Longitudinal SARS-CoV-2 Anti-Receptor Binding Domain (RBD) IgG Dynamics in Healthcare Workers

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BACKGROUND

What is the trajectory of anti-RBD IgG response following SARS-CoV-2 vaccination in HCWs with and without prior infection?

- Antibodies to SARS-CoV-2 correlate with neutralizing antibody titres and have been used to infer immunity, with a threshold titre of 456 BAU/mL considered a correlate for protection.
- Prior SARS-CoV-2 infection and vaccination impact the magnitude and durability of anti-receptor binding domain (RBD) IgG
- We aimed to characterise longitudinal anti-RBD dynamics in HCWs with and without prior infection in the SORTED (Seroprevalence, Seroconversion Rates and Transmission Dynamics of SARS-CoV-2 among Healthcare Workers) study and describe proportions above anti-RBD threshold.

METHODS

- Healthcare workers (HCWs) from Mater Misericordiae University Hospital, Dublin with confirmed prior infection (Group 1) and no history of prior SARS CoV-2 infection (Group 2) were recruited between July 2020 and September 2021.
- Participants underwent SARS CoV-2 mRNA vaccination during follow up with, participants receiving both doses during the study period
- Serum samples were collected at weeks 0, 12, and 48 weeks and tested for anti-RBD IgG titres using an in-house quantitative electrochemiluminescence assay.
- A threshold anti-RBD titre of 456 BAU/ml was considered a correlate of immunity
- Longitudinal changes in log transformed titres were modelled as left-censored data using a Bayesian piecewise linear mixed-effects model.
- Observed anti-RBD IgG antibody titres were log-transformed to stabilize variance, improve normality, and allow interpretation of slopes as relative (multiplicative) changes per week.
- Data are presented as n (%) or median (interquartile range) unless stated.

Despite earlier differences in anti-RBD, similar proportions of both those with and without prior infection achieved an effective anti-RBD threshold

RESULTS

- 249 HCWs were recruited (n=106 in Group 1, n=143 in Group 2), aged 35.6 years (IQR 12.5).
- The majority were female (76.3%) and Caucasian (88.3%). Timing of vaccine doses with respect to study visits is described in Table 1.
- Detectable anti-RBD IgG was present at baseline in 102 participants (96.2%) and 10 participants (7.0%) in Groups 1 and 2, respectively.
- Median anti-RBD titres at study conclusion were 1920 (2712.8), 452.1 (713.4) and 993.3 (1632.1) in Groups 1, 2 and the overall cohort, respectively.

Table 1: Vaccination status during study follow-up

Vaccination status	Group 1 n (%)	Group 2 n (%)	Overall n (%)
Week 0			
Any doses	0 (0)	0 (0)	0 (0)
Week 12			
0 doses	72 (67.9)	70 (49.0)	142 (57.0)
1 dose	9 (8.5)	35 (24.5)	44 (17.7)
2 doses	25 (23.6)	38 (26.6)	63 (25.3)
Week 48			
0 doses	1 (0.9)	3 (2.1)	4 (1.6)
1 dose	2 (1.9)	5 (3.5)	7 (2.8)
2 doses	103 (97.2)	135 (94.4)	237 (95.2)

	Period	Slope	95% CrI	Change % week	95% CrI
Prior infection	Before Wk 12	0.259	0.219; 0.298	0.30	+25; +35
	After Wk12	-0.019	-0.032; -0.006	-0.02	-3; -1
No known infection	Before Wk 12	0.365	0.309; 0.424	0.44	+36; +53
	After Wk 12	0.052	0.040; 0.064	0.05	+4; +7
Between Group Difference	Before Wk 12	-0.106	-0.177; -0.038	-0.1	-16; -4
	After Wk 12	-0.071	-0.089; -0.054	-0.07	-9; -5

Table 2: :Change in anti-RBD levels - posterior mean slopes and 95% Bayesian credible intervals (CrI) before and after week 12.

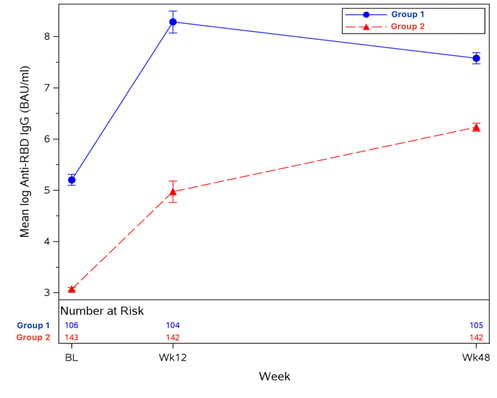


Figure 1: Posterior mean slopes and 95% Bayesian credible intervals before and after week 12.

RESULTS (Contd.)

- Group 1 had 5.23-fold higher baseline anti-RBD titres compared to Group 2 (95% CI 4.50–6.0%)
- Change in anti-RBD
- Those with prior infection (Group 1) showed smaller early increases (+30% per week Group 1 vs +44% Group 2) and
- Group 1 responses declined thereafter (–2% per week Group 1 vs 10% Group 2)
- No associations were observed between antibody dynamics and age, sex, or ethnicity.
- 194 (77.9%) achieved a threshold anti-RBD at some point during the study.
- 129 (51.8%) remained above the threshold for 2 or 3 visits
- At the study conclusion, proportions achieving threshold titre for Groups 1 and 2 were 91.5%, 48.3%, respectively, and 66.7% in the overall cohort.

CONCLUSIONS

- Prior infection resulted in higher baseline anti-RBD IgG but slower post-vaccination increases and earlier plateauing.
- Proportions of HCWs demonstrated sustained antibody increases at above threshold associated with immunity were reassuring.
- Limitations include heterogenous timing of vaccinations across both groups impacting antibody trajectory.
- This contributes to the body of research informing the ongoing rationale for booster vaccinations.
- Further research is required to evaluate anti-RBD durability and functional immunity.

PLAIN LANGUAGE SUMMARY

Healthcare workers who had COVID-19 before vaccination started with higher antibody levels, but their antibodies rose less after vaccination and declined sooner than in those who had never been infected. Vaccination boosted immunity in both groups, though the biggest gains came from early doses rather than follow-up doses.

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