UK Health Security Agency

COVID-19 vaccine surveillance report

Week 29

18 July 2024

Contents

Executive summary

Rigorous clinical trials have been undertaken to understand the immune response, safety profile, and efficacy of all coronavirus (COVID-19) vaccines approved for use in the UK as part of the regulatory process. Ongoing monitoring of the vaccines as they are rolled out in the population is important to continually ensure that clinical and public health guidance on the vaccination programme is built upon the best available evidence.

UK Health Security Agency (UKHSA), formerly Public Health England (PHE), works closely with the Medicines and Healthcare Regulatory Agency (MHRA), NHS England, and other government, devolved administration, and academic partners to monitor the COVID-19 vaccination programme. Details of the vaccine surveillance strategy are set on the page COVID-19: vaccine surveillance strategy (1). As with all vaccines, the safety of COVID-19 vaccines is continuously being monitored by the MHRA. They conclude that overall, the benefits of COVID-19 vaccines outweigh any potential risks (2).

This report contains updates on vaccine effectiveness, vaccination in pregnancy, and vaccine impact on the proportion of the population with antibodies to COVID-19.

Vaccine effectiveness

Vaccine effectiveness (VE) is estimated by comparing rates of disease (or positivity among those tested) in vaccinated individuals to rates in unvaccinated individuals. Below we outline the latest real-world evidence on vaccine effectiveness from studies in UK populations.

Effectiveness against symptomatic disease

Vaccine effectiveness against symptomatic COVID-19 has been assessed in England based on testing data linked to vaccination data from the National Immunisation Management System (NIMS) (3), cohort studies such as the COVID-19 Infection Survey, and GP electronic health record data.

Effectiveness against hospitalisation

Several studies have estimated vaccine effectiveness against hospitalisation, all of which indicate higher levels of protection against hospitalisation than symptomatic disease with all vaccines against the Alpha, Delta and Omicron variants (4 to 8). Given that Omicron generally causes milder disease than previous variants and that population immunity is high from previous infection and vaccinations (9), an increasing proportion of individuals hospitalised with a positive COVID-19 test are likely to have COVID-19 as an incidental finding rather than the primary reason for admission (8). We therefore use strict definitions to define a COVID-19 hospitalisation – at least 2 days stay in the hospital and a respiratory code in the primary diagnostic field.

Analyses for booster vaccination campaigns in autumn 2022 (10) and spring 2023 (11) assessed the incremental effectiveness within those who had had prior doses. Both campaigns showed effectiveness peak at around 50% shortly after vaccination with waning to about 30% after a few months and with a continued waning to no protection after about 6 months (12).

Effectiveness of the spring 2024 booster

The 2024 spring booster programme, which commenced 15 April 2024, was recommended by the Joint Committee on Vaccination and Immunisation (JCVI) for adults aged 75 years and older, residents in care homes for older people, and those aged 6 months or over with a weakened immune system. The products offered were mRNA monovalent Omicron XBB.1.5 vaccines (Pfizer-BioNTech and Moderna).

VE was estimated against hospitalisation amongst those aged 75 years and older for both vaccine manufacturers from 15 April 2024 (Table 1). We compared the odds of testing positive in hospital for COVID-19 in those who received a spring booster against those who did not receive a spring booster, regardless of previous vaccination history. The effectiveness

measured is therefore the incremental protection on top of any from previous vaccinations or infections. Individuals with 2 or more spring boosters and individuals who have received a spring booster less than 12 weeks after their previous vaccine were excluded.

Incremental effectiveness against hospitalisation was highest in the period 2 to 4 weeks post-vaccination at 38.5%. Confidence intervals overlapped so the difference in the VE point estimates was not statistically significant. This is an early assessment of the spring booster programme and further follow-up time is required to assess waning for this booster.

Table 1. Vaccine effectiveness (VE) of the spring 2024 booster against hospitalisation amongst those aged 75 years and older in England

Spring booster	Interval after dose	Controls	Cases	VE (95% C.I.)
No booster	-	4,607	1,012	Baseline
Pfizer or Moderna XBB.1.5 booster	9 to 13 days	253	42	32.8 (5.5 to 52.3)
	2 to 4 weeks	736	123	38.5 (23.5 to 50.6)
	≥ 5 weeks	365	75	36.6 (14.7 to 52.9)

Effectiveness of the autumn 2023 booster

An autumn booster programme was recommended by the JCVI for adults aged 65 years and older, as well as those in a clinical risk group, care home staff and residents, frontline health and social care workers, carers and household contacts of people with immunosuppression. Vaccinations began 11 September 2023, with the most at risk (adult care home residents and people who are immunosuppressed) prioritised for vaccination. The products offered were bivalent Original/Omicron BA.4-5 vaccine (Pfizer-BioNTech) and monovalent XBB.1.5 vaccine (Pfizer-BioNTech and Moderna). The bivalent BA.4-5 boosters were rolled out first, followed by the XBB boosters.

Relative VE was estimated against hospitalisation amongst those aged 65 years and older against all Omicron sub-lineages in circulation between 4 September 2023 and 21 January 2024 (Table 2) (12). Only individuals who had previously received at least 2 doses before their autumn booster and whose last dose was given at least 12 weeks prior were included. The effectiveness measured is therefore incremental effectiveness on top of at least 12 weeks of waned protection.

Incremental effectiveness against hospitalisation for both booster vaccines peaked at about 50%; 45.0% and 54.8% for the bivalent BA.4-5 boosters and monovalent XBB.1.5 boosters, respectively (Table 2). Confidence intervals overlapped so the difference in the VE point

estimates was not statistically significant. There was some evidence of waning with a reduction to about 17% at 15 weeks post vaccination for the bivalent BA.4-5 doses. We do not yet have sufficient data to estimate VE at this time point for the XBB.1.5 doses.

Table 2. Vaccine effectiveness (VE) against hospitalisation amongst those aged 65 years and older in England, stratified by autumn booster manufacturer

Autumn booster [Note 1]	Interval	Controls	Cases	VE (95% C.I.)
No booster	-	10,227	4351	Baseline
Pfizer BA.4-5	9 to 13 days	206	64	44.1% (25.1 to 58.3)
	2 to 4 weeks	1,000	246	45.0% (35.5 to 53.2)
	5 to 9 weeks	1,914	307	42.4% (33.4 to 50.2)
	10-14 weeks	2,136	495	34.3% (25.2 to 42.3)
	15+ weeks	393	89	16.9% (-8.3 to 36.2)
Pfizer XBB.1.5	9 to 13 days	290	72	37.4% (17.8 to 52.3)
	2 to 4 weeks	1,464	214	54.8% (46.8 to 61.6)
	5 to 9 weeks	2,292	393	48.3% (41.0 to 54.7)
	10-14 weeks	1,445	296	42.2% (32.3 to 50.6)
	15+ weeks	27	7	Insufficient data

Note 1. Due to insufficient data, Moderna is not included.

Effectiveness against JN.1 and EG.5.1

During the autumn and winter of 2023 to 2024 the main circulating sub-lineages were XBB sub-lineages, EG.5.1 and JN.1. The prevalence of JN.1 increased in England in December 2023 and JN.1 was dominant by late January 2024. To assess whether VE differed by these sub-lineages VE against hospitalisation was estimated, stratified by variant, between 4 September 2023 and 21 January 2024 (Table 3). Cases were classified as XBB.1.5, EG.5.1 or JN.1 based on whole genome sequencing information. The effectiveness measured was the incremental effectiveness on top of at least 6 months of waned protection in those who had received at least 2 doses.

