Public Health England

Protecting and improving the nation's health

Serological Surveillance: Summary report 4
PHE Surveillance Cell

12 May 2020

Key messages:

- **Results from testing an additional 1974 blood donor samples (collected in early May from London and South East regions; week 18) and 216 paediatric samples from Great Ormond Street Hospital (GOSH) (collected in late April; week 16-17) are included in this week's report.**
- **Prevalence estimates are adjusted for the sensitivity and specificity of the Euroimmun assay and weighted to match age and gender distribution of the general population.**
- **Age – gender weighted adjusted prevalence estimates from GOSH samples show an increase from 9% [95%CI: 3.9%,16.1%] in weeks 12/13 to 19.7% [95% CI: 13-28.2%] in weeks 16-17. Prevalence continues to be higher in younger age groups but further testing of paediatric samples is important to understand these trends.**
- **Age-gender weighted adjusted prevalence estimates from blood donors in London have increased from 1.5% [95%CI: 0.2,3.9%] in week 13 to 12.3% [9, 16.4%] in weeks 15/16 to 17.4% [95%CI: 13.4%, 22.5%] in week 18. Prevalence is higher in young adults although increases in older adults in the most recent London data, potentially suggests older adults being affected later.**
- **Initial prevalence results in the South East are similar (4.2% [95%CI: 1.6,7.1%] to those in the rest of the country outside of London (and those seen in London a few weeks ago).**

Background

Control of COVID-19 requires the ability to detect asymptomatic and mild infections, that would not present to healthcare and would otherwise remain undetected through existing surveillance systems. This is important to determine the true number of infections within the general population to understand transmission, to inform control measures such as social distancing and school closures and to provide a denominator for the estimation of severity measures such as infection fatality and infection hospitalisation ratios.

Enhanced Sero-surveillance

Details of the serosurveillance sample sources can be found in previous reports. The data presented in this report has been ascertained using adult samples from blood donors in England (NHS Blood and

Transplant (NHSBT)) and Wales (Welsh Blood Service, WBS) as well as paediatric samples from Great Ormond Street Hospital (GOSH).

Results

Seroprevalence estimates presented here are based on adult samples from NHSBT (n= 9598) and paediatric samples obtained from GOSH (n=596 aged >1y).

In addition to the 7427 NHSBT samples presented last week, this report includes the results of 954 new samples from London (collected in week 18), and 1020 samples from the south-east of England (collected in week 18).

The GOSH sample results presented in this report have been taken from children aged 1 – 19 years. In addition to the 359 samples presented last week, we now have data from 216 additional samples (collected in late April).

Seroprevalence estimates were adjusted for the sensitivity and sensitivity of the EuroImmun assay, based on sensitivity of 71/100 (71%) and specificity of 777/786 (98.9%) and uncertainty using a Bayesian approach. Matched analysis of the EuroImmun assay was also performed using the in-house Receptor Binding Domain (RBD) assay to gain further insight into the sensitivity of the commercial assay (**Appendix 1)**.

For the first time, this analysis included adjusted prevalence weighted to match the age and gender distribution of the general population – weightings used ONS population data by NHS region(1). For NHSBT, age standardisation was for ages 17 – 70, for GOSH, age standardisation was for ages 1-18, each using age group categories as given in figures 1 and 2.

***Table 1**: Summary of the Prevalence Estimates by Collection and Period of Sampling, using the Euroimmun Assay*

region	date range	week of collection	pos	ind	neg	total	%pos (95% CI)	adjusted prevalence (95%CrI)*	age-gender weighted adjusted prevalence (95% CrI)*
GOSH**									
Lon, SE, EE	20-28 Mar	12-13	13	7	150	170	7.6% (4.1% - 12.7%)	9.1% (3.6% - 16.5%)	9% (3.9% - 16.1%)
Lon, SE, EE	1-12 Apr	14-15	25	6	178	209	12.0% (7.9% - 17.1%)	15.6% (9.4% - 23.5%)	16.2% (10.1% - 24.2%)
Lon, SE, EE	13-20 Apr	16-17	31	6	180	217	14.3% (9.9% - 19.7%)	19% (12.2% - 27.6%)	19.7% (13% - 28.2%)
NHSBT									
Lon	26-27 Mar	13	22	11	724	757	2.9% (1.8% - 4.4%)	1.9% (0% - 4.4%)	1.5% (0.2% - 3.9%)
Lon	9-13 Apr	15-16	107	15	963	1085	9.9% (8.2% - 11.8%)	12.3% (9.2% - 16.2%)	12.3% (9% - 16.4%)
Lon	1-3 May	18	126	9	819	954	13.2% (11.1% - 15.5%)	17.4% (13.5% - 22.1%)	17.4% (13.4% - 22.5%)
Mid	2-3 Apr	14	25	13	878	916	2.7% (1.8% - 4.0%)	1.6% (0% - 3.9%)	1.6% (0.3% - 3.9%)

