Supplementary tables & figures:

1. Supplementary table 1: Search strategy
2. Supplementary table 2: Trial characteristics
3. Supplementary table 3: Antibody titres after the first dose of COVID-19 vaccine
4. Supplementary table 4: Antibody titres after a second dose of COVID-19 vaccine
5. Supplementary table 5: Seroconversion rates and serological titres after a third dose of COVID-19 vaccine
6. Supplementary figure 1. Subgroup analysis of cancer type among patients with haematological cancer after second dose
7. Supplementary figure 2. Subgroup analysis of disease type among IMID patients after second dose
8. Supplementary figure 3. Subgroup analysis of organ type among transplant recipients after second dose
9. Supplementary figure 4. Subgroup analysis of vaccine type among IMID patients after second dose
10. Supplementary tables 6 to 11: Subgroup analyses performed of seroconversion RR amongst immunocompromised patients
11. Supplementary tables 12 to 17: Mixed effects meta-regression of RRs against potential effect moderators (continuous and categorical study-level characteristics) for the longitudinal association of immunocompromised states with seroconversion RR after first and second doses of COVID-19 vaccines
12. Supplementary table 18: Meta-analyses of seroconversion risk and seroconversion RR compared to immunocompetent individuals after the first dose of COVID-19 vaccine in subgroups, stratified by categorical study-level characteristics
13. Supplementary table 19: Meta-analyses of seroconversion risk and seroconversion RR compared to immunocompetent individuals after the second dose of COVID-19 vaccine in subgroups, stratified by categorical study-level characteristics
14. Supplementary table 20: Risk of bias of all included controlled observational studies using the ROBINS-I scale
15. Supplementary figures 5 to 13: Absolute risk of seroconversion among immunocompromised patients after the first and second dose
16. Supplementary figures 14 to 21: Funnel plots with trim-and-fill imputation of potentially missing studies after first dose and second dose in immunocompromised patients

Supplementary table 1: Search strategy

Database	Search terms	Results
CENTRAL	("coronavirus" OR "coronavirus" OR "covid 2019" OR "SARS2" OR "SARS-CoV-2" OR "SARS-CoV-19" OR "novel cov" OR "2019ncov" OR "sars cov2" OR "cov22" OR "ncov" OR "covid-19" OR "covid19" OR "coronaviridae" OR "corona virus") in All Fields AND ("vaccine" OR "vaccination" OR vaccination OR vaccin*) in All Fields AND ("cancer" OR "malignancy" OR "malign*" OR "immunocompromise" OR "immunocompromised" OR "immunodeficiency" OR "immunodeficient" OR "immunodef*" OR "immunocompr*" OR "chemotherapy" OR "chemo*" OR "immunosuppressed" OR "immunosuppression" OR "immunosupp*" OR "rheumatology" OR "rheumatic" OR "rheum*" OR "autoimmune" OR "autoimmunity" OR "transplant" OR "solid organ" OR steroids OR antineoplastic agents OR chemotherapy OR cytotoxicity OR immunologic OR antirheumatic agents OR immunosuppressive agents or steroid* or corticosteroid* or (antineoplastic* AND agent*) OR chemotherap* or cytotoxic*) in All Fields All filters activated Search limits: 1 December 2020 to 5 November 2021	201
MedLine via PubMed	("coronavirus"[MeSH] OR "coronavirus"[All Fields] OR "covid 2019"[All Fields] OR "SARS2"[All Fields] OR "SARS-CoV-2"[All Fields] OR "SARS-CoV-19"[All Fields] OR "novel cov"[All Fields] OR “2019ncov”[All Fields] OR “sars cov2”[All Fields] OR “cov22”[All Fields] OR “ncov”[All Fields] OR “covid-19”[All Fields] OR “covid19”[All Fields] OR “coronaviridae”[All Fields] OR "corona virus"[All Fields]) AND (“vaccine”[MeSH] OR “vaccination”[MeSH] OR vaccine[All Fields] OR vaccination[All Fields] OR vaccin*[All Fields]) AND (“cancer”[MeSH] OR “cancer” OR “malignancy” OR “malign*” OR “immunocompromise”[All Fields] OR “immunocompromised”[All Fields] OR “immunodeficiency”[All Fields] OR “immunodeficient”[All Fields] OR “immunodef*”[All Fields] OR “immunocompr*”[All Fields] OR “chemotherapy”[All Fields] OR “chemo*”[All Fields] OR “immunosuppressed”[All Fields] OR “immunosuppression”[All Fields] OR “immunosupp*”[All Fields] OR “rheumatology”[All Fields] OR “rheumatic”[All Fields] OR “rheum*”[All Fields] OR “autoimmune”[All Fields] OR “autoimmunity”[All Fields] OR “transplant”[All Fields] OR “solid organ”[All Fields] OR steroids[MeSH] OR antineoplastic agents[MeSH] OR chemotherapy[MeSH] OR cytotoxicity[MeSH] OR immunologic[MeSH] OR antirheumatic agents[MeSH] OR immunosuppressive agents[MeSH] or steroid* or corticosteroid* or (antineoplastic* AND agent*) OR chemotherap* or cytotoxic*) Search limits: 1 December 2020 to 5 November 2021	3411

EMBASE	('coronavirinae'/exp OR 'coronavirinae' OR 'coronaviridae infection'/exp OR 'coronaviridae infection' OR 'coronavirus disease 2019'/exp OR 'coronavirus'/exp OR coronavirus OR 'coronavirus infection'/de) AND ('vaccination'/exp OR vaccine OR vaccination OR vaccin*) AND ('cancer' OR 'malignancy' OR 'immunocom*' OR 'immunodef*' OR 'immunosupp*' OR 'immunomod*' OR 'immunocompromised patient'/exp OR 'immune deficiency'/exp OR 'malignant neoplasm'/exp OR 'chemotherapy'/exp OR 'autoimmune disease'/exp OR 'steroid*' OR 'transplant'/exp OR 'solid organ' OR 'immunosuppressive agent'/exp OR 'rheumatic disease'/exp OR immunosuppressed OR rheumatic OR rheumatoid OR autoimmune OR 'autoimmunity'/exp) NOT [medline]/lim Search limits: 1 December 2020 to 5 November 2021	1507

Supplementary table 2: Trial characteristics

Source	Vaccine	n, Population(s) of interest	Age†	Gender‡	Country/Region	n, Comparison	Immunoassay	Threshold for positive response	Endpoints of data collection
Solid cancers									
Monin et al, 2021 (a)*	BNT162b2 (mRNA)	95, solid cancer Women's: 33 (35%) Urological: 15 (16%) Skin: 12 (13%) Thoracic: 21 (22%) Gastrointestinal: 12 (13%) Head and neck: 1 (1%) Glioblastoma: 1 (1%)	Patients: 73.0 (64.5-79.5) (All patients) Control: 40.5 (31.3-50.0)	Patients: 78/151 (48%) (All patients) Controls: 28/54 (52%)	UK	54, healthy controls	Multiple assays in conjunction	Multiple assays in conjunction	3 weeks and 5 weeks after first dose
Terpos et al, 2021 (a)	BNT162b2 (mRNA), mRNA-1273 (mRNA), AZD1222 (Viral vector)	59, cancer patients on checkpoint inhibitors Lung: 16 (27.1%) Bladder: 15 (25.4%) Kidney: 11 (18.6%) Uterine: 5 (8.5%) Pancreatic: 3 (5.1%) Others: 8 (13.6%)	Patients: 66 (61-76) Controls: 64 (59-82)	Patients: 36/59 (61.0%) Controls: NIL	NIL	283, healthy controls	cPass SARS-CoV-2 NAbs Detection Kit, GenScript	Positive serology: NAb titres of ≥30%	22 days after first dose
Palich et al, 2021 (a)	BNT162b2 (mRNA)	110, Cancer Breast: 37 (34%) Lung: 15 (14%) Gynaecological: 15 (14%) Prostate: 11 (10%) Digestive: 8 (7.3%) Kidney: 7 (6.4%) Bladder: 5 (4.5%) Upper aero-digestive tract: 6 (5.5%)	Patients: 66 (54-74) Controls: 55 (38-62)	Patients: 66/110 Controls: 18/25	France	25, healthy controls	Abbott SARS-CoV-2 IgG chemiluminescent microparticle immunoassay (CMIA)	Positive serology: >50 UA/ml	4 weeks after 1st dose

		Thyroid: 5 (4.5%) Others: 3 (2.7%)							
Palich et al, 2021 (b)	BNT162b2 (mRNA)	223, solid cancers Breast: 88 (40%) Digestive: 36 (16%) Lung: 31 (14%) Gynaecologic: 24 (11%) Prostate: 9 (4%) Bladder: 8 (3.6%) Pancreas: 8 (3.6%) Kidney: 6 (2.7%) Upper aero-digestive tract: 6 (2.7%) Others: 7 (3.1%)	Patients: 67 (60-75) Controls: 53 (47-60)	Patients: 81/223 (36%) Controls: 17/49 (35%)	France	49, healthy controls	Abbott IgG anti-SARS-CoV-2 Alinity system, and Roche Elecsys SARS-CoV-2 total Ig electrochemiluminescent immunoassay	Abbott positive serology: >50 UA/ml Roche positive serology: >0.8 U/mL	3-4 weeks after 2nd dose (a mean of 25 days between 2nd dose and serology for SCs, a mean of 7 days between 2nd dose and serology of HVs)
Massarweh et al, 2021	BNT162b2 (mRNA)	102, adult patients with solid tumors undergoing active intravenous anticancer treatment Gastrointestinal: 29 (28%) Lung: 26 (25%) Breast: 18 (18%) Brain: 9 (9%) Genitourinary: 8 (8%) Others: 12 (12%)	Patients: 66 (56-72) Controls: 62 (49-70)	Patients: 58 (57%) Controls: 23 (32%)	Israel	78, healthy controls	SARS-CoV-2 IgG II Quant assay (Abbott Laboratories Diagnostics)	Positive serology: >50 AU/mL	Median time of 38 (patient group) or 40 days (control) after 2nd dose
Eliakim-Raz et al, 2021	BNT162b2 (mRNA)	95, adult patients with solid tumors undergoing active intravenous anticancer treatment Gastrointestinal: 25 (26%) Lung: 24 (25%) Breast: 17 (18%) Brain: 9 (9%)	Patients: 65 (56-72) Controls: 62 (50-70)	Patients: 55/95 (58%) Controls: 21/66 (32%)	Israel	66, healthy controls	ARCHITECT® i2000sr Abbott Diagnostics	Positive serology: > 50 AU/mL.	4 months after 2nd dose

		Genitourinary: 8 (8%) Others: 12 (13%)							
Goshen-Lago et al, 2021	BNT162b2 (mRNA)	232 patients receiving active treatment for cancer Gastrointestinal: 63 (27%) Breast: 42 (18%) Genitourinary: 48 (21%) Gynaecologic: 11 (5%) Head and neck: 11 (5%) Lung: 45 (19%) Melanoma: 5 (2%) Neurologic: 5 (2%) Sarcoma: 2 (1%)	Patients: 68 (range: 25-88) mean(sd): 66 (12.09) Controls: 64 (25-81) mean(sd): 59 (15.7)	Patient: 132/232 (57%) Controls:118/261 (45%)	Israel	261, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay (DiaSorin S.p.A.)	Positive serology: > 15 AU/mL	>10 days after 1st dose 14 days after 2nd dose Repeated 4 weeks after the 2nd dose if negative
Linardou et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA), AZD1222 (Viral vector)	189, solid cancer patients Breast: 51 Lung (NSCLC): 37 Mesothelioma: 1 H&N: 1 Stomach: 6 Pancreatic: 11 Colorectal: 27 Ovarian: 11 Other gynaecological: 1 Bladder: 4 Prostate: 4 Kidney: 4 Testicular: 1 Melanoma: 3 Other: 7	Patients: 46.4% >60 years old Controls: 64% >60 years old	Patients: 124/288 (43.1%) Controls: 87/189 (46.0%)	Greece	99, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay (DiaSorin S.p.A.)	Positive serology: >33.8 BAU/mL	2-4 weeks after 2nd dose
Liontos et al, 2021 (a)	BNT162b2 (mRNA), mRNA-1273 (mRNA),	36, breast cancer patients	Patients: 64 (51–72) Controls: 63 (60-78)	All females	Greece	160, healthy controls	cPass SARS-CoV-2 NAbs Detection Kit, GenScript	Positive serology: Nab titre $\geq$ 30%	22 days after 1st dose 1 month after 2nd dose

	AZD1222 (Viral vector)								
Liontos et al, 2021 (b)	BNT162b2 (mRNA), mRNA-1273 (mRNA), AZD1222 (Viral vector)	25, prostate cancer patients	Patients:of 71(67–76) Controls: 74 (64–83)	All males	Greece	100, healthy controls	cPass SARS-CoV-2 NAbs Detection Kit, GenScript	Positive serology: Nab titre ≥ 30%	3 weeks after 1st dose 3-4 weeks post 2nd dose for mRNA / 7 weeks post 1st dose for AZD1222
Rahav et al, 2021 (c)	BNT162b2 (mRNA)	90, Solid cancer	64 (53-73)	44 (49.4%)	Israel	272, healthy controls	VSV-spike SARS-CoV-2 pseudo-virus neutralisation assay (Gert Zimmer)	Positive serology: RBD: 1.1 were defined positive	30 days after 2nd dose
Agbarya et al, 2021	BNT162b2 (mRNA)	140, patients with solid tumors GI: 48 (34.2%) Breast: 30 (21.4%) Lung: 27 (193%) Gynae: 9 (6.4%) Others: 13 (9.3%)	Patients: Mean (sd): 65.3 (1.4) Controls: Mean (sd): 62.5 (13)	Patients: 76/140 (54%) Controls: 80/140 (37.2%)	Israel	215, healthy controls	SARS-CoV-2 IgG II Quant assay (Abbott)	Positive serology: >150AU/mL	At least 7 days after 2nd dose
Di Noia et al, 2021	BNT162b2 (mRNA)	816, patients with solid tumors Breast: 250 (30.6%) Lung: 168 (20.6%) Melanoma GI: 70 (8.6%) Gynae: 46 (5.6%) Genitourinary: 89 (10.9%)	Patients: Median (range): 62 (21-97) Controls are age-matched.	Patients: 333/816 (40.8%) Controls are sex-matched.	Italy	274, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay (DiaSorin S.p.A.)	Positive serology: >15AU/mL	3 weeks after 1st dose 4 weeks after 2nd dose

		Sarcoma: 54 (6.6%) Head-Neck: 9 (1.1%) Cerebral: 3 (0.4%) NE tumor: 7 (0.9%							
Grinshpun et al, 2021	BNT162b2 (mRNA)	202, cancer patients on active treatment Breast: 66 (32.7%) Lung: 38 (18.8%) GI: 36 (17.8%) Genitourinary: 22 (10.9%) Gynae: 10 (5%) Others: 30 (14.9%)	Patients: Mean (sd): 62.1 (14.1) Controls: -	Patients: 89/202(44.1%) Controls: -	Israel	30, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay (DiaSorin S.p.A.)	Positive serology: >19AU/mL	Median of 77 days after 2nd dose
Iacono et al, 2021	BNT162b2 (mRNA)	36, patients with solid and haematological cancers Haematologic: 10 (27.3%) Solid: 26 (72.2%) Genitourinary: 9 (25%) GI: 8 (22.2%) Breast: 7 (19.4%) Others: 2 (5.5%)	Patients: Median (range): 82 (80-89) Controls: -	Patients: 15/36 (58.4%) Controls: -	Italy	Number of controls not specified.	Abbott IgG anti-SARS-CoV-2 Alinity system	Positive serology: >50AU/mL	1 month after 2nd dose
Shmueli et al, 2021	BNT162b2 (mRNA)	129, patients with solid tumor GI: 55 (42.6%) Breast: 26 (20.2%) Lung: 19 (14.7%) Melanoma: 14 (10.9%) Genitourinary: 10 (7.8%) Others: 5 (3.9%)	Patients: Mean(sd): 62.4 (12.81) Controls (first dose): Mean (sd): 47.28 (12.33) Controls (2nd dose):	Patients: 62/129 (58.1%) Controls (first dose): 76/348 (21.8%) Control (2nd dose):	Israel	348, controls (first dose) 261, controls (2nd dose)	An enzyme-linked immu-nosorbent assay (ELISA) that detects IgG (immuno-globulin G) antibodies against the RBD (receptor-binding domain) of SARS-CoV-2	Positive serology: $\geq$1.1	2-4 weeks after 1st dose 2-4 weeks after 2nd dose