Point estimates were generally highest against XBB sub-lineages with VE (Table 3) (12). VE was lower against both JN.1 and EG.5.1 with confidence intervals non-overlapping with the VE

of the XBB sub-lineages at 2 to 4 weeks for EG.5.1 where VE was 44.5% and at 5 to 9 weeks for JN.1 where VE was 26.4%.

Table 3. Vaccine effectiveness of the autumn 2023 booster against hospitalisation against JN.1, EG.5.1 and XBB sub-lineages amongst those aged 65 years and older

Variant	Booster vaccine	Time since vaccination	Controls	Cases	VE (95% C.I.)
JN.1	None	-	10,227	118	Baseline
	Autumn 2023 booster	2 to 4 weeks	2,464	12	36.6 (-19.5 to 66.4)
	-	5 to 9 weeks	4,206	73	26.4 (-3.4 to 47.6)
	-	10+ weeks	4,001	163	22.5 (-4.4 to 42.5)
EG.5.1	None	-	10,227	357	Baseline
	Autumn 2023 booster	2 to 4 weeks	2,464	48	44.5 (20.2 to 61.4)
	-	5 to 9 weeks	4,206	40	43.2 (13.7 to 62.7)
	-	10+ weeks	4,001	21	21.6 (-43.0 to 57.0)
XBB sub-lineages	None	-	10,227	649	Baseline
	Autumn 2023 booster	2-4 weeks	2,464	37	74.0 (62.4 to 82.1)
	-	5-9 weeks	4,206	37	68.2 (52.9 to 78.5)
	-	10+ weeks	4,001	22	55.1 (23.1 to 73.8)

Effectiveness against mortality

Vaccine effectiveness against mortality with the Omicron variant (all sub-lineages using tests taken until 5 September 2022) has been estimated for those aged 65 years and older using a test-negative case control study design (all vaccines combined) and is published in earlier versions of this report. Due to the small numbers of deaths within those hospitalised, VE against mortality has not been assessed for recent boosters.

Vaccine effectiveness publications

UKHSA and collaborators have published a significant amount of research into vaccine effectiveness. Further results and details of methods used can be accessed at the Monitoring reports of the effectiveness of COVID-19 vaccination page.

Population impact

Vaccines typically have both direct effects on those who are vaccinated and indirect effects on the wider population due to a reduced probability that people will come into contact with an infected individual. The overall impact of the vaccination programme may therefore extend beyond that estimated through vaccine effectiveness analysis alone.

Estimating the impact of a vaccination programme is challenging as there is no completely unaffected control group. Furthermore, the effects of the vaccination programme need to be differentiated from that of other interventions (for example lockdowns or outbreak control measures), changes in behaviour and any seasonal variation in COVID-19 activity.

UKHSA and other government and academic partners monitor the impact of the vaccination programme on levels of COVID-19 antibodies in the population and different disease indicators, including hospitalisations and mortality. This is done through population-based testing and through modelling which combines vaccine coverage rates in different populations, estimates of vaccine effectiveness and disease surveillance indicators.

Impact of the spring and autumn 2023 COVID-19 boosters on hospitalisation, severe hospitalisation, and death

A simple method for estimating averted COVID-19 hospitalisations and deaths from vaccination is to take the observed number of such events and back-calculate the expected based on estimates of vaccine coverage and vaccine effectiveness (VE). Expected is simply observed/impact where impact is 1-VE*coverage. For example with 80% VE and 50% coverage and 100 observed then we expect 100/(1-0.8*0.5) = 100/0.4 = 250, which gives 150 averted. The effectiveness measure that is relevant is the incremental or relative effectiveness of the booster dose on top of any residual protection from past doses rather than compared to completely unvaccinated.

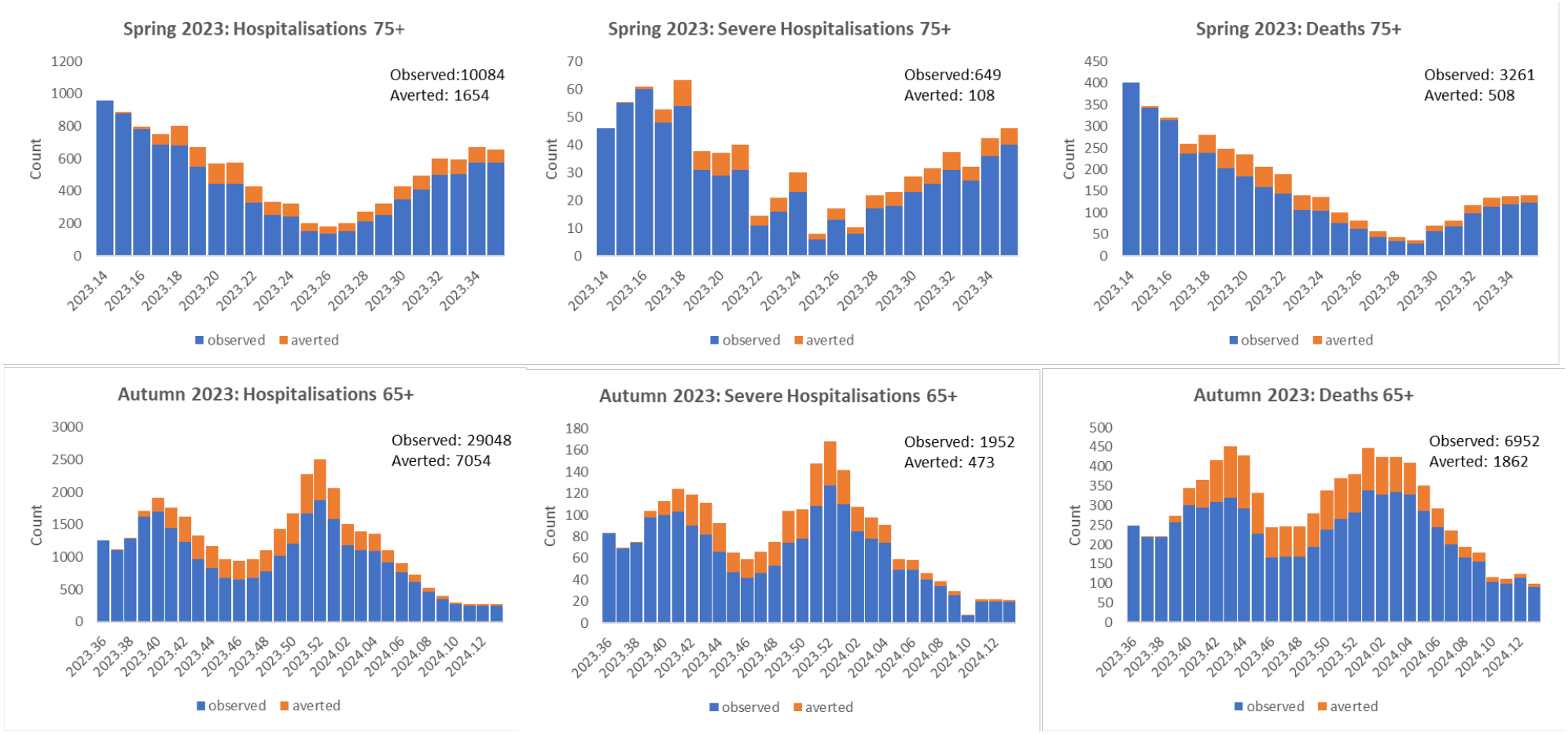
This method was been applied to the observed COVID-19 hospitalisations, severe hospitalisations and deaths in those aged 75 and over for the spring 2023 program (which used Sanofi/GSK (VidPrevtyn Beta) and Pfizer-BioNTech (Comirnaty Original/Omicron BA.4-5) bivalent vaccines) and aged 65 and over for the autumn 2023 program (which used Pfizer-BioNTech (Comirnaty Original/Omicron BA.4-5) bivalent vaccine and Pfizer-BioNTech (monovalent XBB.1.5) vaccines). The analysis used the weekly cases and the weekly doses of vaccine given by 5 year age band and risk group (none, non immunosuppressed risk, immunosuppressed risk) to estimate averted cases within these groups by week and then summing across the groups and weeks for the total. The period considered was April to August for the spring booster and September to March for the autumn booster. VE and how it wanes

was based on UKHSA published estimates for these boosters along with waning data from previous boosters (11,12). This was, by month 1 to 6 post vaccination, 50%, 35%, 30%, 20%, 10%, 0% and 50%, 45%, 35%, 25%, 15%, 10% for spring 2023 and autumn 2023 boosters respectively. Coverage for the spring 2022 programme was 79.0% for those aged 75 and over (13) and for the autumn 2023 programme was 70.4% in those aged 65 and over (14).