Mid	23-24 Apr	17	70	9	964	1043	6.7% (5.3% - 8.4%)	7.6% (4.9% - 10.7%)	8% (5% - 11.4%)
NE	14-16 Apr	16	46	12	958	1016	4.5% (3.3% - 6.0%)	4.3% (1.9% - 7%)	4.2% (1.6% - 7.1%)
NW	15-20 Apr	16-17	55	11	870	936	5.9% (4.5% - 7.6%)	6.4% (3.7% - 9.5%)	6.4% (3.6% - 9.8%)
SW	24-26 Apr	17	42	8	815	865	4.9% (3.5% - 6.5%)	4.8% (2.3% - 7.8%)	4.8% (2.1% - 8.1%)
SE	30-1 May	18	49	11	960	1020	4.8% (3.6% - 6.3%)	4.8% (2.3% - 7.5%)	4.2% (1.6% - 7.1%)
Welsh blood service									
Wales	-	17	34	4	968	1006	3.4% (2.4% - 4.7%)	2.6% (0.3% - 5%)	-

Lon – London, Mid – Midlands, NE – North East England, NW - North West England, SW – South West England, SE – South East England, EE – East of England.

**adjusted based on sensitivity of 71/100 (71%) and specificity of 777/786 (98.9%) - uncertainty of these estimates incorporated into the adjustment using Bayesian analysis (median and 95% credible interval)*

***Analysis for GOSH excludes ages <1. GOSH patients were likely residents of NHS regions London (59%), SE (9%), EE (27%), rest of England & Wales (6%), while all samples were taken at GOSH in London. Age-gender weighted prevalence was weighted to the combined population of London, EE and SE regions.*

Great Ormond Street Hospital

Results among infants (<1y of age) are not included in the overall paediatric analysis. However, infants <1y of age and born before 1st Feb 2020 were included as a separate age group in analyses by age group.

Figure 1: Observed Prevalence by Age Group, GOSH data

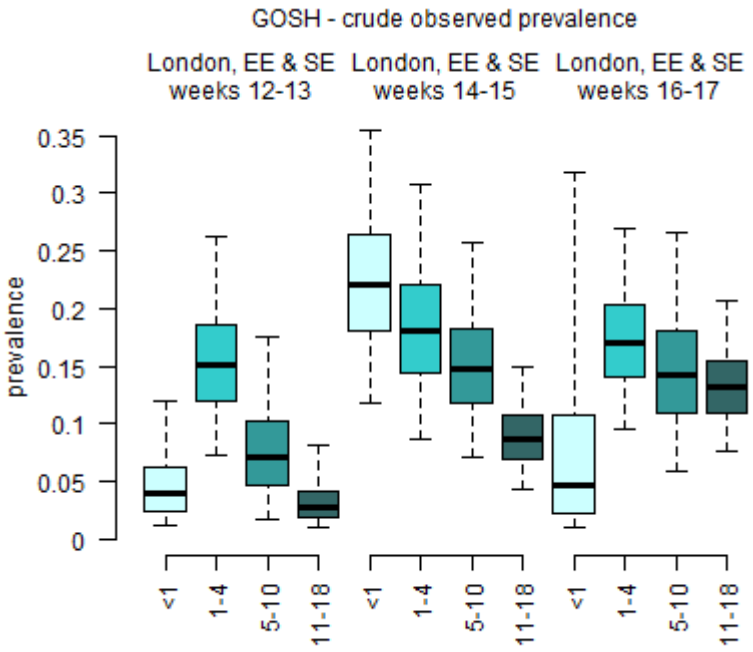


Figure 1 shows the observed prevalence estimates by age group, in March weeks 12-13, April weeks 14-15 and 16-17. The analysis by age group shows a higher prevalence in those aged 1-4 years. Prevalence has remained stable for 1-4 and 5-10 year olds throughout April weeks 14-15 & 16-17, while prevalence in 11-18 year olds has gradually increased. The number of samples for the <1y age group is variable and only 7 samples from weeks 16-17 were available making interpretation difficult.

