Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to: Levin EG, Lustig Y, Cohen C, et al. Waning immune humoral response to BNT162b2 Covid-19 vaccine over 6 months. N Engl J Med. DOI: 10.1056/NEJMo2114583
Supplementary Materials

Table of Contents
Supplementary Methods S1- PCR testing..........................2
Supplementary Methods S2- Criteria for selecting the enriched comorbidity subgroup........3
Supplementary Methods S3- antibody detection testing.................................4
Supplementary Methods S4- IgG linear mixed model..................................5
Supplementary Methods S5- Neutralizing antibody linear mixed model..................6-7
Supplementary Results S1 – IgG Linear Mixed Model..................................8-10
Supplementary Results S2 – Neutralizing antibody Linear Mixed Model................11-13
Supplementary Table S1- Baseline characteristics of the study population...............14
Supplementary Table S2- Computer-based questionnaire...............................15
Supplementary Table S3- Variable definitions..............................................16-18
Supplementary Table S4- Distribution of demographic and comorbidity according to test period of IgG..........................................................19
Supplementary Table S5- Distribution of demographic and comorbidity according to test period of neutralizing antibody...........................................20
Supplementary Table S6- Expected and observed GMTs of IgG and neutralizing antibody in each period .................................................................21
Supplementary Figure S1- Monthly trajectory antibodies of participants with repeated tests..22
Supplementary Figure S2: Monthly correlation between IgG and neutralizing antibody......23
Supplementary References.............................................................................24
Supplementary Methods S1 - PCR testing

Hospital personnel were tested in several scenarios: upon every symptom suspected to be COVID-19, following exposure to a positive COVID-19 contact (hospital or community contacts), as part of a “return to work” protocol during the end of isolation period following exposure or disease.

For quantitative RealTime-PCR (qRT-PCR), nasopharyngeal swabs were placed in 3mL of universal transport medium (UTM) or viral transport medium (VTM). Test was performed according to manufacturers' instructions on various platforms: Allplex™ 2019-nCoV (Seegene, S. Korea), NeuMoDx™ SARS-CoV-2 assay (NeuMoDx™ Molecular, Ann Arbor, Michigan), Xpert®, Xpress SARS-CoV-2 (Cepheid, Sunnyvale, CA, USA).
Supplementary Method S2- Inclusion criteria for selecting the neutralizing antibody subgroup

1. Age $\geq 65$
2. Body mass index $\geq 30$
3. Pregnancy
4. Allergy
5. Hypertension
6. Diabetes
7. Dyslipidemia
8. Heart disease
9. Lung disease
10. Kidney disease
11. Liver disease
12. Autoimmune disease
13. Immunosuppression

Additionally, 50% of healthy health care workers were randomly selected for the neutralizing antibody subgroup.
Supplementary Methods S3- antibody detection

SARS-CoV-2 IgG Assay

Samples from vaccinated health care workers (HCW) were tested using the following immunoassays: The access SARS-CoV-2 RBD IgG assay (Beckman-Coulter, CA, U.S.A.) commercial test was conducted according to manufacturer’s instructions with one modification – based on a national validation study\(^1\) which determined the utility and limitations for SARS-CoV-2 diagnosis the cut off was lowered to 0.62.

SARS-CoV-2 Pseudovirus (psSARS-2) Neutralization Assay

SARS-CoV-2 Pseudo-virus (psSARS-2) Neutralization Assay was performed using a propagation-competent VSV-spike similar to the one previously published\(^2\) which was kindly provided by Gert Zimmer, University of Bern, Switzerland and shown to be highly correlative to authentic SARS-CoV-2 virus micro-neutralization assay. Following titration, 100 focus forming units (ffu) of psSARS-2 were incubated with 2-fold serial dilution of heat inactivated (56°C for 30 min) tested sera. After incubation for 60 min at 37°C, virus/serum mixture was transferred to Vero E6 cells that have been grown to confluency in 96-well plates and incubated for 90 min at 37°C. After the addition of 1% methyl cellulose in dulbecco's modified eagle's medium (DMEM) with 2% of fetal bovine serum (FBS), plates were incubated for 24hr and 50% plaque reduction titer was calculated by counting green fluorescent foci using a fluorescence microscope (EVOS M5000, Invitrogen). Sera not capable of reducing viral replication by 50% at 1 to 8 dilution or below were considered non-neutralizing. For clear presentation non-neutralizing samples were marked as a titer of 2.
**Supplementary Method S4 – IgG Linear Mixed Model**

We modeled the natural log-transformed IgG in a mixed effects linear model with subject level random effects for both intercept and slope across time (measured in days). After inspection of the data, we decided to fit the slope only from 30 days after full vaccination onwards. IgG tests before 30 days were used to estimate the “maximum” IgG attained. First, we fitted a model that included days from the second vaccination (day 30 was defined as day 0 in the model), age, sex, age-sex interaction, time (slope), interaction of time with age and sex as fixed effects, and subject-level random intercept and slope. A 3-way interaction of time with age with sex was included and found to be significant, owing to a faster decline in IgG levels among older men. This we call our basic model.

Next, we added different comorbidities into the model: BMI (<30, 30+), immunosuppression, autoimmune disease, number of specific comorbidities (0, 1 or ≥2), and their interaction with time. We maintained all main effects and the age, sex, and time interactions found previously. Of the comorbidity with time interactions, we retained in the model only the significant interactions (a p-value of 0.01 was used, following a Bonferroni adjustment for the 5 multiple comparisons), and thus only the interaction between BMI with time was retained. This we call our comorbidity model.
Supplementary Method S5 – Neutralizing antibody Linear Mixed Model

We modeled log-transformed neutralizing antibody (NeutAb) using a linear mixed effects model similar to the model used for the IgG analysis. The model included subject-level random effects for both intercept and slope across time. We found that NeutAb kinetics over time were different from IgG kinetics, and modeled them accordingly. The decline started from 30 days after the second vaccination as in the IgG data (see Supplementary Methods 4). However, this decline lasted only up to ~70 days after the second vaccination, and then stabilized to a much slower decline. The rate of this slower decline did not significantly differ across age groups or sex.

The change point at 70 days was chosen based on inspection of the fit without the change point, and examining AIC for models with a change point at 60, 70, 80 and 90 days. The AIC of the basic fitted models (with no comorbidities) with 60, 70, 80, 90 and 100 days were 15530, 15529, 15527, 15526 and 15526 respectively. Thus the best fits were seen with change point at 60 or 70 days. We chose 70 days on the basis of visual comparisons of predicted with observed values. Therefore, we included in the model a common fixed-effects slope from day 70 to day 180. Other main effects and interactions, including interaction between fixed-effect factors with time in the period from day 30 to day 70, were the same as in the model for IgG levels.