			Mean (sd): 55.84 (14.34)	66/261 (25.3%)					
Shroff et al, 2021	Patients: BNT162b2 Controls: BNT162b2 and mrNA-1273	52, patients with solid tumor on immunosuppressive cancer therapy TO ADD ON	Patients: Mean (sd): 63.7 (9.14) Controls: Mean (sd): 41.3 (17.1)	Patients: 10/52 (19.2%) Controls: 17/50 (34%)	USA	50, healthy controls	ELISA for RBD	Not stated	5-9 days after 2nd dose
Zagouri et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA), AZD1222 (Viral vector)	21, breast cancer patients	Patients: 63 (46-76) Controls: 68 (58-82)	-	Greece	160, healthy controls	cPass SARS-CoV-2 NAbs Detection Kit, GenScript	Positive serology: > 30%	22 days after 2nd dose
Barriere et al, 2021	BNT162b2 (mRNA)	122, patients with active treatment for solid tumors at w3-4 42, patients with active treatment for solid tumor at w6-8	Patients: 69.5 (44-90) Controls: 53 (21-81)	Patients: 64/122 (52.5%) Controls: NIL	France	13, healthy volunteers at w3-4 29, healthy volunteers at w6-8	Elecsys® Anti-SARS-CoV-2immunoassay	Positive serology: ≥ 0.8 UI/ ml	During the booster (w3-w4) and 3-4 weeks after the booster (w6-w8).
Haematological cancers									
Monin et al, 2021 (b)*	BNT162b2 (mRNA)	56, haematological cancer Mature B-cell neoplasm: 38 (68%) Mature T-cell neoplasm: 5 (9%) Myeloid and acute leukemia neoplasms: 10 (18%) Others: 3 (5%)	Patients: 73.0 (64.5-79.5) (All patients) Control: 40.5 (31.3-50.0)	Patients: 78/151 (48%) (All patients) Controls: 28/54 (52%)	UK	54, healthy controls	Multiple assays in conjunction	Multiple assays in conjunction	3 weeks and 5 weeks after first dose

Herishanuet al, 2021	BNT162b2 (mRNA)	167, Chronic lymphocytic leukemia (CLL) / small lymphocytic leukemia	Patient: 71.0 (63.0-76.0) Controls are age- and sex-matched	Patients: 112/167 (67.1%)	Israel	52, healthy controls	Elecsys Anti-SARS-CoV-2 S assay on the cobas e 601 (Roche Diagnostics) analyzer	Positive serology: ≥ 0.80 U/mL	2-3 weeks after 2nd dose
Pimpinelli et al, 2021	BNT162b2 (mRNA)	42, multiple myeloma (45.7%) 50, myeloproliferative malignancies (54.3%)	Multiple myeloma: Median (range): 73 (47-78) Myeloproiferative: Median (range): 70 (28-80) Control: Median (range): 81 (79-87)	Multiple myeloma: 23/42 (54.7%) Myeloproiferative: 26/50 (52 %) Control: 18/36 (50%)	Italy	36, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay, DiaSorin	Positive serology: ≥ 15 AU/mL	3 weeks after 1st dose
Tzarfati et al, 2021	BNT162b2 (mRNA)	315 patients with haematologic malignancies Aggressive Non-Hodgkin's Lymphoma (NHL): 51 (16%) Indolent NHL: 40 (13%) Hodgkin lymphoma: 16 (5%) Multiple myeloma: 53 (17%) CLL: 34 (11%) Acute leukemia: 15 (5%)	Patients: 71 (61-78) Controls: 69 (58-74)	Patients: 176/315 (56%) Controls: 47/108 (44%)	Israel	108, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay, DiaSorin	Positive serology: ≥ 12 AU/ml	32-33 days after 2nd dose

		Myelodysplastic syndrome (MDS): 16 (5%) Myeloproliferative neoplasm (MPN): 68 (22%) Chronic myeloid leukemia (CML): 22 (7%)							
Malard et al, 2021	BNT162b2 (mRNA)	195, patients with haematologic malignancies <u>Lymphoid malignancies (136 (69.7%)</u> Acute lymphoblastic leukemia: 3 (1.5%) NHL: 44 (22.6%) Hodgkin lymphoma: 5 (2.6%) CLL: 26 (13.3%) Multiple myeloma: 52 (26.7%) MGUS: 6 (3%) <u>Myeloid malignancies; 59 (30.3%)</u> AML: 31 (15.9%) MDS: 10 (5.1%) MPN: 18 (9.2%)	Patients: Median (range): 68.9 (21.5-91.7) Controls: NIL	Patients: 117/195 (60%) Controls: NIL	France	30, healthy controls	SARS-CoV-2 IgG II Quant assay (Abbott Laboratories Diagnostics)	Positive serology: ≥ 3100 UA/mL correlating with NAb > 30%	28 days after 1st dose 14 days after 2nd dose
Parry et al, 2021	BNT162b2 (mRNA), AZD1222 (Viral vector)	299, patients with chronic lymphocytic leukemia	Patients: 69 (63-74) Controls: *Controls are age-matched.*	Patients: 159/299 (53.2%) Controls: NIL	UK	93, healthy controls	Roche Elecsys® electrochemiluminescence immunoassay (ECLIA) Dried blood spot ELISA analysis	Roche Elecsys® electrochemilumine scence immunoassay (ECLIA) Positive serology: ≥0.8 U/ml Dried blood spot ELISA analysis	5-6 weeks after 1st dose 2-3 weeks after 2nd dose

								Positive serology: ratio of 1 or more.	
Chowdhury, 2021	BNT162b2 (mRNA), AZD1222 (Viral vector)	59, patients with chronic myeloid malignancy CML: 12 (20.3%) Essential thrombocythemia: 16 (27.1%) Myelofibrosis (MF)/pre-fibrotic MF: 7 (11.9%) Polycythemia vera: 11 (18.6%) MDS: 13 (22.0%)	Patients; 62 (52-73) Controls: NIL	Patients: 27/59 (45.8%) Controls: NIL	UK	232, healthy controls	SARS-CoV-2 IgG II Quant assay (Abbott Laboratories Diagnostics)	Positive serology: ≥ 50 AU/ml	Median of 34 days
Gavriatopoulou et al, 2021 (a)	BNT162b2 (mRNA), AZD1222 (Viral vector)	58, patients with Waldenstrom Macroglobulinemia (WM), Chronic Lymphocytic Leukemia (CLL) and Non-Hodgkin Lymphoma (NHL) WM: 28 (48.3%) CLL: 22 (37.9%) NHL: 8 (13.8%)	Patients: Median (range): 75 (40-88) Controls: Median (range): 75 (61-95)	Patients: 28/58 (48.3%) Controls: 100/213 (46.9%)	Greece	213, healthy controls	cPass SARS-CoV-2 NAbs Detection Kit, GenScript	Positive serology: 30% and NAb titres ≥ 50% (clinically relevant viral inhibition) reported	3 weeks after 1st dose
Lindemann et al, 2021	111 comirnaty, 3 spikevax, 2 vaxzevria, 1 vaxzevria then comirnaty	117, HSCT Acute leukemia: 70 MDS: 18 MPN: 14 Lymphoma: 12 Other/ not specified: 3	Patients: Median (range): 59 (21-77) Controls: NIL	Patients: 56/117 (49.6%)	Germany	35, healthy controls	Anti-SARS-CoV-2 IgG semi-quantitative ELISA (Euroimmun, Lübeck, Germany)	Antibody ratio of ≥1.1	Median of 31 days after 2nd dose
Rahav et al, 2021 (a)	BNT162b2 (mRNA)	188 CLL/NHL, 187 multiple myeloma, 111 HSCT, 43 MDS	Patients: CLL/NHL: 69 (61-74) MM: 66 (59-73)	Patients: CLL/NHL: 102/188(54.3%)	Israel	272, healthy controls	VSV-spike SARS-CoV-2 pseudo-virus neutralisation assay (Gert Zimmer)	Positive serology: RBD: >1.1	30 days after 2nd dose

			HSCT: 62 (49-70) MDS: 73 (66-80)	MM: 117/187 (62.6%) HSCT: 70/111 (63.1%) MDS: 22/43 (51.2%)					
Marasco et al, 2021	BNT162b2 and mRNA-1273 (mRNA)s	59 (22.4%) with aggressive B-cell lymphoma, 111 (42.2%) with indolent B-cell lymphoma or CLL, 33 (12.6%) HL, 52 (19.8%) MM and 8 (3%) T-cell lymphoma	Patients: 121 (46%) ≥ 65 years	Patients: 140/263 (53.3%)	Italy	167, healthy controls	Roche Elecsys Anti-SARS-CoV-2 S	Not explicitly stated	4 weeks after 2nd dose
Gavriatopoulou et al, 2021 (b)	BNT162b2 (mRNA), AZD1222 (Viral vector)	106, patients with Waldenstrom macroglobulinemia	Patients: 73 (64-81) Controls: 66 (62-82)	Patients: 46/106 (43%) Controls 98/212 : (46%)	Greece	212, healthy controls	cPass SARS-CoV-2 NAbs Detection Kit, GenScript	>30% NAb	22 days after 1st dose 50 days after 1st dose (3 weeks after 2nd BNT162b2 or 6 weeks after 1st AZD1222)
Terpos et al, 2021 (b)	BNT162b2 (mRNA)	132, patients with chronic lymphocytic leukemia/ lymphoma Non-Hodgkin's lymphoma: 57 (43%) Hodgkin's lymphoma: 22 (17%) Chronic lymphocytic leukemia: 53 (40%)	Patients: Mean (sd): 64.6 (14.3) Controls: Mean (sd): 69.8 (12.5)	Patients: 66/132 (50%) Controls: 96/214 (44.9%)	Greece	214, healthy controls	cPass SARS-CoV-2 NAbs Detection Kit, GenScript	Seropositivity: NAb titres of ≥30%	Day 22 and 50 from first dose

Shem-Tov et al, 2021	BNT162b2 (mRNA)	152, allogeneic hemotopoeitic stem cell transplant recipients AML: 68 (44.7%) MDS: 23 (15.1%) MPD: 16 (10.5%) ALL: 12 (7.9%) NHL: 24 (15.8%) HL: 6 (3.9%) CLL: 2 (1.3%) AA: 1 (0.7%)	Patients: Mean (sd): 58.4 (14.0) Controls: Mean (sd): 55.6 (14.2)	Patients: 96/152 (63.2%) Controls: 66/272 (24.3%)	Italy	272, healthy controls	enzyme-linked immunosorbent assay (ELISA) that detects immunoglobulin G (IgG) antibodies against the receptor-binding domain (RBD) of SARS-CoV-2.9,10	Positive serology: titres > 1.1	2–4 weeks after the 2nd dose after 2nd dose
Sherman et al, 2021	mRNA- 1273 or BNT162b2	20, allogeneic stem cell transplant recipients	Patients: 66 Controls: 24	Patients: 10/20 (50%) Controls: 11/24 (45.8%)	USA	24, healthy controls	anti-SARS-CoV-2 S total antigen-capture (IgG, IgA, IgM) immunoassays on the cobas c602 (Roche Diagnostics, Indianapolis, IN)	Positive serology: ≥ 0.8 U/mL	About 28 days after 2nd dose
Peeters et al, 2021	BNT162b2 (mRNA)	41, patients with hematological malignancies	Patients: Mean (sd): 61.2 (11.5) Controls: Mean (sd): 46.8 (10.2)	Patients: 24/41 (58.5%) Controls: 11/40 (27.5%)	Belgium	40, healthy controls	ELISA for quantitative detection of immunoglobulin G (IgG) antibody levels to SARS-CoV-2 receptor-binding domain (RBD) antigen	Threshold for high responders: 200 IU/mL	28 days after booster dose
Lim et al, 2021	BNT162b2 (mRNA), AZD1222 (Viral vector)	129, patients with lymphoma	Patients: 69 (57-74) Controls: 45 (34-47)	Patients: 48/150 (37%) Controls: 100/150 (67%)	UK	150, healthy controls	IgG antibodies against SARS-CoV-2 spike (S), receptor binding domain (RBD), and nucleocapsid (N) antigens were measured using a qualified electrochemiluminescent assay (Meso Scale Discovery, Rockville, MD, USA)	Anti-S IgG concentrations of 0·55 BAU/mL or lower were below the lower limit of detection.	2 weeks after the first dose or 2–4 weeks after the 2nd dose

Ghione et al, 2021	BNT162 b2 (mRNA) , mRNA-1273 (mRNA)	86, patients with B-cell lymphoma	Patients: Median (range): 70 (35-91) Controls: Data not found	Patients: 45/86 (52.3%) Controls: Data not found	USA	201, healthy controls	KSL chemiluminescence immunoassays (CLIA) to detect anti-RBD antibodies	Positive serology: Value is greater than 1.0 COI	2 to 8 weeks after the final dose of the vaccine
Stampfe r et al, 2021	mRNA-1273 or BNT162 b2	103, patients with active multiple myeloma	Patients: Median (range): 68 (35–88) Controls: Median (range): 61 (26-85)	Patients: 61/103 (59.2%) Controls: 12/31 (38.7%)	USA	31, healthy controls	ELISA assay developed in own laboratory	No response (<50 IU/mL), partial response (50–250 IU/mL), and clinically relevant response >250 IU/mL)	Following their first (12–21 days after dosing) and 2nd (14–21 days following vaccination) doses
Canti et al, 2021	BNT162b2 (mRNA)	37, allogeneic hematopoietic stem cell transplantation recipients	Patients: Median (range): 60 (26-76) Controls: Median (range): 48 (23-64)	Patients: 19/21 (90.5%) Controls: 11/40 (27.5%)	Belgium	40, healthy controls	WANTAI (Beijing Wan-tai Biological Pharmacy Enterprise, Beijing, China) SARS-Cov-2 Ab ELISA	Not stated	Day 21 and 49 post-vaccination
Bitoun et al, 2021	BNT162b2	27, multiple myeloma	Age: Responders: Median (range): 69 (46-93) Non-responders: Median (range): (74 (47-86) Controls:	Patients: 12/27 (44.4%) Controls: 8/28 (28.6%)	France	28, healthy controls	Elecsys Anti- SARS-CoV-2 Cobas, Roche Diagnostics iFlash-2019-nCoV Nab assay, Yhlo	Roche: 0.4 IU/mL Yhlo: 24 IU/mL	1 month after 2nd dose

			Median (range): 58 (26-88)						
Organ transplant									
Yi et al, 2021	BNT162b2 (mRNA) or mRNA-1273	145, Kidney transplant	NIL	NIL	NIL	31, waitlisted patients with chronic kidney disease	Presence of anti-SARS-CoV-2 immunoglobulin (IgG) and total antibody, anti-SARS-CoV-2 nucleocapsid IgG, and antispike IgG titre	Seroconversion rate definitions not explicit.	Before 2nd dose
Grupper et al, 2021 (a)	BNT162b2 (mRNA)	136, kidney transplants	Patients: Mean (sd): 58.6 (12.7) Controls: Mean (sd): 52.7 (11.5)	Patients: 111/136 (8 1.6%) Controls: 8/25 (32%)	NIL	25, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay, DiaSorin	Positive serology: ≥15 AU/mL were considered as positive.	10-20 days after 2nd dose
Rabino wich et al, 2021	BNT162b2 (mRNA)	80, liver transplant	Patients: Mean (sd): 60.1 (12.8) Controls: Mean (sd): 63.22 (11.9)	Patients: 24/80 (30%) Controls: 17/25 (68%)	Israel	25, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay, DiaSorin	Positive serology: ≥15 AU/ml	10–20 days after 2nd dose
Mazzola et al, 2021	BNT162b2 (mRNA)	133, solid organ transplant with negative covid at baseline 143, solid organ transplant	Patients: 61 (55-67) Controls: 55 (38-62)	Patients: 102/143 (71.3%) Controls: 7/25 (22%)	France	25, healthy controls	Chemiluminescent microparticle immunoassays (CMIA) Anti-spike response	Positive serology: 50.0 AU/ml	28 days after 2nd dose
Sattler et al, 2021	BNT162b2 (mRNA)	39, kidney transplant	Patients: Mean (sd): 57.38 (14.04)	Patients: 28/39 (71. 8%)	Germany	39, healthy controls	ELISA-based analysis of SARS-CoV-2 spike SI domain-specific IgG and IgA (EUROIMMUN).	Positive serology: OD ratios of greater than 1.1	7-9 days after 2nd dose