The definition of a COVID-19 hospitalisation was an admission based on data in the Secondary User Service (SUS) database where COVID-19 was coded in the primary discharge code, or where there was a positive PCR test for COVID-19 and the primary discharge code was respiratory. A severe COVID-19 hospitalisation was those where oxygen or ventilation was used, or the patient was admitted to intensive care. Deaths were those were COVID-19 was mentioned as one of the causes on the death certificate. This included non-hospitalised deaths.

Figure 1 shows the observed and estimated averted hospitalisations, severe hospitalisations, and deaths by week for the spring and autumn boosters. The totals were 1,654 hospitalisations (108 severe) and 508 deaths for the spring 2023 booster program in those aged 75 years and over and 7,054 hospitalisations (473 severe) and 1,862 deaths for the autumn 2023 booster program in those aged 65 years and over. These results compare to a previous estimate for the autumn 2022 program of 14,400 averted hospitalisations in those aged 50 and over (15). This direct calculation method does not account for any herd immunity effects and has assumed the effectiveness found against hospitalisation also applies for severe hospitalisation and death. It also assumes that the deaths are due to COVID-19 when it is on the death certificate, but this may not always be the case.

Figure 1: Observed and estimated averted COVID-19 hospitalisations, severe hospitalisations, and deaths by week for the spring and autumn boosters in England in 2023



Vaccination in pregnancy

Pregnant women have been included in the groups of people at greatest risk of severe COVID-19 illness advised by the Joint Committee on Vaccination and Immunisation (JCVI) to have a dose of COVID-19 vaccine in autumn 2023. Vaccination of pregnant women is strongly recommended by the Royal College of Obstetricians and Gynaecologists and the Royal College of Midwives.

Increased severity of COVID-19 disease in pregnant and recently pregnant women was reported after the first SARS-CoV-2 wave in England (16,17) and Scotland (18,19) when Alpha and Delta variants were dominant. The disease is generally reported to be milder during the Omicron variant era with reduced risk of complications in pregnant women when compared to the Delta period (20, 21). The risks of some adverse outcomes were found to be lower for COVID-19 Omicron disease at delivery than Alpha or Delta but still raised compared to pregnant women without COVID-19 disease in a more recent study in the USA (22). When the Omicron variant emerged it was associated with higher rates of infection in pregnant women when compared to Delta (21) and led to intensive care admission, particularly in those who remain unvaccinated (23). Pregnant women who develop severe disease have been found to have increased rates of maternal admission to critical care or death, venous thromboembolism, pre-term delivery and very pre-term delivery due to medical intervention (24).

From 16 April 2021, the JCVI advised that pregnant women be offered COVID-19 vaccines at the same time as people of the same age or risk group (25). Therefore, any pregnant women not in a high-risk group would likely have received their first dose in mid-April 2021 as part of the general adult population programme in those aged under 50 years which was offered by decreasing age group (25). As part of the ongoing review of the programme, the JCVI met on 2 December 2021 and considered further data on the severity of SARS-CoV-2 infection in pregnant women and their pregnancies together with data on vaccine safety. As a result, pregnant women were added to the UK's priority COVID-19 vaccine list (26). The booster dose made available to all individuals with severe immunosuppression from September 2021 and then extended to all eligible adults in England from 30 November 2021, was important to confer high levels of protection against Omicron strains (see report section vaccine effectiveness). Pregnant women were included as one of the priority groups to be offered the autumn 2022 COVID-19 booster dose using the Pfizer-BioNTech and Moderna bivalent vaccines.

There is evidence of high levels of protection against SARS-CoV-2 infection in pregnant women after COVID-19 vaccination (27 to 30) and evidence that vaccination induces higher antibody levels than after disease (30). There is also evidence from studies in England and the USA that 2 doses of mRNA COVID-19 vaccination during pregnancy might help prevent COVID-19 hospitalisations in young infants under 6 months of age (31) with increased protection observed after a booster dose (32). Between February and September 2021, 0.4% of 1,714 pregnant women with COVID-19 symptoms who required hospital treatment in the UK had received 2 doses of COVID-19 vaccine and, of 235 pregnant women who were admitted to intensive care

with COVID-19 disease in that period, none had received 2 doses of vaccine (33). Similar findings were have been reported from Scotland with the report that 90.9% (748 out of 823; 95% CI 88.7 to 92.7) of SARS-CoV-2 associated with hospital admissions, 98% (102 out of 104; 95% CI 92.5 to 99.7) of SARS-CoV-2 associated with critical care admission and all baby deaths, occurred in pregnant women who were unvaccinated at the time of their COVID-19 diagnosis (19,34). The researchers also found a higher extended perinatal mortality rate for women who gave birth within 28 days of a COVID-19 diagnosis compared to rates across the pandemic period and in women vaccinated and going on to give birth within 28 days.

COVID-19 vaccines used in the UK programme do not contain live SARS-CoV-2 virus and therefore cannot infect a pregnant woman or her unborn child with the virus. Whilst as is commonly the case in trials of medicinal products, pregnant women were excluded from the original COVID-19 vaccine trials, there is accumulating experience and evidence of the safe and effective use of mRNA vaccines (such as the Pfizer-BioNTech or Moderna) in pregnant women. In Scotland, the COVID-19 vaccine had been administered to more than 30,000 pregnant women by the end of March 2022 (35). In the USA data collected by the US Centre for Disease Control indicated that around 71% of pregnant people were fully vaccinated before or during pregnancy in the week ending 20 August 2022 (36).

No safety concerns relating to COVID-19 vaccination of pregnant women have been found in published studies to date (24, 36 to 41). The rate of vaccine side effects appears to be similar in pregnant and non-pregnant populations (36). Studies from Norway, the USA and Scotland have found no association between COVID-19 vaccination and the risk of miscarriage (38 to 41).

Findings continue to be provisional and are not directly comparable between reports as data is updated through the complete period under consideration. This section of the report summarises data on coverage of the 2022 autumn boost, published in the COVID-19 vaccine surveillance report in week 41 of 2023, and additionally the coverage for women who had received a COVID-19 vaccine after August 2023 and before they gave birth between September 2023 and March 2024. An autumn dose was recommended to those at higher risk of severe COVID-19 disease in the population who had not been boosted for at least 3 months, including pregnant women. Autumn vaccination of pregnant women began in September 2023.

Vaccine coverage

Please see COVID-19 vaccine quarterly surveillance reports (September 2021 to June 2023) – GOV.UK (www.gov.uk) for previously published data. By October 2022 most first, second and third doses of vaccine given to women who gave birth were administered before the start of their pregnancy.