The analysis of comorbidities was performed as in the IgG analysis. A significant interaction of ≥2 specific comorbidities with time (between 30 to 70 days) was found.

The estimated probabilities and 95%CI of being below various NeutAb thresholds at 180 days after second vaccination for different covariate profiles were estimated using computer simulations, based on the estimated parameters from the final model. For each of the personal profiles in Table 2 (gender x age group x {no comorbidities, BMI 30+ but no other comorbidities, immunosuppressed but no other comorbidities}), a set of 2000 pairs of random intercepts and slopes were first generated from a binormal distribution with zero mean and covariance matrix as estimated from the linear mixed model. The parameters of the fixed effect terms in the mixed model were then drawn from their estimated joint normal distribution and were used to estimate the mean log antibody level at 180 days. To this mean
was added the random intercept plus 180 times the random slope for each pair, yielding 2000 values of the log antibody level at 180 days for the given personal profile. The probability of falling below a certain threshold was then estimated as the proportion of the 2000 values that were less than the threshold. This process was repeated 1000 times. The probabilities reported in Table 2 are the means over the 1000 repeats, and the confidence intervals are based on the distribution of the 1000 values obtained.
Supplementary Results S1 – IgG Linear Mixed Model

Basic Model (output from the R statistical package)

Random effects:
Formula: ~1 + days30 | ID
Structure: General positive-definite, Log-Cholesky parametrization

| StdDev   | Corr |
|----------|------|
| (Intercept) | 0.61143929 (Intr) |
| days30    | 0.00498175    | 0.17 |
| Residual  | 0.26112124    |

The dependent variable is log IgG level.
The Intercept row provides the SD of the random subject peak levels.
The days30 row provides the SD of the random subject slopes with time.
The Corr column gives the correlation between peak level and slope across subjects.
The graph below is a scatter plot of slope versus peak level.

Fixed effects: ligg ~ agec * male * days30

|               | Value   | Std.Error   | DF   | t-value  | p-value |
|---------------|---------|-------------|------|----------|---------|
| (Intercept)   | 3.567585| 0.01610265  | 9862 | 221.55258| 0.0000  |
| agec45-64     | -0.21305| 0.02291731  | 4862 | -9.29645 | 0.0000  |
| agec65+       | -0.515976| 0.0386125   | 4862 | -13.36292| 0.0000  |
| male          | -0.082746| 0.03115104  | 4862 | -2.65628 | 0.0079  |
| days30        | -0.02154| 0.00021134  | 9862 | -101.92107| 0.0000  |
| agec45-64:male| -0.072187| 0.04570284  | 4862 | -1.57949 | 0.1143  |
| agec65+:male  | -0.273893| 0.06522785  | 4862 | -4.19902 | 0.0000  |
| agec45-64:days30| 0.000572| 0.00028183  | 9862 | 2.03015  | 0.0424  |
| agec65+:days30| 0.001751| 0.00052335  | 9862 | 3.34496  | 0.0008  |
| male:days30   | 0.001647| 0.00045862  | 9862 | 3.59134  | 0.0003  |
| agec45-64:male:days30| -0.001964| 0.00061557| 9862 | -3.19025 | 0.0014  |
| agec65+:male:days30| -0.003779| 0.00090073| 9862 | -4.19561 | 0.0000  |

The references for the categorical variables are as follows:
agec45-64 and agec65+ have reference group <45y;
male has reference group female.
days30 is a continuous variable equal to zero for days 0 to 30, and then
equal to time - 30 for days 30 onwards.
The : symbol indicates interaction.
Comorbidity model (output from the R statistical package)

Random effects

Formula: ~1 + days30 | ID  
Structure: General positive-definite, Log-Cholesky parametrization 

|         | StdDev  | Corr |
|---------|---------|------|
| (Intercept) | 0.565444200 | (Intr) |
| days30     | 0.004964874  | 0.171 |
| Residual   | 0.254156686  |       |

Fixed Effects

\[ \text{ligg} \sim \text{agec} \times \text{male} \times \text{days30} + \text{bmi30} \times \text{days30} + \text{ndis} + \text{autoim} + \text{imunosup} \]

|                | Value   | Std.Error | DF   | t-value | p-value |
|----------------|---------|-----------|------|---------|---------|
| (Intercept)    | 3.569736| 0.0176611 | 9167 | -8.78238| 0.0000  |
| agec45-64      | -0.212518| 0.0241982 | 3748 | -8.39188| 0.0000  |
| agec65+        | -0.40201 | 0.0479047 | 3748 | -8.39188| 0.0000  |
| male           | -0.111148| 0.0331988 | 3748 | -3.34795| 0.0008  |
| days30         | -0.021429| 0.0002239 | 9167 | -95.71713| 0.0000  |
| bmi30          | 0.046484 | 0.0276194 | 3748 | 1.68302 | 0.0925  |
| ndis1          | 0.018674 | 0.029121  | 3748 | 0.64126 | 0.5214  |
| ndis2+         | -0.196936| 0.0441415 | 3748 | -4.46148| 0.0000  |
| autoim         | -0.132353| 0.041835  | 3748 | -3.16369| 0.0016  |
| imunosup       | -1.054757| 0.0974591 | 3748 | -10.82256| 0.0000  |
| agec45-64:male | -0.018491| 0.0476245 | 3748 | -0.38826| 0.6978  |
| agec65+:male   | -0.245425| 0.0777133 | 3748 | -3.15808| 0.0016  |
| agec45-64:days30| 0.000836 | 0.0002931 | 9167 | 2.85067 | 0.0044  |
| agec65+::days30| 0.002095 | 0.0005596 | 9167 | 3.74453 | 0.0002  |
| male::days30   | 0.001648 | 0.000475  | 9167 | 3.46843 | 0.0005  |
| days30::bmi30  | 0.00152  | 0.0003343 | 9167 | -4.5464 | 0.0000  |
| agec45-64:male::days30| -0.001951 | 0.0006363 | 9167 | -3.06669| 0.0022  |
| agec65+::male::days30| -0.004407 | 0.000958  | 9167 | -4.60002| 0.0000  |

The meaning and reference groups for the following categorical variables are as follows:
- bmi30: BMI = 30+; reference group: BMI <30;
- ndis1 and ndis2+: number of comorbidities =1 and ≥2 respectively; reference group: 0 comorbidities;
- autoim: autoimmune disease; reference group: no autoimmune disease;
- imunosup: immunosuppressed person; reference group: no immunosuppression.
Further exploration of BMI and its relation with IgG and NeutAb levels:
We divided BMI into four subgroups (<25, 25-30, 30-35, ≥35) instead of <30, ≥30) that was used in the main analysis. We then ran the comorbidity model again with this new categorization of BMI. Results are shown below.

