and staff were screened and a further 12 staff were found to be COVID-19 positive who were asymptomatic.

UHL has currently got 80 patients with confirmed COVID-19 in the hospitals; 10 requiring mechanical ventilation. The hospital surge happened in early April and admissions initially decreased rapidly but have remained steady at between 6 and 10 new COVID-19 confirmed admissions per day over the last 4 weeks.

UHL employs approximately 15,000 staff and 771 were absent on 27 June 2020 for COVID-related reasons (including shielding, vulnerable, household quarantine and symptoms). This is similar to other organisations.

Figure 1.13. Active cases, estimated new cases and discharges from University Hospitals of Leicester, 28/6/2020 (from NHSE/I SitRep)



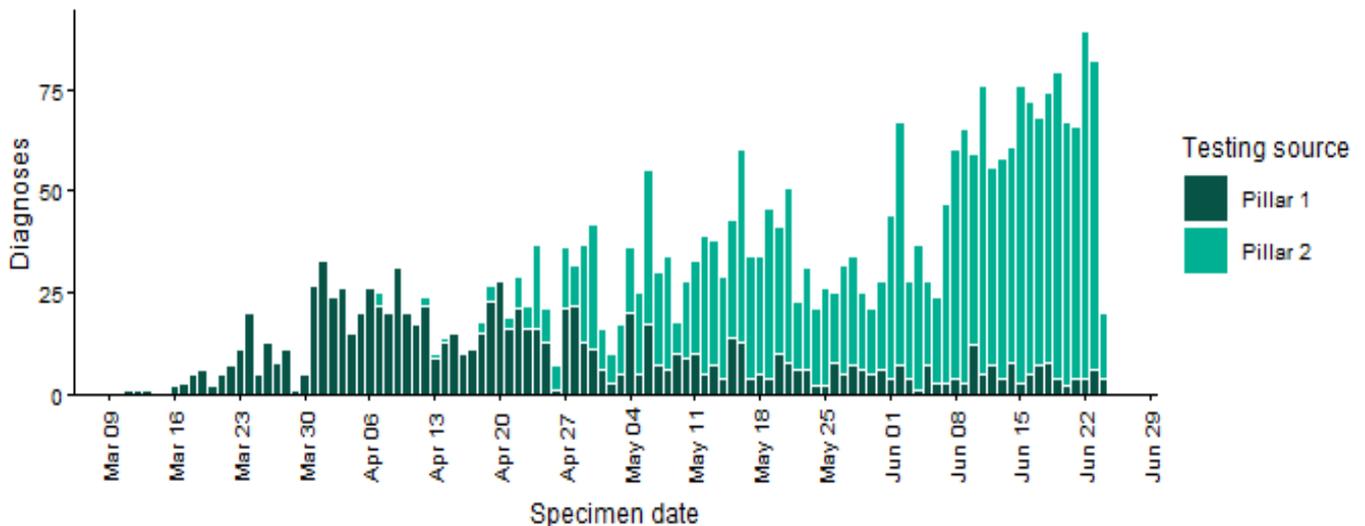
Modelling observations and analysis

Observations

The histogram of pillar 1 and pillar 2 diagnoses appear to suggest that there is an ongoing outbreak of COVID-19 in Leicester with increasing numbers of cases being identified on subsequent days, most notably since early June 2020. However, the absolute change in numbers of clinically unwell cases cannot be readily distinguished from the numbers of new infections (symptomatic and asymptomatic) that might be expected to be seen due to the very significant changes in testing regimes that have occurred during the period mid-March to late June.

It is important to note that both the numbers of tests that can be performed has increased and that the testing regime has been used for a wide range of purposes including outbreak investigation and screening.

Figure 2.1 Cases by testing pillar over time



The national epidemic peaked in the last week of March 2020, and the available laboratory diagnostic data to support clinical services (pillar 1) is most likely to have remained representative of the clinical cases that have arisen in Leicester (as opposed to all the detected infections, clinical and sub-clinical, that are contained in the pillar 1 plus pillar 2 diagnoses); and in that respect the pillar 1 diagnoses appear to be similar to the general national picture for clinically apparent disease at and around the epidemic peak in late March 2020.

The rise in pillar 2 diagnose is probably linked, in part, to the availability of testing to the general public, and at least one component of the rise in new diagnoses is due to a

steadily increasing proportion of infections (symptomatic and asymptomatic) being identified rather than a true increase in the number of new infections occurring.