			Controls: Mean (sd): 53.03 (17.58)	Controls: 20/39 (51.3%)					
Marinaki et al, 2021	BNT162b2 (mRNA)	34, solid organ transplant (10 kidney, 24 heart)	Patients: 60 (49.1-68.4) Controls: Age- and sex-matched	Controls: 27/34 (79.4%)	NIL - study investigators from Greece;	116, healthy	Anti-SARS-CoV-2-RBD IgG assay (Abbott SARS-CoV-2 IgG II Quant).	Positive serology: ≥50 AU/ml	Median of 10 days from 2nd dose
Miele et al, 2021	BNT162b2 (mRNA)	16, solid organ transplant recipient (5 kidney, 5 lung, 4 liver, 2 heart)	Patients: Mean (sd): 57 (15.9) Controls: Mean (sd): 44 (7.2)	Patients: 13/16 (81.2%) Controls: 10/23 (43.5%)	Italy	23, healthy	LIAISON SARS-CoV-2 S1/S2-IgG chemiluminescent assay, (DiaSorin)	Positive serology: ≥15 AU/ml	at least 15 days after 2nd dose
Peled et al, 2021	BNT162b2 (mRNA)	77, Heart transplant recipient	Patients: 62 (49-68) Controls: Mean (sd): 63 (13)	Patients: 50/77 (64%) Controls: 50/136 (37%).	Israel	136, healthy	In-house assay, anti-RBD IgG	Anti-RBD IgG Positive serology: Not reported	3 weeks after 2nd dose
Narasimhan et al, 2021	BNT162b2 (mRNA) or mRNA-1273 (mRNA)	73, lung transplant recipients	Median: 65 (53.5-69.5) Controls: NIL	Patients: 54/73 (74%) Controls: NIL	USA	49, non-transplanted and not had previous SARS-CoV-2 infection	Abbott IgG anti-SARS-CoV-2 Alinity system	No comparison of seropositivity between intervention and control group given, only comparison of seroconversion rates between and mRNA-1273 (mRNA)s.	Approximately 3 weeks following the 2nd dose

Rashidi-Alavijeh et al, 2021	BNT162b2 (mRNA)	43 liver transplant (LT) recipients	Patients: 57 (49-64) Controls: 43.5 (38-53.5)	Patients: 26/43 (60.5%) Controls: 9/20 (45%)	Germany	20, healthcare workers	LIAISON SARS-CoV-2 TrimericS IgG kit	Positive serology: ≥13.0 AU/mL	Median time after 2nd dose: 13 days for controls and 15 days for transplant recipients
Schramm et al, 2021	BNT162b2 (mRNA)	50, cardiothoracic transplant patients	Patients: Mean (sd): 55 (10) Controls: Mean (sd): 47 (10)	Patients: 32/50 (64%) Controls: 17/50 (34%)	Germany	50, healthy staff members	Abbott, Euroimmun and RocheElecsys Immunoassays	Positive serology: ≥7.1 BAU/ml	21 days after 2nd dose
Stumpf et al, 2021	BNT162b2 (mRNA) or mRNA-1273 (mRNA)	144, kidney transplant recipients	Patients: Mean (sd): 57.3 (13.7) Controls: Mean (sd): 48 (11.9)	Patients: 241/368 (65.5%) Controls: 34/144 (23.6%)	Germany	55, medical personnels	Euroimmun ELISAs on Euroimmun analyzers	Seroconversion definition not explicit.	3-4 week after 1st dose
Rincon-Arevalo et al, 2021	BNT162b2 (mRNA)	40, kidney transplant recipients	Patients: 62.4 (51.25-69.5) Controls: 51 (34-80)	Patients: 28/40 (70 %) Controls: 20/35 (57. 1%)	Germany	35, healthy controls	Euroimmun enzyme-linked immunosorbent assay (ELISA)	Seroconversion definition not explicit.	7 ± 2 days after boost vaccination (2nd dose),
Korth et al, 2021	BNT162b2 (mRNA)	23, renal transplant recipients	Patients: Mean (sd): 57.7 (13.5) Controls: Mean (sd): 44.4 (9.2)	Patients: 11/23 (48%) Controls: 9/23 (39%)	Germany	23, healthy controls	LIAISON SARS-CoV-2 TrimericS IgG kit	Positive serology: ≥13.0AU/mL	14 days after 2nd dose
Rahav et al, 2021 (d)	BNT162b2 (mRNA)	36 liver, 111 kidney, 80 heart transplant patients	Liver: 68.0 (51.0 to 71.0)	Patients: Liver: 19 (52.8%)	Israel	272, healthy	VSV-spike SARS-CoV-2 pseudo-virus	Positive serology: RBD: >1.1	30 days after 2nd dose

			Kidney: 60.0 (49.0 to 70.0) Heart: 61.5 (50.0 to 68.0) Controls: 63.0 (51.0 to 72.0)	Kidney:88 (79.3%) Heart: 55 (68.8%) Controls: 654 (65.3%)			neutralisation assay (Gert Zimmer)		
Prendecki et al, 2021 (b)	BNT162b2 (mRNA), AZD1222 (mRNA)	768, kidney transplant	Patients: 59 (Median) Controls: 42.8 (Median)	Patients: 65.7% Controls: 37.%	UK	40, healthy	SARS-CoV-2 IgG II Quant assay (Abbott Laboratories Diagnostics)	7.1 BAU/ml	31 days after 2nd dose
Ruether et al 2021	BNT162b2, mRNA-1273 and AZD1222 vaccines	141, liver transplant	Patients: Mean (sd): 53.8 (9.5) Controls: Mean (sd): 50.9 (11.6)	Patients: 79 (57.2%) male Controls: 19 (36.5%) male	Germany	52, healthy	DiaSorin LIAISON XL anti-SARS-CoV-2 TrimericS IgG ChemiLumi- nescent ImmunoAssay	33.8 BAU/mL	Median 29 days after 2nd dose
Bruminhent et al, 2021	CoronaVac (Inactivated)	37, kidney transplant recipients	Patients: 50 (42-54) Controls: -	Patients: 21/35 (60%) Controls: -	Thailand	38, healthy controls	Abbott SARS-CoV-2 IgG II Quantification assay	Those with anti-RBD antibody levels of > 50 AU/mL were characterized as having a seroconversion.14	2 weeks after 2nd dose
Crespo et al, 2021	Moderna mRNA-1273 or Pfizer BNT162b2 SARS-CoV-2 mRNA vaccines	90, kidney transplant recipients	Patients: Mean (sd): 59.7 (13.9) Controls: Mean (sd): 52.7 (10.7)	Patients: 35/90 (38.9%) Controls: 27/32 (84.4%)	Spain	32, healthy controls	LIAISON SARS-CoV-2 TrimericS IgG kit	Values reached ≥13.0 AU/ml were considered positive.	28 (+/- 3 days) from last vaccine dose

D'Offizi et al, 2021	BNT162b2 or mRNA-1273 anti-SARS-CoV2 vaccine	61, liver transplant recipients	Patients: 59 (56-61) Controls: 43 (36-53)	Patients: 43/61 (70%) Controls: 13/51(25.5 %)	Italy	51, healthy controls	ARCHITECT® i2000sr Abbott Diagnostics, Chicago, IL, USA	Positive serology: ≥7.2 Binding Arbitrary Units (BAU)/mL.	2 weeks after 2nd dose
Danthu et al, 2021	Pfizer/BioNTech (BNT162b2) mRNA vaccine	74, kidney transplant recipients	Patients: Mean (sd): 64.8 (11.5) Controls: Mean (sd): 51.6 (6.8)	Patients: 44/74 (59.5%) Controls: 4/7 (57.1%)	France	7, healthy controls	LIAISON SARS-CoV-2 TrimericS IgG	Positive serology: >13 AU/mL	36 days after 1st dose (8 days after 2nd dose)
Debska-Slizien et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA)	142, infection-naive kidney transplant recipients	Patients: 54 (43-63) Controls: 48 (45-62)	Patients: 83/142 (58.45%) Controls: 21/142 (58.3%)	Switzerland	36, healthy controls	LIAISON SARS-CoV-2 TrimericS IgG kit	Positive serology: >12 AU/mL	14–21 days following the 2nd one
Grupper et al, 2021 (b)	BNT162b2 (mRNA)	109, kidney transplant recipients	Patients: Mean (sd): 57 (12.9) Controls: Mean (sd): 53 (10.9)	Patients: 69/109 (67%) Controls:16/39 (41.0%)	Israel	39, healthy controls	LIAISON SARS-CoV-2 S1/S2 IgG chemiluminescent assay	Positive serology: >15 AU/mL	At least1 month after the 2nd dose
Hod et al, 2021	BNT162b2 (mRNA)	120, kidney transplant recipients	Patients: Mean (sd): 59.7 (13) Controls: Mean (sd): 57.04 (13.55)	Patients: 96/120 (80%) Controls: 141/202 (69.8%)	Israel	202, healthy controls	Enzyme-linked immunosorbent assay (ELISA) that detects IgG antibodies against the RBD of SARS-CoV-2 and SARS-CoV-2 pseudo-virus (psSARS-2) neutralization assay (NA)	Positive serology: RBD IgG ≥ 1.1 and the presence of NA capable of reducing viral replication by 50% at a 16-fold dilution or above.	2–4 wk following the 2nd vaccine dose

Kantaus kaite et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA)	225, kidney transplant recipients	Patients: 62 (54–70) Controls: 60 (54–69)	Patients: 146/225 (64.8%) Controls: 65/176 (37%)	Germany	176, controls	Anti-SARS-CoV-2-QuantiVac-ELISA (Euroimmun AG)	Positive serology: > 35.2 BAU/ ml	14 ± 2 days and 17 days post vaccination in KTRs and control group respectively.
Schmidt et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA), AZD1222 (Viral vector)	40, transplant recipients	Patients: Mean (sd): 54.5 (12.7) Controls: Mean (sd): 50.6 (11.9)	Patients: 22/40 (55%) Controls: 21/70 (30%)	Germany	70, controls	Anti-SARS-CoV-2-QuantiVac-ELISA (Euroimmun)	Positive serology: ≥35.2 BAU/ml	Median 14 days after 2nd dose
IMID									
Furer et al, 2021	BNT162 b2 (mRNA)	686, auto-immune inflammatory rheumatic diseases Rheumatoid arthritis (RA): 263 Psoriatic arthritis: 165 Axial spondyloarthritis: 68 Systemic lupus erythematosus (SLE): 101 Idiopathic inflammatory myositis: 19 Large vessel vasculitis: 21 Antineutrophil antibody (ANCA)- associated vasculitis: 26 Other vasculitis: 23	Patients: Median (range): 59 (19-88) Controls: Median (range): 50 (18-90)	Patients: 211/686 (30.7%) Controls: 43/121 (35.5%)	Israel	121, healthy controls	LIAISON (DiaSorin) quantitative assay.	Positive serology: ≥15 BAU	2-6 weeks after the vaccine dose

Rubbert-Roth et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA)	53, rheumatoid arthritis on DMARDs	NIL	NIL	Switzerland	20, healthy controls	Roche Elecsys Anti-SARS-CoV-2 spike subunit 1 (S1) assay	Positive serology: ≥15 U/mL	3 weeks after first dose and 2 weeks after dose
Deepak et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA)	133, chronic inflammatory disease Inflammatory bowel disease: 42 (31.6%) RA: 38 (28.6%) Spondyloarthritis: 20 (15%) Uveitis: 5 (3.8%) SLE: 15 (11.3%) Other connective tissue disease: 4 (3%) Sjogren's syndrome: 8 (6%) Vasculitis: 5 (3.8%) Autoinflammatory syndrome: 2 (1.5%) Multiple sclerosis: 9 (6.8%) Neuromyelitis optica: 1 (0.8%) IgG4-related disease: 2 (1.5%) Hidradenitis suppurativa: 1 (0.8%) HIV: 1 (0.8%) Anti-phospholipid syndrome: 1 (0.8%)	Patients: Mean (sd): 45.5 (16) Controls: NIL	Patients: 34/133 (25.6%) Controls: NIL	US	53, healthy controls	anti-S IgG quantification using ELISA, ELISpot assays to quantify recombinant S protein-binding IgG-secreting cells. Neutralization assays: fluorescence-based platform	Seroconversion definition not explicit.	1-2 weeks after 2nd dose
Achiron et al, 2021 (a)	BNT162b2 (mRNA)	125, multiple sclerosis	Patients: Data separated into subgroups	Patients: 53/125 (42.4%)	Israel	47, healthy controls	anti-spike protein-based serology (EUROIMMUN)	Positive serology: Index value of 1.1 or higher	1 month after 2nd dose

			Controls: 54.3 (43.1-61.9)	Controls: 17/47 (36.1%)					
Geisen et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA)	26, chronic inflammatory disease Psoriatic arthritis: 2 Psoriasis: 4 RA: 8 MCTD: 1 Spondyloarthropathy: 3 Crohn's: 2 Crohn's/Multiple sclerosis: 1 Giant cell vasculitis: 1 SLE: 2 Myositis: 1 Sarcoidosis: 1	Patients: Mean (sd): 50.5 (15.8) Controls: Mean (sd): 37.5 (13.4)	Patients: (9/26) 35.7% Controls: 13/42 (30.8%)	Germany	42, healthy controls	IgG antibodies against SARS-CoV-2 were quantified by ELISA according to manufacturer's protocol (EUROIMMUN Quan-tiVac).	Seroconversion data not available, and definition of seroconversion not explicit.	7 days after 2nd dose
Izmirly et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA), Ad26.COV2.S (Viral vector)	90, SLE patients	Patients: Mean (sd): 45.5 (14.2) Controls: Mean (sd): 45.3 (14.2)	Patients: 11/90 (12.2%) Controks: 8/20 (40%)	US	20, healthy controls	IgG seroreactivity to the SARS-CoV-2 spike receptor-binding domain (RBD) and SARS-CoV-2 microneutralization were used to evaluate B cell responses	Seroconversion data not available, and definition of seroconversion not explicit.	Median of 23 or 24 days between 2nd vaccine dose and post- vaccine blood draw
Mahil et al, 2021	BNT162b2 (mRNA)	84, patients with psoriasis 77, patients with psoriasis receiving immunosuppressants	Controls & Patients: 43 (31-52) Controls: 34 (27-46)	Patients: 47/84 (56.0%) Controls: 9/17 (53%)	UK	17, healthy controls	ELISA	Positive serology: EC50 value of 25 was used for anti-SARS-CoV-2 IgG titres	28 days after vaccination.