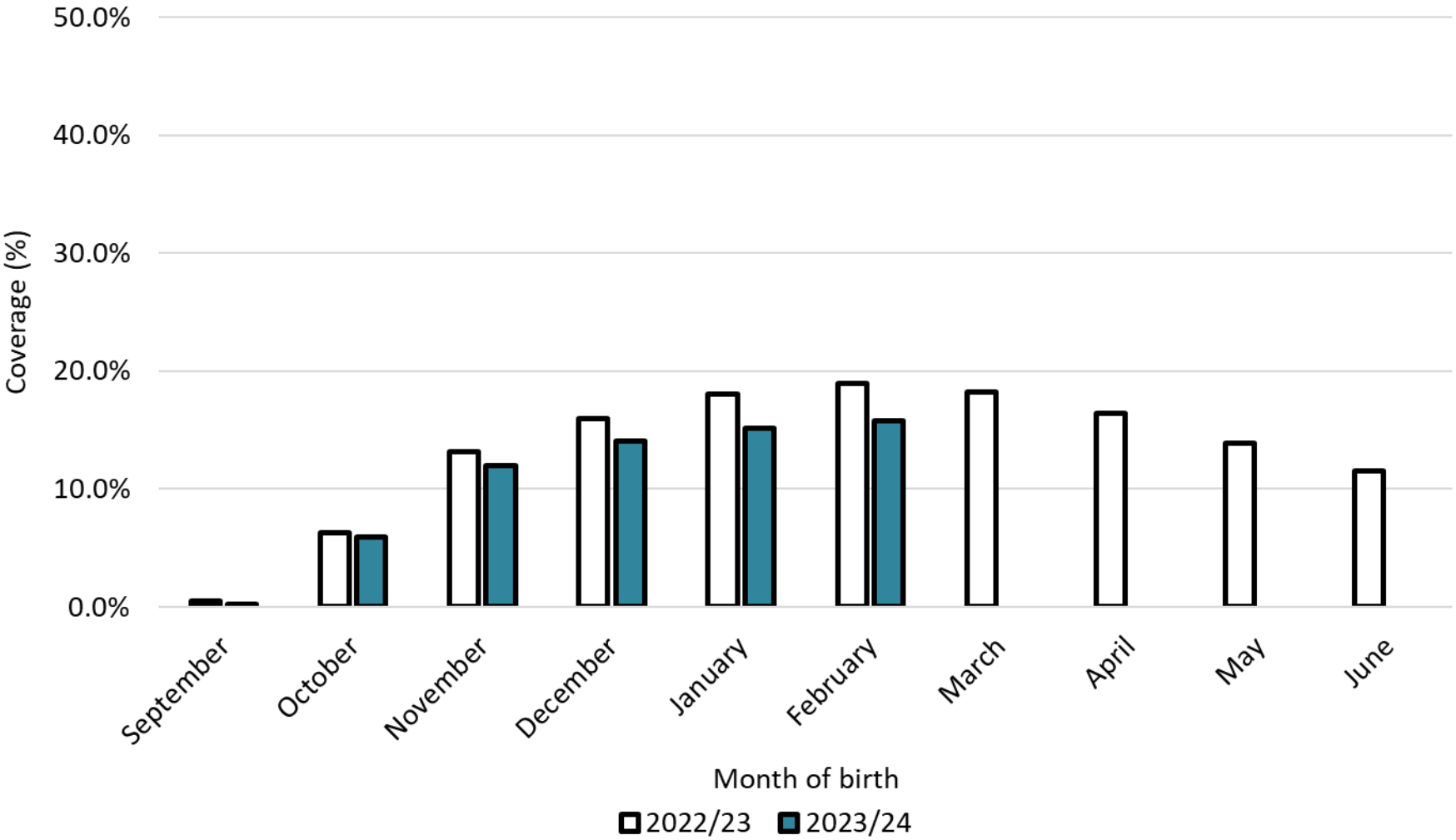
Based on data for women who gave birth and could be linked to their vaccination records extracted in October 2023, a small proportion of women who gave birth in September (0.5%) 2022 had received an autumn dose prior to delivery, rising to 18.1% in January 2023 and peaking at 19.0% in February 2023 (Figure 2). Only 13.1% of women had received the autumn

2022 dose before giving birth between September 2022 and June 2023. A very small proportion of women (1.3% in the 10-month period) received the autumn 2022 boost after they gave birth, 25.5% of women who gave birth had not received any doses of COVID-19 vaccine.

Autumn 2023 COVID-19 vaccine coverage for women who gave birth between September 2023 and February 2024 suggests similar levels with 0.3%[1], 5.9%[1], 12.0%, 14.1%, 15.1% and 15.8% uptake respectively (Figure 2). In this 6-month period 1.2% of women received a dose of COVID-19 vaccine after they gave birth.

[1] These data were generated using an updated method after the January 2024 report

Figure 2. Autumn 2022 COVID-19 vaccine dose coverage in pregnancy in women who gave birth between September 2022 and June 2023 and autumn 2023 dose coverage in pregnancy in women who gave birth between September 2023 and February 2024



Methods

Please see earlier reports for methods to generate data on women who gave birth between September 2022 to June 2023.

Data on COVID-19 vaccination status together with details of each vaccine administered is recorded in a central data set called the IIS (previously NIMS)[2]. In addition, NHS Digital manages the Hospital Episode Statistics (HES) data sets, containing information about hospital activity in England.

Records of women giving birth ('delivery records') in the months between 1 September 2023 and 29 February 2024 were identified in HES. De-duplication of delivery records resulted in a data set of women who had given birth, identified by her NHS Number, and the latest 'delivery episode' associated with her. An 'earliest' and 'latest' likely pregnancy start date were assigned to each woman's record, using the known delivery date and further information from her record, where available:

1. Where a valid gestational age was recorded (GESTAT_1 between 24 and 42), the woman's earliest pregnancy start date was calculated by taking the number of weeks away from the delivery date and then calculating an additional earlier week, to account for GESTAT_1 recording completed weeks of pregnancy. In a similar way, the latest pregnancy start date was calculated by taking the number of weeks of GESTAT_1 away from the delivery date.

2. Where no valid GESTAT_1 was available, the first 12 diagnostic codes were examined to identify any with a code suggesting delivery at term (O60.2). In this case, the gestational age at delivery was assumed to be between 37 and 42 completed weeks of pregnancy, and a similar method was used to establish the earliest and latest pregnancy start dates.

3. Where no valid GESTAT_1 was available and there were no codes suggesting term delivery, the first 12 diagnosis codes were examined to identify any suggesting pre-term delivery (O60.1 or O60.3). In this case, the gestational age at delivery was assumed to be between 24 and 36 completed weeks of pregnancy, and these values were used to establish the earliest and latest pregnancy start dates.

4. In the absence of any additional information in the woman's record (or in conflicting cases where diagnostic codes suggesting both term and pre-term delivery appeared in the same record), the gestational age at delivery was assumed to be between 24 and 42 completed weeks of pregnancy, and these values were used to establish earliest and latest pregnancy start dates.

Each woman's delivery record was linked to her record(s) in the IIS using the NHS Number, establishing her vaccine status as either having had one or more doses before delivery

[2] IIS Data controllers are NHSEI and NHSD.

(including any prior to becoming pregnant) or not having had any doses of the vaccine prior to giving birth, using the IIS vaccine records. For a woman to be identified as having had the autumn booster dose bivalent vaccine was recorded in IIS on or after 1 September 2023 to 29 February 2024.