There is an almost linear rise in the numbers of new cases being identified from the beginning of May until mid-June. However, this is not characteristic of unconstrained growth of an epidemic from an organism that is well characterised as having an $R_0 \approx 3$.

The proportion of positive PCR tests (as a proportion of all test) is rising. This is suggestive of a genuine increase in numbers of new infections, not simply an artefact of increasing test rates.

This effect is most marked in the under 19-year-old group where the proportion of test positive cases fell to $\approx 5\%$ (across all age groups) after the end of the initial epidemic peak, and has climbed back from mid-May to a current value of $\approx 15\%$.

The proportion of positive tests in working age people has also risen to $\approx 15\%$.

Figure 2.2 % of tests with positive results in <19-year age group

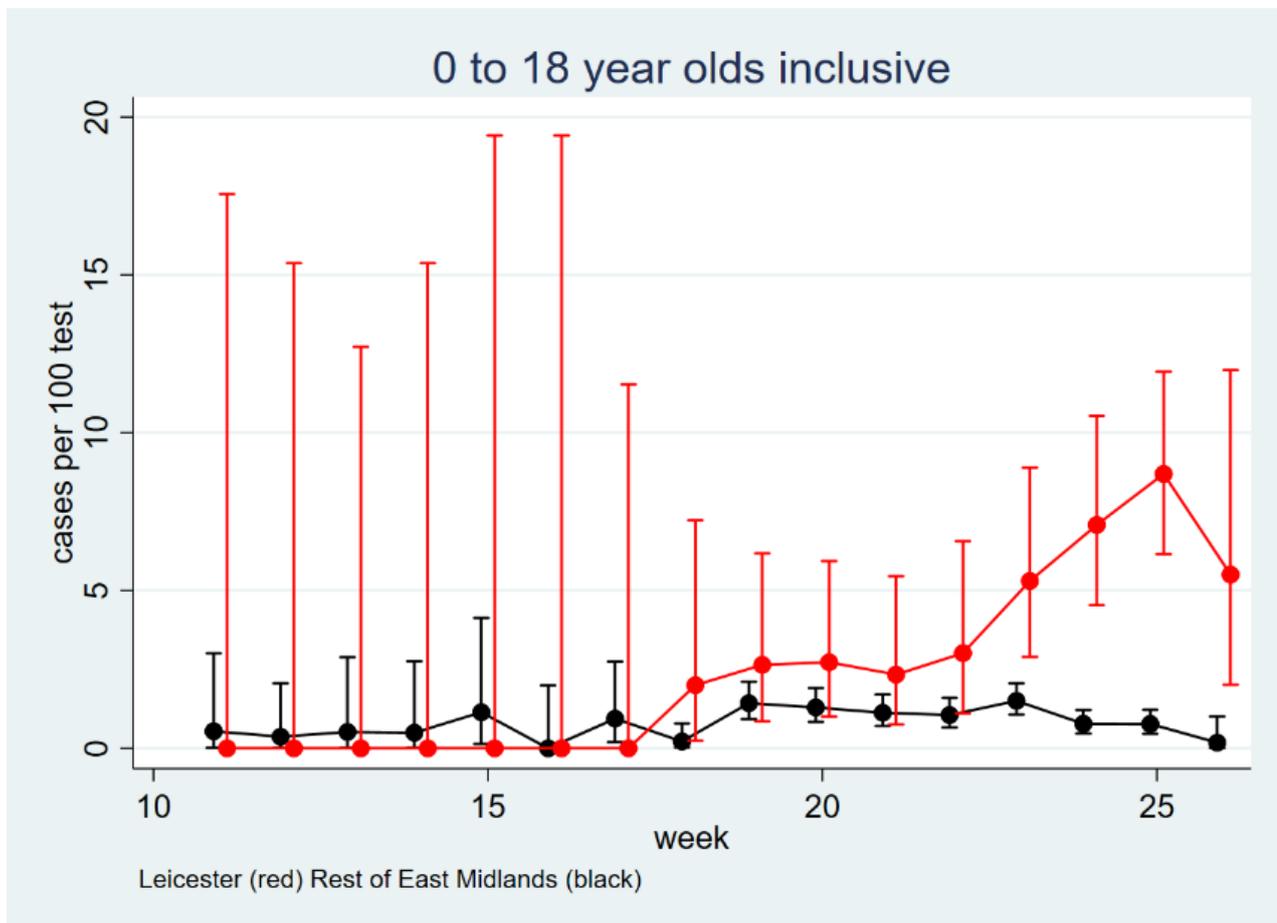


Figure 2.3 % of tests with positive results in 19 to 64 year age group

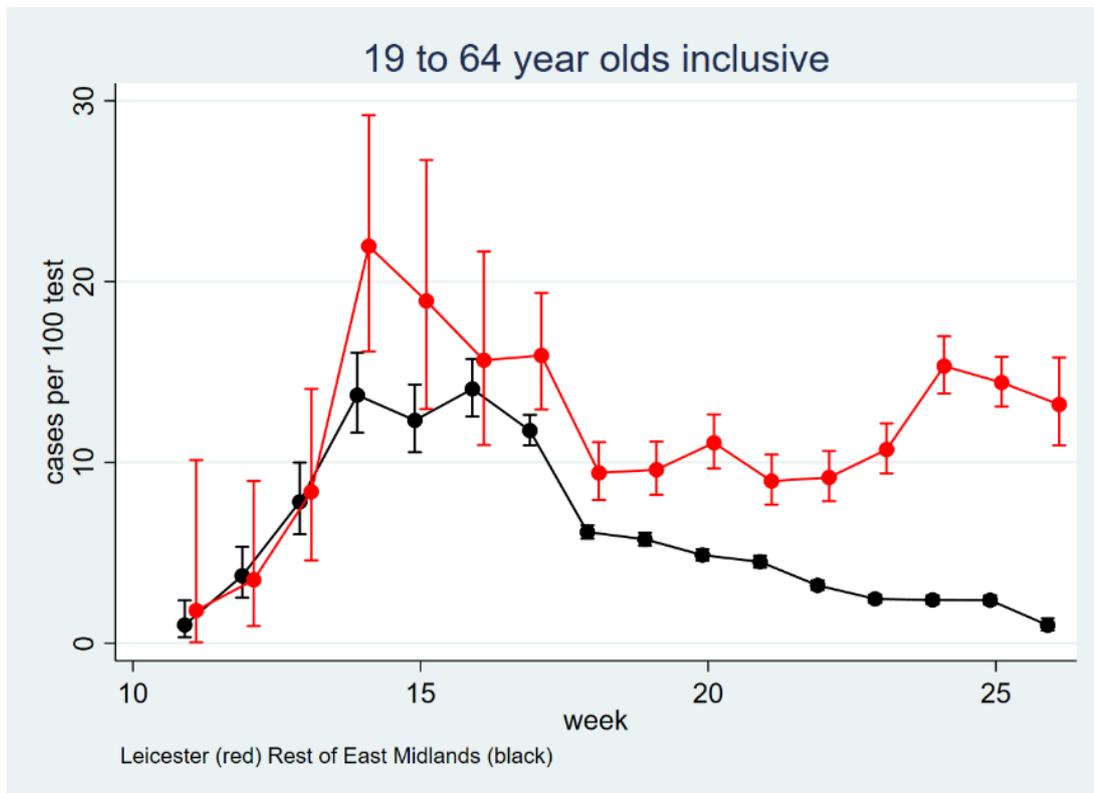
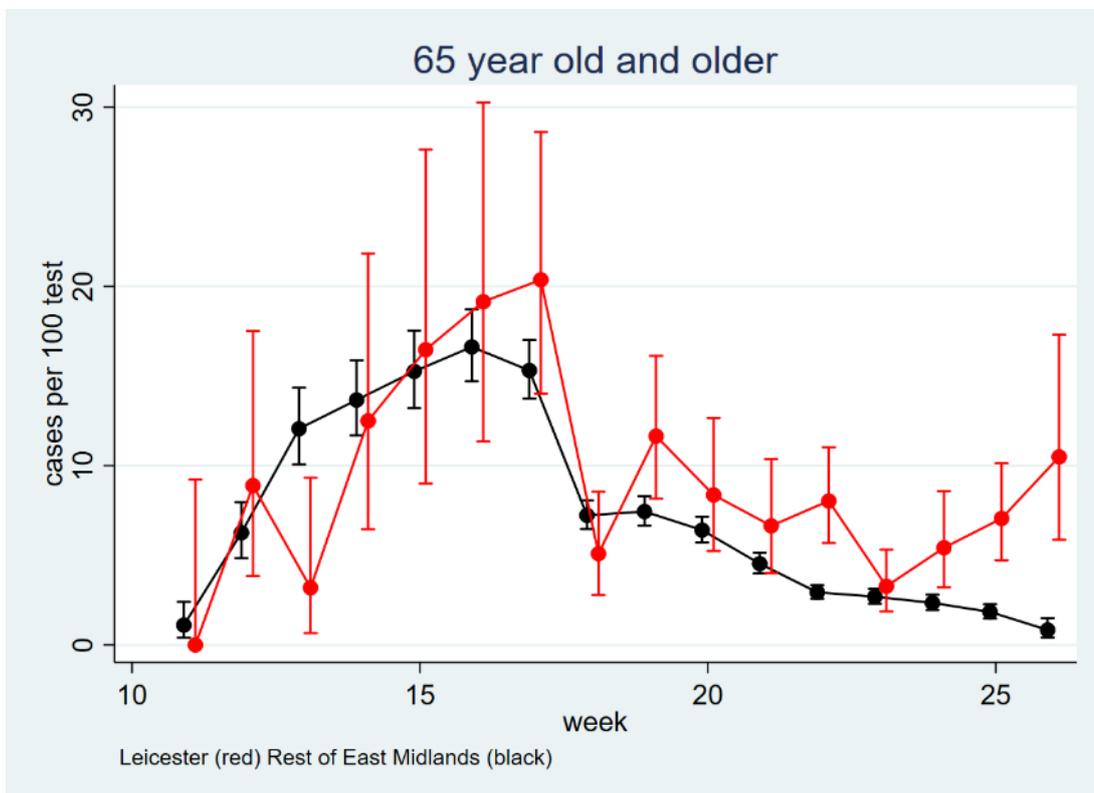
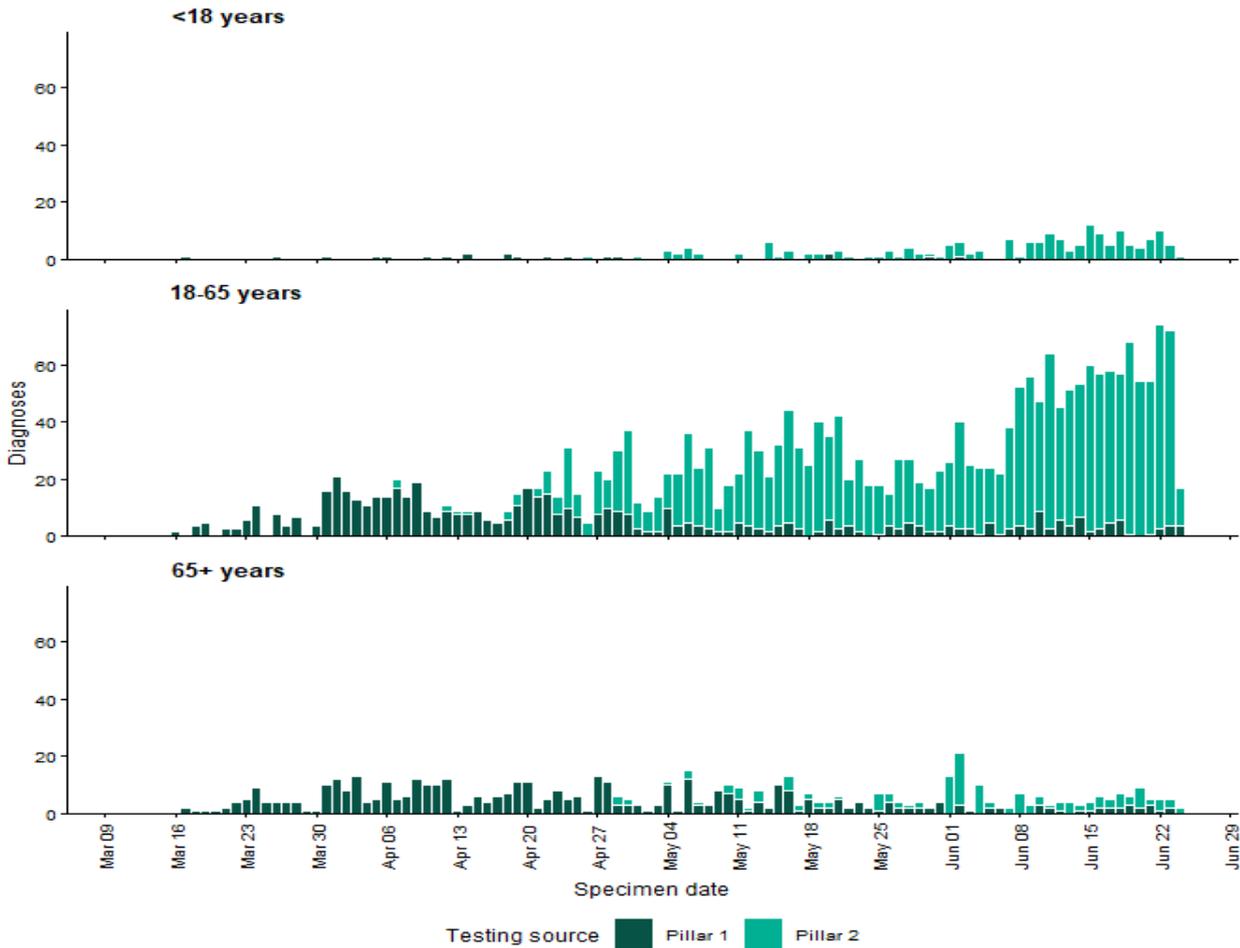