Random effects:
Formula: ~1 + days30 | ID
Structure: General positive-definite, Log-Cholesky parametrization

|                | StdDev | Corr   |
|----------------|--------|--------|
| (Intercept)    | 0.2456 | (Intr) |
| days30         | 0.0021 | 0.174  |
| Residual       | 0.1097 |        |

Fixed effects: ligg ~ agec * male * days30 + bmi * days30 + ndis + autoim + imunosup

|                | Value  | Std .Error | DF     | t-value | p-value |
|----------------|--------|------------|--------|---------|---------|
| (Intercept)    | 1.5474 | 0.0081     | 9161   | 191.034 | 0.0000  |
| agec45-64      | -0.0938| 0.0105     | 3754   | -8.9037 | 0.0000  |
| agec65+        | -0.1764| 0.0209     | 3754   | -8.4598 | 0.0000  |
| male           | -0.0504| 0.0145     | 3754   | -3.4771 | 0.0005  |
| days30         | -0.0093| 0.0001     | 9161   | -90.325 | 0.0000  |
| bmi[25,30)     | 0.0116 | 0.0099     | 3754   | 1.1704  | 0.2419  |
| bmi[30,35)     | 0.0277 | 0.0141     | 3754   | 1.9667  | 0.0493  |
| bmi[35,100)    | 0.0206 | 0.0222     | 3754   | 0.9282  | 0.3533  |
| ndis1          | 0.0069 | 0.0127     | 3754   | 0.5443  | 0.5862  |
| ndis2+         | -0.0896| 0.0192     | 3754   | -4.6696 | 0.0000  |
| autoim         | -0.0576| 0.0182     | 3754   | -3.1731 | 0.0015  |
| imunosup       | -0.457 | 0.0423     | 3754   | -10.801 | 0.0000  |
| agec45-64:male | -0.0079| 0.0207     | 3754   | -0.3811 | 0.7031  |
| agec65+:male   | -0.1054| 0.0337     | 3754   | -3.1256 | 0.0018  |
| agec45-64:days30| 0.0004| 0.0001     | 9161   | 3.113   | 0.0019  |
| agec65+:days30 | 0.001  | 0.0002     | 9161   | 3.9222  | 0.0001  |
| male:days30    | 0.0008 | 0.0002     | 9161   | 3.6653  | 0.0002  |
| days30:bmi[25,30)| -0.0001| 0.0001    | 9161   | -1.0361 | 0.3002  |
| days30:bmi[30,35)| -0.0006| 0.0002    | 9161   | -3.2918 | 0.001   |
| days30:bmi[35,100)| -0.0012| 0.0003    | 9161   | -4.2144 | 0.0000  |
| agec45-64:male:days30 | -0.009 | 0.0003 | 9161 | -3.1837 | 0.0015  |
| agec65+:male:days30 | -0.0019| 0.0004 | 9161 | -46728  | 0.0000  |

The meaning and reference groups for the following categorical variables are as follows:
- bmi[25,30): BMI ≥ 25 and <30; reference group: BMI <25;
- bmi[30,35): BMI ≥ 30 and <35; reference group: BMI <25;
- bmi[35,100): BMI ≥ 35; reference group: BMI <25.
The meaning of the other variables and their reference groups is explained in the footnotes to the models displayed in the sections preceding this one.
Supplementary Results S2 – Neutralizing Antibody Linear Mixed Model

Basic Model (output from the R statistical package)

Random effects:
Random effects:
Formula: ~1 + days30 | ID
Structure: General positive-definite, Log-Cholesky parametrization

|                     | StdDev  | Corr   |
|---------------------|---------|--------|
| (Intercept)         | 1.7176  | (Intr) |
| days30              | 0.0227  | -0.63  |
| Residual            | 0.9803  |        |

The dependent variable is log NeutAb level.
The Intercept row provides the SD of the random subject peak levels.
The days30 row provides the SD of the random subject slopes with time.
The Corr column gives the correlation between peak level and slope across subjects.

The graph below is a scatter plot of slope versus peak level

```
 Fixed effects: lneut ~ days30 * agec * male + days70

|                      | Value   | Std.Error  | DF     | t-value   | p-value |
|----------------------|---------|------------|--------|-----------|---------|
| (Intercept)          | 9.9596  | 0.1136     | 3253   | 87.67     | 0.0000  |
| days30               | -0.0560 | 0.0026     | 3253   | -21.94    | 0.0000  |
| agec45-64            | -1.0101 | 0.1587     | 1263   | -6.37     | 0.0000  |
| agec65+              | -0.9292 | 0.1757     | 1263   | -5.29     | 0.0000  |
| male                 | -0.8897 | 0.1985     | 1263   | -4.53     | 0.0000  |
| days70               | -0.0036 | 0.0006     | 3253   | -5.89     | 0.0000  |
| days30:agec45-64     | 0.0123  | 0.0034     | 3253   | 3.68      | 0.0002  |
| days30:agec65+       | 0.0049  | 0.0039     | 3253   | 1.29      | 0.1957  |
| days30:male          | 0.0148  | 0.0050     | 3253   | 2.49      | 0.0127  |
| agec45-64:male       | 0.4299  | 0.3995     | 1263   | 1.08      | 0.2821  |
| agec65+:male         | 0.1247  | 0.3611     | 1263   | 0.34      | 0.7285  |
| days30:agec45-64:male| -0.0230 | 0.0086     | 3253   | -2.69     | 0.007   |
| days30:agec65+:male  | -0.0190 | 0.0077     | 3253   | -2.48     | 0.0131  |
```

The references for the categorical variables are as follows:
agec45-64 and agec65+ have reference group <45y; male has reference group female.
days30 is a continuous variable equal to zero for days 0 to 30, and then equal to time - 30 for days 30 -70, and then equal to 40 for days 70 onwards.
Days70 is a continuous variable equal to zero for days 0 to 70, and then equal to time - 70 for days 70 onwards.
The : symbol indicates interaction.
Comorbidity model (output from the R statistical package)

