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| Table S1. Anti-SARS-CoV-2 S1 IgG levels (BAU/mL) |
|  | Healthcare Workers & University Students | Healthcare Employees & Students |
|  | BNT162b2 | mRNA-1273 |
|  | (Second Dose at Week 3) | (Second Dose at Week 4) |
|  | Q1 | Q2 | Q3 | Q1 | Q2 | Q3 |
| 1ɑ, 25-(OH)2 vitamin D | ≤52.4 | 53.7–64.0 | ≥64.6 | ≤52.4 | 53.7–64.0 | ≥64.6 |
| Baseline |  |  |  |  |  |  |
| Week 0 |  |  |  |  |  |  |
| N | 22 | 23 | 17 | 7 | 7 | 12 |
| Median | 0.44 | 0.44 | 0.39 | 0.44 | 0.51 | 0.46 |
| (IQR) | (0.33–0.53) | (0.36–0.55) | (0.32–0.52) | (0.39–0.62) | (0.41–0.64) | (0.29–0.54) |
| First dose |  |  |  |  |  |  |
| Week 1 | 1 week after the first dose |  |  |  |
| N | 8 | 8 | 4 |  |  |  |
| Median | 1.13 | 0.53 | 0.63 |  |  |  |
| (IQR) | (0.41–5.7) | (0.48–0.9) | (0.42–24.98) |  |  |  |
| Week 2 | 2 weeks after the first dose |  |  |  |
| N | 8 | 7 | 4 |  |  |  |
| Median | 66.9 | 42.2 | 69.7 |  |  |  |
| (IQR) | (31.1–91.5) | (11.1–65) | (60.7–195) |  |  |  |
| Week 3 | 3 weeks after the first dose | 3 weeks after the first dose |
| N | 22 | 22 | 17 | 7 | 7 | 12 |
| Median | 124 | 128 | 135 | 277 | 304 | 372 |
| (IQR) | (100–200) | (81–225) | (91–154) | (168–572) | (139–393) | (186–449) |
| Second dose |  |  |  |  |  |  |
| Week 1 | 1 week after the second dose |  |  |  |
| N | 8 | 8 | 3 |  |  |  |
| Median | 904 | 629 | 2110 |  |  |  |
| (IQR) | (634–1626) | (439–1314) | (434–3145) |  |  |  |
| Week 2 | 2 weeks after the second dose |  |  |  |
| N | 8 | 7 | 4 |  |  |  |
| Median | 2383 | 1118 | 2184 |  |  |  |
| (IQR) | (1346–2620) | (642–2523) | (1428–2722) |  |  |  |
| Week 3 | 3 weeks after the second dose |  |  |  |
| N | 8 | 7 | 4 |  |  |  |
| Median | 1871 | 991 | 1637 |  |  |  |
| (IQR) | (1085–2256) | (641–1975) | (1213–1939) |  |  |  |
| Month 1 | 1 month after the second dose | 1 month after the second dose |
| N | 22 | 23 | 17 | 7 | 7 | 12 |
| Median | 1592 | 1668 | 1276 | 3209 | 2680 | 3128 |
| (IQR) | (1145–2292) | (1174–1880) | (776–1887) | (1661–5225) | (1820–3565) | (2538–3637) |
| Month 2 | 2 months after the second dose |  |  |  |
| N | 22 | 22 | 17 |  |  |  |
| Median | 896 | 724 | 526 |  |  |  |
| (IQR) | (572–971) | (544–949) | (419–953) |  |  |  |
| Month 3 | 3 months after the second dose | 3 months after the second dose |
| N | 22 | 22 | 17 | 7 | 7 | 12 |
| Median | 524 | 602 | 362 | 1640 | 1211 | 1494 |
| (IQR) | (402–964) | (379–852) | (300–921) | (742–1935) | (703–1608) | (1134–1883) |
| Month 6 | 6 months after the second dose | 6 months after the second dose |
| N | 22 | 22 | 16 | 7 | 7 | 10 |
| Median | 260 | 259 | 151 | 968 | 602 | 761 |
| (IQR) | (179–395) | (158–395) | (119–351) | (623–1062) | (280–826) | (613–1128) |
| Month 8 | 8 months after the second dose |  |  |  |
| N | 22 | 22 | 16 |  |  |  |
| Median | 195 | 196 | 127 |  |  |  |
| (IQR) | (135–324) | (136–333) | (93–333) |  |  |  |

