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REACT-1 round 9 final report: Continued but slowing decline of prevalence of SARS-CoV-2 during national lockdown in England in February 2021

Steven Riley^{1,2,*}, Haowei Wang^{1,2}, Oliver Eales^{1,2}, David Haw^{1,2}, Caroline E. Walters^{1,2}, Kylie E. C. Ainslie^{1,2,12}, Christina Atchison¹, Claudio Fronterre³, Peter J. Diggle³, Deborah Ashby¹, Christl A. Donnelly^{1,2,4}, Graham Cooke^{5,6,7}, Wendy Barclay⁵, Helen Ward^{1,6,7}, Ara Darzi^{6,7,8}, Paul Elliott^{1,6,7,9,10,11 *}

¹ School of Public Health, Imperial College London, UK

² MRC Centre for Global infectious Disease Analysis and Abdul Latif Jameel Institute for Disease and Emergency Analytics, Imperial College London, UK

³ CHICAS, Lancaster Medical School, Lancaster University, UK and Health Data Research, UK

⁴ Department of Statistics, University of Oxford, UK

⁵ Department of Infectious Disease, Imperial College London, UK

⁶ Imperial College Healthcare NHS Trust, UK

⁷ National Institute for Health Research Imperial Biomedical Research Centre, UK

⁸ Institute of Global Health Innovation at Imperial College London, UK

⁹ MRC Centre for Environment and Health, School of Public Health, Imperial College London, UK

¹⁰ Health Data Research (HDR) UK London at Imperial College

¹¹ UK Dementia Research Institute at Imperial College

¹² Centre for Infectious Disease Control, National Institute for Public Health and the Environment, Bilthoven, The Netherlands

*Corresponding authors: Steven Riley and Paul Elliott, s.riley@imperial.ac.uk, p.elliott@imperial.ac.uk, School of Public Health, Imperial College London, Norfolk Place, London, W2 1PG

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Abstract

Background

England will start to exit its third national lockdown in response to the COVID-19 pandemic on 8th March 2021, with safe effective vaccines being rolled out rapidly against a background of emerging transmissible and immunologically novel variants of SARS-CoV-2. A subsequent increase in community prevalence of infection could delay further relaxation of lockdown if vaccine uptake and efficacy are not sufficiently high to prevent increased pressure on healthcare services.

Methods

The PCR self-swab arm of the REal-time Assessment of Community Transmission Study (REACT-1) estimates community prevalence of SARS-CoV-2 infection in England based on random cross-sections of the population ages five and over. Here, we present results from the complete round 9 of REACT-1 comprising round 9a in which swabs were collected from 4th to 12th February 2021 and round 9b from 13th to 23rd February 2021. We also compare the results of REACT-1 round 9 to round 8, in which swabs were collected mainly from 6th January to 22nd January 2021.

Results

Out of 165,456 results for round 9 overall, 689 were positive. Overall weighted prevalence of infection in the community in England was 0.49% (0.44%, 0.55%), representing a fall of over two thirds from round 8. However the rate of decline of the epidemic has slowed from 15 (13, 17) days, estimated for the period from the end of round 8 to the start of round 9, to 31 days estimated using data from round 9 alone (lower confidence limit 17 days). When comparing round 9a to 9b there were apparent falls in four regions, no apparent change in one region and apparent rises in four regions, including London where there was a suggestion of sub-regional heterogeneity in growth and decline. Smoothed prevalence maps suggest large contiguous areas of growth and decline that do not align with administrative regions. Prevalence fell by 50% or more across all age groups in round 9 compared to round 8, with prevalence (round 9) ranging from 0.21% in those aged 65 and over to 0.71% in those aged 13 to 17 years. Round 9 prevalence was highest among Pakistani participants at 2.1% compared to white participants at 0.45% and Black participants at 0.83%. There were higher adjusted odds of infection for healthcare and care home workers, for those working in public transport and those working in education, school, nursery or childcare and lower adjusted odds for those not required to work outside the home.

Conclusions

Community prevalence of swab-positivity has declined markedly between January and February 2021 during lockdown in England, but remains high; the rate of decline has slowed in the most recent period, with a suggestion of pockets of growth. Continued adherence to social distancing and public health measures is required so that infection rates fall to much lower levels. This will help to ensure that the benefits of the vaccination roll-out programme in England are fully realised.

Introduction

Most European countries started 2021 with high numbers of COVID-19 cases [1] and stringent interventions [2]. During the first eight weeks of the year, cases fell across Europe before starting to increase again during February [1]. England entered its third national lockdown on 5th January 2021 [3] with the seven-day rolling average of cases at 95 per 100,000. By the 22nd February 2021, cases had fallen to an average of 18 per 100,000 during the previous seven days [4]. Over the same period, daily hospital admissions for COVID-19 fell from 3,592 to 949 (seven-day average) [4]. By the 22nd February, 15,113,158 people in England had received at least one dose [4] of either the BNT162b2 mRNA [5] or ChAdOx1 [6] COVID-19 vaccines.

On 22nd February 2021, the UK government announced a plan (roadmap) for the gradual easing of the lockdown to start on 8th March 2021 with the opening of schools before proceeding in four additional steps [7]. The roadmap leaves five-week minimum periods between steps to allow time for the impact of each set of relaxations on the epidemic to be assessed against four criteria: successful continuation of the vaccine roll-out programme, good efficacy of the vaccine against hospitalisations and deaths, no substantial change in the overall risk assessment of the pandemic because of SARS-CoV-2 variants, and no evidence that an increase in infections in the community may lead to a surge in hospitalisations such that healthcare services would be placed under unsustainable pressure.

Largely in line with cases, prevalence of infections in the community in England dropped substantially during January and early February 2021 [8,9]. Any large uptick in the prevalence of infections would signal a potential threat to the smooth continuation of the roadmap; but with high vaccine uptake [4] and encouraging early estimates of vaccine efficacy [5], the link between infections and strain on healthcare services will likely be weakened in the near future.

The PCR self-swab arm of the REal-time Assessment of Community Transmission Study (REACT-1) is designed to measure community prevalence of SARS-CoV-2 infection in England [10]. Here, we present results from the complete round 9 of REACT-1 comprising round 9a in which swabs were collected from 4th to 12th February 2021 and round 9b from 13th to 23rd February 2021. We also compare the results of REACT-1 round 9 to round 8, in which swabs were collected mainly from 6th January to 22nd January 2021.

Results

REACT-1 round 9 included 165,456 individuals with a valid swab result of whom 689 tested positive, giving a weighted prevalence overall of 0.49% (0.44%, 0.55%), down by over two thirds from 1.57% (1.49%, 1.66%) in round 8 (Table 1). The round 9 data comprised 388 positives from 87,408 swabs in round 9a, with weighted prevalence of 0.51% (0.44%, 0.59%) and 301 positives from 78,047 swabs in round 9b, with a weighted prevalence slightly lower at 0.47% (0.40%, 0.55%) .

Using a constant growth rate model, we estimated halving times and R numbers for England using two time periods: from the second half of round 8 (8b) to round 9a and within round 9 (Table 2). We estimated a halving time of 15 (13, 17) days, corresponding to an R of 0.73 (0.69, 0.76) between rounds 8b and 9a, whereas from round 9a to 9b we estimated a halving time of 31 days (lower confidence limit 17 days) and a corresponding R of 0.86 (0.76, 0.97). We thus observe a slowing in the rate of decline of the epidemic in England on comparing these estimates (probability of difference in Rs > 0.99, not accounting for overlap in the time periods), although note that the estimate of R in the most recent period is still reliably below one. This slowing is reflected in the fitted P-spline which shows a flattening off in the most recent period (Figure 1).

The decline in prevalence from round 8 to round 9 was seen in all age groups, which was 50% or more over this period (Table 3, Table 4, Figure 2). In the latter half of round 9 (9b), prevalence varied from 0.21% (0.14%, 0.31%) in those aged 65 and over to 0.71% (0.34%, 1.45%) in those aged 13 to 17 years.

We observed differences in patterns of regional prevalence between rounds 8 and 9 when compared with patterns between rounds 9a and 9b (Table 3, Table 4, Figure 3). Between rounds 8 and 9 there were substantial falls in weighted prevalence in seven of the nine regions with smaller apparent falls in Yorkshire and The Humber and in North East. However, between rounds 9a and 9b, while there were apparent falls in North East, North West, East of England and South West, and no apparent change in Yorkshire and The Humber, there were apparent rises in London, South East, East Midlands and West Midlands. Using a constant regional growth rate model, we found evidence suggestive of growth (80% or greater probability) in London and South East and robust evidence of decline in North West (Table 5). These patterns were also reflected in the regional fitted P-splines (Figure 4).

Maps for rounds 9a and 9b of unweighted, unsmoothed swab-positivity at the level of lower-tier local authorities (LTLA) suggest reductions in prevalence in eastern part of North

West region, but are otherwise difficult to interpret with highly fragmented groups of high and low prevalence areas (Figure 5). We therefore used nearest neighbours within the study sample to smooth LTLA prevalence. We aimed to reveal underlying spatial structure and thus allow visualisation of apparent growth or decline. The resultant maps suggest large contiguous areas of apparent increasing or decreasing prevalence when comparing rounds 9a and 9b (Figure 6). A long tract of apparent increasing prevalence runs from the south coast, through south and west London (Figure 7) into the Midlands and then on to the west side of Yorkshire and the Humber. One contiguous area of decreasing prevalence was seen in north and east London, the southern part of East of England and the northern part of South East, with another in the western part of South West. We also observed sharp declines in the conurbations in the North West reflecting the overall decline in prevalence in that region.

We observed robust patterns in the prevalence of swab-positivity for ethnicity subgroups in both rounds 8 and 9 (Table 3b). In round 8, unweighted prevalence among Bangladeshi participants was very high at 6.1% (4.0%, 9.3%) compared to 1.2% (1.2%, 1.3%) in white participants. However unweighted prevalence in Bangladeshi fell to 0.85% (0.29%, 2.5%) in round 9 (we report unweighted prevalence for Bangladeshi participants because of small numbers of positives in round 9). In round 9, the highest weighted prevalence was amongst Pakistani participants at 2.1% (1.0%, 4.2%) compared with white participants at 0.41% (0.37%, 0.46%). Corresponding odds ratios adjusted for: age, sex, region, deprivation (core variables), showed similar patterns (Table 6).

We also give prevalence and adjusted odds ratios for occupation for both rounds 8 and 9 (Table 3c, Table 4, Table 7). Healthcare workers and care home workers had higher adjusted odds of infection at 1.48 (1.25, 1.77) in round 8 and 1.37 (1.02, 1.86) in round 9 (Table 4) compared with other workers. Higher adjusted odds were seen in participants who worked in public transport at 2.17 (1.58, 2.97) in round 8, and 2.14 (1.20, 3.83) in round 9, compared with those who did not; higher adjusted odds were also seen in those working in education, school, nursery or childcare at 1.20 (1.03, 1.39) in round 8 and 1.43 (1.07, 1.91) in round 9 compared with participants not working in those settings (Table 7). Lower adjusted odds of swab-positivity were seen among those not currently required to work outside their home at 0.67 (0.61, 0.74) in round 8 and 0.64 (0.54, 0.76) in round 9 compared with those currently required to work outside their home.

Community prevalence of infection, as measured by REACT-1, shows strong apparent correlation with hospital admissions in England. With a fitted lag of 18 (18, 20) days between dates of swab and admissions, the national trend in swab-positivity and hospital admissions

are well-aligned (Figure 8). Best-fit lags were slightly different across the age groups: 19 (19, 19) days for 6-17 year olds, 22 (22, 22) days for 18-64 year olds, 20 (18, 21) days for 65-84 year olds and 16 (12, 29) for 85+ year olds.

Discussion

Round 9 of the REACT-1 study was carried out during February 2021, some four to seven weeks after the beginning of the third national lockdown in England. We observed a marked decline in prevalence compared to the high levels seen at the beginning of the lockdown (round 8) [8], although the rate of decline slowed nationally during the most recent period. These results are consistent with community testing data (Pillar 2) which have likewise shown a slowing in the decline in prevalence over the recent period [4].