**Random effects:**
Formula: ~1 + days30 | ID
Structure: General positive-definite, Log-Cholesky parametrization

|                | StdDev        | Corr  |
|----------------|---------------|-------|
| (Intercept)    | 1.68095284    | (Intr) |
| days30         | 0.02290468    | -0.632 |
| Residual       | 0.97881590    |       |

**Fixed effects:**
\[ \text{ln}e\text{ut} \sim \text{days}30 \times \text{agec} \times \text{male} + \text{days}70 + \text{bmi}30 + \text{ndis} \times \text{days}30 + \text{autoim} + \text{imunosup} \]

|                  | Value    | Std.Error | DF    | t-value | p-value |
|------------------|----------|-----------|-------|---------|---------|
| (Intercept)      | 9.921351 | 0.121149  | 3110  | 81.894  | 0.0000  |
| days30           | -0.05729 | 0.002636  | 3110  | -21.735 | 0.0000  |
| agec45-64        | -1.0095  | 0.163409  | 1128  | -6.17776| 0.0000  |
| agec65+          | -0.78398 | 0.200859  | 1128  | -3.90312| 0.0001  |
| male             | -0.91286 | 0.297237  | 1128  | -3.07113| 0.0022  |
| days70           | -0.0036  | 0.000609  | 3110  | -5.90941| 0.0000  |
| bmi30            | 0.388413 | 0.104767  | 1128  | 3.70741 | 0.0002  |
| ndis1            | -0.18439 | 0.167655  | 1128  | -1.0998 | 0.2717  |
| ndis2+           | -0.76741 | 0.219079  | 1128  | -3.5029 | 0.0005  |
| autoim           | 0.190596 | 0.146375  | 1128  | 1.30211 | 0.1931  |
| imunosup         | -1.71742 | 0.301595  | 1128  | -5.69447| 0.0000  |
| days30:agec45-64| 0.011803 | 0.003495  | 3110  | 3.37703 | 0.0007  |
| days30:agec65+   | 0.003393 | 0.004279  | 3110  | 0.79277 | 0.428   |
| days30:male      | 0.014891 | 0.006216  | 3110  | 2.39583 | 0.0166  |
| agec45-64:male   | 0.567702 | 0.408549  | 1128  | 1.38956 | 0.1649  |
| agec65+:male     | 0.256511 | 0.386597  | 1128  | 0.66351 | 0.5071  |
| days30:ndis1     | 0.004141 | 0.003599  | 3110  | 1.15047 | 0.25    |
| days30:ndis2+    | 0.014825 | 0.004718  | 3110  | 3.14209 | 0.0017  |
| days30:agec45-64:male | -0.02386 | 0.008801 | 3110  | -2.71059| 0.0068  |
| days30:agec65+:+male | -0.02037 | 0.00816  | 3110  | -2.49666| 0.0126  |

The meaning and reference groups for the following categorical variables are as follows:
- bmi30: BMI = 30+; reference group: BMI <30;
- ndis1 and ndis2: number of comorbidities =1 and ≥2 respectively; reference group: 0 comorbidities;
- autoim: autoimmune disease; reference group: no autoimmune disease;
- imunosup: immunosuppressed person; reference group: no immunosuppression.
Further exploration of BMI and its relation with IgG and NeutAb levels:
We divided BMI into four subgroups (<25, 25-30, 30-35, ≥35) instead of <30, ≥30) that was used in the main analysis. We then ran the comorbidity model again with this new categorization of BMI. Results are shown below.

Random effects:
Formula: ~1 + days30 | ID
Structure: General positive-definite, Log-Cholesky parametrization

|          | StdDev | Corr |
|----------|--------|------|
| (Intercept) | 1.68344125 | (Intr) |
| days30  | 0.02298689 | -0.638 |
| Residual | 0.97239137 |        |

Fixed effects:
\[
\text{lnneut} \sim \text{days30} \ast \text{agec} \ast \text{male} + \text{days70} + \text{bmi} + \text{ndis} \ast \text{days30} + \text{autoim} + \text{imunosup}
\]

|          | Value   | Std.Error | DF | t-value | p-value |
|----------|---------|-----------|----|---------|---------|
| (Intercept) | 9.837   | 0.1256    | 3106 | 78.3068 | 0.0000 |
| days30  | -0.0574 | 0.0026    | 3106 | -21.8367 | 0.0000 |
| agec45-64 | -1.0285 | 0.1636    | 1126 | -6.288  | 0.0000 |
| agec65+ | -0.8265 | 0.2015    | 1126 | -4.102  | 0.0000 |
| male   | -0.9175 | 0.2973    | 1126 | -3.0866 | 0.0021 |
| days70  | -0.0037 | 0.0006    | 3106 | -6.1558 | 0.0000 |
| bmi[25,30) | 0.2835  | 0.1115    | 1126 | 2.5437  | 0.0111 |
| bmi[30,35) | 0.5221  | 0.1238    | 1126 | 4.2167  | 0.0000 |
| bmi[35,100) | 0.455   | 0.1793    | 1126 | 2.5375  | 0.0113 |
| ndis1   | -0.1947 | 0.1677    | 1126 | -1.1613 | 0.2457 |
| ndis2+  | -0.8087 | 0.2199    | 1126 | -3.6771 | 0.0002 |
| autoim  | 0.1889  | 0.1459    | 1126 | 1.2946  | 0.1957 |
| imunosup | -1.6897 | 0.3008    | 1126 | -5.6177 | 0.0000 |
| days30:agec45-64 | 0.0121 | 0.0035    | 3106 | 3.4626  | 0.0005 |
| days30:agec65+ | 0.0038 | 0.0043    | 3106 | 0.8858  | 0.3758 |
| days30:male | 0.0153 | 0.0062    | 3106 | 2.463   | 0.0138 |
| agec45-64:male | 0.5428 | 0.4088    | 1126 | 1.3278  | 0.1845 |
| agec65+:male | 0.2274 | 0.3869    | 1126 | 0.5877  | 0.5569 |
| days30:ndis1 | 0.0041 | 0.0036    | 3106 | 1.1454  | 0.2521 |
| days30:ndis2+ | 0.0149 | 0.0047    | 3106 | 3.1724  | 0.0015 |
| days30:agec45-64:male | -0.0243 | 0.0088 | 3106 | -2.7637 | 0.0057 |
| days30:agec65+:male | -0.0208 | 0.0081 | 3106 | -2.5599 | 0.0105 |

The meaning and reference groups for the following categorical variables are as follows:
- bmi[25,30): BMI ≥ 25 and <30; reference group: BMI <25;
- bmi[30,35): BMI ≥ 30 and <35; reference group: BMI <25;
- bmi[35,100): BMI ≥ 35; reference group: BMI <25.