The prevalence in children <10 years of age needs to be interpreted with caution, as unlike in children >10 years and in adults, the distribution of results in known positive samples is very close to the assay

cut-off value, suggesting that a better understanding of assay performance is needed to interpret the prevalence age trends in the paediatric population.

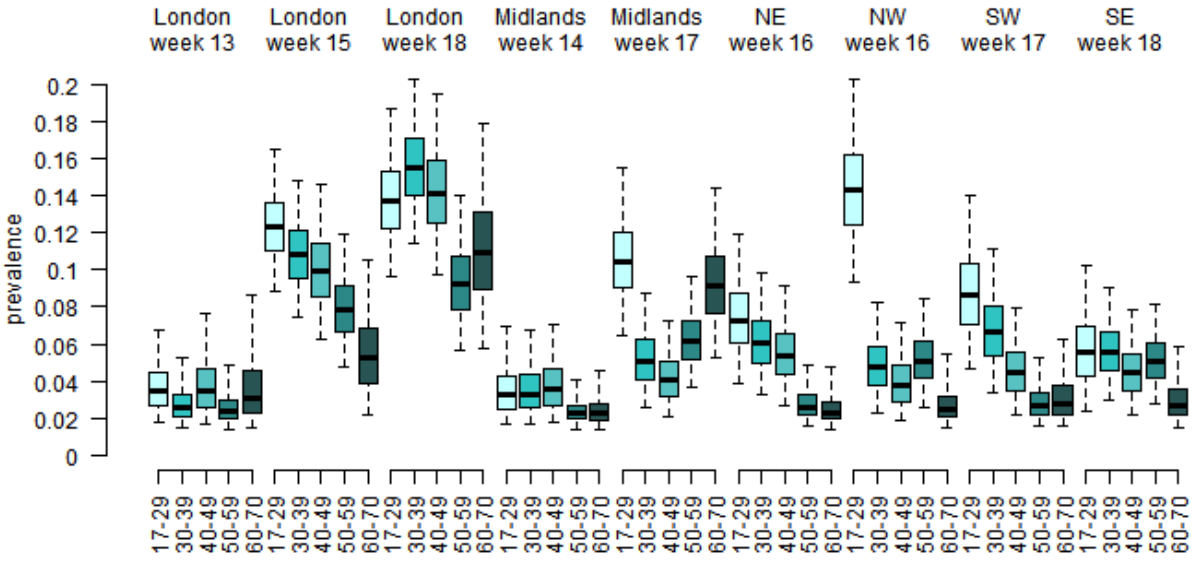
Blood donor data

The additional results from week 18 (**Table 1**) show that prevalence in London continues to be above baseline, with a continued increase between weeks 15 and 18 (observed difference of 3.3% (9.9% - 13.2%)). In contrast the week 18 data for the South East (first sample set from this region) indicates significantly lower prevalence – closer to that observed in other regions outside of London. These patterns persist when the data is weighted for age and gender.

The observed prevalence estimates by ~10 year age bands are shown in **Figure 2**. Week 18 data continues to show a higher prevalence among younger adults in both London and the South East – this disparity is significantly larger in London. However in the most recent London data, prevalence has increased notably in older adults.

Please note that about 1-2% of the samples come without demographic data, and hence prevalence estimates in this report are based on the 98-99% sets with available data.

Figure 2: *Observed Prevalence by Age Group and Collection, NHSBT data*



Comments

This week's report provides more detailed analyses on the results of serial sampling in London, and first prevalence estimates for the South East amongst adult blood donors.