At regional scale, we observed a suggestion of plateauing or small rise in some areas, most notably in London, where there appeared to be sub-regional heterogeneity in the rates of growth and decline – while prevalence in north and east London appeared to be declining, there were apparent increases in parts of west and south London. Prevalence also appeared to be increasing in parts of West and East Midlands and the east coast of England, while there were continued sharp declines in North West conurbations which had seen high levels of infection during the second wave. Continued vigilance is necessary to ensure that the evident gains achieved in lockdown are maintained as lockdown measures are eased over coming weeks.

Unlike our previous reports, we show here results for more detailed categories of ethnicity and occupation. The highest prevalence by ethnicity across rounds 8 and 9 was found among Bangladeshi participants in whom unweighted prevalence reached 6% in January, before falling to less than one percent in February 2021. There were also high rates among Black, Indian and Pakistani compared to white participants in January 2021 when infections were still near their peak in the second wave. We found modestly higher adjusted odds of infection among those working in healthcare and care home settings and in education, school, nursery or childcare, whereas those working in public transport had over 2-fold increased adjusted odds of infection. In contrast, we found adjusted odds lower by approximately one third in those who were not required to work outside the home, stressing the importance of working from home during lockdown where possible to minimise social contacts and hence reduce the risk of transmission.

Our findings in February 2021 are possibly too early to detect the effect of the vaccination programme on rates of infection. The vaccination programme began to be rolled out in earnest from late December 2020 and early January 2021 in England, and to date over 17

million adults in England have received their first dose of vaccine [4]. Results from population studies indicate that one dose of either BNT162b2 mRNA or ChAdOx1 COVID-19 vaccines confers not only a reduction in risk of severe infection and hospitalisation but is also protective against symptomatic infection [11].

We show that trends in hospitalisations for COVID-19 closely match those of community SARS-CoV-2 infection prevalence in REACT-1 but with a lag period of around 16 to 22 days depending on age. We may expect to see a divergence in these curves in future rounds to the extent that there is an uncoupling between risk of infection and risk of severe disease and hospitalisation as a result of the vaccination programme. Specifically, we note that if vaccination has higher age-specific efficacy against hospital admission than efficacy against being found swab positive, we would expect the correlation between infection prevalence and hospital admissions to decrease in the affected age groups. On the other hand, should new variants subsequently emerge against which vaccines are less effective, or should protection from natural or vaccine-induced immunity wane, we would expect the correlation between community infection prevalence and hospital admissions to increase.

Our study has limitations. We include randomly selected cross-sections of the population of England and as such our estimates include people without symptoms as well as symptomatic people who are eligible for routine testing. We are therefore able to track the spread of the virus at population level and not rely on presentation of individuals to the routine testing programme. Our sampling method is designed to provide reliable estimates of prevalence at the small-area (LTLA) scale; however this does mean that we over-sample more rural areas and under-sample more urban areas, requiring re-weighting to obtain prevalence estimates that are representative of the country as a whole. As the vaccination programme is extended across the adult population, there may in the future be a greater reluctance to take part in our study if people feel they are protected from infection based on vaccination history. In addition, schools-based testing using lateral flow tests is being implemented in England which may again have an impact on participation rates. However, to date engagement with the programme has been high with swabs obtained from 22% to over 30% of people invited by letter to join the study.

In conclusion, community prevalence of swab-positivity has declined markedly between January and February 2021 during lockdown in England, but remains high; the rate of decline has slowed in the most recent period, with a suggestion of pockets of growth. Continued adherence to social distancing and public health measures is required so that infection rates fall to much lower levels. This will help to ensure that the benefits of the vaccination roll-out programme in England are fully realised.

Methods

In REACT-1, we invite a random sample of the population in England (ages 5 years and over) to undertake a self-administered throat and nose swab (parent/guardian assisted at ages 5 to 12 years) and complete a questionnaire on demographics, health and lifestyle [10]. Swabs are picked up by courier and sent chilled to a single laboratory for RT-PCR. We use the National Health Service patient register to obtain the sample, aiming to obtain approximately equal numbers of participants in each of the 315 LTLAs in England.

In round 9, we sent out 761,000 letters to named individuals, with 210,046 (27.6%) kits dispatched. From these, we received completed swabs with a valid test result from 165,458 (78.8%) individuals giving an overall response rate (valid swabs divided by total number of people invited) of 21.7%.

We calculate prevalence of RT-PCR swab-positivity both unweighted and weighted to take account of the sample design and variable non-response, aiming to be representative of the population of England as a whole, by age, sex, region and ethnicity. We estimate prevalence by region, socio-demographic, occupational and other characteristics, as well as odds of swab-positivity based on a multivariable logistic regression model to account for potential confounding.

We use exponential growth models to estimate the reproduction number R , across and within rounds, both at national and regional levels. We examine trends over time by plotting the daily prevalence of swab-positivity and fitting a smoothed P-spline function to these daily prevalence data with knots at 5-day intervals [12]. We map the smoothed geographic variation in prevalence at LTLA level by use of a neighbourhood spatial smoothing method (scale: up to 30 km) across nearest neighbours as described in Figure 6.

We include sensitivity analyses in the estimation of R using different cut-points of cycle threshold (CT) values for determining swab-positivity, and by consideration only of individuals who did not report symptoms in the previous week. We also compare our data over time with those on hospitalisations from the Office for National Statistics.

We carried out the statistical analyses in R [13]. We obtained research ethics approval from the South Central-Berkshire B Research Ethics Committee (IRAS ID: 283787).

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Data availability

Supporting data for tables and figures are available either: in this Google [spreadsheet](#); or in the inst/extdata directory of this [GitHub R package](#).

Declaration of interests

We declare no competing interests.

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Tables and Figures

Table 1. Unweighted and weighted prevalence of swab-positivity across nine rounds of REACT-1.

Round	Tested swabs	Positive swabs	Unweighted prevalence (95% CI)	Weighted prevalence (95% CI)	First sample	Last sample
1	120,620	159	0.13% (0.11%, 0.15%)	0.16% (0.13%, 0.19%)	1/5/2020	1/6/2020
2	159,199	123	0.077% (0.065%, 0.092%)	0.088% (0.068%, 0.11%)	19/6/2020	7/7/2020
3	162,821	54	0.033% (0.025%, 0.043%)	0.040% (0.027%, 0.053%)	24/7/2020	11/8/2020
4	154,325	137	0.089% (0.075%, 0.11%)	0.13% (0.096%, 0.15%)	20/8/2020	8/9/2020
5	174,949	824	0.47% (0.44%, 0.50%)	0.60% (0.55%, 0.71%)	18/9/2020	5/10/2020
6	160,175	1,732	1.08% (1.03%, 1.13%)	1.30% (1.21%, 1.39%)	16/10/2020	2/11/2020
6a	85,965	863	1.00% (0.94%, 1.07%)	1.28% (1.16%, 1.42%)	16/10/2020	25/10/2020
6b	74,210	869	1.17% (1.10%, 1.25%)	1.32% (1.20%, 1.45%)	26/10/2020*	2/11/2020
7	168,181	1,299	0.77% (0.73%, 0.82%)	0.94% (0.87%, 1.01%)	13/11/2020	3/12/2020
7a	105,122	821	0.78% (0.73%, 0.84%)	0.96% (0.87%, 1.05%)	13/11/2020	24/11/2020
7b	63,059	478	0.76% (0.69%, 0.83%)	0.91% (0.81%, 1.03%)	25/11/2020*	3/12/2020
8	167,642	2,282	1.36% (1.31%, 1.42%)	1.57% (1.49%, 1.66%)	06/01/2021*	22/01/2021
9	165,456	689	0.42% (0.39%, 0.45%)	0.49% (0.44%, 0.55%)	6/2/2021	23/2/2021
9a	87,408	388	0.44% (0.40%, 0.49%)	0.51% (0.44%, 0.59%)	6/2/2021*	12/2/2021
9b	78,047	301	0.39% (0.34%, 0.43%)	0.47% (0.40%, 0.55%)	13/02/2021	23/2/2021

* Includes small number of samples from previous days

Table 2. Estimates of national growth rates, doubling times and reproduction numbers for round 9a and 9b, and for round 8b and 9a.

Round	Outcome	Growth rate	R	Probability R>1	Growth(+)/Decay(-) rate
9a and 9b	All positives	-0.022 (-0.041 , -0.004)	0.86 (0.76 , 0.97)	<0.01	-30.9 (-17.0 , *)
	Non-symptomatics	-0.028 (-0.057 , 0.002)	0.83 (0.67 , 1.01)	0.03	-25.2 (-12.1 , *)
	Positive for both E and N genes	-0.036 (-0.060 , -0.012)	0.79 (0.66 , 0.93)	<0.01	-19.5 (-11.5 , *)
	Positive for both E and N genes or positive only for N gene with CT 35 or less	-0.022 (-0.042 , -0.003)	0.86 (0.75 , 0.98)	0.01	-30.8 (-16.5 , *)
8b and 9a	All positives	-0.047 (-0.054 , -0.040)	0.73 (0.69 , 0.76)	<0.01	-14.7 (-12.8 , -17.2)
	Non-symptomatics	-0.033 (-0.045 , -0.021)	0.80 (0.74 , 0.87)	<0.01	-21.0 (-15.5 , -33.3)
	Positive for both E and N genes	-0.053 (-0.062 , -0.044)	0.69 (0.65 , 0.74)	<0.01	-13.1 (-11.2 , -15.6)
	Positive for both E and N genes or positive only for N gene with CT 35 or less	-0.048 (-0.055 , -0.040)	0.72 (0.68 , 0.76)	<0.01	-14.6 (-12.6 , -17.3)

* Doubling/Halving time had an estimated magnitude greater than 50 days and so represented approximately constant prevalence

Table 3a. Unweighted and weighted prevalence of swab-positivity for core variables for rounds 8 and 9.