The meaning of the other variables and their reference groups is explained in the footnotes to the models displayed in the sections preceding this one.
### Supplementary Table S1 – Baseline characteristics of the study population

| Variable                  | Whole study population (N=4,868) | NeutAb subgroup* (N=1,269) |
|---------------------------|----------------------------------|----------------------------|
| **Gender, n (%)**         |                                  |                            |
| Female                    | 3558 (73.09)                     | 959 (75.57)                |
| Male                      | 1310 (26.91)                     | 310 (24.43)                |
| **Age, mean (+/-std)**    | 46.90 (+/-13.69)                 | 52.70 (+/-14.23)           |
| **Age, n (%)**            |                                  |                            |
| 18-44.99                  | 2241 (46.04)                     | 398 (31.36)                |
| 45-64.99                  | 2072 (42.56)                     | 527 (41.53)                |
| 65+                       | 555 (11.40)                      | 344 (27.11)                |
| **BMI, mean (+/-std)**    | 25.51 (+/-4.62)                  | 26.86 (+/-5.28)            |
| **BMI, n (%)**            |                                  |                            |
| <25                       | 1948 (51.71)                     | 488 (42.84)                |
| 25-29.99                  | 1216 (32.28)                     | 325 (28.53)                |
| 30+                       | 446 (11.84)                      | 326 (28.62)                |
| **Sector, n (%)**         |                                  |                            |
| Physician                 | 909 (18.67)                      | 246 (19.39)                |
| Nurse                     | 1391 (28.57)                     | 282 (22.22)                |
| Para                      | 1161 (23.85)                     | 349 (27.50)                |
| Administration            | 1407 (28.90)                     | 392 (30.89)                |
| **Comorbidity, n (%)**    |                                  |                            |
| Pregnancy                 | 31 (0.64)                        | 23 (1.81)                  |
| Allergy                   | 77 (2.00)                        | 46 (3.98)                  |
| Hypertension              | 411 (10.79)                      | 206 (17.93)                |
| Diabetes                  | 209 (5.49)                       | 102 (8.88)                 |
| Dyslipidemia              | 244 (6.41)                       | 119 (10.36)                |
| Heart disease             | 104 (2.73)                       | 51 (4.44)                  |
| Lung disease              | 124 (3.26)                       | 48 (4.18)                  |
| Kidney disease            | 21 (0.55)                        | 7 (0.61)                   |
| Coagulation disease       | 68 (1.79)                        | 25 (2.18)                  |
| Liver disease             | 26 (0.68)                        | 12 (1.04)                  |
| Autoimmune disease        | 242 (6.36)                       | 137 (11.92)                |
| Immunosuppression         | 41 (1.08)                        | 28 (2.44)                  |
| **Specific comorbidities**, n (%) |                      |                            |
| 0                         | 3001 (78.81)                     | 785 (61.86)                |
| 1                         | 568 (14.92)                      | 233 (18.36)                |
| ≥2                        | 239 (6.28)                       | 131 (10.32)                |

*NeutAb subgroup was defined as HCW with at least one NeutAb assays during study follow-up. **Specific comorbidities included the following: hypertension, diabetes, dyslipidemia, heart disease, lung disease, kidney disease and liver disease. BMI=Body mass index; NeutAb=neutralizing antibodies.
## Supplementary Table S2 - Computer-based questionnaire

| Question                                                                 | Answer1 | Answer2 |
|--------------------------------------------------------------------------|---------|---------|
| 1. What is your date of birth?                                           |         |         |
| 2. What is your gender? Male Female                                       |         |         |
| 3. What is your current height in m?                                     |         |         |
| 4. What is your current weight in kg?                                    |         |         |
| 5. Did you perform an IgG assay before receiving the first dose of the vaccine? | Yes     | No      |
| 6. Do you have high blood pressure disease (systolic blood pressure above 140) treated with medication? | Yes     | No      |
| 7. Do you have dyslipidemia (total cholesterol above 200 or LDL cholesterol above 160) treated with medication? | Yes     | No      |
| 8. Do you have autoimmune disease treated with medication?               | Yes     | No      |
| 9. Do you have diabetes (HbA1C>6.5 or fasting blood sugar>126) treated with medication? | Yes     | No      |
| 10. Do you have heart disease treated with medication?                   | Yes     | No      |
| 11. Do you have lung disease as asthma, COPD, lung fibrosis treated with medication/s? | Yes     | No      |
| 12. Do you have any coagulation disorder resulting in hemorrhage or thrombosis treated with medication? | Yes     | No      |
| 13. Are you immunosuppressed (organ transplantation, biologic therapy, chemotherapy, steroids, splenectomy, or HIV)? | Yes     | No      |
| 14. Have you ever had a serious allergic reaction (anaphylaxis) that required immediate treatment? | Yes     | No      |
| 15. Do you have liver disease as cirrhosis, hepatitis, liver cancer, metabolic disorder? | Yes     | No      |
| 16. Do you have kidney disease (creatinine>1.2 or GFR<60) treated with medication? | Yes     | No      |
| 17. Are you pregnant (confirmed by a beta HCG blood test and ultrasound fetal heartbeats detection)? | Yes     | No      |

The questionnaire was reviewed and approved by the Institutional review board of the Sheba Medical Center.

IgG=Immunoglobulin G; BMI=Body mass index; Kg=kilogram. M=meter; LDL=low-density lipoproteins; HbA1C=hemoglobin A1C; COPD= chronic obstructive pulmonary disease; HIV=human immunodeficiency; GFR=Glomerular filtration rate.
## Supplementary Table S3- Variable Definitions