			Patients (reported in subgroups)						
Medeiros-Ribeiro et al, 2021	Corona Vac (Inactivated)	859, autoimmune rheumatic diseases Chronic inflammatory arthritis (RA, psoriatic arthritis, axial spondyloarthritis): 451 (49.6%) Other autoimmune rheumatic disease (SLE, primary vasculitis, systemic sclerosis, primary Sjogren;s syndrome, idiopathic inflammatory myopathies, primary anti-phospholipid syndrome): 459 (50.4%)	Patients: 51 (40-60) Controls: 50 (41-60)	Patients: 210/910 (23.1%) Controls: 42/182 (23.1%)	Brazil	179, healthy controls	A chemiluminescent immunoassay was used to measure human IgG antibodies against proteins S1 and S2 in the receptor-binding domain (RBD) (Indirect ELISA, LIAISON SARS-CoV-2 S1/S2 IgG, DiaSorin).	Positive serology: ≥15.0 UA/ml	28 days after 1st dose and 69 days after 2nd dose
Reuken et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA), AZD1222 (Viral vector)	28 patients with IBD were included in the analysis, among them 17 patients with Crohn's disease (CD) and 10 patients with ulcerative colitis (UC) and one with not defined IBD.	Patients: 42 (36-59) Controls: NIL (age- and sex-matched)	Patients: 15/28 (53.6%) Controls: NIL (age- and sex-matched)	Germany	27, healthy controls	LIAISON SARS-CoV-2 TrimericS IgG kit	Positive serology: SARS-CoV-2-specific trimeric spike glycoprotein ≥13 AU/ml or ≥33.8 BAU/ml	3 weeks after 1st dose
Seyahi et al, 2021	Corona Vac (Inactivated)	104 patients with immune-mediated diseases RA: 19 (18.3%)	Information in its subgroups of hospital workers	Patients: 35/104 (33.7%)	Turkey	347, healthy controls	Elecsys® Anti-SARS-CoV-2 assay (Roche Diagnostics International Ltd, Rotkreuz, Switzerland)	antibodies against receptor binding domain of the S1 spike protein (anti-	3 weeks after 2nd dose

		Connective tissue disease: 17 (16.3%) Spondyloarthropathies: 24 (23.1%) Behcet syndrome: 16 (15.4%) Familial Mediterranean fever: 10 (9.6%) Vasculitis: 7 IBD: 5 (4.8%) Others: 6 (5.8%)	and elderly population, unable to pool together.	Controls: 130/347 (37.5%)				spike SARS-CoV-2 IgG) Positive serology: ≥ 0.8 U/mL	
Haberman et al, 2021	BNT162b2 (mRNA)	<u>25 patients with IMID on methotrexate</u> Psoriasis and/or psoriatic arthritis: 15 (57.7%) RA: 10 (38.5%) Others: 1 (3.8%) <u>26 patients with IMID not on treatment</u> Psoriasis and/or psoriatic arthritis: 9 (36%) RA: 12 (48.0%) Others: 4 (16%)	IMID on MTX: Mean (sd): 63.2 (11.9) IMID no MTX: Mean (sd): 49.1 (14.9) Controls: Mean (sd): 49.2 (11.9)	IMID on MTX: 18/25 (72%) IMID no MTX: 18/26 (69.2%) Controls: 16/26 (61.5%)	USA	26, healthy controls	EUROIMMUN Analyzer I platform	Positive serology: 5000 units or greater	Healthy controls: 29.0 days (4.6) IMID no MTX: 32.5 days (5.0) IMID on MTX: 34.6 days (9.9)
Simon et al, 2021	BNT162b2 (mRNA)	84 patients with various IMIDs and immuno-modulatory therapy Spondyloarthritis: 27 (32.1%) RA: 25 (29.8%) IBD: 8 (9.5%) Psoriasis: 8 (9.5%) Systemic: 16 (19.1%)	IMIDs: Mean (sd): 53.1 (17.0) Controls: Mean (sd): 40.8 (12.0)	IMIDs: 29/84 (34.5%) Controls: 78/182 (42.9%)	USA	182, healthy controls	EUROIMMUN Analyzer I platform	Positive serology: ≥0.8 (OD 450 nm)	At least 10 days after vaccination

Prendecki et al, 2021 (a)	BNT162b2 (mRNA), AZD1222 (Viral vector)	119 ANCA-associated vasculitis and anti-GBM disease: 45 (37.8%) Podocytopathy: 28 (23.5%) Membranous glomerulonephritis: 23 (19.3%) SLE: 19 (16.0%) Others: 4 (3.4%)	Data stratified according to those who seroconverted and who did not, hence unable to obtain data for patient and controls.	Data stratified according to those who seroconverted and who did not, hence unable to obtain data for patient and controls.	UK	70, healthy controls	Abbott Architect SARS-CoV-2 IgG Quant II CMIA	7.1 binding antibody units (BAU)/mL	28-40 days after 1st dose 18-29 days after 2nd dose
Achiron et al, 2021 (b)	BNT162b2 (mRNA)	414, multiple sclerosis	Patients: Data reported in treatment subgroups, and was not pooled together. Control: mean (sd): 53.5 (15.4)	Patients: 132/414 (31.9%) Controls: 25/89 (28.1%)	Israel	503, healthy controls	ELISA kit based on the recombinant S1 protein from the SARS-COV-2 spike protein (Euroimmun, Lubeck, Germany).	Index values (signal to cut-off ratios) >1.1 were considered positive (	At least 28 days after 2nd dose
Ali et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA)	42, multiple sclerosis	Patients: Data reported in subgroups, and was not pooled together. Controls: Mean (sd): 41.6 (10.5)	Patients: 32/42 (76.2%) Controls: 32/42 (76.2%) 2/7 (28.6%)	USA	7, healthy controls	Siemens SARS-CoV-2 Spike RBD total antibody assay	Index value > 1	3 weeks after 2nd dose

Apostolidis et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA)	20, multiple sclerosis	Patients: Mean (sd): 40.35 (8.44) Controls: Mean (sd): 35.2 (9.9)	Patients: 5/20 (25%) Controls: 4/10 (40%)	USA	10, healthy controls	Qiagen	Not stated	25-30 days after 2nd dose
Boekel et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA), AZD1222 (Viral vector), Ad26.COV2.S (Viral vector)	632, patients with autoimmune conditions RA: 260 (41%) Psoriatic arthritis: 68 (11%) AS (68 (11%) Axial or peripheral spondyloarthritis: 6 (1%) Juvenile idiopathic arthritis 8 (1%) SLE: 33 (5%) Vasculitis: 11 (2%) Polymyalgia rheumatica: 37 (6%) Sjogren's syndrome: 33 (5%) Other rheumatic diseases: 103 (16%) MS: 58 (9%)	Patients: Mean (sd): 63 (11) Controls: Mean (sd): 63 (11)	Patients: 209/632 (33%) Controls: 94/289 (33%)	Netherlands	289, healthy controls	In-house ELISA Anti-RBD IgG	Not stated	1st dose: from 14 days after the first dose until 3 days after a second dose. 2nd dose: at least 7 days after the second dose.
Mrak et al, 2021	BNT162b2 (mRNA), mRNA-1273 (mRNA)	74, patients under rituximab treatment 2 (2.7%) IgG4-related disease, 22 (29.7%) connective tissue diseases, 33 (44.6%) RA, 17 (23%) vasculitis	Patients: 61.7 (13.3) Patients and controls were age-matched..	Patients: 17/74 (23.0%) Patients and controls were sex-matched.	Austria	15, healthy controls	Elecsys Anti-SARS-CoV-2 S immunoassay	Not stated	At a mean of 21.9days (range: 7–49 days) after the 2nd dose

Shinjo et al, 2021	CoronaVac (Inactivated)	53, patients with systemic autoimmune myopathies	Patients: Mean (sd): 50.7 (11.1) Controls: Mean (sd): 50.5 (10.6)	Patients: 13/53 (24.5%) Controls: 26/106 (24.5%)	Brazil	106, healthy controls	Indirect ELISA, LIAISONVR SARS-CoV-2 S1/S2 IgG, DiaSorin, Italy	Positive serology: >15.0 UA/ml	Day 28 after first dose
HIV									
Rahav et al, 2021 (b)	BNT162 b2 (mRNA)	156, HIV patients	Patients: 49 (42-57)	137 (87.8%)	Israel	272, healthy controls	VSV-spike SARS-CoV-2 pseudo-virus neutralisation assay (Gert Zimmer)	Positive serology: RBD: >1.1	30 days after 2nd dose
Jedicke 2021, et al	BNT162b2 (mRNA)	88, HIV patients	Patients: Mean (range): 53.5 (26-86) Controls: Mean (range): 44 (23-61)	Patients: 86/88 (97.7%) Controls: 32/41 (78.0%)	Germany	41, healthy controls	ELISA (QuantiVac; Euroimmun, Lübeck, Germany)	Not explicitly stated	Mean of 18.7 days (range 0–42 days) after the first and 35 days (range 1–128 days) after the boost vacci- nation.
Itzchak et al, 2021	BNT162b2 (mRNA)	143, HIV patients	Patients: Mean (sd): 49.8 (11.6) Controls: Mean (sd): 55.8 (14.3)	Patients: 131/143 (91.6%) Controls: 66/261 (25.3%)	Israel	261, healthy controls	ELISA that detects IgG antibodies against the receptor-binding domain (RBD) of SARS-CoV-2	Positive serology: $\geq$ 1.1	2-3 weeks following 2nd dose
Shabir et al, 2021	AZD1222 (Viral vector)	52, HIV patients	Patients: 37 (32-45) Controls: 34 (23-41)	Patients: 16/52 (31%) Controls: 17/29 (59%)	South Africa	24, healthy controls	Singleplex bead-based immunoassays were developed on the Luminex platform to quantitatively measure serum	Seropositive: >2-fold increase	Day 28 from first dose and 14 days post booster

							IgG binding to FLS and RBD		
Woldemeskel et al, 2021	BNT162b2 (mRNA)	12, HIV patients	Patients: Median (range): 52 (25-59) Controls: Median (range): 41 (24-59):	Patients: 5/12 (41.7%) Controls: 10/17 (58.8%)	USA	17, healthy controls	Euroimmun Anti-SARS-CoV-2 immunoglobulin G (IgG) ELISA	Not stated	Between 7 and 17 days after 2nd dose

*Study reported data amongst both solid cancer and haematological cancer patients

†Reported as median (IQR) unless otherwise stated

‡Reported as percentage of males unless otherwise stated

Supplementary table 3: Antibody titres after the first dose of COVID-19 vaccine

Source	Outcome	n, compromised	Median, unless otherwise stated	IQR, unless otherwise stated	n, controls	Median, unless otherwise stated	IQR, unless otherwise stated	Fold difference (Control / compromised)	Endpoints of data collection
Solid cancers									
Terpos et al, 2021	SARS-CoV-2 NAb inhibition	59	22%	13.4 to 30.2%	283	38%	23 to 54%	1.73	22 days after 1st dose
Goshen-Lago et al, 2021	SARS-CoV-2 S1/S2 IgG	86	42.3 AU/mL	-	261	72.0 AU/mL	-	1.70	10 days after 1st dose
Palich et al, 2021 (Dose 1)‡	SARS-CoV-2 anti-S IgG	64	359 UA/mL	178 to 998 UA/mL	25	680 UA/mL	360 to 930 UA/mL	1.89	Median 27 (Immunocompromised) and 23 days (Healthy) after 1st dose
Liontos et al, 2021 (Prostate)	NAb	25	37%	21 to 47%	100	31%	27 to 36%	-	22 days after 1st dose
Liontos et al, 2021 (Ovarian)	NAb	36	20.0%	5.5 to 31.9%	160	42.5%	28.1 to 58.7%	-	22 days after 1st dose
Zagouri et al, 2021	NAb	18	39.5%	-	160	42.83%	-	1.08	22 days after 1st dose
Di Noia et al, 2021	IgG	206	GMC: 23.32	1.61 to 337.69	219	236.37	GMC: 13.77 to 4055.91	10.1	3 weeks after 1st dose
Barriere et al, 2021	Anti-S antibodies	122	0.52 UI/ml	Range: 0 to 1962 UI/ml	13	21.6 UI/ml	Range: 3.26 to 723.2 UI/ml	41.5	Week 3-4 after 1st dose

Haematological cancers									
Chowdhury et al, 2021	SARS-CoV-2 anti-S IgG	59	75 AU/mL	19 to 328 AU/mL	232	630 AU/mL	284 to 1328 AU/mL	8.4	At least 14 days after 1st dose
Parry et al, 2021	SARS-CoV-2 Spike IgG	86	0.4 U/mL	-	95	41.6 U/mL	-	104	Median 43 days after 1st dose
Pimpinelli et al, 2021 (Multiple myeloma)	SARS-CoV-2 S1/S2 IgG	42	7.5 AU/mL	95%CI: 5.6 to 10.4 AU/mL	36	17.1 AU/mL	95%CI: 12.0 to 24.1 AU/mL	2.28	21 days after 1st dose
Pimpinelli et al, 2021 (Myeloproliferative neoplasms)	SARS-CoV-2 S1/S2 IgG	42	16.2 AU/mL	95%CI: 11.7 to 22.3 AU/mL	36	17.1 AU/mL	95%CI: 12.0 to 24.1 AU/mL	1.06	21 days after 1st dose
Sherman et al, 2021	Anti-S1 IgG	20	0.91 normalized average enzymes per bead (nAEB)	-	24	21.22 nAEB	-		At the time of 2nd dose
Gavriatopoulou (b)	Neutralising antibodies	90	28.2%	2.5%	174	41.3%	1.8%	-	Day 22 from 1st dose
Peeters	SARS-CoV-2 RBD-IgG	41	GMT: 4	-	40	GMT: 287	-	71.8	Day 21 from priming dose (1st dose)
Lim et al, 2021 (on treatment)	Anti-S IgG antibodies	33	GMT: 2·5 BAU/mL	95% CI: 1·1 to 5·8 BAU/mL	BNT162b2: 65 AZD1222: 20	GMT: BNT162b2: 2339 BAU/mL	95% CI: BNT162b2: 40 to 111 AZD1222: 140 to 282	BNT162b2: 935.6 AZD1222: 79.6	2–4 weeks after the second dose

						AZD1222: 199 BAU/mL			
Lim et al, 2021 (not on treatment)		30	GMT: 141·8 BAU/mL	95% CI: 75·6 to 266·0 BAU/mL				BNT162b2: 16.5 ChAdOx1: 1.40	2–4 weeks after the second dose
Stampfer et al, 2021	Anti-spike IgG	96	Median: 11.58 IU/mL	Standard deviation: 297.25 IU/mL	31	Median: 117.25 IU/mL	Standard deviation: 584.38 IU/mL	10.1	12–21 days after 1st dose
IMID									
Rubbert-Roth et al, 2021	SARS-CoV-2 anti-S1 IgG	51	0.4 U/mL	0.4 to 2.13 U/mL	20	99.2 U/mL	24.8 to 172 U/mL	248	3 weeks after 1st dose
Medeiros-Ribeiro et al, 2021	SARS-CoV-2 IgG	859	5.1 AU/mL	4.7 to 5.5 AU/mL	179	10.3 AU/mL	8.5 to 12.5 AU/mL	2.02	28 days after 1st dose
Reuken et afl, 2021	SARS-CoV-2 IgG	20	57.2 BAU/mL	-	23	105.0 BAU/mL	-		21 days after 1st dose
Mahil et al, 2021	SARS-CoV-2 IgG	77	43	25 to 162	17	101	55 to 200	2.35	28 days after 1st dose
Prendecki et al, 2021 (IMID)	anti-S	119	0.61 BAU/mL	0.03 to 9.8 BAU/mL	79	90 BAU/mL	40.7 to 199.8 BAU/mL	147.54	28-40 days after 1st dose
Shinjo et al, 2021	anti-SARS-CoV-2 S1/S2 IgG	37	GMT: 3.3	95% CI: 2.5 to 4.3	79	GMT: 9.6	95% CI: 7.2 to 12.9	2.91	28 days after 1st dose