Variable	Category	Round 8						Round 9							
		Positive	Total	Unweighted Prevalence			Weighted Prevalence			Positive	Total	Unweighted Prevalence			Weighted Prevalence*
Gender	Male	1043	75,296	1.39%	(1.30% , 1.47%)	1.63%	(1.50% , 1.77%)	315	75,027	0.42%	(0.38% , 0.47%)	0.50%	(0.43% , 0.59%)		
	Female	1239	92,340	1.34%	(1.27% , 1.42%)	1.51%	(1.41% , 1.63%)	374	90,425	0.41%	(0.37% , 0.46%)	0.49%	(0.43% , 0.56%)		
	NA	0	6	0.00%	(0.00% , 31.08%)	NA	(NA , NA)	0	4	0.00%	(0.00% , 40.35%)	NA	(NA , NA)		
Age	05-12	170	11,727	1.45%	(1.25% , 1.66%)	1.59%	(1.32% , 1.93%)	81	13,605	0.60%	(0.48% , 0.74%)	0.72%	(0.54% , 0.95%)		
	13-17	172	8,947	1.92%	(1.66% , 2.23%)	2.25%	(1.85% , 2.73%)	45	10,155	0.44%	(0.33% , 0.59%)	0.57%	(0.38% , 0.87%)		
	18-24	156	6,753	2.31%	(1.98% , 2.70%)	2.44%	(1.96% , 3.03%)	40	6,788	0.59%	(0.43% , 0.80%)	0.71%	(0.45% , 1.12%)		
	25-34	263	15,031	1.75%	(1.55% , 1.97%)	1.95%	(1.68% , 2.26%)	68	14,801	0.46%	(0.36% , 0.58%)	0.46%	(0.34% , 0.61%)		
	35-44	314	21,764	1.44%	(1.29% , 1.61%)	1.62%	(1.41% , 1.85%)	94	21,088	0.45%	(0.36% , 0.55%)	0.57%	(0.42% , 0.77%)		
	45-54	412	27,982	1.47%	(1.34% , 1.62%)	1.61%	(1.43% , 1.81%)	132	27,595	0.48%	(0.40% , 0.57%)	0.50%	(0.41% , 0.62%)		
	55-64	413	31,909	1.29%	(1.17% , 1.42%)	1.29%	(1.15% , 1.45%)	135	31,727	0.43%	(0.36% , 0.50%)	0.49%	(0.40% , 0.60%)		
65+	382	43,449	0.88%	(0.80% , 0.97%)	0.93%	(0.82% , 1.05%)	94	39,697	0.24%	(0.19% , 0.29%)	0.26%	(0.21% , 0.33%)			
Region	South East	578	39,156	1.48%	(1.36% , 1.60%)	1.61%	(1.46% , 1.77%)	119	36,642	0.32%	(0.27% , 0.39%)	0.36%	(0.29% , 0.44%)		
	North East	62	5,731	1.08%	(0.84% , 1.38%)	1.22%	(0.87% , 1.69%)	41	5,836	0.70%	(0.52% , 0.95%)	0.69%	(0.49% , 0.98%)		
	North West	220	17,917	1.23%	(1.08% , 1.40%)	1.38%	(1.16% , 1.64%)	112	19,402	0.58%	(0.48% , 0.69%)	0.69%	(0.54% , 0.88%)		
	Yorkshire and The Humber	93	10,665	0.87%	(0.71% , 1.07%)	0.80%	(0.62% , 1.03%)	42	11,218	0.37%	(0.28% , 0.51%)	0.60%	(0.37% , 0.96%)		
	East Midlands	225	21,698	1.04%	(0.91% , 1.18%)	1.16%	(0.99% , 1.36%)	103	21,193	0.49%	(0.40% , 0.59%)	0.59%	(0.45% , 0.77%)		
	West Midlands	198	15,088	1.31%	(1.14% , 1.51%)	1.66%	(1.32% , 2.10%)	60	15,478	0.39%	(0.30% , 0.50%)	0.36%	(0.25% , 0.52%)		
	East of England	391	25,178	1.55%	(1.41% , 1.71%)	1.78%	(1.57% , 2.02%)	86	23,672	0.36%	(0.29% , 0.45%)	0.47%	(0.36% , 0.60%)		
	London	390	15,641	2.49%	(2.26% , 2.75%)	2.83%	(2.53% , 3.16%)	91	15,492	0.59%	(0.48% , 0.72%)	0.60%	(0.48% , 0.76%)		
South West	125	16,568	0.75%	(0.63% , 0.90%)	0.87%	(0.71% , 1.08%)	35	16,523	0.21%	(0.15% , 0.29%)	0.23%	(0.15% , 0.36%)			
Employment type	Health care or care home worker	161	8,259	1.95%	(1.67% , 2.27%)	2.24%	(1.84% , 2.72%)	55	9,042	0.61%	(0.47% , 0.79%)	0.73%	(0.49% , 1.08%)		
	Other essential/key worker	531	30,239	1.76%	(1.61% , 1.91%)	1.79%	(1.61% , 2.00%)	165	31,393	0.53%	(0.45% , 0.61%)	0.57%	(0.46% , 0.70%)		
	Other worker	867	64,772	1.34%	(1.25% , 1.43%)	1.55%	(1.42% , 1.70%)	244	59,907	0.41%	(0.36% , 0.46%)	0.47%	(0.40% , 0.56%)		
	Not full-time, part-time, or self-employed	670	60,438	1.11%	(1.03% , 1.20%)	1.36%	(1.23% , 1.50%)	202	60,496	0.33%	(0.29% , 0.38%)	0.43%	(0.36% , 0.52%)		
	NA	53	3,934	1.35%	(1.03% , 1.76%)	1.58%	(1.10% , 2.27%)	23	4,618	0.50%	(0.33% , 0.75%)	0.55%	(0.33% , 0.92%)		
Ethnic group	White	1938	152,111	1.27%	(1.22% , 1.33%)	1.41%	(1.33% , 1.49%)	596	149,859	0.40%	(0.37% , 0.43%)	0.45%	(0.41% , 0.50%)		
	Asian	163	6,537	2.49%	(2.14% , 2.90%)	2.80%	(2.32% , 3.37%)	52	6,516	0.80%	(0.61% , 1.04%)	0.95%	(0.64% , 1.41%)		
	Black	60	1,832	3.28%	(2.55% , 4.19%)	3.07%	(2.29% , 4.09%)	14	2,151	0.65%	(0.39% , 1.09%)	0.79%	(0.39% , 1.60%)		
	Mixed	46	2,751	1.67%	(1.26% , 2.22%)	1.78%	(1.28% , 2.46%)	8	2,926	0.27%	(0.14% , 0.54%)	NA	(NA , NA)		
	Other	29	1,190	2.44%	(1.70% , 3.48%)	2.42%	(1.59% , 3.65%)	5	1,185	0.42%	(0.18% , 0.98%)	NA	(NA , NA)		
NA	46	3,221	1.43%	(1.07% , 1.90%)	1.76%	(1.23% , 2.50%)	14	2,819	0.50%	(0.30% , 0.83%)	0.54%	(0.30% , 0.94%)			
Household size	1	275	25,360	1.08%	(0.96% , 1.22%)	1.24%	(1.06% , 1.44%)	68	23,576	0.29%	(0.23% , 0.37%)	0.31%	(0.24% , 0.42%)		
	2	622	61,379	1.01%	(0.94% , 1.10%)	1.11%	(1.01% , 1.23%)	177	59,046	0.30%	(0.26% , 0.35%)	0.32%	(0.27% , 0.38%)		
	3	455	29,965	1.52%	(1.39% , 1.66%)	1.67%	(1.49% , 1.88%)	145	30,652	0.47%	(0.40% , 0.56%)	0.52%	(0.42% , 0.64%)		
	4	568	34,847	1.63%	(1.50% , 1.77%)	1.77%	(1.59% , 1.96%)	182	35,280	0.52%	(0.45% , 0.60%)	0.56%	(0.46% , 0.67%)		
	5	246	11,566	2.13%	(1.88% , 2.41%)	2.48%	(2.05% , 3.00%)	83	12,055	0.69%	(0.56% , 0.85%)	0.84%	(0.62% , 1.12%)		
	6	116	4,525	2.56%	(2.14% , 3.07%)	3.01%	(2.39% , 3.77%)	34	4,847	0.70%	(0.50% , 0.98%)	1.41%	(0.88% , 2.26%)		
COVID case contact	No	1130	138,065	0.82%	(0.77% , 0.87%)	0.94%	(0.87% , 1.02%)	350	139,231	0.25%	(0.23% , 0.28%)	0.29%	(0.25% , 0.33%)		
	Yes, contact with a confirmed/tested COVID-19 case	730	5,008	14.58%	(13.63% , 15.58%)	15.61%	(14.26% , 17.06%)	215	2,587	8.31%	(7.31% , 9.44%)	9.41%	(7.85% , 11.23%)		
	Yes, contact with a suspected COVID-19 case	58	1,329	4.36%	(3.39% , 5.60%)	4.94%	(3.57% , 6.79%)	15	640	2.34%	(1.43% , 3.83%)	3.07%	(1.02% , 8.90%)		
	NA	364	23,240	1.57%	(1.41% , 1.73%)	1.64%	(1.45% , 1.87%)	109	22,998	0.47%	(0.39% , 0.57%)	0.52%	(0.41% , 0.66%)		
Symptom status	Classic COVID symptoms	822	6,475	12.70%	(11.81% , 13.53%)	14.05%	(12.89% , 15.30%)	223	4,968	4.49%	(3.95% , 5.10%)	4.89%	(4.02% , 5.92%)		
	Other symptoms	350	19,609	1.78%	(1.61% , 1.98%)	1.89%	(1.66% , 2.15%)	105	17,099	0.61%	(0.51% , 0.74%)	0.74%	(0.56% , 0.96%)		
	No symptoms	747	118,401	0.63%	(0.59% , 0.68%)	0.76%	(0.68% , 0.84%)	256	120,482	0.21%	(0.19% , 0.24%)	0.26%	(0.22% , 0.31%)		
NA	363	23,157	1.57%	(1.42% , 1.74%)	1.65%	(1.45% , 1.87%)	105	22,907	0.46%	(0.38% , 0.55%)	0.50%	(0.40% , 0.64%)			
Deprivation	1 Most deprived	257	15,190	1.69%	(1.50% , 1.91%)	1.79%	(1.53% , 2.10%)	108	15,718	0.69%	(0.57% , 0.83%)	0.85%	(0.66% , 1.09%)		
	2	449	26,012	1.73%	(1.57% , 1.89%)	1.95%	(1.74% , 2.19%)	142	25,369	0.56%	(0.48% , 0.66%)	0.59%	(0.49% , 0.72%)		
	3	479	36,061	1.33%	(1.22% , 1.45%)	1.52%	(1.36% , 1.69%)	122	35,741	0.34%	(0.29% , 0.41%)	0.34%	(0.28% , 0.42%)		
	4	540	42,002	1.29%	(1.18% , 1.40%)	1.41%	(1.27% , 1.56%)	157	41,455	0.38%	(0.32% , 0.44%)	0.38%	(0.32% , 0.46%)		
	5 Least deprived	557	48,377	1.15%	(1.06% , 1.25%)	1.22%	(1.10% , 1.35%)	160	47,173	0.34%	(0.29% , 0.40%)	0.36%	(0.30% , 0.43%)		

* We do not present weighted prevalence for categories where the number of positive swabs is fewer than 10.

Table 3b. Unweighted and weighted prevalence of swab-positivity for detailed ethnicity categories for rounds 8 and 9.