| Variable | Values | Definitions | Timing |
|----------|--------|-------------|--------|
| **Outcomes** | | | |
| IgG at the peak period | Continuous (S/CO) | SARS-CoV-2 Receptor Binding Domain (RBD) Immunoglobulin G (IgG) assay (Beckman-Coulter, CA, U.S.A.) | During the peak period (days 4-30 after the second vaccination) |
| NeutAb at the peak period | Continuous (50% titer) | SARS-CoV-2 Pseudo-virus (psSARS-2) Neutralization Assay | During the peak period (days 4-30 after the second vaccination) |
| IgG in the EoS | Continuous (S/CO) | SARS-CoV-2 Receptor Binding Domain (RBD) Immunoglobulin G (IgG) assay (Beckman-Coulter, CA, U.S.A.) | At the end of the study (day 175 after the second vaccination) |
| IgG and NeutAb in the EoS | Continuous (50% titer) | SARS-CoV-2 Pseudo-virus (psSARS-2) Neutralization Assay | At the end of the study (day 175 after the second vaccination) |
| **Variables** | | | |
| Sex | Female/male | As defined in SMC' files | Current |
| Age | Continuous (years) | As defined in SMC' files | At second vaccine dose |
| BMI | Categorical: <25, 25-29.99, ≥30 | BMI was calculated by weight (kg)/(height (m))^2 according to the HCW answer to the questionnaire. | At second vaccine dose |
| Blood pressure disease | 0/1 | According to the HCW answer to the questionnaire: defined as systolic blood pressure above 140 treated with medication | At second vaccine dose |
| Dyslipidemia | 0/1 | According to the HCW answer to the questionnaire: defined as total cholesterol above 200 or LDL cholesterol above 160 treated with medication | At second vaccine dose |
| Autoimmune disease | 0/1 | According to the HCW answer to the questionnaire: defined as known autoimmune | At second vaccine dose |
| Disease                        | Code | Definition                                                                                                                                  | Date of Treatment          |
|-------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Diabetes                      | 0/1  | According to the HCW answer to the questionnaire: defined as HbA1C>6.5 or fasting blood sugar>126 treated with medication                   | At second vaccine dose    |
| Heart disease                 | 0/1  | According to the HCW answer to the questionnaire: defined as known heart disease treated with medication                                   | At second vaccine dose    |
| Lung disease                  | 0/1  | According to the HCW answer to the questionnaire: defined as defined as known lung disease treated with medication                   | At second vaccine dose    |
| Coagulation disorder          | 0/1  | According to the HCW answer to the questionnaire: defined as known hemorrhage or thrombosis disease treated with medication          | At second vaccine dose    |
| Immunosuppressed              | 0/1  | According to the HCW answer to the questionnaire: defined as organ transplantation, biologic therapy, chemotherapy, steroids, splenectomy, or HIV | At second vaccine dose    |
| Allergy                       | 0/1  | According to the HCW answer to the questionnaire: defined as a serious allergic reaction (anaphylaxis) that required immediate treatment | During the life           |
| Liver disease                 | 0/1  | According to the HCW answer to the questionnaire: defined as cirrhosis, hepatitis, liver cancer, metabolic disorder                  | At second vaccine dose    |
| Kidney disease                | 0/1  | According to the HCW answer to the questionnaire: defined as creatinine>1.2 or GFR<60) treated with medication                       | At second vaccine dose    |
| Pregnancy                     | 0/1  | According to the HCW answer to the questionnaire:                                                                                     | At second vaccine dose    |
| Specific comorbidities | Categorical: 0, 1, ≥2 | Count of comorbidities that were with significant lower antibodies titers compared to healthy people during the first 5 weeks after the first vaccine dose³:
- Hypertension
- Diabetes
- Dyslipidemia
- Heart disease
- Lung disease
- Kidney disease
- Liver disease | At second vaccine dose |

Abbreviations: NeutAb= neutralizing antibodies; EoS=end of study; IgG=Immunoglobulin G; S/CO=sample cutoff ratio; SARS-CoV-2=severe acute respiratory syndrome; BMI=Body mass index; Kg=kilogram. M=meter; HCW=health care worker; LDL=low-density lipoproteins; HIV=human immunodeficiency; GFR=Glomerular filtration rate; HbA1C=hemoglobin A1C.
**Supplementary Table S4 – Distribution of demographic and comorbidity according to test period of IgG**