Boekel et al (d1), 2021 (rheumatoid arthritis)	SARS-CoV-2 IgG	189	2.1 AU/mL	0.56 to 0.88 AU/mL	210	8.1AU/mL	3.8 to 21.5AU/mL	2.08	34 days (IQR 31–38) for patients and 36 days (34–41) after 1st dose
Boekel et al (d1), 2021 (ankylosing spondylitis)		45	7.5 AU/mL	3.1 to 19 AU/mL					
Boekel et al (d1), 2021 (systemic lupus erythematosus)		23	7.7 AU/mL	2.3 to 50 AU/mL					
Boekel et al (d1), 2021 (multiple sclerosis)		45	4.0 AU/mL	0.83 to 17 AU/mL					
Organ transplant									
Mazzola et al, 2021‡	SARS-CoV-2 Anti-spike Ab	9	153 AU/mL	129 to 860	Not reported	NIL	NIL	NIL	28 days after 1st dose
Schramm et al, 2021	SARS-CoV-2 IgG	50	(2 patients showed a response)	-	50	82 BAU/mL	41 to 149 BAU/mL	NIL	21 days after 1st dose
Prendecki et al, 2021 (Transplant)	Anti-S	768, infection-naive patients	BNT162b2: 34 BAU/mL ChAdOx1: 7.1 BAU/mL	BNT162b2: 7.1 to 861 BAU/mL AZD1222: 7.1-13 BAU/mL	65	BNT162b2: 815 BAU/mL AZD1222: 88 BAU/mL	BNT162b2: 318 to 2033 BAU/mL AZD1222: 47 to 395 BAU/mL	BNT162b2: 24.0 ChAdOx: 12.4	A median of 28 (controls) and 31 (patients) days after vaccination
Bruminhent et al (d1), 2021	Anti-RBD IgG	35	1.5 AU/mL	0.7 to 3.4 AU/mL	38	89.2 AU/mL	51.2 to 198.5 AU/mL	59.5	4 weeks after 1st dose

D'Offizi et al (d1), 2021	SARS-CoV-2 anti-Spike IgG	61	1.7 BAU/mL	0.47 to 9.12 BAU/mL	51	100.2 BAU/mL	54.70 to 231.60 BAU/mL	58.9	On day of 2nd dose (doses administered 3-4 weeks apart)
Canti et al (d1), 2021	Anti-RBD SARS-CoV-2 IgG	37	6 IU/mL	2.5 to 77.5 IU/mL	40	385.4 IU/mL	148.2 to 554.7 IU/mL	64.2	3 weeks after 1st dose
HIV									
Jedicke et al, 2021	Anti-S IgG	88	18.7 RU/mL	0 to 42 RU/mL	41	20 RU/mL	12–27 RU/mL	1.07	Mean of 18.7 days (range 0–42 days) after the priming dose

‡data was only reported amongst seropositive individuals

Supplementary table 4: Antibody titres after a second dose of COVID-19 vaccine

Source	Outcome	n, compromised	Median, unless otherwise stated	IQR, unless otherwise stated	n, controls	Median, unless otherwise stated	IQR, unless otherwise stated	Fold difference (Control / compromised)	Endpoints of data collection
Solid cancers									
Palich et al, 2021 (Dose 2)	SARS-CoV-2 anti-Spike IgG	111	252U/mL	-	24	2517U/mL	-	9.99	3-4 weeks after 2nd dose
Massarweh et al, 2021	SARS-CoV-2 IgG	102	1931 AU/mL	509 to 4386 AU/mL	78	7160AU/mL	3129 to 11241 AU/mL	3.71	Median of 38 (patients) or 40 days (controls) after 2nd dose
Eliakim-Raz et al, 2021	SARS-CoV-2 anti-Spike IgG	95	417 AU/mL	136 to 895 AU/mL	66	1220 AU/mL	588 to 1987 AU/mL	2.93	Approx 4 months after 2nd dose
Linardou et al, 2021	SARS-CoV-2 S1/S2 IgG	232	523 BAU/mL	Range: 4.81 to 2080 BAU/mL	100	2050 BAU/mL	Range: 4.81 to 2090 BAU/mL	3.92	2-4 weeks after 2nd dose
Liontos et al, 2021 (Prostate)	NAb	36	88%	62 to 95%	160	81%	44 to 94%	NIL	On day 22 (D22) (i.e., 3 weeks after vaccination) and on day 50 (3 or 4 weeks post 2nd dose for mRNA vaccines and 7 weeks post 1st dose for AZD1222 vaccine).

Liontos et al, 2021 (Ovarian)	NAb	25	83.6%	37.4 to 90.7%	100	92.9%	82.4 to 96.6%	NIL	On day 22, and one month after the second vaccination dose.
Rahav et al, 2021	RBD-IgG	90	GMT: 3.17	95%CI: 2.56 to 3.92	272	GMT: 5.98	95%CI: 5.70 to 6.28	1.89	30 days after 2nd dose
Shmueli et al, 2021	RBD-IgG	71	GMT: 3.25	95% CI: 2.7 to 3.9	348	GMT: 6.1	95% CI: 5.8 to 6.4	1.88	20 days (mean) after 2nd dose
Agbarya et al, 2021	SARS-CoV-2 anti-Spike IgG	140	2231 AU/mL	445 to 8023 AU/mL	215	4100 AU/mL	2231 to 6774 AU/mL	1.84	At least 7 days from 2nd dose
Di Noia et al, 2021	SARS-CoV-2 IgG	194	GMC: 236.37	13.77 to 4055.91	204	GMC: 262.98	101.42 to 681.96	1.11	7 weeks after 1st dose (4 weeks after 2nd dose)
Iacono et al, 2021	SARS-CoV-2 IgG	36	2396,10 AU/ml	Range: 0 to 32,763,00 AU/mL	-	8737,49 AU/ml	Range: 398.90 to 976,280,00 AU/mL	3.65	1 month after administering 2nd dose
Barriere et al, 2021	Anti-S antibodies	42	245.2 UI/ml	Range: 0 to 5467 UI/ml	24	2517 UI/ml	Range: 157.6 to 6318.0 UI/ml	10.3	Week 6-8 after 1st dose
Haematological cancers									
Herishanu et al, 2021	SARS-CoV-2 anti-Spike IgG	52	0.824U/mL	0.4 to 167.3U/mL	52	1084U/mL	128.9 to 1879U/mL	1315.5	2-3 weeks after 2nd dose
Parry et al, 2021	SARS-CoV-2 anti-Spike IgG	9	53 U/mL	-	59	3900 U/mL	-	73.6	Median 18 days after 2nd dose

Tzarfati et al, 2021	SARS-CoV-2 IgG	315	85 AU/mL	10.7 to 172 AU/mL	108	157 AU/mL	130 to 221 AU/mL	1.85	30-60 days after 2nd dose
Pimpinelli et al, 2021 (Multiple myeloma)	SARS-CoV-2 S1/S2 IgG	42	106.7 AU/mL*	95%CI: 62.3 to 179.7 AU/mL	36	353.3 AU/mL*	95%CI: 255.6 to 470.0 AU/mL	3.31	14 days after 2nd dose
Pimpinelli et al, 2021 (Myeloproliferative neoplasms)	SARS-CoV-2 S1/S2 IgG	50	172.9 AU/mL*	95%CI: 106.5 to 257.0 AU/mL	-	-	-	2.04	14 days after 2nd dose
Lindemann et al, 2021	SARS-CoV-2 anti-Spike IgG	117	Antibody ratio of 4.7	-	35	Antibody ratio of 9.0	-	1.91	Median 31 days after 2nd dose
Rahav et al, 2021 (Multiple myeloma)	RBD-IgG	187	GMT: 2.76	95%CI: 2.38 to 3.20	272	GMT: 5.98	95%CI: 5.70 to 6.28	2.17	30 days after 2nd dose
Rahav et al, 2021 (HSCT)	RBD-IgG	111	GMT: 2.55	95%CI: 2.03 to 3.21	272	GMT: 5.98	95%CI: 5.70 to 6.28	2.35	30 days after 2nd dose
Rahav et al, 2021 (Myelodysplastic)	RBD-IgG	43	GMT: 1.54	95%CI: 1.04 to 2.28	272	GMT: 5.98	95%CI: 5.70 to 6.28	3.88	30 days after 2nd dose
Rahav et al, 2021 (CLL/NHL)	RBD-IgG	188	GMT: 1.18	95%CI: 0.97 to 1.43	272	GMT: 5.98	95%CI: 5.70 to 6.28	5.07	30 days after 2nd dose
Marasco et al. 2021	RBD-IgG	263	175 U/mL	0.44 to 2600 U/mL	167	1078 U/mL	643 to 1841 U/mL	6.16	2 weeks after 2nd dose
Peeters et al. 2021	RBD-IgG	41	17.61 IU/mL	95% CI: 7.17 to 43.24 IU/mL	40	2955.04 IU/ML	2280.17 to 3829.65 IU/mL	167.80	28 days after 2nd dose

Shem-Tov et al, 2021*	RBD-IgG	118	GMT: 2.61	95% CI: 2.16 to 3.16	269	GMT: 5.98	95% CI: 5.70 to 6.28	2.29	28 days (median) after 2nd dose
Sherman et al, 2021	Anti-S1 IgG	20	136.39 nAEB	-	24	30.04 nAEB	-	4.54	28 days after 2nd dose
Gavriatopoulou (b)	Neutralising antibodies	90	52%	+/-4.3%	174	87.4%	+/-1.3%	1.68	Day 50 from 1st dose
Stampfer et al, 2021	Anti-spike IgG	96	Median: 173.72 IU/mL	Standard deviation: 1653.32 IU/mL	31	Median: 893.6 IU/mL	Standard deviation: 1474.76 IU/mL	5.1	14-21 days after 2nd dose
Organ transplant									
Rabinowich et al, 2021‡	SARS-CoV-2 anti-S1/S2 IgG	38	95.41AU/mL	Standard deviation: 92.4AU/mL	25	200.5AU/mL	Standard deviation: 65.1AU/mL	2.10	10-20 days after 2nd dose
Schramm et al, 2021	T-cell response following boost SARS-CoV-2 vaccination, The Interferon (IFN)-γ response to spike antigens SARS-CoV-2 peptides	50	0.031	0.007 to 0.141	50	0.512	0.172 to 1.281	16.52	21 days after boost dose
Mazzola et al, 2021‡	SARS-CoV-2 anti-Spike Ab	38	759 AU/mL	257 to 3269	Not reported	-	-	-	28 days after 2nd dose
Grupper et al, 2021 (a)	SARS-CoV-2 anti-Spike IgG	136	5.9 AU/mL	3.8-4.2	25	189.0 AU/mL	141.0-248 AU/mL	32.0	10-20 days after 2nd dose

Korth et al, 2021	SARS-CoV-2 IgG	23	50.9 AU/mL*	138.7†	23	727.7 AU/mL*	151.3†	14.30	15.8 +/− 3.0 days after 2nd dose
Marinaki et al, 2021	SARS-CoV-2 anti-RBD IgG	20	1370AU/mL	-	116	11710AU/mL	-	8.55	10 days after 2nd dose (median)
Miele et al, 2021	SARS-CoV-2 anti-S1/S2 IgG	16	87.32 UA/mL	-	23	233 UA/mL	-	2.67	At least 15 days after 2nd dose
Schramm et al, 2021	SARS-CoV-2 IgG	50	(5 patients showed a response)	-	50	1417 BAU/mL	732 to 2589 BAU/mL	-	21 days after 2nd dose
Rashidi-Alavijeh et al, 2021	SARS-CoV-2 IgG	43	216 BAU/mL	-	20	>2080 BAU/mL	-	>9.63	Median 15 days (IQR, 12–24) after 2nd dose
Narasimhan et al, 2021	SARS-CoV-2 IgG	73	1.7 AU/mL	95%CI: 0.6 to 7.5 AU/mL	49	14209 AU/mL	95%CI: 11261 to 18836 AU/mL	8358.24	Median 17.5 days (BNT162b2) or median 19 days (mRNA-1273) after 2nd dose
Hod et al, 2021	SARS-CoV-2 anti-RBD IgG	120	83.7*	95%CI: 50.52 to 138.8†	202	482.3*	95%CI: 410.9 to 566†	5.76	2-4 weeks after 2nd dose
Rahav et al. 2021 (Liver)	RBD-IgG	36	GMT: 2.14	95%CI: 1.46 to 3.14	272	GMT: 5.98	95%CI: 5.70 to 6.28	2.79	30 days after 2nd dose
Rahav et al. 2021 (Kidney)	RBD-IgG	111	GMT: 1.00	95%CI: 0.80 to 1.24	272	GMT: 5.98	95%CI: 5.70 to 6.28	5.98	30 days after 2nd dose

Rahav et al. 2021 (Heart)	RBD-IgG	80	GMT: 0.55	95%CI: 0.44 to 0.68	272	GMT: 5.98	95%CI: 5.70 to 6.28	10.9	30 days after 2nd dose
Prendecki et al, 2021 (BNT162b2)	anti-S IgG	410	58 BAU/mL	7.1 to 722 BAU/mL	32	815 BAU/mL	318 to 2033 BAU/mL	14.1	31 days after 2nd dose
Prendecki et al, 2021 (AZD1222)	anti-S IgG	358	7.1 BAU/mL	7.1 to 39 BAU/mL	8	88 BAU/mL	47 to 395 BAU/mL	12.6	31 days after 2nd dose
Ruether et al, 2021	Anti-S trimer	138	154 U/mL	1 to 1723 U/mL	52	Significantly lower than patients	-	-	Median 29 days after 2nd dose
Bruminhent et al (d2), 2021	Anti-RBD IgG	35	2.4 AU/mL	1.1 to 3.7 AU/mL	38	1742.0 AU/mL	747.0 to 3783.0 AU/mL	726	2 weeks after 2nd dose
Canti et al, 2021	Anti-RBD SARS-CoV-2 IgG	37	455 IU/mL	58.5 to 2007 IU/mL	40	3565 IU/mL	1593 to 5609 IU/mL	7.84	Day 49 after 1st dose
Crespo et al, 2021	SARS-CoV-2 anti-Spike IgG	90	139 AU/mL	43.4 to 440 AU/mL	32	734 AU/mL	532 to 1149 AU/mL	5.28	28 (+/- 3 days) from 2nd dose
D'Offizi et al (d2), 2021	SARS-CoV-2 anti-Spike IgG	61	82.5 BAU/mL	6.15 to 491.20 BAU/mL	51	1991 BAU/mL	1164 to 4451 BAU/mL	24.1	2 weeks after 2nd dose
Danthu et al, 2021	SARS-CoV-2 anti-Spike IgG	72	NA	NA	7	1082 AU/ml	293-5500 AU/mL	NA	36 days after 1st dose (8 days after 2nd dose)
Debska-Slizien[1]	Anti-S IgG	142	111 AU/mL	33.90 to 327 AU/mL	36	815 AU/mL	698.5 to 1440 AU/mL	7.34	

[1] Titre data reported refers to those who have seroconverted.