Figure 2.4 % of tests with positive results in 65+ year age group



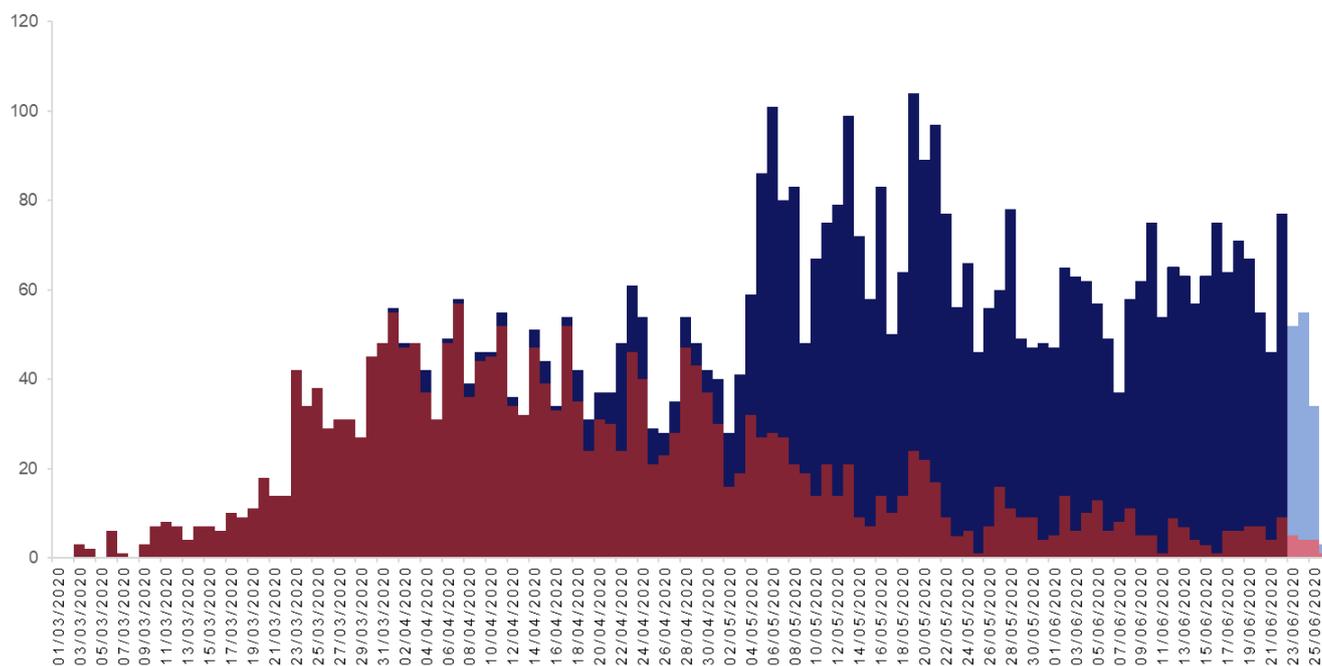
Disaggregation of cases by age groups of these diagnoses in Leicester suggests that if an excess of infections has occurred then it is occurring in young and middle-aged people:

Figure 2.5 Cases by <18 years, 18 to 65 years and 65 + years over time



There is, however, no similar rise in such diagnoses notable across England, with the numbers of diagnoses in children relatively static since the introduction of pillar 2 testing.

