Supplementary appendix

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**Supplementary appendix**

**Appendix Table 1.** Baseline characteristics of study participants with data following both the first and second dose of COVID-19 vaccine BNT162b2.

|                     | HV        | MTX       | TNFi      | IL17i     | IL23i     | Total     |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Number in each group|           |           |           |           |           |           |
|                     | F (n=7)   | M (n=8)   | F (n=11)  | M (n=8)   | F (n=7)   | M (n=7)   |
| Age (year)†         | 27.0 (24.0-48.0) | 38.9 (33.0-46.5) | 52.0 (46.0-56.0) | 47.5 (41.0-57.5) | 31.0 (22.0-52.0) | 45.5 (30.0-55.5) | 39.0 (37.0-48.0) | 45.0 (40.0-49.0) | 46.0 (34.5-50.5) | 54.5 (35.5-60.0) | 40.0 (28.0-51.0) | 46.0 (37.0-57.0) |
| BMI (mg/m²)†        | 25.3 (21.8-31.6) | 24.0 (21.7-27.0) | 31.5 (28.0-41.9) | 27.1 (25.9-28.5) | 29.3 (24.5-31.4) | 31.6 (29.6-34.9) | 26.5 (23.7-28.3) | 29.3 (25.2-34.3) | 28.0 (23.7-30.5) | 29.0 (27.4-35.3) | 28.3 (23.7-31.4) | 28.7 (26.5-31.9) |
| Ethnicity, n (%)    |           |           |           |           |           |           |
| White               | 6 (85.7%) | 7 (87.5%) | 6 (100.0%)| 5 (62.5%) | 11 (100.0%)| 7 (87.5%) | 6 (85.7%) | 6 (85.7%) | 7 (87.5%) | 10 (83.3%) | 36 (92.3%) | 35 (81.4%) |
| Black               | 0         | 0         | 0         | 1 (12.5%) | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1 (2.3%) |
| South Asian         | 1 (14.3%) | 1 (12.5%) | 0         | 2 (25.0%) | 0         | 1 (12.5%) | 1 (14.3%) | 1 (14.3%) | 1 (12.5%) | 1 (8.3%) | 3 (7.7%) | 6 (14.0%) |
| Mixed               | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1 (8.3%) | 0         | 1 (2.3%) |
| Disease severity measure (psoriasis area severity index)† | - | - | 2.1 (0.8-3.9) | 2.3 (1.0-3.8) | 1.0 (0.0-3.8) | 1.8 (1.0-3.0) | 0.0 (0.0-0.4) | 1.2 (0.4-1.8) | 0.6 (0.0-2.8) | 0.6 (0.0-3.0) | 0.7 (0.0-2.8) | 1.3 (0.4-3.0) |
| Concomitant psoriatic arthritis, n (%) | - | - | 2 (33.3%) | 0 | 0 | 3 (37.5%) | 4 (57.1%) | 3 (42.9%) | 3 (37.5%) | 3 (25.0%) | 9 (23.1%) | 9 (20.9%) |
| Proximity MTX/biologic to v1 (days) | - | - | 3.5 (2.0-5.0) | 3.5 (1.0-4.5) | 8.0 (1.0-10.0) | 6.0 (5.5-10.0) | 18.0 (11.0-21.0) | 19.0 (10.0-21.0) | 44.0 (28.0-57.5) | 38.5 (19.0-45.5) | 10.0 (5.0-21.0) | 10.0 (4.0-26.0) |
| Proximity MTX/biologic to v2 (days) | - | - | 2.0 (2.0-3.0) | 3.0 (1.0-5.5) | 7.0 (3.0-9.0) | 4.0 (0.0-6.0) | 20.0 (8.0-22.0) | 17.0 (9.0-23.0) | 47.0 (19.0-70.5) | 34.5 (26.0-43.5) | 8.0 (3.0-22.0) | 6.0 (3.0-28.0) |
| Time between vaccine doses (weeks) | 11.0 (10.3-11.1) | 11.0 (10.4-11.5) | 10.0 (9.9-10.7) | 9.5 (9.3-9.8) | 9.0 (8.9-9.1) | 10.4 (10.1-10.9) | 9.1 (8.4-11.0) | 9.9 (9.6-10.0) | 9.9 (8.5-10.3) | 10.1 (9.8-10.9) | 9.9 (9.0-10.7) | 10.0 (9.7-11.0) |