Variable	Category	Round 8				Round 9			
		Positive	Total	Unweighted Prevalence	Weighted Prevalence	Positive	Total	Unweighted Prevalence	Weighted Prevalence
Ethnic group	White	1998	152,111	1.27% (1.22%, 1.33%)	1.41% (1.33%, 1.49%)	596	149,859	0.40% (0.37%, 0.43%)	0.45% (0.40%, 0.50%)
	Asian	163	6,537	2.49% (2.14%, 2.90%)	2.80% (2.32%, 3.37%)	52	6,516	0.80% (0.61%, 1.04%)	0.91% (0.61%, 1.36%)
	Black	60	1,832	3.28% (2.55%, 4.19%)	3.07% (2.29%, 4.09%)	14	2,151	0.65% (0.39%, 1.09%)	0.83% (0.41%, 1.68%)
	Mixed	46	2,751	1.67% (1.26%, 2.22%)	1.78% (1.28%, 2.46%)	8	2,926	0.27% (0.14%, 0.54%)	NA (NA , NA)
	Other	29	1,190	2.44% (1.70%, 3.48%)	2.42% (1.59%, 3.65%)	5	1,185	0.42% (0.18%, 0.98%)	NA (NA , NA)
	NA	46	3,221	1.43% (1.07%, 1.90%)	1.76% (1.23%, 2.50%)	14	2,819	0.50% (0.30%, 0.83%)	0.51% (0.28%, 0.92%)
White ethnic group	English/Welsh/Scottish/Northern Irish/British	1752	142,570	1.23% (1.17%, 1.29%)	1.35% (1.27%, 1.44%)	524	140,193	0.37% (0.34%, 0.41%)	0.41% (0.37%, 0.46%)
	Irish	30	1,558	1.93% (1.35%, 2.74%)	2.15% (1.40%, 3.29%)	6	1,428	0.42% (0.19%, 0.91%)	NA (NA , NA)
	Gypsy or Irish Traveller	0	42	0.00% (0.00%, 6.05%)	NA (NA , NA)	0	37	0.00% (0.00%, 6.81%)	NA (NA , NA)
	Other white background	156	7,941	1.96% (1.68%, 2.29%)	2.14% (1.78%, 2.56%)	66	8,201	0.80% (0.63%, 1.02%)	0.95% (0.71%, 1.27%)
Asian ethnic group	Indian	69	3,183	2.17% (1.72%, 2.73%)	2.42% (1.82%, 3.21%)	26	3,119	0.83% (0.57%, 1.22%)	0.72% (0.47%, 1.10%)
	Pakistani	19	728	2.61% (1.68%, 4.04%)	2.29% (1.40%, 3.72%)	11	818	1.34% (0.75%, 2.39%)	2.08% (1.02%, 4.20%)
	Bangladeshi	20	327	6.12% (3.99%, 9.26%)	6.03% (3.77%, 9.52%)	3	351	0.85% (0.29%, 2.48%)	NA (NA , NA)
	Chinese	9	811	1.11% (0.58%, 2.10%)	NA (NA , NA)	1	748	0.13% (0.02%, 0.75%)	NA (NA , NA)
	Other Asian background	46	1,488	3.09% (2.33%, 4.10%)	3.02% (2.16%, 4.20%)	11	1,480	0.74% (0.42%, 1.33%)	0.55% (0.29%, 1.04%)
Black ethnic group	African	42	1,123	3.74% (2.78%, 5.02%)	3.43% (2.41%, 4.86%)	11	1,417	0.78% (0.43%, 1.38%)	1.02% (0.47%, 2.21%)
	Caribbean	12	553	2.17% (1.25%, 3.75%)	1.90% (1.02%, 3.52%)	1	588	0.17% (0.03%, 0.96%)	NA (NA , NA)
	Other Black/African/Caribbean background	6	156	3.85% (1.77%, 8.14%)	NA (NA , NA)	2	146	1.37% (0.38%, 4.86%)	NA (NA , NA)
Mixed ethnic group	White and Black Caribbean	7	489	1.43% (0.70%, 2.93%)	NA (NA , NA)	1	540	0.19% (0.03%, 1.04%)	NA (NA , NA)
	White and Black African	5	292	1.71% (0.73%, 3.95%)	NA (NA , NA)	0	323	0.00% (0.00%, 0.83%)	NA (NA , NA)
	White and Asian	18	1,000	1.80% (1.14%, 2.83%)	1.90% (1.11%, 3.23%)	5	1,072	0.47% (0.20%, 1.09%)	NA (NA , NA)
	Other Mixed/Multiple ethnic background	16	970	1.65% (1.02%, 2.66%)	1.98% (1.15%, 3.39%)	2	991	0.20% (0.06%, 0.73%)	NA (NA , NA)
Other	Arab	6	296	2.03% (0.93%, 4.35%)	NA (NA , NA)	4	314	1.27% (0.50%, 3.23%)	NA (NA , NA)
	Other ethnic group	23	930	2.47% (1.65%, 3.68%)	3.02% (2.16%, 4.20%)	2	916	0.22% (0.06%, 0.79%)	NA (NA , NA)
	Prefer not to say	28	1,430	1.96% (1.36%, 2.82%)	2.55% (1.64%, 3.96%)	7	1,125	0.62% (0.30%, 1.28%)	NA (NA , NA)
	NA	18	1,755	1.03% (0.65%, 1.62%)	0.99% (0.57%, 1.70%)	6	1,649	0.36% (0.17%, 0.79%)	NA (NA , NA)

Table 3c. Unweighted and weighted prevalence of swab-positivity for detailed work types for respondents for rounds 8 and 9.

Variable	Category	Round 8				Round 9			
		Positive	Total	Unweighted Prevalence	Weighted Prevalence	Positive	Total	Unweighted Prevalence	Weighted Prevalence
Work type high level *	1. Health care workers with direct patient contact	134	5,922	2.09% (1.76% , 2.49%)	2.45% (1.93% , 3.05%)	42	6,430	0.65% (0.48% , 0.86%)	0.87% (0.55% , 1.37%)
	2. Health care workers with no patient contact	14	1,896	0.74% (0.44% , 1.04%)	0.97% (0.49% , 1.82%)	9	2,041	0.44% (0.23% , 0.84%)	0.32% (0.16% , 0.64%)
	3. Care home workers with direct contact with clients	28	780	3.59% (2.50% , 5.14%)	4.42% (2.80% , 6.77%)	4	891	0.45% (0.17% , 1.19%)	0.42% (0.15% , 1.18%)
	4. Care home workers without contact with clients	9	196	5.77% (3.00% , 10.60%)	5.50% (2.54% , 11.52%)	3	188	1.52% (0.52% , 4.56%)	1.07% (0.29% , 3.81%)
	5. Other essential/key	952	31,300	1.70% (1.62% , 1.92%)	1.64% (1.60% , 2.05%)	368	32,426	0.52% (0.45% , 0.60%)	0.35% (0.45% , 0.68%)
	6. None of these	1430	119,720	1.19% (1.13% , 1.26%)	1.41% (1.31% , 1.51%)	411	112,669	0.36% (0.33% , 0.40%)	0.45% (0.39% , 0.51%)
	7. Don't know	33	2,479	1.32% (0.92% , 1.88%)	1.43% (0.94% , 2.17%)	11	2,309	0.48% (0.27% , 0.82%)	0.43% (0.20% , 0.92%)
NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)	
Work type detail **	1. Delivering to homes - No	1885	151,649	1.24% (1.25% , 1.37%)	1.49% (1.41% , 1.59%)	584	145,767	0.40% (0.37% , 0.43%)	0.47% (0.42% , 0.53%)
	Delivering to homes - Yes	30	1,850	1.62% (1.34% , 2.32%)	2.09% (1.24% , 3.50%)	6	1,837	0.33% (0.15% , 0.71%)	0.45% (0.10% , 1.27%)
	NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
	2. Food retail, other shop work - No	1886	146,737	1.29% (1.23% , 1.34%)	1.49% (1.37% , 1.54%)	561	142,123	0.39% (0.36% , 0.43%)	0.46% (0.41% , 0.52%)
	Food retail, other shop work - Yes	129	6,762	1.91% (1.61% , 2.26%)	2.36% (1.75% , 3.19%)	29	3,481	0.83% (0.37% , 0.76%)	0.66% (0.40% , 1.11%)
	NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
	3. Hospitality - No	1957	150,372	1.30% (1.25% , 1.36%)	1.49% (1.40% , 1.59%)	581	145,588	0.40% (0.37% , 0.43%)	0.47% (0.42% , 0.52%)
	Hospitality - Yes	58	1,127	1.85% (1.44% , 2.39%)	2.16% (1.59% , 2.95%)	9	2,016	0.45% (0.24% , 0.82%)	0.53% (0.23% , 1.19%)
	NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
	11. Personal care - No	1096	151,998	1.31% (1.26% , 1.37%)	1.50% (1.41% , 1.59%)	588	146,032	0.40% (0.37% , 0.43%)	0.47% (0.42% , 0.53%)
	Personal care - Yes	17	1,501	1.13% (0.71% , 1.81%)	1.94% (1.09% , 3.43%)	2	972	0.21% (0.06% , 0.75%)	0.22% (0.05% , 1.05%)
	NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
	3. Policing, prisons, fire & rescue, coastguard - No	1884	151,134	1.30% (1.25% , 1.36%)	1.49% (1.41% , 1.59%)	581	146,221	0.40% (0.37% , 0.43%)	0.47% (0.42% , 0.52%)
	Policing, prisons, fire & rescue, coastguard - Yes	31	1,365	2.27% (1.60% , 3.21%)	2.51% (1.60% , 3.91%)	9	1,363	0.65% (0.34% , 1.23%)	0.78% (0.31% , 1.46%)
	NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
	4. Public transport - No	1979	151,277	1.30% (1.24% , 1.35%)	1.49% (1.40% , 1.57%)	578	146,467	0.39% (0.36% , 0.43%)	0.46% (0.41% , 0.52%)
	Public transport - Yes	42	1,222	3.44% (2.25% , 4.81%)	3.70% (2.53% , 5.36%)	12	1,137	1.06% (0.60% , 1.84%)	1.42% (0.72% , 2.77%)
	NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
	5. Education, school, nursery or childcare - No	1811	141,182	1.28% (1.23% , 1.34%)	1.47% (1.38% , 1.56%)	518	138,192	0.39% (0.36% , 0.42%)	0.46% (0.41% , 0.51%)
	Education, school, nursery or childcare - Yes	304	12,317	1.66% (1.45% , 1.90%)	1.85% (1.54% , 2.24%)	52	8,412	0.62% (0.47% , 0.81%)	0.78% (0.52% , 1.02%)
	NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
	12. Childcare - No	NA	NA	NA (NA , NA)	NA (NA , NA)	588	146,778	0.40% (0.37% , 0.43%)	0.47% (0.42% , 0.52%)
	Childcare - Yes	NA	NA	NA (NA , NA)	NA (NA , NA)	3	826	0.34% (0.07% , 0.88%)	0.35% (0.09% , 1.56%)
	NA	NA	NA	NA (NA , NA)	NA (NA , NA)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	NA	NA	NA (NA , NA)	NA (NA , NA)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
	6. Armed forces - No	2010	151,285	1.31% (1.26% , 1.37%)	1.50% (1.42% , 1.59%)	588	147,388	0.40% (0.37% , 0.43%)	0.47% (0.42% , 0.53%)
	Armed forces - Yes	5	214	2.34% (1.00% , 5.25%)	1.57% (0.57% , 4.34%)	2	206	0.97% (0.27% , 3.47%)	0.56% (0.12% , 2.48%)
	NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)
	Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)
7. Another public facing role - No	1769	139,689	1.28% (1.23% , 1.34%)	1.47% (1.38% , 1.56%)	529	135,827	0.39% (0.36% , 0.42%)	0.46% (0.41% , 0.51%)	
Another public facing role - Yes	222	15,811	1.61% (1.41% , 1.85%)	1.84% (1.55% , 2.17%)	61	11,777	0.52% (0.40% , 0.66%)	0.61% (0.43% , 0.87%)	
NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)	
Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)	
8. Work outside but not in public facing role - No	1886	131,481	1.28% (1.22% , 1.34%)	1.51% (1.41% , 1.61%)	481	129,247	0.37% (0.34% , 0.41%)	0.45% (0.40% , 0.51%)	
Work outside but not in public facing role - Yes	329	22,018	1.49% (1.34% , 1.66%)	1.49% (1.30% , 1.68%)	308	18,257	0.59% (0.49% , 0.72%)	0.63% (0.49% , 0.81%)	
NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)	
Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)	
9. Not currently required to work outside my home - No	1025	61,457	1.68% (1.58% , 1.79%)	1.80% (1.75% , 2.07%)	281	30,148	0.98% (0.50% , 0.93%)	0.64% (0.25% , 0.75%)	
Not currently required to work outside my home - Yes	680	92,042	1.06% (1.00% , 1.13%)	1.22% (1.12% , 1.32%)	308	97,656	0.32% (0.28% , 0.35%)	0.38% (0.33% , 0.44%)	
NA	92	5,389	1.71% (1.39% , 2.09%)	2.02% (1.54% , 2.63%)	41	8,292	0.49% (0.30% , 0.67%)	0.66% (0.43% , 1.01%)	
Didn't answer	175	8,754	2.00% (1.73% , 2.31%)	2.36% (1.97% , 2.87%)	58	9,560	0.61% (0.47% , 0.78%)	0.71% (0.49% , 1.05%)	

* These categories are defined to key worker type in the core variables: they do not distinguish between full-time, part-time, self-employed and other employment types
 ** Respondents only answered for work type detail if they did not answer type 1 to 4 for work type higher

Table 4. Mutually adjusted odds ratios for core variables for rounds 8 and 9. The deprivation index is based on the Index of Multiple Deprivation (2019) at lower super output area. Here we group scores into quintiles, where 1 = most deprived and 5 = least deprived. HCW/CHW = health care or care home workers; Not FT, PT, SE = Not full-time, part-time, or self-employed. Yorkshire = Yorkshire and The Humber.