Grupper et al, 2021	SARS-CoV-2 anti-Spike IgG	109	10.7 AU/mL	0 to 62.5 AU/mL	39	156 AU/mL	99.7 to 215.5 AU/mL	14.6	At least 1 month after 2nd dose
Hod (b) et al, 2021	SARS CoV-2 anti-RBD IgG	120	GMT: 0.93	95% CI: 0.76 to 1.15	202	GMT: 6.02	95% CI: 5.66 to 6.42	6.47	2-4 weeks after 2nd dose
Kantauskaite et al, 2021	SARS-CoV-2 anti-Spike IgG	225	239 BAU/ mL	78 to 519 BAU/mL	176	1826 BAU/mL	560 to 3180 BAU/mL	7.64	14 +/- 2 days and 17 days post vaccination in KTRs and control group respectively
IMID									
Achiron et al (a), 2021 (Cladribine)	SARS-CoV-2 IgG	23	7.0	6.5 to 8.1	47	7.4	6.4 to 8.1	1.06	1 month after 2nd dose
Achiron et al (a), 2021 (Fingolimod)	SARS-CoV-2 IgG	26	0.27	0.12 to 0.45	47	7.4	6.4 to 8.1	27.41	1 month after 2nd dose
Achiron et al (a), 2021 (Ocrelizumab)	SARS-CoV-2 IgG	44	0.29	0.06 to 0.89	47	7.4	6.4 to 8.1	25.52	1 month after 2nd dose
Geisen et al, 2021	SARS-CoV-2 IgG	26	2053 BAU/mL*	1218 BAU/mL†	42	2685 BAU/mL*	1102BAU/mL†	1.31	7 days after dose 2
Haberman et al, 2021	SARS-CoV-2 IgG	25	46901	Range: 25 to 694528	26	104354	Range: 141 to 601185	2.23	1 week after 2nd dose
Furer et al, 2021	SARS-CoV-2 S1/S2 IgG	686	132.9 BAU/mL*	91.7 BAU/mL†	121	218.6 BAU/mL*	82.06BAU/mL†	1.65	2-6 weeks after 2nd dose

Simon et al, 2021	SARS-CoV-2 IgG	84	6.47*	3.14†	182	9.36*	1.85†	1.45	At least 10 days after 2nd dose
Reuken et al, 2021	SARS-CoV-2 IgG	12	1119 BAU/mL	-	12	1570 BAU/mL	-	1.40	21 days after 1st dose
Medeiros-Ribeiro et al, 2021	SARS-CoV-2 S1/S2 IgG	859	27.0 AU/mL	95%CI: 24.7 to 29.5 AU/mL	179	67.0 AU/mL	95%CI: 59.8 to 74.9 AU/mL	2.48	6 weeks after 2nd dose
Izmirly et al, 2021	SARS-CoV-2 Anti-RBD IgG	90	235.2 units/mL	75.9 to 531.4 units/mL	20	435.7 units/ mL	269.0 to 768.6 units/mL	1.85	A median of 23 to 24 days after 2nd dose
Prendecki et al, 2021	anti-S IgG	91	58.7 BAU/mL	0.8 to 437.2 BAU/mL	Not reported	877 BAU/mL	575 to 2203 BAU/mL	14.940	18-29 days after 2nd dose
Shinjo et al, 2021	anti-SARS-CoV-2 S1/S2 IgG	37	GMT: 16.6 AU/mL	95% CI: 9.7 to 28.3 AU/mL	79	GMT: 58.5 AU/mL	95% CI: 48.4 to 70.8 AU/mL	3.524	41 days after 2nd dose
Achiron et al (b), 2021 (untreated)	SARS-CoV-2 IgG	76	Median: 7.9	95% CI: 9.5 to 14.7	89	Median: 7.1	95% CI: 6.2 to 7.1	0.90	Within a median range of 2.3-6.3 months
Achiron et al (b), 2021 (alemtuzumab)	SARS-CoV-2 IgG	22	Median: 7.0	95% CI: 5.7 to 8.3	89	Median: 7.1	95% CI: 6.2 to 7.1	1.01	Within a median range of 2.3-6.3 months
Achiron et al (b), 2021 (cladribine)	SARS-CoV-2 IgG	48	Median: 6.6	95% CI: 5.7 to 8.3	89	Median: 7.1	95% CI: 6.2 to 7.1	1.08	Within a median range of 2.3-6.3 months

Achiron et al (b), 2021 (dimethyl fumarate)	SARS-CoV-2 IgG	35	Median: 7.6	95% CI: 7.1 to 7.9	89	Median: 7.1	95% CI: 6.2 to 7.1	0.93	Within a median range of 2.3-6.3 months
Achiron et al (b), 2021 (fingolimod)	SARS-CoV-2 IgG	42	Median: 0.3	95% CI: 0.3 to 0.7	89	Median: 7.1	95% CI: 6.2 to 7.1	23.7	Within a median range of 2.3-6.3 months
Achiron et al (b), 2021 (natalizumab)	SARS-CoV-2 IgG	32	Median: 7.3	95% CI: 6.6 to 7.8	89	Median: 7.1	95% CI: 6.2 to 7.1	0.97	Within a median range of 2.3-6.3 months
Achiron et al (b), 2021 (ocrelizumab)	SARS-CoV-2 IgG	114	Median: 0.2	95% CI: 0.6 to 1.2	89	Median: 7.1	95% CI: 6.2 to 7.1	35.5	Within a median range of 2.3-6.3 months
Achiron et al (b), 2021 (rituximab)	SARS-CoV-2 IgG	6	Median: 0.8	95% CI: -0.7 to 5.2	89	Median: 7.1	95% CI: 6.2 to 7.1	8.88	Within a median range of 2.3-6.3 months
Achiron et al (b), 2021 (teriflunomide)	SARS-CoV-2 IgG	39	Median: 6.8	95% CI: 6.1 to 7.2	89	Median: 7.1	95% CI: 6.2 to 7.1	1.04	Within a median range of 2.3-6.3 months
Boekel et al, 2021 (rheumatoid arthritis)	SARS-CoV-2 IgG antibody	31	47 AU/mL	18 to 131 AU/mL	40	87	45 to 205 AU/mL	1.78	At least 7 days after 2nd dose
Boekel et al, 2021 (ankylosing spondylitis)	SARS-CoV-2 IgG antibody	10	58 AU/mL	20 to 189 AU/mL	40	87	45 to 205 AU/mL	1.50	At least 7 days after 2nd dose
Boekel et al, 2021 (systemic lupus erythematosus)	SARS-CoV-2 IgG antibody	10	124 AU/mL	18 to 208 AU/mL	40	87	45 to 205 AU/mL	0.70	At least 7 days after 2nd dose

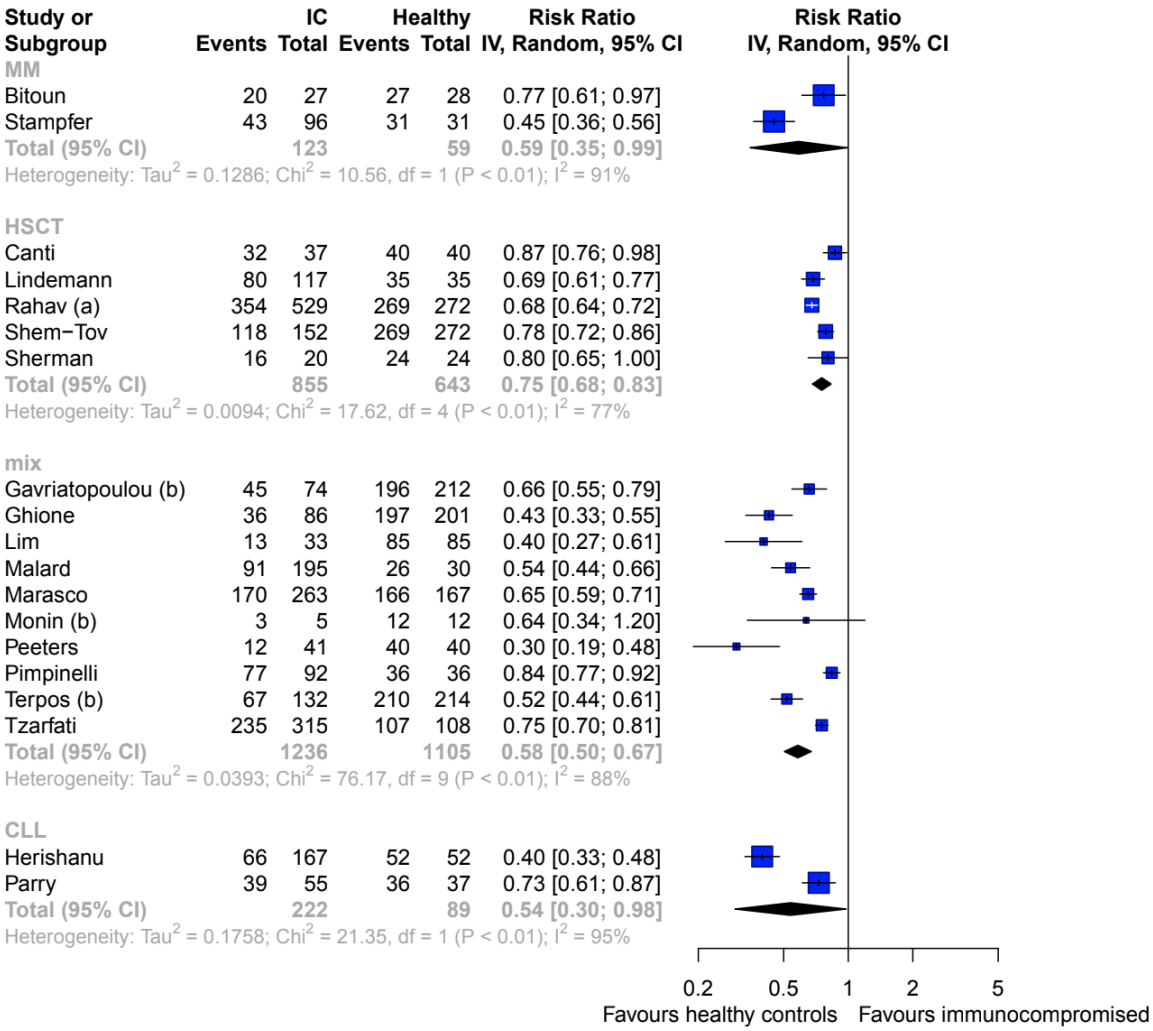
Boekel et al, 2021 (multiple sclerosis)	SARS-CoV-2 IgG antibody	7	9.0 AU/mL	0.75 to 34 AU/mL	40	87	45 to 205 AU/mL	9.67	At least 7 days after 2nd dose
Apostolidis et al, 2021	Anti-RBD	20	28.3	0.01	10	585	453	20.7	25-30 days after 2nd dose
HIV									
Rahav et al, 2021	RBD-IgG	156	GMT: 5.14	4.84 to 5.46	272	GMT: 5.98	95%CI: 5.70 to 6.28	1.16	30 days after 2nd dose
Jedicke et al	Anti-S IgG	52	35 RU/mL	1 to 128 RU/mL	41	26 RUmL	18 to 37 RU/mL	0.74	Mean of 35 days (range 1–128 days) after 2nd dose

*serological titres were measured and reported as means
†value is reported as standard deviation
‡data was only reported amongst seropositive individuals

Supplementary table 5: Seroconversion rates and serological titres after a third dose of COVID-19 vaccine

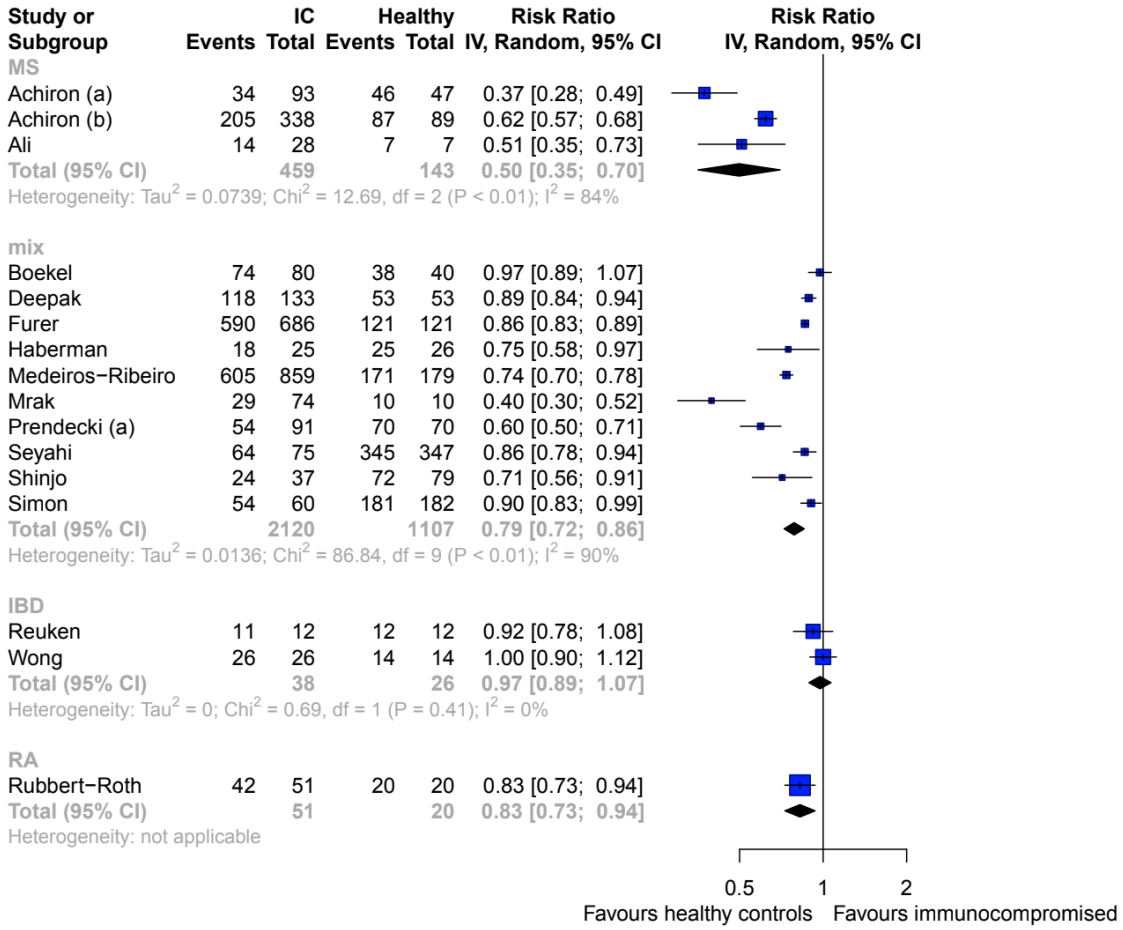
Source	Outcome	n, compromised	n, seroconverted	Country of study	Definition of response	Median	IQR, unless otherwise stated	n, controls	Endpoints of data collection
Solid cancers									
Shroff et al. 2021	Neutralising antibodies	20 patients, 10 seronegative after 2nd dose	5 (50.0%)	USA	Not explicitly stated	"16 participants demonstrated a median threefold increase in neutralizing antibody responses"		Controls did not receive third dose	1 week after 3rd dose
Haematological cancers									
Greenberger et al, 2021	Anti-RBD IgG	49 patients, 38 seronegative after 2nd dose	21 (55.3%)	USA	>0.8 AU/mL	32/49 (65.3%) had a rise in antibody level		No controls	Median of 28 days after 3rd dose
Organ Transplant									
Chavarot et al, 2021	Anti-spike IgG	62, kidney transplant	4 (6.5%)	France	>50 AU/mL	0 AU/mL	0 to 1 AU/mL	No controls	Mean of 28 days after 3rd dose
Benotmane et al, 2021	Anti-RBD	159, kidney transplant	78 (49.1%)	France	>50 AU/mL	NIL	NIL	No controls	Median of 28 days after 3rd dose
Del Bello et al, 2021	Various assays used in different patients	232, solid organ transplant patients seronegative after 2nd dose	105 (45.3%)	France	Various assays used in different patients	NIL	NIL	No controls	4 weeks after 3rd dose

Peled et al (b), 2021	Anti-RBD IgG or neutralizing antibodies	96, heart transplant	64 (66.7%)	Israel	Presence of either IgG anti-RBD or neutralizing antibodies	Anti-RBD GMT: 1.58	Anti-RBD 95% CI: 1.24 to 2.00	No controls	18 days after 3rd dose
Westhoff et al, 2021	SARS-CoV-2 anti-spike IgG	10, renal transplant	6 (60.0%)	France	Elecsys Anti-SARSCoV-2-S (Roche) manufacturer recommendations	542 U/mL	478 to 923 U/mL	No controls	2 weeks after third dose
Bertrand et al, 2021	Anti-spike IgG	80, kidney transplant	49 (61.2%)	France	50 AU/mL	2238.3 AU/mL	1934.4 to 7220.6 AU/mL	No controls	1 month after 3rd dose
Schrezenmeier et al, 2021	Anti-spike S1 IgG	25, kidney transplant	9 (36.0%)	Germany	OD ratios of ≥1.1	"Only three developed high titre anti–S1 IgG (OD IgG >5) whereas one was just above the threshold for positivity"		No controls	19-27 days after 3rd dose
Hall et al, 2021	Anti-RBD IgG and neutralising antibodies	60, transplant recipients	Intervention: 33 (55.0%) Controls: 10 (17.5%)	Canada	Anti-RBD >100U/mL	Intervention: 71% median neutralisation Controls: 13% median neutralisation	NIL	57, transplant recipients who received 2 doses of mRNA-1273 and one saline placebo	1 month after 3rd dose
IMID									
Schmiedeberg et al, 2021	Anti-SARS-CoV-2 S1	17, rheumatoid arthritis	15 (88.2%)	Switzerland	133 U/mL	2500 U/mL	798 to 2500 U/mL	No controls	2 weeks after 3rd dose
No studies were identified for HIV patients.									