All values are given as numbers (%) unless otherwise specified. † Median (IQR). HV, healthy volunteers; MTX, methotrexate; TNFi, TNF inhibitors; IL17i, IL-17 inhibitors; IL23i, IL-23 inhibitors; v1, vaccine dose 1; v2, vaccine dose 2.
### Appendix Table 2: Adverse events following the second dose of COVID-19 vaccine BNT162b2, disaggregated by sex.

| Number in each group       | HV               | MTX              | TNFii             | IL17i             | IL23i             | Total             |
|----------------------------|------------------|------------------|-------------------|-------------------|-------------------|-------------------|
|                            | F (n=7)          | M (n=8)          | F (n=6)           | M (n=8)           | F (n=7)           | M (n=7)           |
| Any Adverse Event          |                  |                  |                   |                   |                   |                   |
| Mild                       | 5 (71.4%)        | 7 (87.5%)        | 4 (66.7%)         | 3 (37.5%)         | 7 (63.6%)         | 5 (62.5%)         |
| Any Systemic Event         |                  |                  |                   |                   |                   |                   |
| Mild                       | 3 (42.9%)        | 5 (62.5%)        | 0 (0.0%)          | 2 (25.0%)         | 4 (36.4%)         | 3 (37.5%)         |
| Fever                      |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 1 (12.5%)        | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Headache                   |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 1 (12.5%)        | 0 (0.0%)          | 2 (25.0%)         | 2 (18.2%)         | 0 (0.0%)          |
| Malaise                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Nausea                     |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 0 (0.0%)         | 0 (0.0%)          | 1 (12.5%)         | 0 (0.0%)          | 0 (0.0%)          |
| Any Local Event            |                  |                  |                   |                   |                   |                   |
| Mild                       | 5 (71.4%)        | 5 (62.5%)        | 5 (83.3%)         | 2 (25.0%)         | 7 (63.6%)         | 3 (37.5%)         |
| Induration                 |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0%)           | 0 (0%)           | 0 (0%)            | 0 (0%)            | 0 (0%)            | 0 (0%)            |
| Itch                       |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0%)           | 0 (0%)           | 0 (0%)            | 0 (0%)            | 0 (0%)            | 0 (0%)            |
| Pain                       |                  |                  |                   |                   |                   |                   |
| Mild                       | 4 (57.1%)        | 5 (62.5%)        | 5 (83.3%)         | 2 (25.0%)         | 6 (54.5%)         | 3 (37.5%)         |
| Redness                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 0 (0%)           | 0 (0%)            | 0 (0%)            | 0 (0%)            | 0 (0%)            |
| Swelling                   |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 0 (0%)           | 1 (16.7%)         | 0 (0%)            | 2 (28.6%)         | 0 (0%)            |
| Tenderness                 |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 2 (25.0%)        | 2 (33.3%)         | 0 (0%)            | 3 (27.3%)         | 0 (0%)            |
| Worsening Psoriasis        |                  |                  |                   |                   |                   |                   |
| Yes                        |                  |                  |                   |                   | 1 (16.7%)         | 1 (12.5%)         |
| Nausea                     |                  |                  |                   |                   | 1 (14.3%)         | 0 (0.0%)          |
| Mild                       | 0 (0%)           | 0 (0%)           | 0 (0%)            | 0 (0%)            | 0 (0%)            | 0 (0%)            |
| Soreness                   |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0%)           | 0 (0%)           | 0 (0%)            | 0 (0%)            | 0 (0%)            | 0 (0%)            |
| Fatigue                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 3 (37.5%)        | 1 (9.1%)          | 3 (37.5%)         | 2 (28.6%)         | 2 (28.6%)         |
| Malaise                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Fatigue                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Malaise                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Itch                       |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0%)           | 0 (0%)           | 0 (0%)            | 0 (0%)            | 0 (0%)            | 0 (0%)            |
| Headache                   |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 1 (12.5%)        | 0 (0.0%)          | 2 (25.0%)         | 1 (14.3%)         | 0 (0.0%)          |
| Fatigue                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 3 (37.5%)        | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Malaise                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Fever                      |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Headache                   |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Fatigue                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Malaise                    |                  |                  |                   |                   |                   |                   |
| Mild                       | 0 (0.0%)         | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Fever                      |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
| Headache                   |                  |                  |                   |                   |                   |                   |
| Mild                       | 1 (14.3%)        | 0 (0.0%)         | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          | 0 (0.0%)          |
### Appendix Table 3. Individual cytokine response following the first and second dose of COVID-19 vaccine BNT162b2 in study participants.