Variable	Category	8	9
Sex	Male	Ref	Ref
	Female	0.95 [0.87,1.03]	0.94 [0.80,1.10]
Age Group	5-12	0.94 [0.78,1.15]	1.22 [0.90,1.67]
	13-17	1.70 [1.36,2.12]	0.91 [0.59,1.40]
	18-24	1.71 [1.40,2.09]	1.34 [0.92,1.96]
	25-34	1.30 [1.10,1.54]	1.11 [0.81,1.52]
	35-44	Ref	Ref
	45-54	1.15 [0.99,1.34]	1.18 [0.90,1.54]
	55-64	1.19 [1.02,1.39]	1.17 [0.89,1.56]
	65+	1.02 [0.85,1.22]	0.80 [0.57,1.13]
Region	North East	0.70 [0.54,0.92]	1.93 [1.33,2.79]
	North West	0.78 [0.66,0.92]	1.63 [1.24,2.14]
	Yorkshire	0.60 [0.48,0.75]	1.09 [0.76,1.58]
	East Midlands	0.69 [0.59,0.81]	1.50 [1.14,1.96]
	West Midlands	0.86 [0.73,1.02]	1.16 [0.84,1.59]
	East of England	1.01 [0.89,1.16]	1.09 [0.82,1.45]
	London	1.47 [1.27,1.69]	1.58 [1.18,2.12]
	South East	Ref	Ref
	South West	0.51 [0.42,0.62]	0.65 [0.44,0.96]
Key Worker Status	HCW/CHW	1.48 [1.25,1.77]	1.37 [1.02,1.86]
	Key worker (other)	1.35 [1.20,1.51]	1.19 [0.97,1.46]
	Other worker	Ref	Ref
	Not FT, PT, SE	0.90 [0.80,1.02]	0.99 [0.80,1.23]
Ethnicity	Asian	1.35 [1.14,1.61]	1.56 [1.15,2.11]
	Black	1.63 [1.24,2.14]	1.06 [0.60,1.87]
	Mixed	1.03 [0.77,1.39]	0.51 [0.24,1.09]
	Other	1.39 [0.96,2.03]	0.69 [0.26,1.85]
	White	Ref	Ref
Household Size	1-2 People	Ref	Ref
	3-5 People	1.37 [1.24,1.52]	1.56 [1.29,1.89]
	6+ People	2.02 [1.64,2.50]	1.80 [1.19,2.72]
Deprivation Index Quintile	1 - Most Deprived	Ref	Ref
	2	1.03 [0.88,1.21]	0.84 [0.65,1.09]
	3	0.82 [0.70,0.97]	0.57 [0.43,0.74]
	4	0.82 [0.70,0.96]	0.64 [0.50,0.83]
	5 - Least Deprived	0.72 [0.61,0.84]	0.57 [0.44,0.74]

Table 5. Estimates of regional growth rates, doubling times and reproduction numbers for round 9a and 9b, and for round 8b and 9a.

Round	Region	Growth rate	R	Probability R>1	Halving (-) / Doubling (+) time
9a and 9b	East Midlands	-0.026 (-0.074 , 0.022)	0.84 (0.59 , 1.15)	0.15	-27.1 (-9.3 , 31.2)
	West Midlands	-0.001 (-0.063 , 0.059)	0.99 (0.64 , 1.41)	0.49	* (-11.0 , 11.8)
	East of England	-0.049 (-0.103 , 0.002)	0.71 (0.46 , 1.01)	0.03	-14.1 (-6.8 , *)
	London	0.033 (-0.015 , 0.081)	1.22 (0.91 , 1.59)	0.91	21.2 (-47.5 , 8.6)
	North West	-0.086 (-0.135 , -0.039)	0.53 (0.34 , 0.77)	<0.01	-8.0 (-5.1 , -17.8)
	North East	-0.032 (-0.109 , 0.041)	0.81 (0.44 , 1.28)	0.19	-21.5 (-6.4 , 16.9)
	South East	0.018 (-0.024 , 0.061)	1.12 (0.85 , 1.43)	0.80	37.9 (-28.5 , 11.5)
	South West	-0.077 (-0.162 , 0.002)	0.58 (0.25 , 1.02)	0.03	-9.0 (-4.3 , *)
Yorkshire **	-0.055 (-0.134 , 0.019)	0.69 (0.35 , 1.13)	0.08	-12.7 (-5.2 , 36.2)	
8b and 9a	East Midlands	-0.040 (-0.059 , -0.021)	0.76 (0.66 , 0.87)	<0.01	-17.2 (-11.7 , -33.8)
	West Midlands	-0.048 (-0.073 , -0.024)	0.72 (0.60 , 0.86)	<0.01	-14.4 (-9.5 , -29.5)
	East of England	-0.062 (-0.080 , -0.045)	0.65 (0.56 , 0.74)	<0.01	-11.2 (-8.7 , -15.4)
	London	-0.070 (-0.088 , -0.052)	0.61 (0.53 , 0.70)	<0.01	-10.0 (-7.9 , -13.4)
	North West	-0.018 (-0.038 , 0.004)	0.89 (0.78 , 1.02)	0.05	-38.7 (-18.3 , *)
	North East	0.002 (-0.034 , 0.046)	1.02 (0.80 , 1.32)	0.55	* (-20.4 , 15.1)
	South East	-0.062 (-0.078 , -0.045)	0.65 (0.57 , 0.73)	<0.01	-11.2 (-8.9 , -15.3)
	South West	-0.031 (-0.060 , 0.000)	0.82 (0.66 , 1.00)	0.03	-22.7 (-11.5 , *)
Yorkshire **	-0.012 (-0.046 , 0.029)	0.93 (0.73 , 1.19)	0.28	* (-15.0 , 23.9)	

* Doubling/Halving time had an estimated magnitude greater than 50 days and so represented approximately constant prevalence

** Yorkshire and The Humber

Table 6. Mutually adjusted odds ratios among core variables and odds ratios for core-variable adjusted detailed ethnicity categories.

Category	Round 8	Round 9
English/Welsh/Scottish/Northern Irish/British	Ref	Ref
Irish	1.41 [0.98,2.04]	1.16 [0.52,2.61]
Gypsy or Irish Traveller	0.00 [0.00,Inf]	0.00 [0.00,Inf]
Other white background	1.25 [1.05,1.49]	2.01 [1.54,2.64]
White and Black Caribbean	0.82 [0.39,1.74]	0.39 [0.06,2.81]
White and Black African	1.05 [0.43,2.55]	0.00 [0.00,Inf]
White and Asian	1.15 [0.72,1.84]	1.08 [0.44,2.62]
Other Mixed/Multiple ethnic background	1.01 [0.61,1.67]	0.46 [0.11,1.86]
Indian	1.36 [1.06,1.74]	2.02 [1.35,3.02]
Pakistani	1.58 [0.99,2.50]	2.68 [1.46,4.93]
Bangladeshi	3.03 [1.90,4.82]	1.57 [0.50,4.96]
Chinese	0.70 [0.36,1.36]	0.33 [0.05,2.34]
Other Asian background	1.81 [1.34,2.45]	1.72 [0.94,3.16]
African	1.92 [1.39,2.65]	1.46 [0.79,2.70]
Caribbean	1.24 [0.70,2.22]	0.39 [0.05,2.76]
Other Black/African/Caribbean background	2.25 [0.99,5.12]	2.93 [0.72,11.94]
Arab	1.18 [0.52,2.66]	2.69 [0.99,7.28]
Other ethnic group	1.51 [0.99,2.29]	0.52 [0.13,2.09]
Prefer not to say	1.36 [0.93,1.99]	1.54 [0.72,3.25]
NA	0.93 [0.58,1.49]	1.08 [0.48,2.42]

Table 7. Odds ratios for detailed work types, unadjusted and adjusted for gender, age group, region, ethnicity and deprivation index.

Variable	Category	Round 8		Round 9	
		Univariate	Adjusted	Univariate	Adjusted
Work type high level *	1. Health care workers with direct patient contact	1.19 [0.98,1.43]	1.16 [0.93,1.41]	1.26 [0.90,1.77]	1.23 [0.87,1.73]
	2. Health care workers with no patient contact	0.41 [0.24,0.71]	0.42 [0.24,0.71]	0.85 [0.43,1.67]	0.89 [0.45,1.74]
	3. Care home workers with direct contact with clients	2.07 [1.41,3.05]	2.02 [1.37,2.98]	0.87 [0.32,2.34]	0.81 [0.30,2.18]
	4. Care home workers without contact with clients	3.41 [1.73,6.72]	3.52 [1.78,6.95]	2.95 [0.94,9.33]	3.04 [0.96,9.64]
	5. Other essential/key workers	Ref	Ref	Ref	Ref
	6. None of these	0.67 [0.61,0.74]	0.71 [0.64,0.78]	0.70 [0.59,0.84]	0.83 [0.69,1.00]
	7. Don't know	0.75 [0.53,1.07]	0.69 [0.48,0.99]	0.92 [0.50,1.69]	0.89 [0.48,1.64]
	NA	0.97 [0.77,1.21]	0.53 [0.39,0.73]	0.95 [0.68,1.34]	0.93 [0.59,1.48]
Work type detail	1. Delivering to homes - No	Ref	Ref	Ref	Ref
	Delivering to homes - Yes	1.24 [0.86,1.79]	1.13 [0.80,1.63]	0.81 [0.36,1.82]	0.72 [0.32,1.61]
	NA	1.31 [1.06,1.62]	0.75 [0.55,1.01]	1.24 [0.90,1.70]	1.08 [0.70,1.66]
	Didn't answer	1.54 [1.32,1.80]	1.42 [1.21,1.67]	1.52 [1.16,1.99]	1.30 [0.99,1.71]
	2. Food retail, other shop work - No	Ref	Ref	Ref	Ref
	Food retail, other shop work - Yes	1.49 [1.25,1.79]	1.30 [1.08,1.56]	1.34 [0.92,1.95]	1.13 [0.77,1.65]
	NA	1.33 [1.08,1.65]	0.76 [0.56,1.04]	1.25 [0.91,1.72]	1.09 [0.70,1.68]
	Didn't answer	1.57 [1.34,1.83]	1.44 [1.23,1.69]	1.54 [1.17,2.02]	1.31 [1.00,1.73]
	10. Hospitality - No	Ref	Ref	Ref	Ref
	Hospitality - Yes	1.43 [1.10,1.87]	1.20 [0.92,1.56]	1.12 [0.58,2.17]	0.92 [0.47,1.78]
	NA	1.32 [1.07,1.63]	0.76 [0.56,1.02]	1.24 [0.90,1.70]	1.08 [0.70,1.67]
	Didn't answer	1.55 [1.32,1.81]	1.42 [1.21,1.67]	1.52 [1.16,2.00]	1.30 [0.99,1.72]
	11. Personal care - No	Ref	Ref	Ref	Ref
	Personal care - Yes	0.86 [0.53,1.39]	0.81 [0.50,1.30]	0.51 [0.13,2.06]	0.47 [0.12,1.87]
	NA	1.30 [1.06,1.61]	0.74 [0.55,1.01]	1.23 [0.90,1.70]	1.08 [0.70,1.66]
	Didn't answer	1.53 [1.31,1.79]	1.41 [1.20,1.66]	1.52 [1.16,1.99]	1.30 [0.98,1.71]
	3. Policing, prisons, fire & rescue, coastguard - No	Ref	Ref	Ref	Ref
	Policing, prisons, fire & rescue, coastguard - Yes	1.76 [1.23,2.52]	1.68 [1.17,2.41]	1.64 [0.85,3.18]	1.49 [0.77,2.90]
	NA	1.31 [1.06,1.62]	0.75 [0.55,1.01]	1.25 [0.91,1.71]	1.08 [0.70,1.68]
	Didn't answer	1.54 [1.32,1.80]	1.43 [1.22,1.68]	1.53 [1.17,2.01]	1.31 [1.00,1.73]
	4. Public transport - No	Ref	Ref	Ref	Ref
	Public transport - Yes	2.71 [1.99,3.70]	2.17 [1.58,2.97]	2.69 [1.52,4.78]	2.14 [1.20,3.83]
	NA	1.32 [1.07,1.63]	0.75 [0.56,1.02]	1.25 [0.91,1.72]	1.09 [0.70,1.68]
	Didn't answer	1.55 [1.33,1.82]	1.43 [1.22,1.68]	1.54 [1.18,2.02]	1.32 [1.00,1.74]
	5. Education, school, nursery or childcare - No	Ref	Ref	Ref	Ref
	Education, school, nursery or childcare - Yes	1.30 [1.12,1.50]	1.20 [1.03,1.39]	1.60 [1.20,2.13]	1.43 [1.07,1.91]
	NA	1.34 [1.08,1.65]	0.77 [0.57,1.05]	1.28 [0.93,1.76]	1.12 [0.72,1.73]
	Didn't answer	1.57 [1.34,1.84]	1.45 [1.23,1.70]	1.57 [1.20,2.05]	1.35 [1.02,1.79]
	12. Childcare - No	Ref	Ref	Ref	Ref
	Childcare - Yes	NA	NA	0.60 [0.15,2.42]	0.57 [0.14,2.29]
	NA	NA	NA	1.24 [0.90,1.70]	1.08 [0.70,1.67]
	Didn't answer	NA	NA	1.52 [1.16,1.99]	1.30 [0.99,1.71]
	6. Armed forces - No	Ref	Ref	Ref	Ref
	Armed forces - Yes	1.80 [0.74,4.38]	1.84 [0.76,4.48]	2.45 [0.61,9.88]	2.24 [0.55,9.07]
	NA	1.31 [1.06,1.61]	0.75 [0.55,1.01]	1.24 [0.90,1.70]	1.08 [0.70,1.67]
	Didn't answer	1.54 [1.31,1.79]	1.42 [1.21,1.67]	1.52 [1.16,2.00]	1.31 [0.99,1.72]
	7. Another public facing role - No	Ref	Ref	Ref	Ref
	Another public facing role - Yes	1.26 [1.09,1.45]	1.21 [1.05,1.39]	1.33 [1.02,1.74]	1.22 [0.93,1.59]
	NA	1.34 [1.08,1.65]	0.75 [0.56,1.02]	1.27 [0.92,1.75]	1.09 [0.71,1.69]
	Didn't answer	1.57 [1.34,1.84]	1.45 [1.23,1.70]	1.56 [1.19,2.05]	1.33 [1.01,1.76]
	8. Work outside but not in public facing role - No	Ref	Ref	Ref	Ref
	Work outside but not in public facing role - Yes	1.17 [1.04,1.32]	1.12 [0.99,1.27]	1.60 [1.30,1.97]	1.48 [1.19,1.83]
	NA	1.34 [1.08,1.65]	0.75 [0.55,1.01]	1.33 [0.97,1.83]	1.12 [0.72,1.73]
	Didn't answer	1.57 [1.34,1.84]	1.44 [1.23,1.69]	1.63 [1.24,2.15]	1.39 [1.05,1.83]
	9. Not currently required to work outside my home - No	Ref	Ref	Ref	Ref
	Not currently required to work outside my home- Yes	0.63 [0.58,0.69]	0.67 [0.61,0.74]	0.56 [0.48,0.66]	0.64 [0.54,0.76]
	NA	1.01 [0.82,1.26]	0.60 [0.44,0.82]	0.88 [0.63,1.22]	0.80 [0.51,1.26]
	Didn't answer	1.19 [1.01,1.40]	1.17 [0.99,1.38]	1.08 [0.82,1.44]	1.03 [0.77,1.37]