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| Table S2. Sensitivity analysis: fixed effects of baseline characteristics on log-transformed anti-S1 IgG, BAU/mL |
| 　 | Model 1 | Model 2 | Model 3 |
|  | N = 87  | N = 87  | N = 87 |
|  |  639 observations |  639 observations |  639 observations |
|  | AIC = 1259 | AIC = 1241 | AIC = 1250 |
| 　 | β | *p-value* | β | *p-value* | β | *p-value* |
| BNT162b2 (reference) |  |  |  |  |  |  |
| mRNA-1273 | 0.784 | 0.008 | 0.837 | <0.001 | 0.864 | <0.001 |
| Age (per year old) |  |  | -0.008 | 0.006 | -0.012 | <0.001 |
| Female sex |  |  | 0.024 | 0.771 | -0.054 | 0.542 |
| ALDH2 variant allele number  |  |  | -0.158 | <0.001 | -0.185 | <0.001 |
| Height (per cm) |  |  | -0.013 | 0.008 | -0.012 | 0.020 |
| Smoking status, yes |  |  |  |  | 0.288 | 0.013 |
| Ethanol intake (per category) |  |  |  |  | -0.062 | 0.195 |
| Exercise habit (per category) |  |  |  |  | -0.037 | 0.123 |
| Perceived stress (per category) |  |  |  |  | 0.047 | 0.021 |
| Steroid use, yes |  |  |  |  | -0.142 | 0.434 |
| Allergic disease, yes |  |  |  |  | 0.024 | 0.682 |
| Log (vitamin D\* pg/mL) | -0.299 | 0.012 | -0.397 | <0.001 | -0.473 | <0.001 |

*β,* partial correlation coefficient. AIC, Akaike's Information Criterion. \*1α, 25-(OH)2 vitamin D.

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| Table S3. Anti-SARS-CoV-2 S1 IgM levels (SU/mL) |
|  | Healthcare Workers & University Students | Healthcare Employees & Students |
|  | BNT162b2 | mRNA-1273 |
|  | (Second Dose at Week 3) | (Second Dose at Week 4) |
|  | Q1 | Q2 | Q3 | Q1 | Q2 | Q3 |
| 1ɑ, 25-(OH)2 vitamin D | ≤52.4 | 53.7–64.0 | ≥64.6 | ≤52.4 | 53.7–64.0 | ≥64.6 |
| Baseline |  |  |  |  |  |  |
| Week 0 |  |  |  |  |  |  |
| N | 22 | 23 | 17 | 7 | 7 | 12 |
| Median | 0.8 | 0.77 | 0.51 | 0.42 | 0.49 | 0.61 |
| (IQR) | (0.53–1.57) | (0.44–1.03) | (0.35–0.84) | (0.3–0.63) | (0.42–0.58) | (0.41–1.68) |
| First dose |  |  |  |  |  |  |
| Week 1 | 1 week after the first dose |  |  |  |
| N | 8 | 8 | 4 |  |  |  |
| Median | 1.91 | 0.86 | 0.7 |  |  |  |
| (IQR) | (1.15–2.51) | (0.71–1.18) | (0.38–2.21) |  |  |  |
| Week 2 | 2 weeks after the first dose |  |  |  |
| N | 8 | 7 | 4 |  |  |  |
| Median | 0.9 | 8.8 | 16.5 |  |  |  |
| (IQR) | (0.7–1.2) | (5–34.9) | (13.9–22) |  |  |  |
| Week 3 | 3 weeks after the first dose | 3 weeks after the first dose |
| N | 22 | 22 | 17 | 7 | 7 | 12 |
| Median | 23 | 28 | 16 | 28 | 18 | 24 |
| (IQR) | (10–41) | (10–49) | (11–31) | (6–63) | (11–96) | (14–48) |
| Second dose |  |  |  |  |  |  |
| Week 1 | 1 week after the second dose |  |  |  |
| N | 8 | 8 | 3 |  |  |  |
| Median | 63 | 36 | 22 |  |  |  |
| (IQR) | (42–103) | (27–50) | (15–44) |  |  |  |
| Week 2 | 2 weeks after the second dose |  |  |  |
| N | 8 | 7 | 4 |  |  |  |
| Median | 55 | 26 | 26 |  |  |  |
| (IQR) | (31–142) | (19–41) | (18–32) |  |  |  |
| Week 3 | 3 weeks after the second dose |  |  |  |
| N | 8 | 7 | 4 |  |  |  |
| Median | 38 | 20 | 22 |  |  |  |
| (IQR) | (21–98) | (12–30) | (12–27) |  |  |  |
| Month 1 | 1 month after the second dose | 1 month after the second dose |
| N | 22 | 23 | 17 | 7 | 7 | 12 |
| Median | 27 | 34 | 21 | 20 | 34 | 30 |
| (IQR) | (19–59) | (17–51) | (14–121) | (11–55) | (9–66) | (18–61) |
| Month 2 | 2 months after the second dose |  |  |  |
| N | 22 | 22 | 17 |  |  |  |
| Median | 11.4 | 12.8 | 7.4 |  |  |  |
| (IQR) | (7.6–25.1) | (7.8–19.8) | (3.6–28.3) |  |  |  |
| Month 3 | 3 months after the second dose | 3 months after the second dose |
| N | 22 | 22 | 17 | 7 | 7 | 12 |
| Median | 6.2 | 5 | 4.4 | 3 | 3.4 | 5.9 |
| (IQR) | (4.2–12.9) | (3.3–7.9) | (2–9) | (2–9.7) | (2.1–11.1) | (2.6–11) |
| Month 6 | 6 months after the second dose | 6 months after the second dose |
| N | 22 | 22 | 16 | 7 | 7 | 10 |
| Median | 3.8 | 1.8 | 1.7 | 1.7 | 1.3 | 2.8 |
| (IQR) | (2.5–7.9) | (1.4–4) | (0.9–3) | (1.3–3.6) | (1–1.7) | (1–4.2) |
| Month 8 | 8 months after the second dose |  |  |  |
| N | 22 | 22 | 16 |  |  |  |
| Median | 3.7 | 2.5 | 1.6 |  |  |  |
| (IQR) | (2.2–7.5) | (1.5–4.1) | (1.1–3.5) |  |  |  |