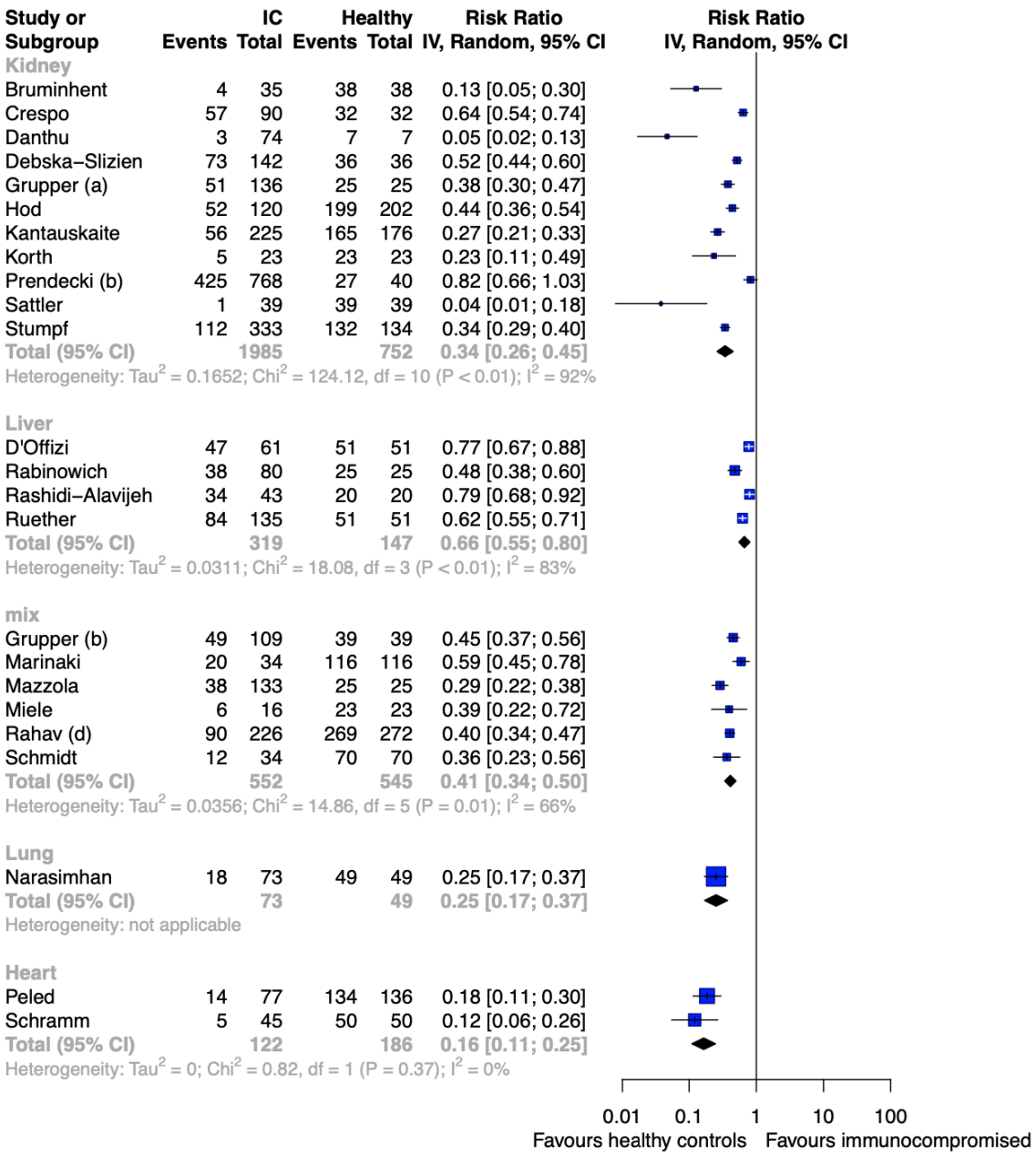
Supplementary figure 1. Subgroup analysis of cancer type among patients with haematological cancer after second dose

Abbreviations: MM, multiple myeloma; HSCT: haematopoietic stem cell transplant; CLL: chronic lymphocytic leukemia; CI, confidence interval; IC, immunocompromised



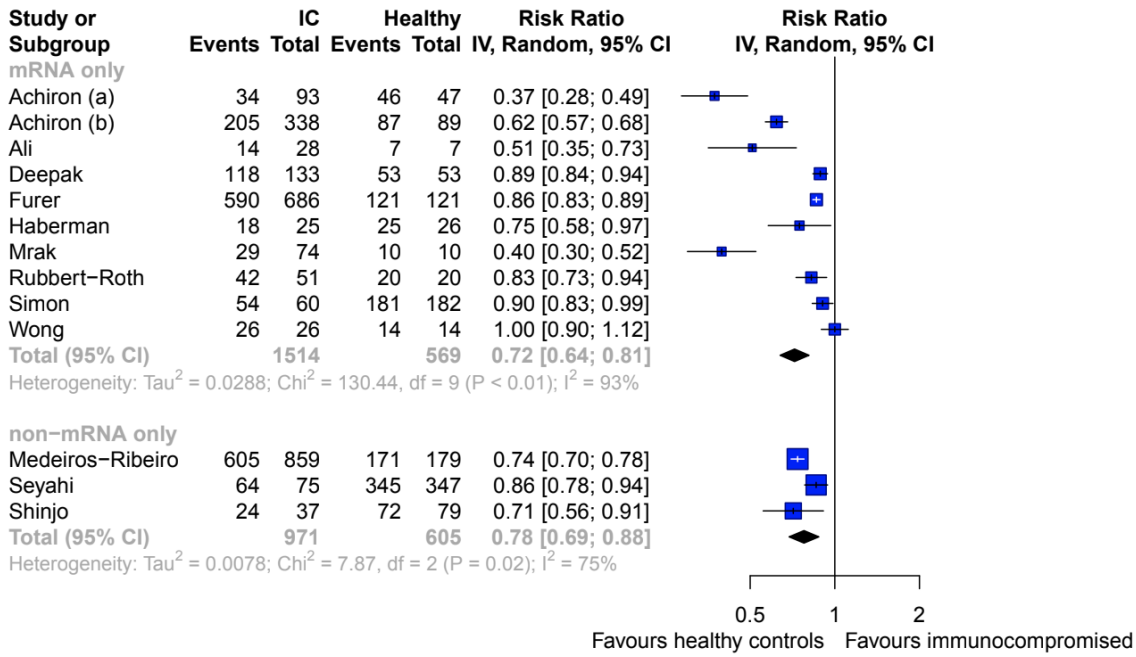
Supplementary figure 2. Subgroup analysis of disease type among IMID patients after second dose

Abbreviations: MS: multiple sclerosis; IBD: inflammatory bowel disease; RA: rheumatoid arthritis; CI: confidence interval; IC: immunocompromised



Supplementary figure 3. Subgroup analysis of organ type among transplant recipients after second dose

Abbreviations: CI: confidence interval; IC: immunocompromised



Supplementary figure 4. Subgroup analysis of vaccine type among IMID patients after second dose

Abbreviations: CI: confidence interval; IC: immunocompromised

Supplementary table 6: Subgroup analysis of seroconversion RR amongst solid cancer patients after the first dose of COVID-19 vaccine

Variable	Studies	RR (95% CI)	Test for subgroup differences (p-value)
Brand of serology kit			
LIAISON	2	0.49 (0.26 to 0.91)	0.5750
GenScript	5	0.64 (0.44 to 0.91)	
Nil / mixed	2	0.47 (0.34 to 0.63)	
Abbott	1	0.55 (0.46 to 0.66)	
Roche	1	0.48 (0.40 to 0.58)	
Country			
Italy	1	0.66 (0.59 to 0.74)	0.0044
Greece	4	0.61 (0.35 to 1.07)	
Israel	2	0.43 (0.28 to 0.67)	
UK	1	0.40 (0.28 to 0.57)	
France	2	0.51 (0.45 to 0.59)	
USA	1	0.69 (0.57 to 0.84)	

Abbreviations: RR, risk ratio; CI, confidence interval

Supplementary table 7: Subgroup analysis of seroconversion RR amongst haematological cancer patients after the first dose of COVID-19 vaccine

Variable	Studies	RR (95% CI)	Test for subgroup differences (p-value)
Brand of serology kit			
WANTAI	1	0.55 (0.41 to 0.73)	<0.0001
Abbott	1	0.60 (0.47 to 0.76)	
Roche	2	0.42 (0.28 to 0.62)	
Nil / mixed	2	0.25 (0.16 to 0.39)	
Siemens	1	0.06 (0.02 to 0.20)	
LIAISON	1	0.72 (0.48 to 1.08)	
GenScript	3	0.40 (0.24 to 0.68)	
Country			
Belgium	2	0.20 (0.02 to 1.70)	0.2124
UK	4	0.35 (0.22 to 0.55)	
Greece	3	0.37 (0.24 to 0.56)	
Italy	2	0.57 (0.41 to 0.80)	
Disease			
Haematopoietic stem cell transplant	1	0.55 (0.41 to 0.73)	0.0406
Study involved mixed conditions	8	0.41 (0.31 to 0.53)	
Chronic lymphocytic leukemia	1	0.33 (0.26 to 0.43)	

Abbreviations: RR, risk ratio; CI, confidence interval

Supplementary table 8: Subgroup analysis of seroconversion RR amongst solid cancer patients after the second dose of COVID-19 vaccine

Variable	Studies	RR (95% CI)	Test for subgroup differences (p-value)
Brand of serology kit			
Abbott	3	0.88 (0.85 to 0.92)	0.4313
LIAISON	3	0.91 (0.88 to 0.95)	
GenScript	3	0.91 (0.76 to 1.08)	
Nil / mixed	4	0.90 (0.84 to 0.96)	
Roche	1	0.95 (0.89 to 1.02)	
Country			
Israel	6	0.87 (0.85 to 0.90)	0.0009
Italy	1	0.93 (0.90 to 0.97)	
Greece	3	0.94 (0.86 to 1.03)	
UK	1	0.95 (0.86 to 1.05)	
France	2	0.94 (0.92 to 0.97)	
USA	1	0.79 (0.69 to 0.91)	

Abbreviations: RR, risk ratio; CI, confidence interval

Supplementary table 9: Subgroup analysis of seroconversion RR amongst haematological cancer patients after the second dose of COVID-19 vaccine

Variable	Studies	RR (95% CI)	Test for subgroup differences (p-value)
Brand of serology kit			
Yhlo	1	0.77 (0.61 to 0.97)	<0.0001
WANTAI	1	0.87 (0.76 to 0.98)	
Roche	4	0.62 (0.48 to 0.81)	
Euroimmun	1	0.69 (0.61 to 0.77)	
Abbott	1	0.54 (0.44 to 0.66)	
Nil / mixed	6	0.56 (0.46 to 0.68)	
Siemens	1	0.30 (0.19 to 0.48)	
LIAISON	2	0.79 (0.71 to 0.88)	
GenScript	2	0.58 (0.46 to 0.74)	
Country			
France	2	0.64 (0.45 to 0.91)	0.8016
Belgium	2	0.52 (0.19 to 1.47)	
Greece	2	0.58 (0.46 to 0.74)	
Israel	4	0.65 (0.55 to 0.77)	
Germany	1	0.69 (0.61 to 0.77)	
Italy	2	0.74 (0.58 to 0.95)	
UK	3	0.58 (0.39 to 0.88)	
USA	3	0.54 (0.36 to 0.81)	
Disease			

Multiple myeloma	2	0.59 (0.35 to 0.99)	0.0111
Haematopoietic stem cell transplant	5	0.75 (0.68 to 0.83)	
Study involved mixed conditions	10	0.58 (0.50 to 0.67)	
Chronic lymphocytic leukemia	2	0.54 (0.30 to 0.98)	

Abbreviations: RR, risk ratio; CI, confidence interval

Supplementary table 10: Subgroup analysis of seroconversion RR amongst IMID patients after the second dose of COVID-19 vaccine

Variable	Studies	RR (95% CI)	Test for subgroup differences (p-value)
Vaccine type			
mRNA	10	0.72 (0.64 to 0.81)	0.6502
non-mRNA	3	0.78 (0.69 to 0.88)	
Brand of serology kit			
Euroimmun	4	0.64 (0.47 to 0.87)	0.0002
Siemens	2	0.73 (0.38 to 1.41)	
Nil / mixed	2	0.92 (0.84 to 1.01)	
LIAISON	4	0.81 (0.72 to 0.91)	
Roche	3	0.68 (0.50 to 0.92)	
Abbott	1	0.60 (0.50 to 0.71)	
Country			
Israel	3	0.60 (0.43 to 0.84)	<0.0001
USA	4	0.83 (0.70 to 0.98)	
Netherlands	1	0.97 (0.89 to 1.07)	
Brazil	2	0.74 (0.70 to 0.78)	
Austria	1	0.40 (0.30 to 0.52)	
UK	1	0.60 (0.50 to 0.71)	
Germany	2	0.91 (0.84 to 0.98)	
Switzerland	1	0.83 (0.73 to 0.94)	
Turkey	1	0.86 (0.78 to 0.94)	

Disease			
Multiple sclerosis	3	0.50 (0.35 to 0.70)	<0.0001
Study involved mixed conditions	10	0.79 (0.72 to 0.86)	
Inflammatory bowel disease	2	0.97 (0.89 to 1.07)	
Rheumatoid arthritis	1	0.83 (0.73 to 0.94)	

Abbreviations: RR, risk ratio; CI, confidence interval

Supplementary table 11: Subgroup analysis of seroconversion RR amongst organ transplant patients after the second dose of COVID-19 vaccine

Variable	Studies	RR (95% CI)	Test for subgroup differences (p-value)
Brand of serology kit			
Abbott	7	0.37 (0.24 to 0.57)	<0.0001
LIAISON	9	0.45 (0.35 to 0.57)	
Thermo	1	0.44 (0.36 to 0.54)	
Euroimmun	4	0.29 (0.22 to 0.40)	
Nil / mixed	2	0.28 (0.13 to 0.60)	
Roche	1	0.62 (0.55 to 0.71)	
Country			
Thailand	1	0.13 (0.05 to 0.30)	<0.0001
Spain	1	0.64 (0.54 to 0.74)	
Italy	2	0.59 (0.31 to 1.13)	
France	2	0.13 (0.02 to 0.74)	
Poland	1	0.52 (0.44 to 0.61)	
Israel	5	0.39 (0.32 to 0.47)	
Switzerland	1	0.44 (0.36 to 0.54)	
Germany	8	0.33 (0.22 to 0.48)	
Greece	1	0.59 (0.45 to 0.78)	
USA	1	0.25 (0.17 to 0.37)	
UK	1	0.82 (0.66 to 1.03)	
Solid organ transplanted			

Kidney	11	0.34 (0.26 to 0.45)	<0.0001
Liver	4	0.66 (0.55 to 0.80)	
Lung	1	0.25 (0.17 to 0.37)	
Heart	2	0.16 (0.11 to 0.25)	
Study involved mixed conditions	6	0.41 (0.34 to 0.50)	

Abbreviations: RR, risk ratio; CI, confidence interval

Supplementary table 12: Mixed effects meta-regression of RRs against potential effect moderators (continuous and categorical study-level characteristics) for the longitudinal association of solid cancer with seroconversion RR after first dose of COVID-19 vaccine

	Ratio	P	95% CI Lower	95% CI Upper	I^2 (% residual heterogeneity)
Average age	0.9762	0.3003	0.9327	1.0217	73.82
ROBINS-I of moderate	0.9204	0.6429	0.6480	1.3071	76.62
Timepoint of 2-4 weeks	1.0486	0.8600	0.6480	1.7770	76.45

Abbreviations: RR, risk ratio; ROBINS-I, Risk Of Bias In Non-randomized Studies of Interventions; CI, confidence interval