* These categories do not distinguish between full-time, part-time, self-employed and other employment types, as is the case in the core variable worker type categories.

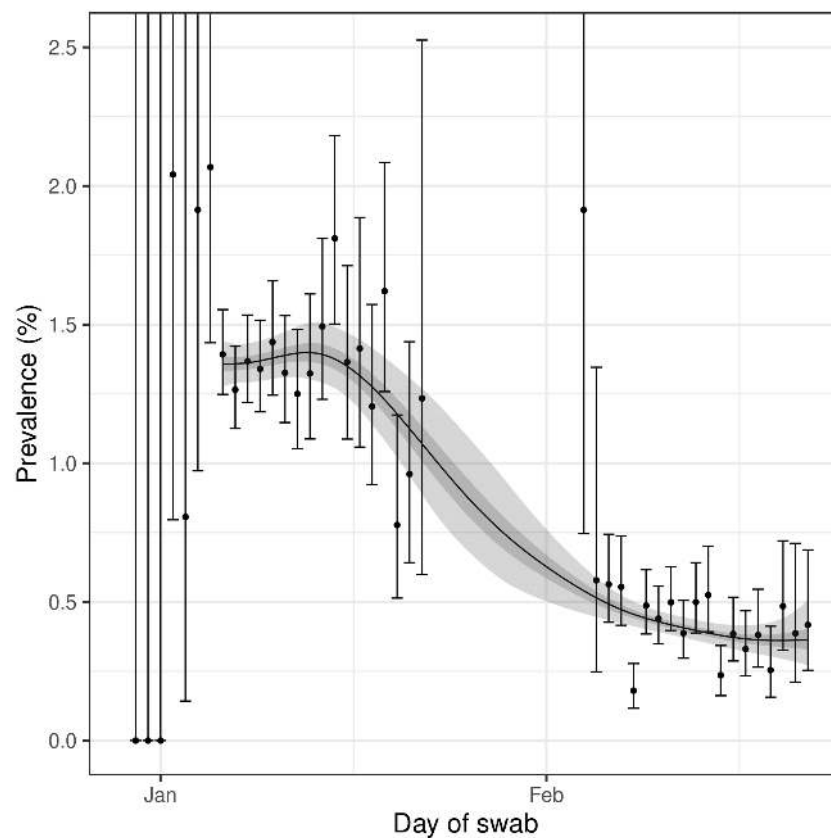


Figure 1. Prevalence of national swab-positivity for England estimated using a P-spline for all nine rounds with central 50% (dark grey) and 95% (light grey) posterior credible intervals. Shown here only for the period of round 8 to round 9. Unweighted observations (black dots) and 95% binomial confidence intervals (vertical lines) are also shown.

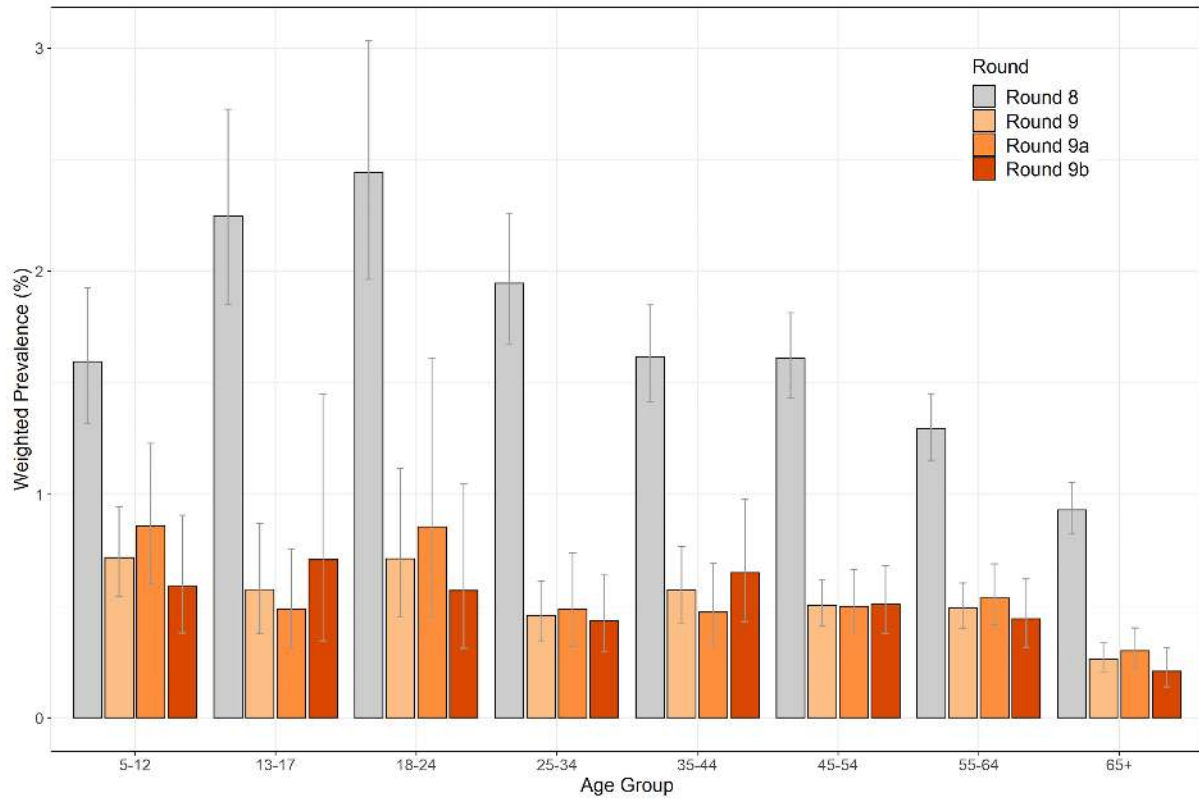


Figure 2. Weighted prevalence of swab-positivity by age groups for rounds 8, 9, 9a and 9b. Bars show 95% confidence intervals.

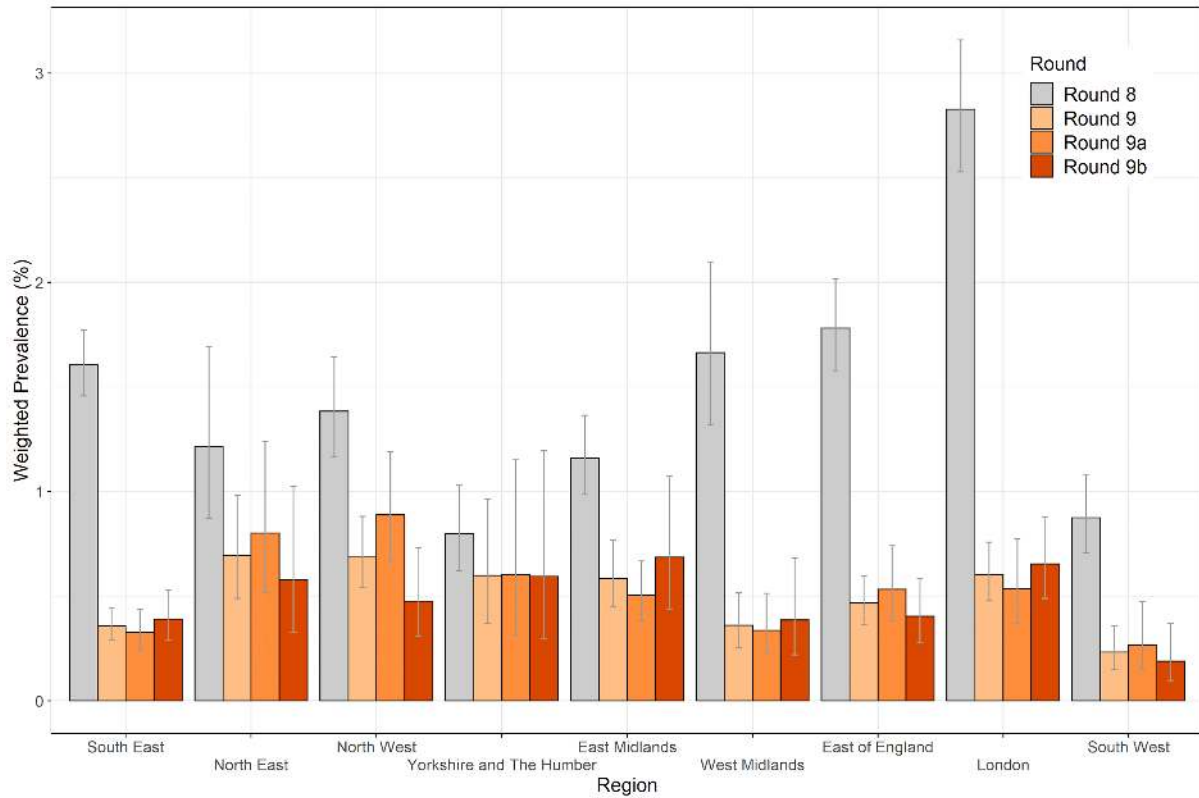


Figure 3. Weighted prevalence of swab-positivity by region for rounds 8, 9, 9a and 9b. Bars show 95% confidence intervals.