| Variable                              | P0 (N=3991) | P1 (N=2690) | P2 (N=1829) | P3 (N=1732) | P4 (N=1606) | P5 (N=1518) | P6 (N=1370) |
|---------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Number of days after the 2nd vaccine, mean (+/-std) | 11.19 (+/-3.27) | 27.88 (+/-4.19) | 56.40 (+/-3.79) | 85.08 (+/-4.37) | 112.85 (+/-4.33) | 140.96 (+/-4.74) | 167.89 (+/-3.91) |
| Gender, n (%)                         |             |             |             |             |             |             |             |
| Female                                | 2960 (74.17) | 2028 (75.39) | 1442 (78.84) | 1380 (79.68) | 1258 (78.33) | 1194 (78.66) | 1046 (76.35) |
| Male                                  | 1031 (25.83) | 662 (24.61)  | 387 (21.16)  | 352 (20.32)  | 348 (21.67)  | 324 (21.34)  | 324 (23.65)  |
| Age, mean (+/-std)                    |             |             |             |             |             |             |             |
| 18-44.99                              | 1798 (45.05) | 1183 (43.98) | 760 (41.55)  | 688 (39.72)  | 636 (39.60)  | 573 (37.75)  | 483 (35.26)  |
| 45-64.99                              | 1754 (43.95) | 1232 (45.80) | 894 (48.88)  | 874 (50.46)  | 816 (50.81)  | 795 (52.37)  | 747 (54.53)  |
| 65+                                   | 439 (11.00)  | 275 (10.22)  | 175 (9.57)   | 170 (9.82)   | 154 (9.59)   | 150 (9.88)   | 140 (10.22)  |
| BMI, mean (+/-std)                    |             |             |             |             |             |             |             |
| <25                                   | 1645 (51.83) | 1204 (51.94) | 877 (52.61)  | 846 (53.61)  | 785 (52.47)  | 735 (52.16)  | 669 (51.66)  |
| 25-29.99                              | 1024 (32.26) | 740 (31.92)  | 525 (31.49)  | 486 (30.80)  | 478 (31.95)  | 442 (31.37)  | 410 (31.66)  |
| 30+                                   | 505 (15.91)  | 374 (16.13)  | 265 (15.90)  | 246 (15.59)  | 233 (15.57)  | 232 (16.47)  | 216 (16.68)  |
| Sector, n (%)                         |             |             |             |             |             |             |             |
| Physician                             | 732 (18.34)  | 480 (17.84)  | 302 (16.51)  | 273 (15.76)  | 260 (16.19)  | 245 (16.14)  | 240 (17.52)  |
| Nurse                                 | 1131 (28.34) | 720 (26.77)  | 435 (23.78)  | 411 (23.73)  | 380 (23.66)  | 358 (23.58)  | 328 (23.94)  |
| Para                                  | 1000 (25.06) | 699 (25.99)  | 555 (30.34)  | 521 (30.08)  | 505 (31.44)  | 468 (30.83)  | 396 (28.91)  |
| Administration                        | 1128 (28.26) | 791 (29.41)  | 537 (29.36)  | 527 (30.43)  | 461 (28.70)  | 447 (29.45)  | 406 (29.64)  |
| Comorbidity, n (%)                    |             |             |             |             |             |             |             |
| Pregnancy                             | 25 (0.63)    | 23 (0.86)    | 19 (1.04)    | 12 (0.69)    | 8 (0.50)     | 5 (0.3)      | 2 (0.15)     |
| Allergy                               | 64 (1.97)    | 56 (2.38)    | 42 (2.49)    | 45 (2.81)    | 40 (2.65)    | 39 (2.73)    | 13 (0.99)    |
| Hypertension                          | 348 (10.84)  | 259 (11.07)  | 185 (11.01)  | 191 (12.00)  | 188 (12.49)  | 178 (12.54)  | 171 (13.09)  |
| Diabetes                              | 168 (5.23)   | 120 (5.13)   | 82 (4.88)    | 83 (5.21)    | 77 (5.12)    | 79 (5.57)    | 75 (5.74)    |
| Dyslipidemia                          | 212 (6.60)   | 150 (6.41)   | 113 (6.73)   | 105 (6.60)   | 108 (7.18)   | 99 (6.98)    | 104 (7.96)   |
| Heart disease                         | 93 (2.90)    | 57 (2.44)    | 46 (2.74)    | 40 (2.51)    | 39 (2.59)    | 38 (2.68)    | 35 (2.68)    |
| Lung disease                          | 106 (3.30)   | 84 (3.59)    | 62 (3.69)    | 59 (3.71)    | 60 (3.99)    | 59 (4.16)    | 52 (3.98)    |
| Kidney disease                        | 20 (0.62)    | 15 (0.64)    | 8 (0.48)     | 8 (0.50)     | 10 (0.66)    | 9 (0.63)     | 7 (0.54)     |
| Coagulation disease                   | 59 (1.84)    | 46 (1.97)    | 35 (2.08)    | 29 (1.82)    | 31 (2.06)    | 28 (1.97)    | 25 (1.91)    |
| Liver disease                         | 22 (0.69)    | 15 (0.64)    | 14 (0.83)    | 11 (0.69)    | 7 (0.47)     | 9 (0.63)     | 11 (0.84)    |
| Autoimmune disease                    | 211 (6.57)   | 157 (6.71)   | 118 (7.02)   | 107 (6.72)   | 99 (6.58)    | 97 (6.84)    | 80 (6.13)    |
| Immunosuppression                     | 38 (1.18)    | 28 (1.20)    | 24 (1.43)    | 21 (1.32)    | 21 (1.40)    | 14 (0.99)    | 13 (1.00)    |
| Specific comorbidities*, n (%)        |             |             |             |             |             |             |             |
| No disease                            | 2525 (78.66) | 1842 (78.75) | 1319 (78.51) | 1240 (77.89) | 1161 (77.14) | 1093 (77.03) | 993 (76.03)  |
| One disease                           | 481 (14.98)  | 351 (15.01)  | 251 (14.94)  | 249 (15.64)  | 237 (15.75)  | 221 (15.57)  | 211 (16.16)  |
| ≥2 diseases                           | 204 (6.36)   | 146 (6.24)   | 110 (6.55)   | 103 (6.47)   | 107 (7.11)   | 105 (7.40)   | 102 (7.81)   |

*Specific comorbidities included the following: hypertension, diabetes, dyslipidemia, heart disease, lung disease, kidney disease, and liver disease. Abbreviations: P=period. BMI =Body mass index.
Supplementary Table S5 – Distribution of demographic and comorbidity according to test period of neutralizing antibody

| Variable                                                                 | P0 (N=681) | P1 (N=622) | P2 (N=724) | P3 (N=559) | P4 (N=700) | P5 (N=721) | P6 (N=520) |
|--------------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|
| Number of days after the 2nd vaccine, mean (+/-std)                      | 9.20 (+/-3.26) | 28.20 (+/-3.26) | 56.36 (+/-3.33) | 83.87 (+/-2.72) | 112.91 (+/-4.08) | 140.82 (+/-4.32) | 167 (+/-2.92) |
| Gender, n (%)                                                            | 518 (76.06) | 484 (77.81) | 578 (79.83) | 426 (76.21) | 533 (76.47) | 556 (77.12) | 378 (73.11) |
| Number of days after the 2nd vaccine, mean (+/-std)                      | 9.20 (+/-3.26) | 28.20 (+/-3.26) | 56.36 (+/-3.33) | 83.87 (+/-2.72) | 112.91 (+/-4.08) | 140.82 (+/-4.32) | 167 (+/-2.92) |
| Number of days after the 2nd vaccine, mean (+/-std)                      | 9.20 (+/-3.26) | 28.20 (+/-3.26) | 56.36 (+/-3.33) | 83.87 (+/-2.72) | 112.91 (+/-4.08) | 140.82 (+/-4.32) | 167 (+/-2.92) |
| Age, mean (+/-std)                                                       | 54.06 (+/-15.61) | 51.94 (+/-14.9) | 51.07 (+/-13.34) | 52.38 (+/-12.65) | 51.86 (+/-12.76) | 51.77 (+/-12.56) | 52.19 (+/-12.25) |
| Age, n (%)                                                               | 222 (32.6) | 222 (35.69) | 255 (35.22) | 163 (29.16) | 216 (30.99) | 223 (30.93) | 154 (29.79) |
| BMI, mean (+/-std)                                                       | 25.65 (+/-4.74) | 25.45 (+/-4.72) | 27.18 (+/-5.47) | 26.82 (+/-5.24) | 26.6 (+/-5.24) | 26.83 (+/-5.3) | 26.77 (+/-5.09) |
| BMI, n (%)                                                               | 299 (50.34) | 303 (52.79) | 283 (41.07) | 236 (43.54) | 299 (44.96) | 298 (43.5) | 223 (44.16) |
| Sector, n (%)                                                            | 139 (20.41) | 129 (20.74) | 135 (18.65) | 103 (18.43) | 121 (17.36) | 120 (16.64) | 95 (18.38) |
| Comorbidity, n (%)                                                       | 12 (1.76) | 15 (2.41) | 9 (1.24) | 2 (0.36) | 2 (0.29) | 5 (0.69) | 1 (0.19) |
| Pregnancy, n (%)                                                         | 20 (3.3) | 33 (5.67) | 29 (4.16) | 9 (1.64) | 16 (2.37) | 22 (3.17) | 8 (1.56) |
| Hypertension, n (%)                                                      | 108 (18.03) | 96 (16.55) | 120 (17.27) | 97 (17.73) | 122 (18.15) | 129 (18.67) | 97 (19.02) |
| Diabetes, n (%)                                                          | 47 (7.85) | 38 (6.55) | 58 (8.35) | 49 (8.96) | 55 (8.18) | 61 (8.83) | 46 (9.02) |
| Dyslipidemia, n (%)                                                      | 63 (10.52) | 59 (10.17) | 69 (9.93) | 57 (10.42) | 65 (9.67) | 66 (9.55) | 55 (10.78) |
| Heart disease, n (%)                                                     | 30 (5.01) | 21 (3.62) | 28 (4.03) | 22 (4.02) | 25 (3.72) | 24 (3.47) | 18 (3.53) |
| Lung disease, n (%)                                                      | 23 (3.84) | 27 (4.66) | 33 (4.75) | 22 (4.02) | 31 (4.61) | 33 (4.78) | 23 (4.51) |
| Kidney disease, n (%)                                                    | 6 (1) | 4 (0.69) | 2 (0.29) | 2 (0.37) | 4 (0.6) | 3 (0.43) | 2 (0.39) |
| Coagulation disease, n (%)                                               | 13 (2.17) | 16 (2.76) | 15 (2.16) | 12 (2.19) | 15 (2.23) | 15 (2.17) | 10 (1.96) |
| Liver disease, n (%)                                                     | 5 (0.83) | 4 (0.69) | 10 (1.44) | 7 (1.28) | 6 (0.89) | 8 (1.16) | 8 (1.57) |
| Autoimmune disease, n (%)                                                | 71 (11.85) | 91 (15.69) | 87 (12.52) | 55 (10.05) | 64 (9.52) | 74 (10.71) | 54 (10.59) |
| Immunosuppression, n (%)                                                 | 22 (3.67) | 20 (3.45) | 19 (2.73) | 10 (1.83) | 14 (2.08) | 13 (1.88) | 8 (1.57) |