For each vaccine dose in the 2023 autumn dose period the woman was known to have received, the following information was ascertained:

Dose administered pre-pregnancy	Dose administered before the earliest pregnancy start date
Dose administered in pregnancy	Dose administered after the latest pregnancy start date and before the delivery date
Dose administered post-pregnancy	Dose administered on or after the delivery date based on IIS records extracted on 11 July 2024
Dose in pregnancy: unknown	Dose administered around the start of pregnancy: after the earliest pregnancy start date and before the latest pregnancy start date
Unvaccinated	No vaccine records exist for the woman, based on the NHS number

The ethnicity, residence and age information, when used, is taken from the IIS record. The latest HES data available for publication was for February 2024, and all HES data since April 2023 is considered provisional.

Interpretation and limitations

There are recognised limitations of the data sets including the level of completeness of the relevant fields. HES birth data was used to monitor coverage and found similar very low levels of uptake in women who gave birth in the first 2 months of the programme. Further breakdown of these data by age, ethnicity and deprivation scores will be undertaken when more eligible women have given birth, but previous reports have shown increasing uptake with increasing age and in more affluent populations with differences by broad ethnic categories showing white women have the highest coverage.

Main findings

COVID-19 vaccination is the safest and most effective way for women to protect themselves and their pregnancies against severe COVID-19 disease. The JCVI has advised that women who are pregnant are in a clinical risk group within the COVID-19 autumn vaccine programmes. Unvaccinated women who became pregnant were strongly encouraged to come forward for vaccination during the autumn 2022 booster programme. Women who were pregnant and had previously been vaccinated were offered a booster dose (JCVI updated statement on the COVID-19 vaccination programme for autumn 2022). Pregnancy is a risk category that was

included by the JCVI for the autumn 2023 COVID-19 vaccine dose. Only 10.4% of women who gave birth in the first 6 months of the offer had received the autumn 2023 COVID-19 vaccine.

Vaccine impact on proportion of population with antibodies to COVID-19

Seroprevalence

The results from testing samples provided by healthy adult blood donors aged 17 years and older, supplied by the NHS Blood and Transplant (NHS BT collection) between weeks 35 2020 and week 26 2024 are summarised. Between week 44 2020 and week 10 2024, approximately 250 samples from each geographic NHS region were tested each week; from week 11 2024 onwards, approximately 55 samples from each geographic region are tested each week.

The COVID-19 vaccination campaign began on 8 December 2020 (week 50) with a phased roll out by age and risk group. Booster doses have been offered from the beginning of September 2021. Further doses are typically offered in spring and autumn campaigns to populations in risk groups. The 2023 autumn booster programme began in September 2023 for adults aged 65 and older, people in clinical risk groups, older adults in care homes, health and social care workers and individuals who live closely with or are carers for clinically vulnerable people. The 2024 spring booster programme began in April 2024 for adults aged 75 years and older, residents of care homes and immunosuppressed individuals aged 6 months and older. We intend to monitor the programme and its impact on seroprevalence.

Please note that this section will be updated quarterly. This update was published on 18 July 2024.

Seroprevalence in blood donors aged 17 years and older

The results presented here are based on testing samples with Roche nucleoprotein (N) and Roche spike (S) antibody assays.

Nucleoprotein (Roche N) assays only detect post-infection antibodies, whereas spike (Roche S) assays will detect both post-infection antibodies and vaccine-induced antibodies. Thus, changes in seropositivity for the Roche N assay reflect the effect of natural infection. Increases in seropositivity as measured by S antibody reflect both infection and vaccination. Antibody responses to both targets reflect infection or vaccination occurring at least 2 to 3 weeks previously given the time taken to generate a COVID-19 antibody response. Currently donors are asked to defer donations for at least 48 hours post vaccination (previously 7 days), and for at least 7 days following resolution of any COVID-19 symptoms (previously 28 days, changes were implemented during January 2022).

This report presents Roche N and Roche S seropositivity estimates on the same set of samples, using a 12-week rolling prevalence for national, age group and regional estimates. Seropositivity estimates are plotted using the mid-point of a 12-weekly rolling period. This means the data will reflect seroprevalence several weeks previously. Seroprevalence estimates reported are based on seropositivity which are unadjusted for the sensitivity and specificity of the assays used.

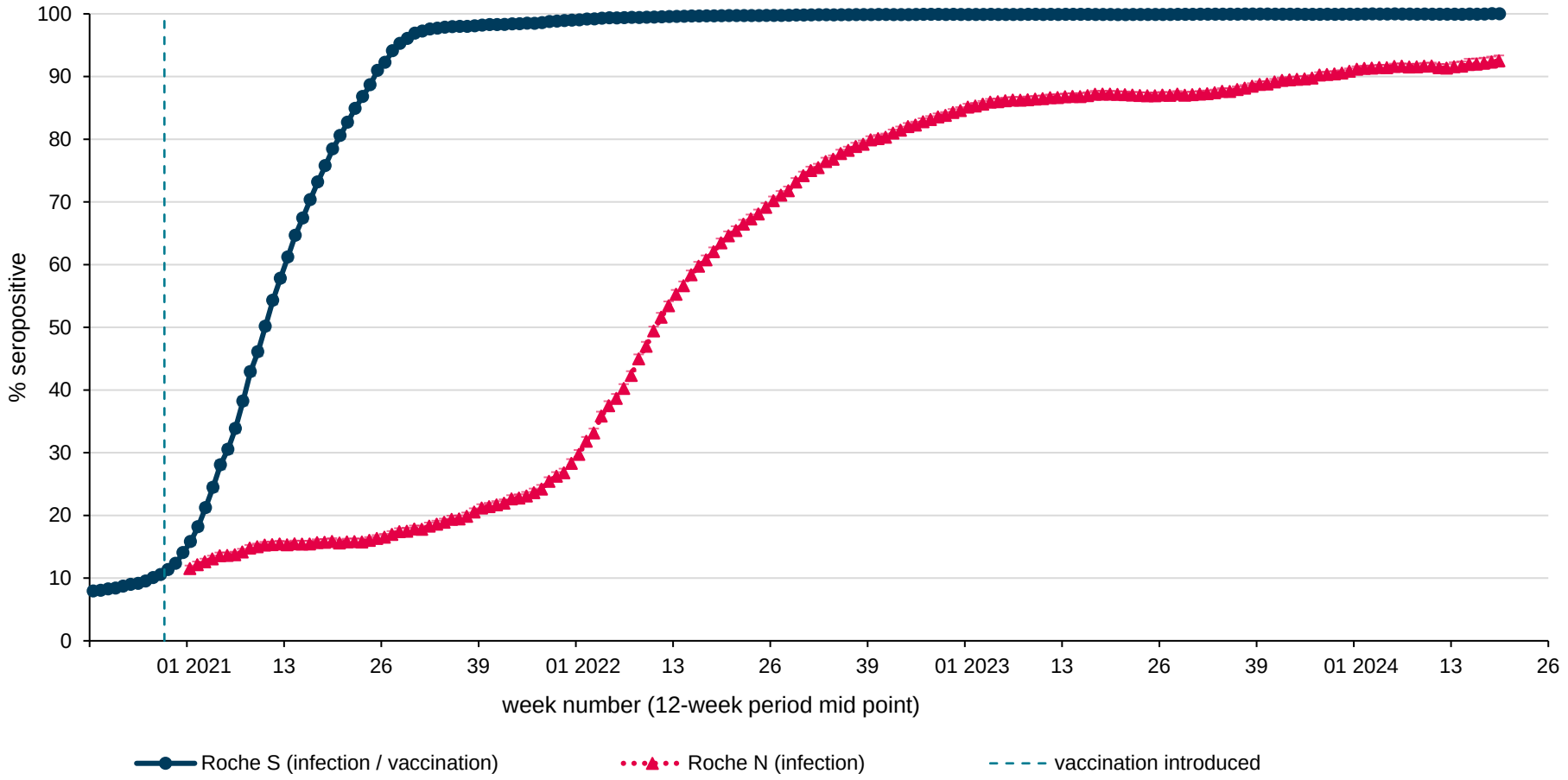
National prevalence

Overall population weighted (by age group, sex and NHS region) antibody prevalence among blood donors aged 17 years and older in England was 92.5% (95% CI 91.6% - 93.4%) using the Roche N assay and 100.0% (95% CI 99.9% - 100.0%) using the Roche S assay for the period 10 April to 28 June 2024 (week 15 to week 26 2024).