|                                | IL-2 response | IL-21 response | IFNγ response |
|--------------------------------|---------------|----------------|---------------|
| **1st Vaccine Dose**           |               |                |               |
| Healthy controls               | 10/15         | 8/15           | 9/15          |
| Patients on immunosuppressants | 54/67         | 57/67          | 43/67         |
| Patients on methotrexate       | 11/14         | 13/14          | 9/14          |
| Patients on TNF inhibitors     | 14/19         | 15/19          | 15/19         |
| Patients on IL17 inhibitors    | 12/14         | 12/14          | 7/14          |
| Patients on IL23 inhibitors    | 17/20         | 17/20          | 12/20         |
| Total 64/82                    | Total 65/82   | Total 52/82    |               |
| **2nd Vaccine Dose**           |               |                |               |
| Healthy controls               | 13/14         | 14/14          | 11/14         |
| Patients on immunosuppressants | 43/63         | 47/63          | 42/63         |
| Patients on methotrexate       | 7/13          | 8/13           | 7/13          |
| Patients on TNF inhibitors     | 13/19         | 15/19          | 14/19         |
| Patients on IL17 inhibitors    | 8/13          | 10/13          | 8/13          |
| Patients on IL23 inhibitors    | 15/18         | 14/18          | 13/18         |
| Total 56/77                    | Total 61/77   | Total 53/77    |               |

The threshold values for IL-2, IL-21 and IFNγ response were established as 14, 10 and 17 cytokine secreting cells per million PBMCs, respectively, at which the response was classified as positive.
Appendix Table 4. Clinical and demographic characteristics by cellular response.

|                          | Vaccine Dose 1 |                      | Vaccine Dose 2 |                      |
|--------------------------|----------------|----------------------|----------------|----------------------|
|                          | T cell response | No T cell response   | T cell response | No T cell response   |
| Number in each group     | N=68           | N=14                 | N=59           | N=18                 |
| Age (year)†              | 43.5 (32.0-51.0) | 44.5 (33.0-58.0)     | 41.0 (29.0-50.0) | 51.0 (40.0-58.0)     |
| Gender (male)            | 35 (51.5%)     | 8 (57.1%)            | 31 (52.5%)     | 11 (61.1%)           |
| BMI (kg/m²)†             | 28.3 (25.4-31.3) | 29.1 (24.0-35.3)     |                |                      |
| Ethnicity, n (%)         |                |                      |                |                      |
| White                    | 58 (85.3%)     | 13 (92.9%)           | 52 (88.1%)     | 14 (77.8%)           |
| Black                    | 1 (1.5%)       | 0 (0.0%)             | 0 (0.0%)       | 1 (5.6%)             |
| South Asian              | 8 (11.8%)      | 1 (7.1%)             | 7 (11.9%)      | 2 (11.1%)            |
| Mixed                    | 1 (1.5%)       | 0 (0.0%)             | 0 (0.0%)       | 1 (5.6%)             |
| Disease severity measure (psoriasis area severity index)† | 1.2 (0.3-2.3) | 0.8 (0.6-1.1) | 0.9 (0.0-2.1) | 1.8 (0.6-3.2) |
| Concomitant psoriatic arthritis, n (%) | 14 (20.6%) | 4 (28.6%)              |                |                      |
| Treatment group          |                |                      |                |                      |
| HV                       | 10 (14.7%)     | 5 (35.7%)            | 14 (23.7%)     | 0 (0.0%)             |
| MTX                      | 13 (19.1%)     | 1 (7.1%)             | 8 (13.6%)      | 5 (27.8%)            |
| TNFi                     | 15 (22.1%)     | 4 (28.6%)            | 15 (25.4%)     | 4 (22.2%)            |
| IL17i                    | 13 (19.1%)     | 1 (7.1%)             | 8 (13.6%)      | 5 (27.8%)            |
| IL23i                    | 17 (25.0%)     | 3 (21.4%)            | 14 (23.7%)     | 4 (22.2%)            |
| Time between vaccine doses (weeks) | -               | -                    | 10.0 (9.1-11.0) | 9.9 (9.7-10.1) |