*Specific comorbidities included the following: hypertension, diabetes, dyslipidemia, heart disease, lung disease, kidney disease, and liver disease. Abbreviations: P=period. BMI =Body mass index.
Supplementary Table S6: Expected and observed GMTs of IgG and neutralizing antibody in each period

|                               | Baseline: Days 4-17 | P1: Days 18-42 | P2: Days 43-70 | P3: Days 71-98 | P4: Days 99-126 | P5: Days 127-154 | P6: Days 155-175 |
|-------------------------------|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| N of IgG tests                | 3991                | 2690           | 1829           | 1732           | 1606           | 1518           | 1370           |
| IgG, period observed GMT (95% CI), S/CO | 32.9 (32.2-33.6)     | 25.5 (24.8-26.2) | 15.1 (14.6-15.7) | 7.6 (7.3-7.9)  | 4.8 (4.6-5.0)  | 2.9 (2.8-3.0)  | 1.8 (1.7-1.8)  |
| IgG, mid-period expected GMT (95% CI), S/CO | 29.3 (28.7-29.8)     | 29.3 (28.7-29.8) | 16.9 (16.6-17.3) | 9.4 (9.2-9.6)  | 5.2 (5.1-5.4)  | 2.9 (2.8-3.0)  | 1.6 (1.5-1.7)  |
| N of Neutralizing antibody tests | 681                 | 622            | 724            | 559            | 697            | 721            | 517            |
| Neutralizing antibody, period observed GMT (95% CI), 50% titer | 685.5 (608.5-772.1)  | 497.5 (447.5-553.2) | 254.4 (232.2-278.6) | 141.0 (128.7-154.4) | 138.7 (127.0-151.6) | 115.0 (106.0-124.9) | 113.3 (102.9-124.7) |
| Neutralizing antibody, mid-period expected GMT (95% CI), 50% titer | 557.1 (510.8-607.7)  | 557.1 (510.8-607.7) | 229.5 (214.7-245.4) | 142.4 (132.2-153.4) | 138.0 (128.7-148.0) | 128.4 (120.6-136.7) | 119.4 (112.0-127.3) |

S/CO=sample-to-cutoff ratio. P=period.
Supplementary Figure S1: Monthly trajectory antibodies of participants with repeated tests

Legend: Each line represents the monthly trajectory of participants with repeated IgG or NeutAb tests. NeutAb=neutralizing antibody. RBD=receptor binding domain. s/co=sample-to-cutoff ratio. P=period
Supplementary Figure S2: Monthly correlation between IgG and neutralizing antibody

Legend: Each line was obtained by local polynomial regression and represents the association between IgG and NeutAb of each period. NeutAb=neutralizing antibody. RBD=receptor binding domain. s/co=sample-to-cutoff ratio. P=period.

| N  | Spearman's correlation coefficient | P-value |
|----|-----------------------------------|---------|
| P0 | 675                               | 0.749   | <0.001  |
| P1 | 621                               | 0.727   | <0.001  |
| P2 | 723                               | 0.720   | <0.001  |
| P3 | 558                               | 0.749   | <0.001  |
| P4 | 698                               | 0.693   | <0.001  |
| P5 | 729                               | 0.684   | <0.001  |
| P6 | 529                               | 0.691   | <0.001  |
Supplementary References

1. Oved K, Olmer L, Shemer-Avni Y, Wolf T, Supino-Rosin L, Prajgrod G, et al. Multi-center nationwide comparison of seven serology assays reveals a SARS-CoV-2 non-responding seronegative subpopulation. EClinicalMedicine. 2020; 29: 100651.

2. Dieterle ME, Haslwanter D, Bortz RH, 3rd, Wirchnianski AS, Lasso G, Vergnolle O, et al. A Replication-Competent Vesicular Stomatitis Virus for Studies of SARS-CoV-2 Spike-Mediated Cell Entry and Its Inhibition. Cell Host Microbe. 2020; 28(3): 486-96 e6.

3. Lustig Y, Sapir E, Regev-Yochay G, et al. BNT162b2 COVID-19 vaccine and correlates of humoral immune responses and dynamics: a prospective, single-centre, longitudinal cohort study in health-care workers. Lancet Respir Med. Published online July 2, 2021:S2213-2600(21)00220-4.