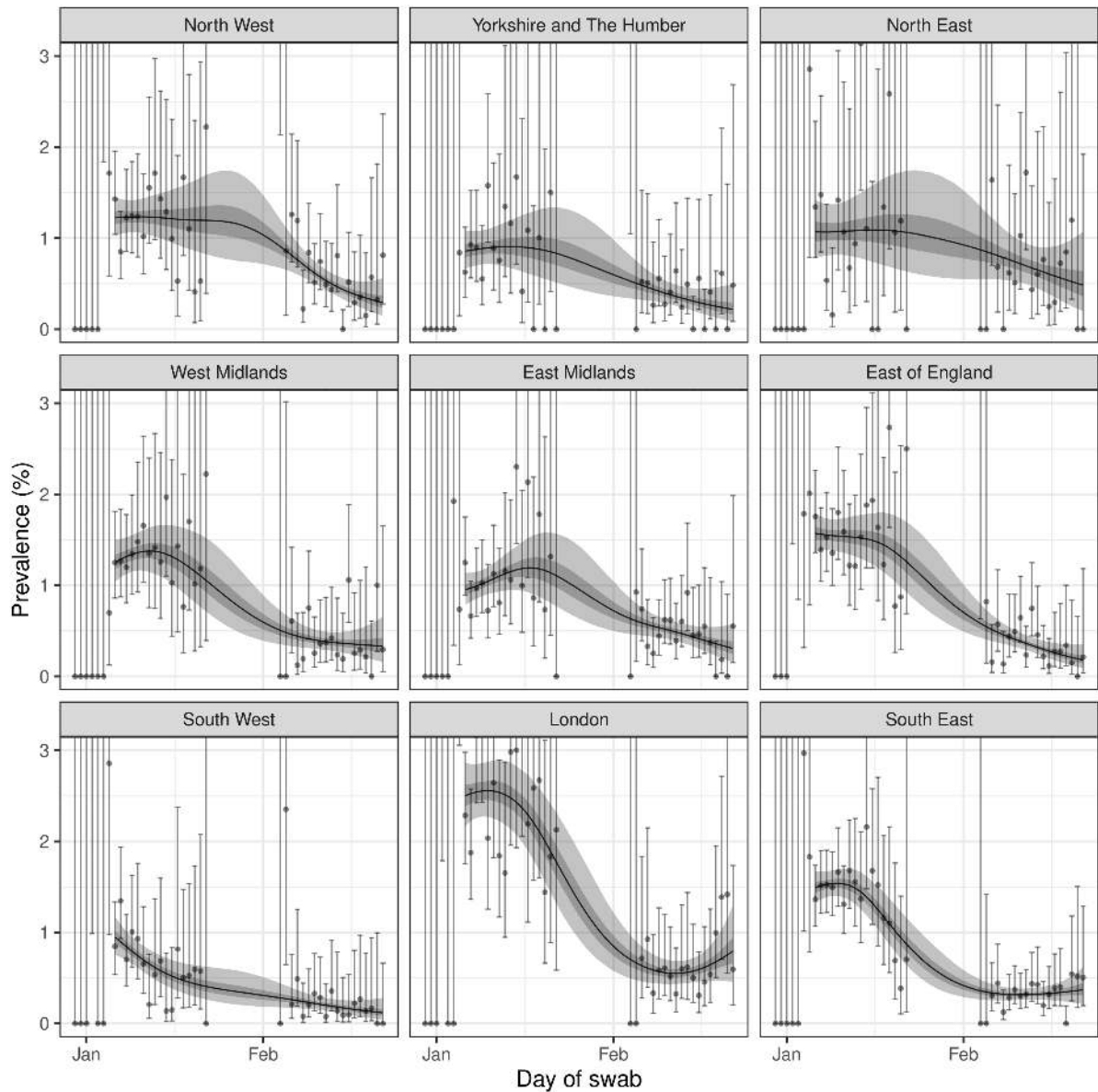


Figure 4. Prevalence of swab-positivity estimated using a P-spline (with constant second-order random walk prior) for each region of England separately. Each model was fit to all nine rounds but is only shown here for the period of round 8 to round 9. Central 50% (dark grey) and 95% (light grey) posterior credible intervals are also shown.

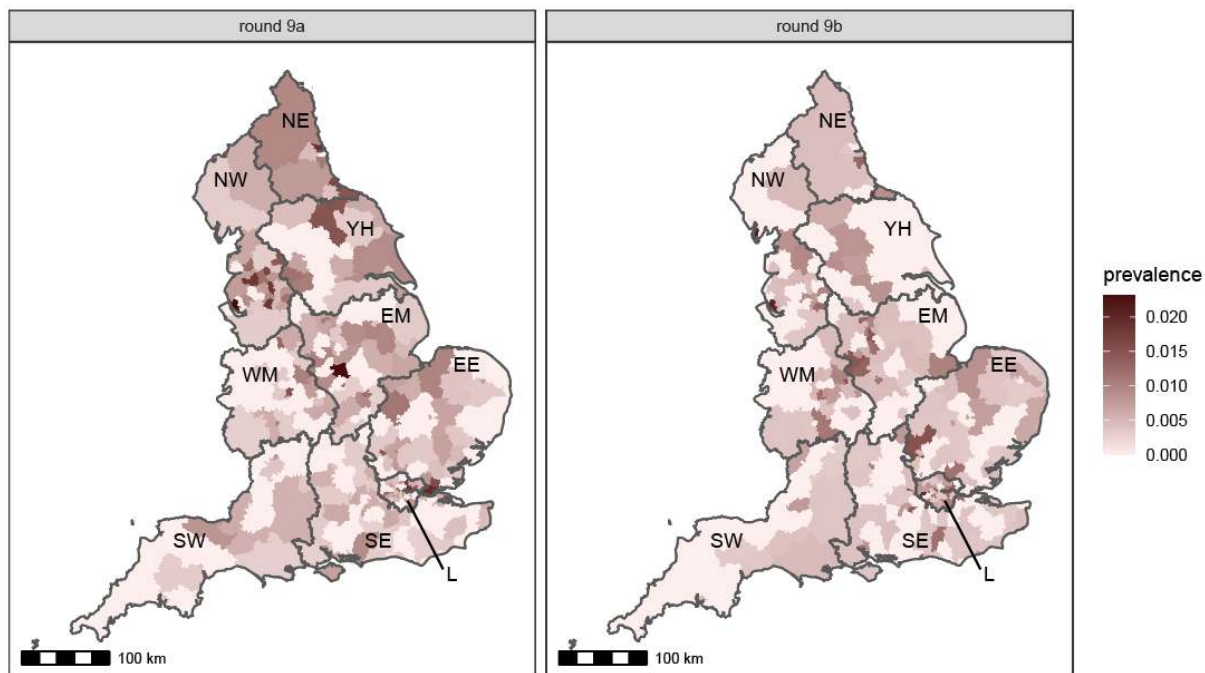


Figure 5. Unweighted, unsmoothed swab-positivity for lower-tier local authorities in England for rounds 9a and 9b of REACT-1. Regions: NE = North East, NW = North West, YH = Yorkshire and The Humber, EM = East Midlands, WM = West Midlands, EE = East of England, L = London, SE = South East, SW = South West.

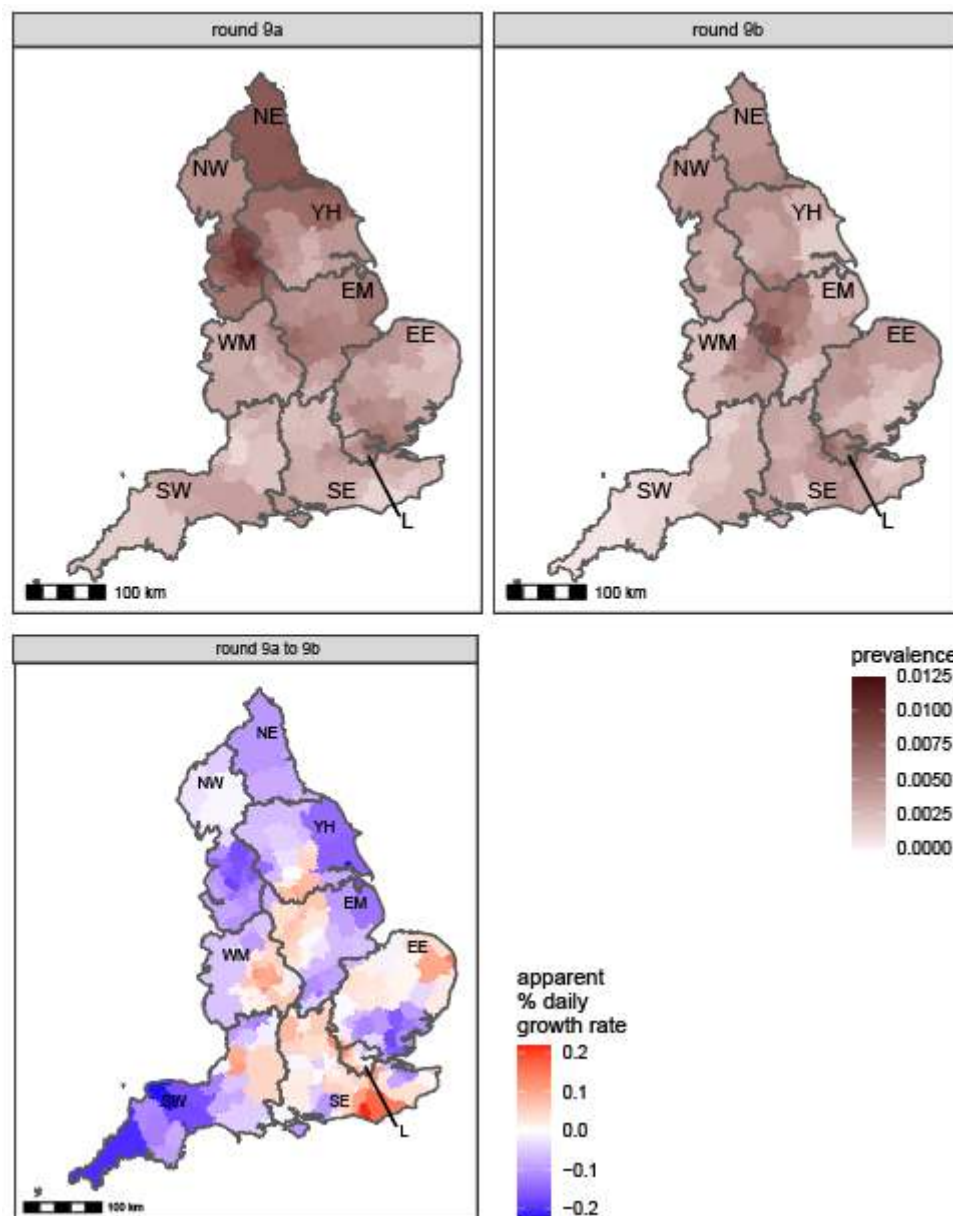


Figure 6. Neighbourhood prevalence of swab-positivity for rounds 9a and 9b (top), apparent percentage change in daily growth rate from round 9a to round 9b (bottom). Neighbourhood prevalence calculated from 2,532 (round 9a) and 2,193 (round 9b) nearest neighbours in the sample (the median number of neighbours within 30km in the study). Neighbourhood prevalence displayed as an average of a random sample of 15 participants for each lower-tier local authority (LTLA). Apparent percentage change in daily growth rate calculated as round 9b prevalence divided by round 9a prevalence divided by the difference in the median round date (in days). Regions: NE = North East, NW = North West, YH = Yorkshire and The Humber, EM = East Midlands, WM = West Midlands, EE = East of England, L = London, SE = South East, SW = South West.