4,327 out of 4,665 were Roche N positive and 4,666 out of 4,667 samples were Roche S positive. This compares with 91.5% (95% CI 91.0% - 92.0%) Roche N seropositivity and 99.9% (95% CI 99.9% - 100.0%) Roche S seropositivity for the period of 17 January to 05 April 2024 (week 03 to week 14 2024).

Seropositivity (weighted by region, age group and sex) varies over time. Figure 3 shows the overall 12-weekly rolling proportion seropositive over time for the Roche N and Roche S assays. Seropositivity estimates are plotted weekly using the mid-point of a rolling 12-weekly period. The high N seropositivity in 2024 implies that the majority of recent COVID-19 cases have experienced prior infection.

Figure 3. Overall 12-weekly rolling SARS-CoV-2 antibody seroprevalence (% seropositive) in blood donors



Regional prevalence of infection over time

Seropositivity (weighted by age group and sex) using the Roche N assay which detects infection only, has previously varied by region (Figure 4).

Figure 4: 12-weekly rolling SARS-CoV-2 antibody seroprevalence (% seropositive) in blood donors by region, using Roche N test; error bars show 95% confidence intervals.

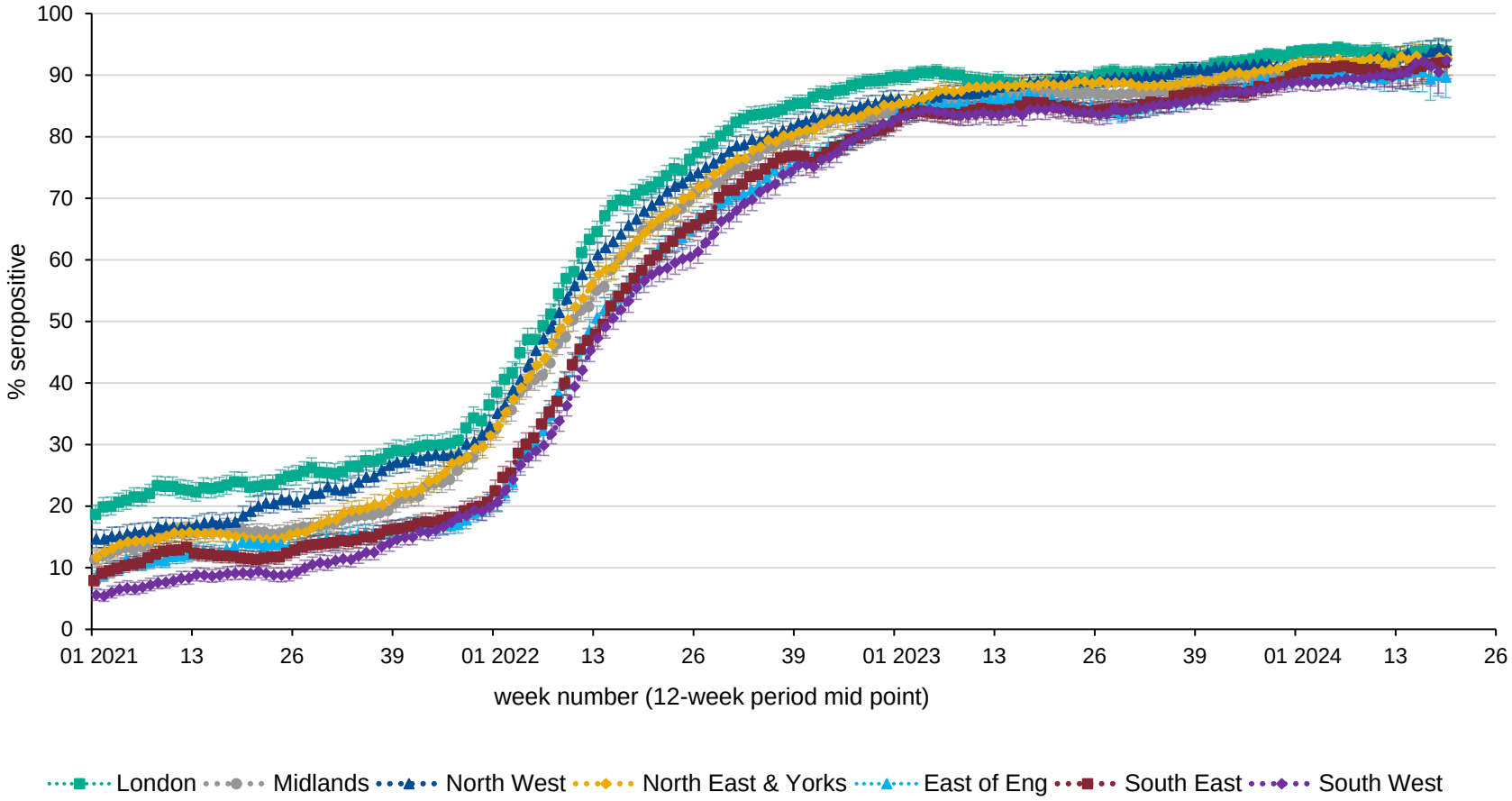


Table 4. Roche N seropositivity (95% CI) estimates by NHS region

NHS region	Weeks 03 to 14 2024	Weeks 15 to 26 2024
East of England	89.8% (88.3% - 91.1%)	89.7% (86.4% - 92.3%)
London	93.9% (92.7% - 95.0%)	93.8% (91.5% - 95.5%)
Midlands	91.1% (89.7% - 92.4%)	92.5% (89.9% - 94.4%)
North East and Yorkshire	92.2% (90.9% - 93.4%)	92.7% (90.0% - 94.7%)
North West	91.9% (90.5% - 93.1%)	94.0% (91.6% - 95.8%)
South East	91.2% (89.9% - 92.4%)	92.1% (89.2% - 94.2%)
South West	89.4% (87.8% - 90.9%)	92.4% (89.4% - 94.6%)