Figure 2.6 England confirmed cases <19 years old by diagnostic pillar



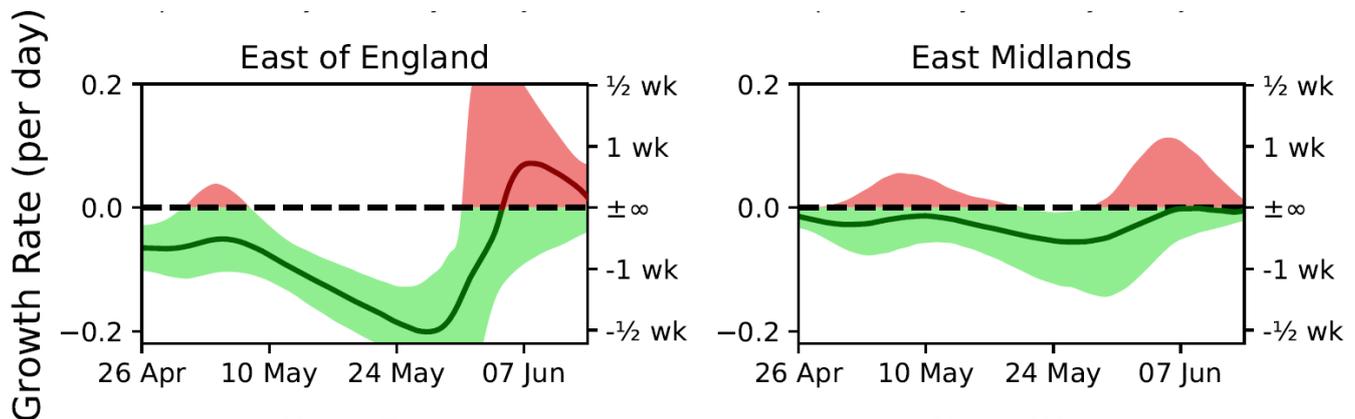
Pillar 1 results in red / pillar 2 in blue

Since the beginning of June there has been good provision of primary school access for children in Leicester, with 38% of the all age school capacity now being available (we believe that secondary access is currently still restricted to children of essential workers); and of this 94% of child-day place availability capacity is being utilised.

We have been unable to provide any analytical link to correlate this observation with any real or apparent rise in new infections in the Leicester area. However, it would seem sensible to investigate this association to exclude any evidence of the recent rise in observed case numbers of being linked to a return of larger numbers of children to school.

As yet unpublished ONS data analysed for growth rates and doubling times by colleagues at the University of Manchester for the contiguous East of England and East Midlands Regions are giving a soft signal of plateauing case numbers that conflict with the general decline in numbers of new infections that are being seen elsewhere in England (see figure below where the brown areas refer to increased growth).

Figure 2.7 Growth rate per day – East of England and East Midlands



These soft signals are also to be seen in national data from ONS at:

<https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurveysurvey/pilot/england25june2020>

1. PHE exceedance reports only identify Leicester (rising) and Bedford (plateauing) as significant trends in these regions.
2. There are no explanatory outbreaks in care homes, hospital settings, or industrial processes to immediately explain the apparent rise in new diagnoses to be found from searching outbreak reports and case report databases.
3. There are no supportive death reporting data suggestive of an epidemic dynamic that is different in the East Midlands Region to the rest of England at this time.

Conclusions

1. The strongest evidence of an outbreak is given by the numbers of new infections identified in children and working age people, and rising proportion of positive tests also seen in these age groups, from late May onwards. These are trends not observed in other parts of the Midlands, or related travel areas.
2. Evidence for the scale of the outbreak is limited and may, in part, be artefactually related to growth in availability of testing.
3. If an outbreak is occurring, then care should be taken to ensure that the artificial geographical reporting boundaries do not obscure a problem that may cross the East Midlands and East of England border.