The estimates among adults show a continued increase in prevalence within London, however the increase seen between weeks 16 and 18 is relatively smaller than the increase observed between weeks 13 and 16. As antibody response takes at least two weeks to become detectable, those displaying a positive result in week 18 are likely to have become infected before mid April, and the increased prevalence may only have just begun to slow following the impact of lockdown measures. As seen previously, the highest prevalence in all regions is found among adolescents and young adults

in the 17-24 year old age group. The same finding in the unadjusted results using the slightly more sensitive RBD assay (appendix 1) provides further evidence that supports a higher initial incidence in this age group. The increase now seen in older age groups in London suggests that this population may have been affected later. These patterns may reflect differences in behaviour and mixing patterns in the different age groups, but repeated data in the same regions in the coming weeks would be required to better understand whether differences by age group may also relate to differences in adhering to physical distancing rules under lockdown. A high prevalence in young children may reflect intergenerational mixing patterns but obtaining more data in paediatric age groups and adolescents/young adults (15-25 year olds) is also important. Samples from What's the Story study, with healthy children and adolescents up to the age of 25, should provide more insight.

Recommendations

1. PHE continues to collect samples for assay evaluation including later convalescent samples from cases and additional sample sets to better establish specificity, including among paediatric age groups.

2. PHE continues to investigate alternative commercial assays. Results generated using the EuroImmun assay should be used with caution for modelling until more information is available on the antibody dynamics using this test or a more accurate assay is available. Parallel testing of some sample sets which are now being undertaken with the in-house assays will allow better adjustments to be made to future results.

3. Additional evaluation of other PHE assays under development continues, and will be used to retest some of the above samples sets (or equivalents) to confirm the initial findings. Further development may include development of assays suitable for oral fluid. Assays targeting different antigens or antibody classes may be key for vaccine evaluation, and may have different antibody dynamics which can be used to inform seroprevalence in this rapidly changing situation.

4. More representative samples from young children and adolescents are being sourced urgently. Testing of precious low volume samples (such as those from children) should proceed with caution, ideally using the most accurate assays.

5. Now that NHSBT have targeted most regions as baseline repeat sampling at intervals of at least two weeks, as the change in prevalence will enable, in concert with other surveillance data, us to better understand both transmission and antibody dynamics.

6. PHE continues to work with other groups in the NHS and academia to increase the pool of information on the range of assays available to select the best choice of tests for current and future sero-epidemiology studies.

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1. Clinical commissioning group population estimates (National Statistics) - Office for National Statistics [Internet]. [cited 2020 May 12]. Available from:

https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/clinicalcommissioninggroupmidyearpopulationestimates

Appendix 1: RBD and Euroimmun assays

Parallel testing of 730 NHSBT (London week 15) samples that had been tested using the Euroimmun assay was tested using the in-house RBD assay. On comparison of matched data, the overall adjusted prevalence was the same as the adjusted prevalence using the Euroimmun. (**Table 1**). However, the prevalence estimates by age appear to be more pronounced with the RBD assay showing higher adjusted prevalence estimates across all age groups below 40 years of age compared with the Euroimmun, and lower estimates in those over 60 years.

Table1: Prevalence and adjusted prevalence for RBD and Euroimmun assays

Assay	Age group	#pos	#ind	#neg	total	% pos (95% CI)	adjusted prevalence (95% CrI)*
RBD	all	92	12	626	730	12.6% (10.3% - 15.2%)	12.2% (9.6% - 15.2%)
Euroimmun	all	72	11	647	730	9.9% (7.8% - 12.3%)	12.5% (9.2% - 16.4%)
RBD	17-29	32	6	149	187	17.1% (12% - 23.3%)	17.2% (11.7% - 23.9%)
	30-39	31	1	166	198	15.7% (10.9% - 21.5%)	15.6% (10.4% - 21.7%)
	40-49	13	1	109	123	10.6% (5.7% - 17.4%)	10% (4.8% - 17.1%)
	50-59	13	2	120	135	9.6% (5.2% - 15.9%)	9% (4.1% - 15.5%)
	60-70	3	2	82	87	3.4% (0.7% - 9.7%)	2% (0% - 7.8%)
Euroimmun	17-29	23	3	161	187	12.3% (8% - 17.9%)	16.2% (9.7% - 24.4%)
	30-39	23	6	169	198	11.6% (7.5% - 16.9%)	15.1% (9.2% - 23%)
	40-49	12	0	111	123	9.8% (5.1% - 16.4%)	12.4% (5.8% - 21.7%)
	50-59	10	1	124	135	7.4% (3.6% - 13.2%)	9% (3.4% - 16.7%)
	60-70	4	1	82	87	4.6% (1.3% - 11.4%)	4.7% (0.2% - 13.7%)