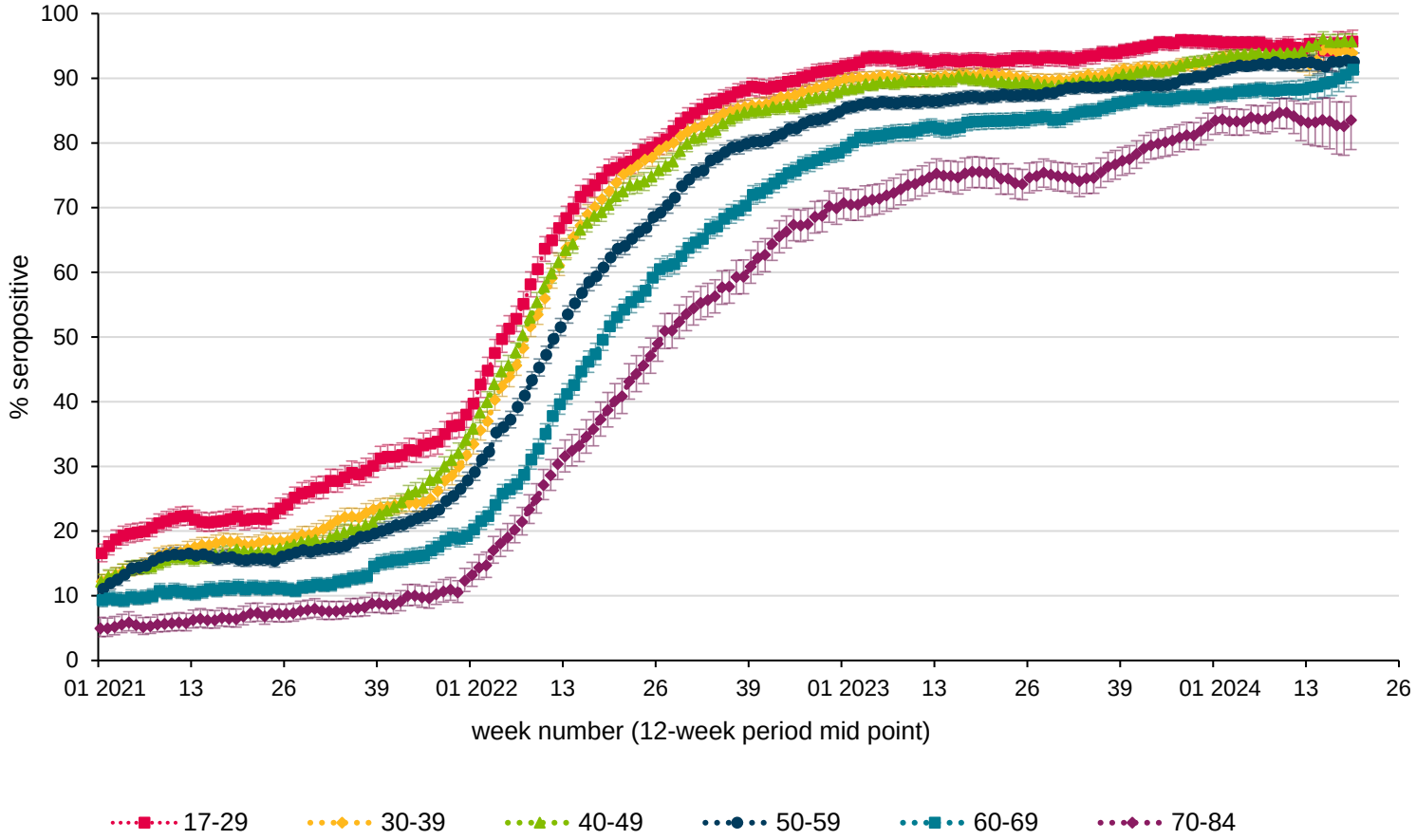
Roche N seropositivity has remained stable or increased slightly compared to the previous 12-week period (Table 4). Estimates have changed by -0.2 to 3.0% between the two periods.

The difference in seropositivity by region has narrowed over time. Historically the highest seropositivity was observed in London; and during the period weeks 03 to 14 2024 seropositivity was higher in London than in the East of England, South East and South West. With reduced sample numbers during the period weeks 15 to 26 2024 there is greater uncertainty in estimates and no longer a clear difference in seropositivity between regions.

Prevalence by age group

Seropositivity estimates by age group using the Roche N assay are presented below.

Figure 5. Population weighted 12-weekly rolling SARS-CoV-2 antibody seroprevalence (% seropositive) in blood donors from the Roche N assay by age group



Based on testing samples using the Roche N assay (Figure 5) as a marker of infection, the highest seropositivity continues to be observed in those aged 17 to 29 and the lowest in those aged 70 to 84.

Table 5. Roche N seropositivity (95% CI) estimates by age group

Age group	Weeks 43 2023 to 02 2024	Weeks 03 to 10 2024
17 to 29	95.1% (93.8% - 96.2%)	95.7% (92.9% - 97.4%)
30 to 39	93.4% (92.4% - 94.3%)	93.9% (92.0% - 95.4%)
40 to 49	93.8% (92.9% - 94.7%)	95.7% (94.1% - 96.8%)
50 to 59	92.1% (91.2% - 92.9%)	92.6% (91.0% - 93.9%)
60 to 69	88.1% (86.9% - 89.2%)	91.3% (89.3% - 93.0%)
70 to 84	83.7% (81.4% - 85.8%)	83.5% (79.0% - 87.3%)

N seropositivity has remained stable or increased slightly across age groups (Table 5) compared to the previous 12-week period.

Roche S seropositivity in blood donors has plateaued and is now over 99% across all age groups. Historical seropositivity estimates for S antibody in blood donors are likely to have risen more steeply than would be expected in the general population, reflecting the fact that donors are more likely to be vaccinated. Seropositivity estimates for N antibody will underestimate the proportion of the population previously infected due to (i) waning of the N antibody response over time and (ii) observations from UK Health Security Agency (UKHSA) surveillance data that N antibody levels are lower in individuals who acquire infection following vaccination. These lower N antibody responses in individuals with breakthrough infections (post-vaccination) compared to primary infection likely reflect the shorter and milder infections in these patients. Patients with breakthrough infections continue to have significant increases in S antibody levels consistent with boosting of their antibody levels.

Vaccination has made an important contribution to the overall Roche S seropositivity increases observed since the roll out of the vaccination programme. The impact of the booster vaccination programmes can be assessed by monitoring Roche S antibody levels across the population over time.

Roche S levels by age group and month

The Roche S assay that the UK Health Security Agency (UKHSA) uses for serological surveillance is fully quantitative, meaning that it measures the level of antibodies in a blood sample; an antibody level above 0.8 au/ml (approximately 1 IU/ml using the WHO standard) is deemed positive. The UKHSA surveillance since Autumn 2021 has found that over 99% of the population of blood donors test positive for S-antibodies, which may have resulted from either COVID-19 infection or vaccination. With such high seropositivity, it is important to look at population antibody levels in order to assess the impact of the vaccination booster programmes.

Figure 6 shows monthly categorised Roche S levels over the past two years by N antibody status. N-antibody positive individuals are those likely to have experienced past infection. Antibody levels will be influenced by vaccination history, time since infection, variant and severity of infection, as well as individual factors such as underlying health conditions, age and genetics. N-antibody negative individuals are those who have either: never experienced infection, or who experienced infection in the past but made little N antibody response, or whose N antibody levels have waned into the negative range over time. In both panels of Figure 4, increased S-antibody levels can be seen around the time of the autumn 2022 and autumn 2023 vaccination campaigns, during the months of October to December. S-antibody levels were also high during February 2024. Comparing the left and right panels, the overall higher profile of antibody levels in those who are N antibody positive is evident; vaccination post infection, breakthrough infection following vaccination and re-infection are all expected to boost existing S-antibody levels.

Figure 7 shows categorised Roche S levels by age group. From spring 2023 the proportion of donors aged 50 to 69 years with very high antibody levels of 25,000+ AU/ml clearly decreased, subsequently increasing through October and November 2023. This trend is similar for donors aged 70-84, but with small increases in May-June. These trends are most prominent in older donors; and follow the autumn 2022 and autumn 2023 COVID-19 vaccine booster offers. The small increases during spring in donors aged 70-84 are in line with the spring 2023 COVID-19 vaccine booster offer. The profile of antibody levels is similar across donors aged 17 to 49 and is lower overall than in those aged above 50.

By 31 December 2023, 70.2% of all people aged 65 years and older, living in England, had been vaccinated with a Autumn 2023 booster dose (Weekly national Influenza and COVID-19 surveillance report week 1 2024).

Whilst it is thought that there is no threshold antibody level that offers complete protection against infection, higher antibody levels are likely to be associated with lower probability of infection.