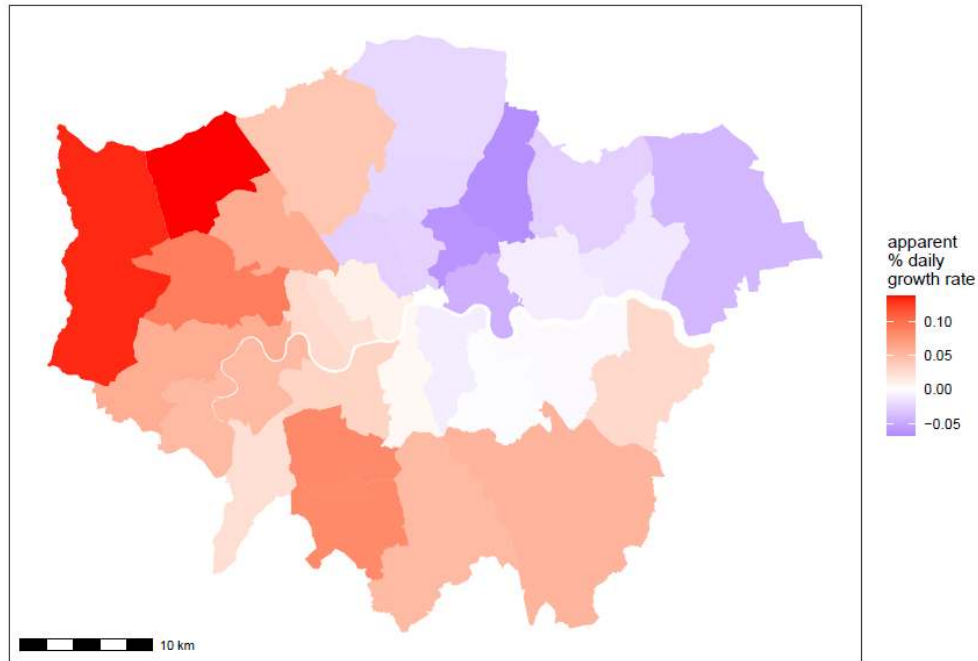


Figure 7. Apparent percentage change in daily growth rate from round 9a to round 9b for London, calculated as round 9b prevalence divided by round 9a prevalence divided by the difference in the median round date (in days).

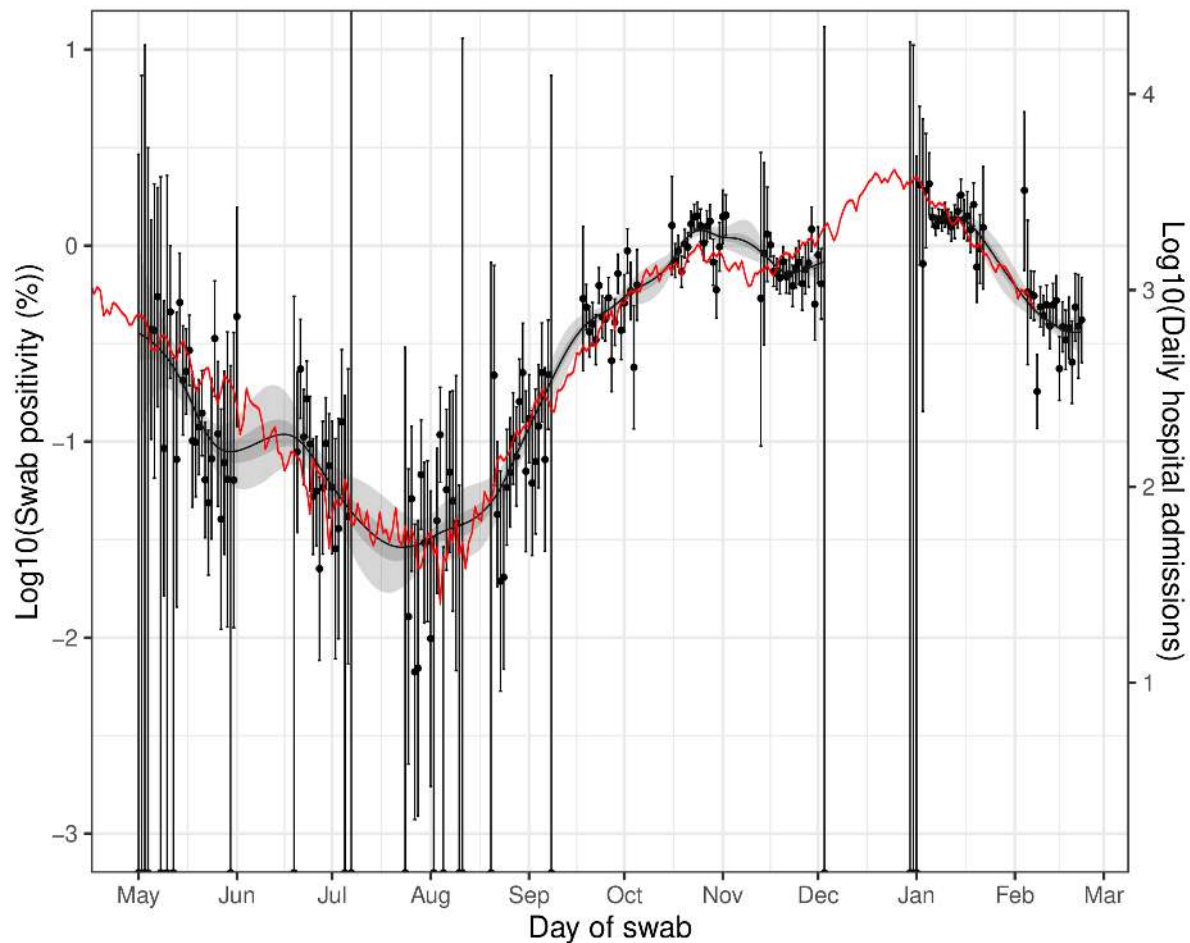


Figure 8. Daily hospital admissions in England (Solid red line, right hand y-axis) shifted by a lag parameter along the x-axis (see below), and daily swab positivity for all 9 rounds of the study (dots with 95% confidence intervals, left hand y-axis) and the P-spline estimate for swab positivity (Solid black line, dark grey shaded area is 50% central credible interval, light grey shaded area is 95% central credible interval, left-hand y-axis). Daily hospital admissions have been fit to observations from the REACT-1 study to obtain scaling and lag parameters. These parameter values were estimated using a Bayesian MCMC model: $\text{daily_positives}(t) \sim \text{Binomial}(\text{daily_swab_tests}(t), p = \text{daily_admissions}(t+\text{lag}) \cdot \text{scale})$. The time lag parameter was estimated at 18 (18, 20) days. Note the P-spline is not plotted for the region between round 7 and 8 in which there was an unobserved peak in swab-positivity.

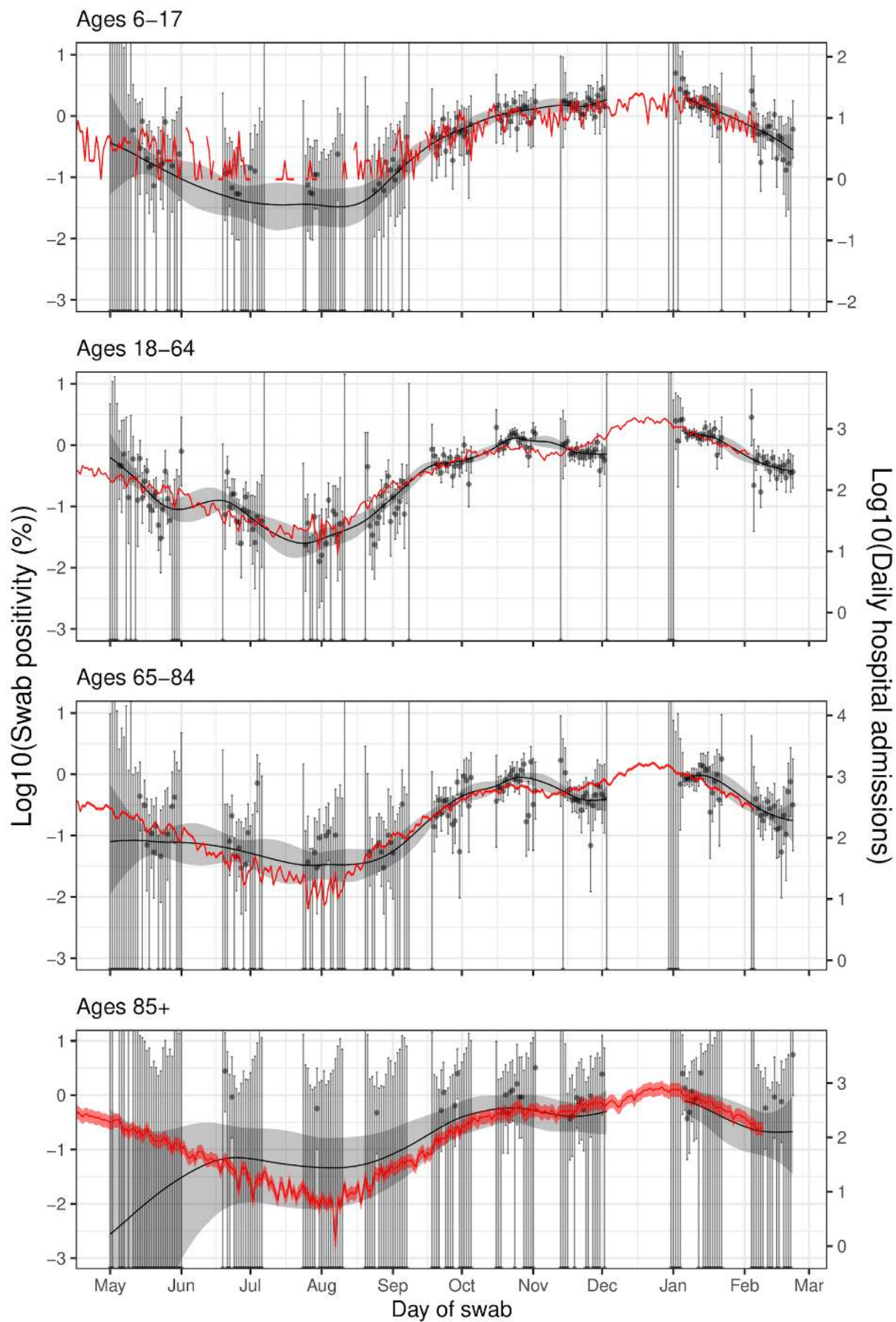


Figure 9. Legend on following page.

Figure 9. Figure on previous page. Daily hospital admissions in England for age groups 6-17, 18-64, 65-84 and 85+(Solid red line, right hand y-axis) shifted by 19, 22, 20 and 16 days along the x-axis respectively. Also plotted is the daily swab positivity for all 9 rounds of the study (Points with 95% confidence intervals, left hand y-axis) and the P-spline estimate for swab positivity (Solid black line, light grey shaded area is 95% central credible interval, left-hand y-axis). Note the p-spline is not plotted for the region between round 7 and 8 in which there was a peak that we do not have data to capture. Daily hospital admissions have been multiplied by a scaling parameter, alpha, and shifted by a time lag parameter, tau in order to correspond to the left hand y-axis. These parameter values were estimated using an MCMC with likelihood function: $\text{daily_swab_positives}(t) \sim \text{Binomial}(\text{daily_swab_tests}(t), p = \text{daily_hospital_admissions}(t+\text{tau}) * \text{alpha})$. Estimated time lag parameters were 19 (19, 19) days for 6-17 year olds, 22 (22, 22) days for 18-64 year olds, 20 (18, 21) days for 65-84 year olds and 16 (12, 29) for 85+ year olds. Shaded red region shows the uncertainty in the parameter alpha and by how much daily hospital admissions should be scaled to correspond to swab positivity on the left hand y-axis. Note that for 6-17 year olds some days had zero hospital admissions and so these have not been included on the log scale graph.