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| Table S4. Sensitivity analysis: fixed effects of baseline characteristics on log-transformed anti-S1 IgM, SU/mL |
|  | Model 1 | Model 2 | Model 3 |
|  | N = 87  | N = 87  | N = 87 |
|  |  639 observations |  639 observations |  639 observations |
|  | AIC = 1689 | AIC = 1690 | AIC = 1697 |
|  | β | *p-value* | β | *p-value* | β | *p-value* |
| BNT162b2 (reference) |  |  |  |  |  |  |
| mRNA-1273 | -0.032 | 0.839 | 0.053 | 0.613 | 0.040 | 0.709 |
| Age (per year old) |  |  | -0.012 | 0.001 | -0.012 | 0.003 |
| Female sex |  |  | -0.208 | 0.080 | -0.249 | 0.054 |
| ALDH2 variant allele number  |  |  | 0.010 | 0.845 | -0.013 | 0.832 |
| Height (per cm) |  |  | -0.019 | 0.005 | -0.019 | 0.008 |
| Smoking status, yes |  |  |  |  | 0.020 | 0.903 |
| Ethanol intake (per category) |  |  |  |  | 0.044 | 0.523 |
| Exercise habit (per category) |  |  |  |  | 0.022 | 0.515 |
| Perceived stress (per category) |  |  |  |  | -0.002 | 0.946 |
| Steroid use, yes |  |  |  |  | -0.882 | 0.001 |
| Allergic disease, yes |  |  |  |  | 0.106 | 0.197 |
| Log (vitamin D\* pg/mL) | -0.486 | 0.004 | -0.605 | <0.001 | -0.677 | <0.001 |

*β,* partial correlation coefficient. AIC, Akaike's Information Criterion. \*1α, 25-(OH)2 vitamin D.

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| Table S5.IFN-γ ELISPOT count (SFC/2.0 x10⁵ PBMC) |
|  | University Students | Healthcare Employees & Students |
|  | BNT162b2 | mRNA-1273 |
| 　 | (Second Dose at Week 3) | (Second Dose at Week 4) |
| 　 | Q1 | Q2 | Q3 | Q1 | Q2 | Q3 |
| 1α, 25-(OH)₂ vitamin D, pg/mL | ≤52.4 | 53.7–64.6 | ≥64.6 | ≤52.4 | 53.7–64.6 | ≥64.6 |
| Baseline |  |  |  |  |  |  |
| Week 0 |  |  |  |  |  |  |
| N |  |  |  | 7 | 7 | 12 |
| Median |  |  |  | 0 | 5.5 | 3.5 |
| (IQR) |  |  |  | (0–11) | (0–11) | (0–12) |
| First dose |  |  |  |  |  |  |
| Week 3 | 3 weeks after the first dose | 3 weeks after the first dose |
| N |  |  |  | 7 | 7 | 12 |
| Median |  |  |  | 61 | 52 | 85 |
| (IQR) |  |  |  | (45–109) | (36–291) | (56–145) |
| Second dose |  |  |  |  |  |  |
| Month 1 | 1 month after the second dose | 1 month after the second dose |
| N |  |  |  | 7 | 7 | 12 |
| Median |  |  |  | 273 | 155 | 134 |
| (IQR) |  |  |  | (189–301) | (99–285) | (122–261) |
| Month 3 | 3 months after the second dose | 3 months after the second dose |
| N |  |  |  | 5 | 6 | 9 |
| Median |  |  |  | 127 | 84 | 140 |
| (IQR) |  |  |  | (102–180) | (38–148) | (126–208) |
| Month 6 | 6 months after the second dose | 6 months after the second dose |
| N |  |  |  | 7 | 7 | 10 |
| Median |  |  |  | 33 | 13 | 27 |
| (IQR) |  |  |  | (9–51) | (3–28) | (1–76) |
| Month 8 | 8 months after the second dose | 8 months after the second dose |
| N | 7 | 5 | 7 |  |  |  |
| Median | 49 | 279 | 100 |  |  |  |
| (IQR) | (25–152) | (115–327) | (52–182) | 　 | 　 | 　 |