Figure 6: Categorised Roche S antibody levels by N antibody status and month, July 2022 to June 2024

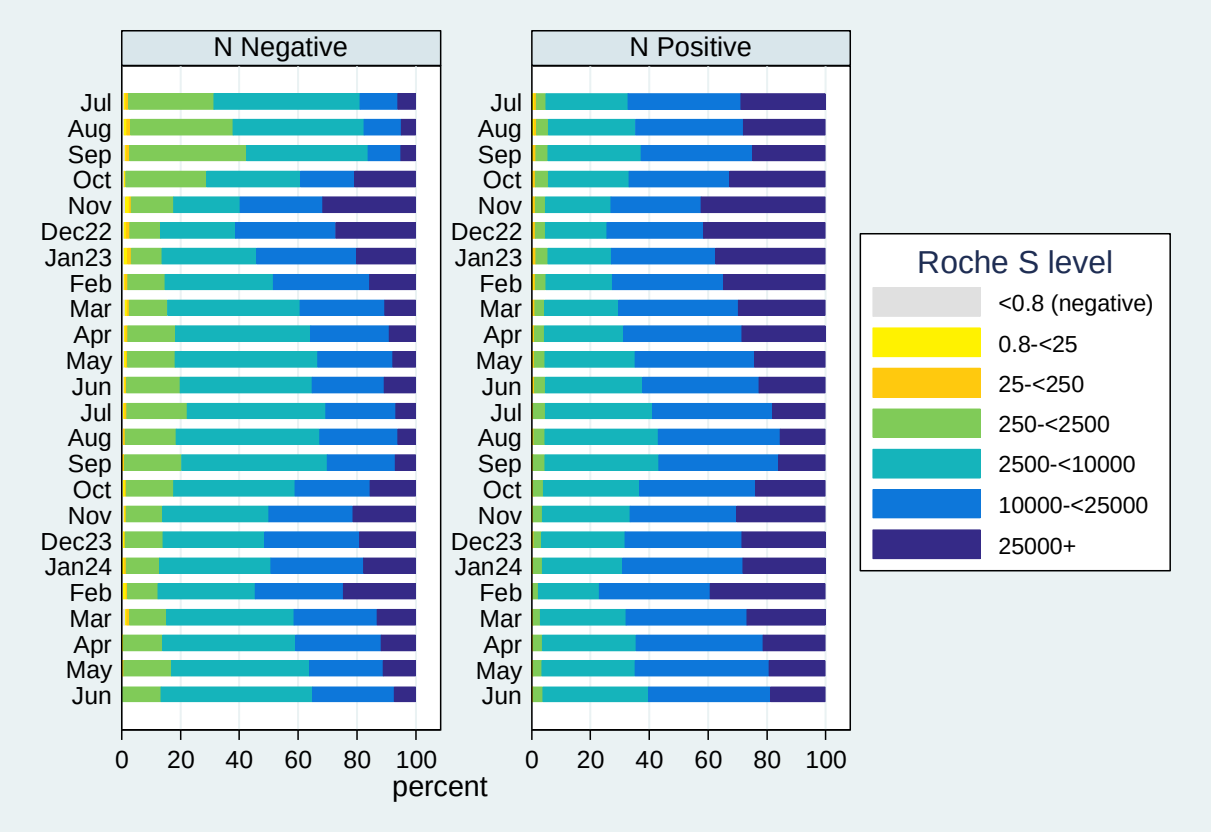
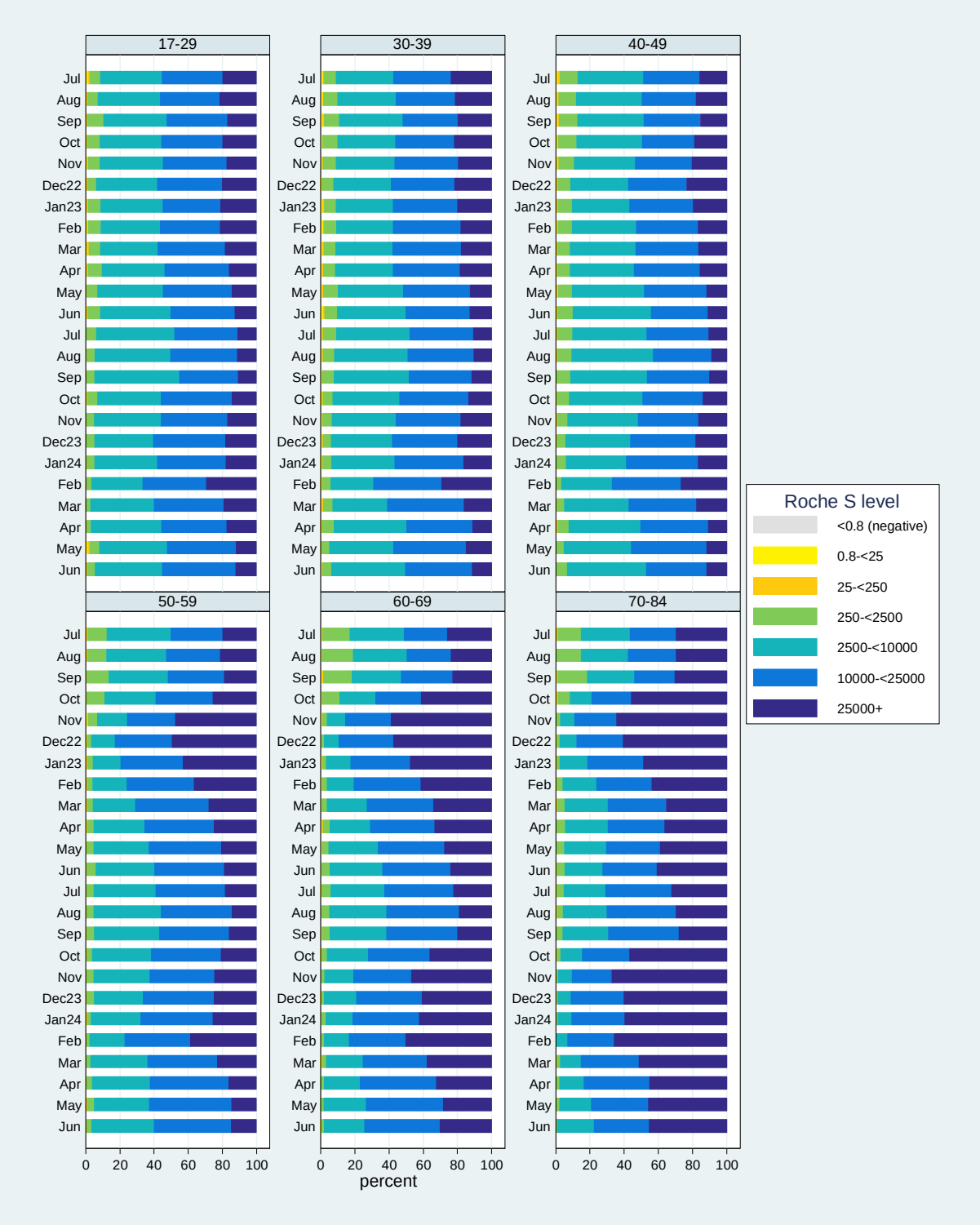


Figure 7: Categorised Roche S antibody levels by age group and month, July 2022 to June 2024



SARI-Watch surveillance data

It was decided to drop this analysis from the report due to the limited additional insight it currently affords. Although consecutive analyses tend to show a similar picture with the majority of admissions occurring in the elderly, with a high proportion vaccinated on admission as they are a highly vaccinated group, these outputs are increasingly based on small volumes of data from a small number of trusts leading to high levels of uncertainty in interpretation and multiple instances of small cells sizes within the current stratifications. Should data volumes increase, and interpretability improve, we would consider reintroducing similar analyses to future reports.

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