† Median (IQR). HV, healthy volunteers; MTX, methotrexate; TNFi, TNF inhibitors; IL17i, IL-17 inhibitors; IL23i, IL-23 inhibitors.
Appendix Figure 1. Local and systemic adverse events reported within 14 days after the second COVID-19 vaccine BNT162b2 dose.
Proportion of participants in each study group reporting local and systemic adverse events following the second dose of COVID-19 vaccine BNT162b2. HV, healthy volunteers; MTX, methotrexate; TNFi, TNF inhibitors; IL17i, IL-17 inhibitors; IL23i, IL-23 inhibitors.

Symptoms were assessed according to the following scale: mild (no/minimal interference with activity and no/minimal medical intervention required), moderate (limitation in activity and medical intervention required), and severe (marked limitation in activity and medical intervention required).
Appendix Figure 2. Impact of time interval between vaccine doses upon neutralising antibody titres following the second COVID-19 vaccine BNT162b2 dose.

A. Prototypic (wild-type) strain by vaccine dose spacing

B. Alpha variant by vaccine dose spacing

C. Delta variant by vaccine dose spacing
Appendix Figure 3. Total T cell response (IFNγ, IL-2 or IL-21) after the first and second dose of COVID-19 vaccine BNT162b2, by study participant.

HV, healthy volunteers; MTX, methotrexate; TNFi, TNF inhibitors; IL17i, IL-17 inhibitors; IL23i, IL-23 inhibitors.

HV, healthy volunteers; MTX, methotrexate; TNFi, TNF inhibitors; IL17i, IL-17 inhibitors; IL23i, IL-23 inhibitors.
Appendix Figure 4. Individual cytokine response (IFNγ, IL-2, IL-21) after the first and second dose of COVID-19 vaccine BNT162b2.

Individual cytokine response, as determined by A) IFNγ, B) IL-2 and C) IL-21 responses to stimulation with peptides from total Spike peptide pools, reported as number of cytokine secreting cells per 10^6 cells in PBMC samples at day 28 following the first dose and at day 14 following the second dose of COVID-19 vaccine BNT162b2. The circles represent individual values. The red diamonds and range lines indicate the median and interquartile range (IQR), respectively. Horizontal dashed lines indicate the cytokine response threshold. In the IL23i group, filled circles represent participants receiving IL-23p19 inhibitors and hollow circles represent participants receiving IL-23p40/IL-12 inhibition.

HV, healthy volunteers; MTX, methotrexate; TNFi, TNF inhibitors; IL17i, IL-17 inhibitors; IL23i, IL-23 inhibitors.
Appendix Figure 5. Impact of time interval between vaccine doses upon total T cell response following the second COVID-19 vaccine BNT162b2 dose.

A. Spearman correlation between the time interval between the first and second doses of BNT162b2 and total T cell response post-second dose (cytokine secreting cells/10^6 PBMC).

B. Spearman correlation between the time interval between the first and second doses of BNT162b2 and the fold change in total T cell response post-first and second dose of BNT162b2.

HV, healthy volunteers; MTX, methotrexate; TNFi, TNF inhibitors; IL17i, IL-17 inhibitors; IL23i, IL-23 inhibitors.