Supplementary table 13: Mixed effects meta-regression of RRs against potential effect moderators (continuous and categorical study-level characteristics) for the longitudinal association of haematological cancer with seroconversion RR after first dose of COVID-19 vaccine

	Ratio	P	95% CI Lower	95% CI Upper	I^2 (% residual heterogeneity)
Average age	0.9815	0.5283	0.9262	1.0401	81.11
ROBINS-I of moderate	1.0624	0.8472	0.5744	1.965	81.58
Timepoint of 2-4 weeks	1.2331	0.6480	0.5016	3.0310	82.26
Timepoint of >=4 weeks	1.5433	0.3619	0.6073	3.9220	

Abbreviations: RR, risk ratio; ROBINS-I, Risk Of Bias In Non-randomized Studies of Interventions; CI, confidence interval

Supplementary table 14: Mixed effects meta-regression of RRs against potential effect moderators (continuous and categorical study-level characteristics) for the longitudinal association of solid cancer with seroconversion RR after second dose of COVID-19 vaccine

		P	95% CI Lower	95% CI Upper	I^2 (% residual heterogeneity)
Average age	1.011	0.0265	1.0012	1.0200	50.76
ROBINS-I of moderate	1.0191	0.5411	0.9592	1.0827	54.41
Timepoint of 2-4 weeks	1.0378	0.4898	0.9342	1.1529	53.67
Timepoint of >=4 weeks	1.0109	0.8398	1.5008	1.1227	

Abbreviations: RR, risk ratio; ROBINS-I, Risk Of Bias In Non-randomized Studies of Interventions; CI, confidence interval

Supplementary table 15: Mixed effects meta-regression of RRs against potential effect moderators (continuous and categorical study-level characteristics) for the longitudinal association of haematological cancer with seroconversion RR after second dose of COVID-19 vaccine

	Ratio	**P**	**95% CI Lower**	**95% CI Upper**	**I^2 (% residual heterogeneity)**
Average age	0.9870	0.2637	0.9644	1.0099	89.01
ROBINS-I of moderate	1.0984	0.5037	0.8342	1.4463	87.92
Timepoint of 2-4 weeks	0.9894	0.9773	0.4749	2.0612	88.52
Timepoint of >=4 weeks	1.0417	0.9140	2.0174	2.1893	

Abbreviations: RR, risk ratio; ROBINS-I, Risk Of Bias In Non-randomized Studies of Interventions; CI, confidence interval

Supplementary table 16: Mixed effects meta-regression of RRs against potential effect moderators (continuous and categorical study-level characteristics) for the longitudinal association of IMIDs with seroconversion RR after second dose of COVID-19 vaccine

	Ratio	P	95% CI Lower	95% CI Upper	I^2 (% residual heterogeneity)
Average age	0.9946	0.4587	0.9804	1.0089	90.37
ROBINS-I of moderate	1.3239	0.0030	1.0998	1.5938	90.93
Timepoint of 2-4 weeks	0.8714	0.3770	0.6422	1.1825	87.98
Timepoint of >=4 weeks	0.6942	0.0221	0.5079	0.9489	

Abbreviations: RR, risk ratio; ROBINS-I, Risk Of Bias In Non-randomized Studies of Interventions; CI, confidence interval

Supplementary table 17: Mixed effects meta-regression of RRs against potential effect moderators (continuous and categorical study-level characteristics) for the longitudinal association of transplant with seroconversion RR after second dose of COVID-19 vaccine

	Ratio	P	95% CI Lower	95% CI Upper	I^2 (% residual heterogeneity)
Average age	0.9725	0.2542	0.9271	1.0202	91.68
ROBINS-I of moderate	1.6977	0.0080	1.1479	2.5108	91.93
Timepoint of 2-4 weeks	1.7069	0.1423	0.8356	3.4872	92.92
Timepoint of >=4 weeks	2.5849	0.0157	1.1960	5.5868	

Abbreviations: RR, risk ratio; ROBINS-I, Risk Of Bias In Non-randomized Studies of Interventions; CI, confidence interval

Supplementary table 18: Meta-analyses of seroconversion risk and seroconversion RR compared to immunocompetent individuals after the first dose of COVID-19 vaccine in subgroups, stratified by categorical study-level characteristics

	Seroconversion risk			Seroconversion RR		
	Studies	**Risk (95% CI)**	**I^2**	**Studies**	**RR (95% CI)**	**I^2**
Population						
Solid cancer	11	0.44 (0.36-0.53)	84%	11	0.55 (0.46-0.65)	78%
Haematological cancer	11	0.29 (0.20-0.40)	89%	11	0.40 (0.32-0.50)	80%
Organ transplant	6	0.06 (0.04-0.08)	0%	6	0.06 (0.04-0.09)	0%
IMID	7	0.29 (0.11-0.58)	97%	7	0.53 (0.39-0.71)	89%
HIV/AIDS	1	0.69 (0.53-0.82)	NA	1	1.06 (0.74-1.54)	NA
Healthy	35	0.91 (0.83-0.95)	91%	Reference		

Abbreviations: RR, risk ratio; CI, confidence interval

Supplementary table 19: Meta-analyses of seroconversion risk and seroconversion RR compared to immunocompetent individuals after the second dose of COVID-19 vaccine in subgroups, stratified by categorical study-level characteristics

	Seroconversion risk			Seroconversion RR		
	Studies	**Risk (95% CI)**	**I^2**	**Studies**	**RR (95% CI)**	**I^2**
Population						
Solid cancer	14	0.89 (0.86-0.91)	49%	14	0.90 (0.88-0.93)	51%
Haematological cancer	19	0.62 (0.54-0.70)	90%	19	0.63 (0.57-0.69)	88%
Organ transplant	24	0.35 (0.26-0.46)	92%	24	0.39 (0.32-0.46)	92%
IMID	16	0.77 (0.66-0.85)	93%	16	0.75 (0.69-0.82)	92%
HIV	4	0.97 (0.83-1.00)	89%	4	1.00 (0.98-1.01)	0%
Healthy	73	0.99 (0.99-1.00)	61%	Reference		

Abbreviations: RR, risk ratio; CI, confidence interval.

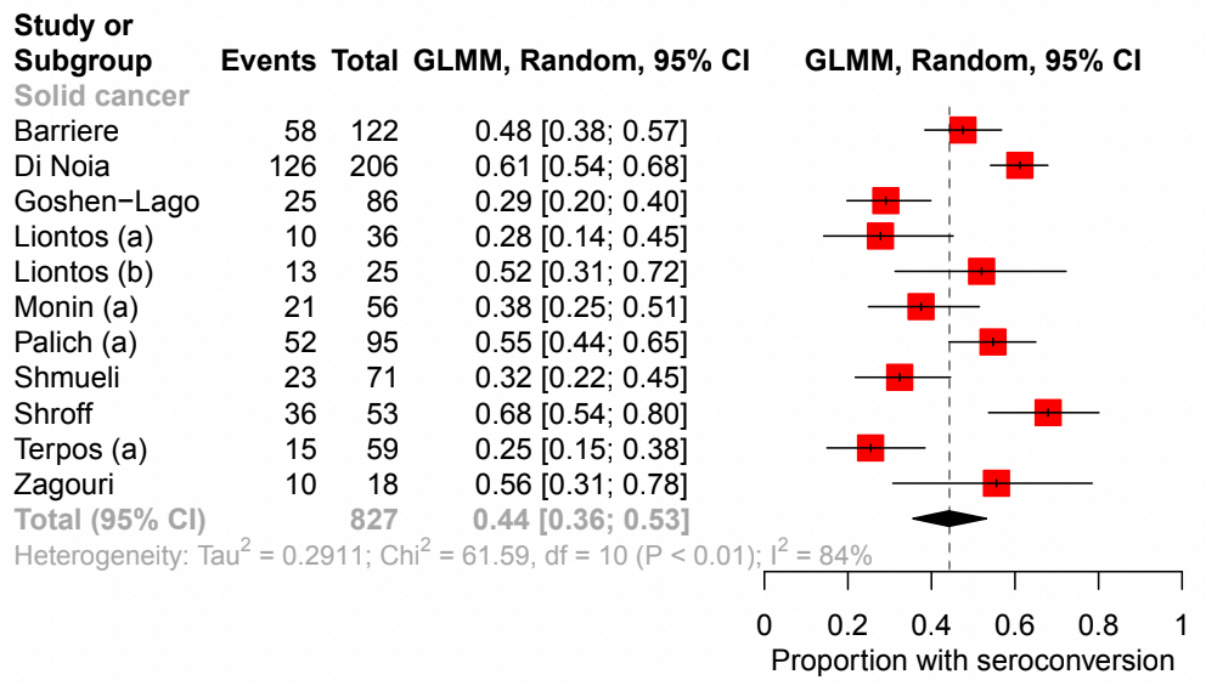
Supplementary table 20: Risk of bias of all included controlled observational studies using the ROBINS-I scale

	Domain 1: Risk of bias due to confounding	Domain 2: Bias in selection of participants into the study	Domain 3: Bias in classification of interventions	Domain 4: Bias due to deviations from intended interventions	Domain 5: Bias due to missing data	Domain 6: Bias in measurement of outcomes	Domain 7: Bias in selection of the reported result	Overall bias
Seyahi	L	L	L	L	L	L	L	L
Peled	L	L	L	L	L	L	L	L
Herishanu	L	L	L	L	L	L	L	L
Massarweh	L	L	L	L	L	L	L	L
Pimpinelli	M	L	L	L	L	L	L	M
Deepak	M	L	L	L	L	L	L	M
Achiron (a)	L	L	L	L	L	L	L	L
Danthu	L	L	L	L	L	L	L	L
Furer	L	L	L	L	L	L	L	L
Sattler	L	L	L	L	L	L	L	L
Rincon-Arevalo	L	L	L	L	L	L	L	L
Korth	L	L	L	L	L	L	L	L
Haberman	L	L	L	L	L	L	L	L
Grupper (a)	L	L	L	L	L	L	L	L
Monin	M	L	L	L	L	L	L	M
Simon	L	L	L	L	L	L	L	L
Rubbert-Roth	M	L	L	L	L	L	L	M
Chowdhury	L	L	L	L	L	L	L	L
Stephanie	M	L	L	L	L	L	L	M
Rabinowich	L	L	L	L	L	L	L	L
Terpos (a)	L	L	L	L	L	L	L	L
Mazzola	L	L	L	L	L	L	L	L
Palich (a)	L	L	L	L	L	L	L	L
Palich (b)	L	L	L	L	L	L	L	L
Marinaki	L	L	L	L	L	L	L	L
Miele	M	L	L	L	L	L	L	M
Eliakim-Raz	L	L	L	L	L	L	L	L
Gavriatopoulou (a)	L	L	L	L	L	L	L	L
Goshen-Lago	L	L	L	L	L	L	L	L
Tzarfati	L	L	L	L	L	L	L	L
Hod	L	L	L	L	L	L	L	L
Mahil	L	L	L	L	L	L	L	L
Malard	M	L	L	L	L	L	L	M
Medeiros-Ribeiro	L	L	L	L	L	L	L	L
Narasimh	L	L	L	L	L	L	L	L

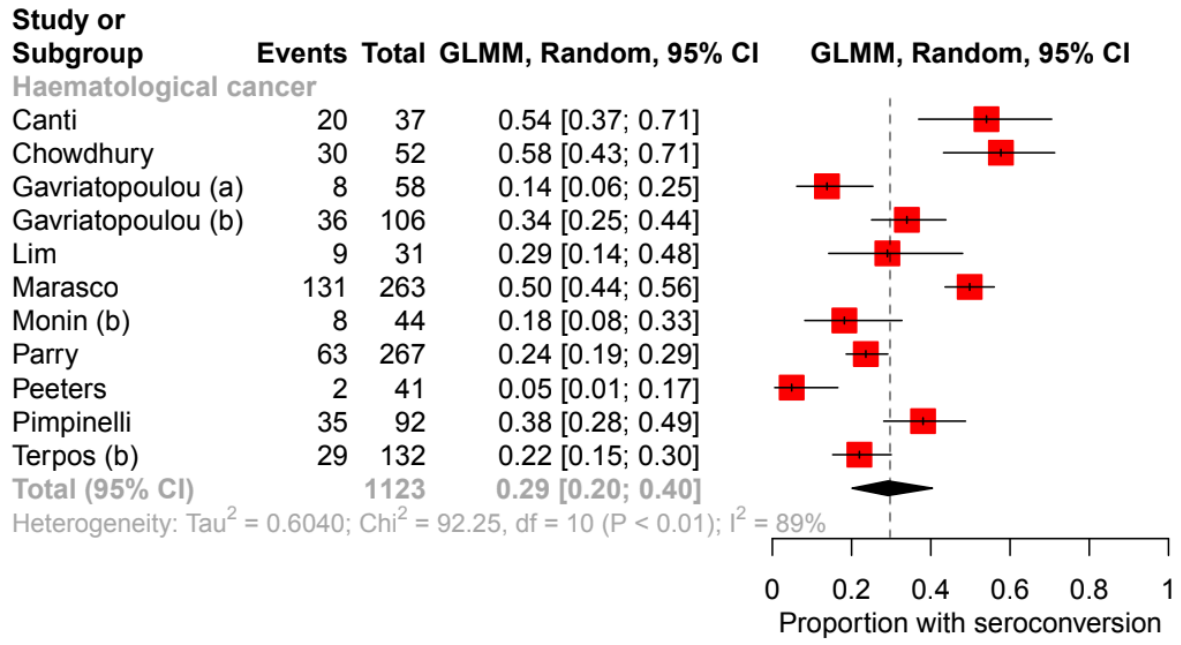
an								
Parry	L	L	L	L	L	L	L	L
Rashidi-Alavijeh	M	L	L	L	L	L	L	M
Reuken	L	L	L	L	L	L	L	L
Schramm	L	L	L	L	L	L	L	L
Stumpf	M	L	L	L	L	L	L	M
Canti	L	L	L	L	L	L	L	L
Bitoun	L	L	L	L	L	L	L	L
Lindeman n	L	L	L	L	L	L	L	L
Gavriatop oulou (b)	L	L	L	L	L	L	L	L
Terpos (b)	L	L	L	L	L	L	L	L
Rahav	L	L	L	L	L	L	L	L
Shem-Tov	L	L	L	L	L	L	L	L
Marasco	L	L	L	L	L	L	L	L
Lim	L	L	L	L	L	L	L	L
Sherman	L	L	L	L	L	L	L	L
Ghione	L	L	L	L	L	L	L	L
Stampfer	L	L	L	L	L	L	L	L
Itzchak	L	L	L	L	L	L	L	M
Shabir	L	L	L	L	L	L	L	L
Woldeme skel	L	L	L	L	L	L	L	L
Mrak	L	L	L	L	L	L	L	L
Shinjo	L	L	L	L	L	L	L	L
Achiron (b)	L	L	L	L	L	L	L	L
Boekel	L	L	L	L	M	L	L	M
Prendecki (a)	L	L	L	L	L	L	L	L
Ali	L	L	L	L	L	L	L	L
Wong	L	M	L	L	M	L	L	M
Barriere	L	L	L	L	L	L	L	M
Linardou	M	L	L	L	L	L	L	M
Liontos (a)	L	L	L	L	L	L	L	L
Liontos (b)	L	L	L	L	L	L	L	L
Zagouri	L	L	L	L	M	L	L	M
Agbarya	L	L	L	L	L	L	L	L
Grinshpun	L	L	L	L	L	L	L	L
Shmueli	M	L	L	L	L	L	L	M
Di Noia	L	L	L	L	L	L	L	L
Kantausk aite	L	L	L	L	L	L	L	L
Ruether	L	L	L	L	L	L	L	L
Schmidt	L	L	L	L	L	L	L	L
Grupper (b)	L	L	L	L	L	L	L	L
D'Offizi	L	L	L	L	L	L	L	L
Debska-Slizien	L	L	L	L	M	L	L	M
Crespo	M	L	L	L	L	L	L	M
Bruminhe nt	L	L	L	L	L	L	L	L

Prendecki (b)	L	L	L	L	L	L	L	M
Shroff	L	L	L	L	L	L	L	L
Peeters	L	L	L	L	L	L	L	L

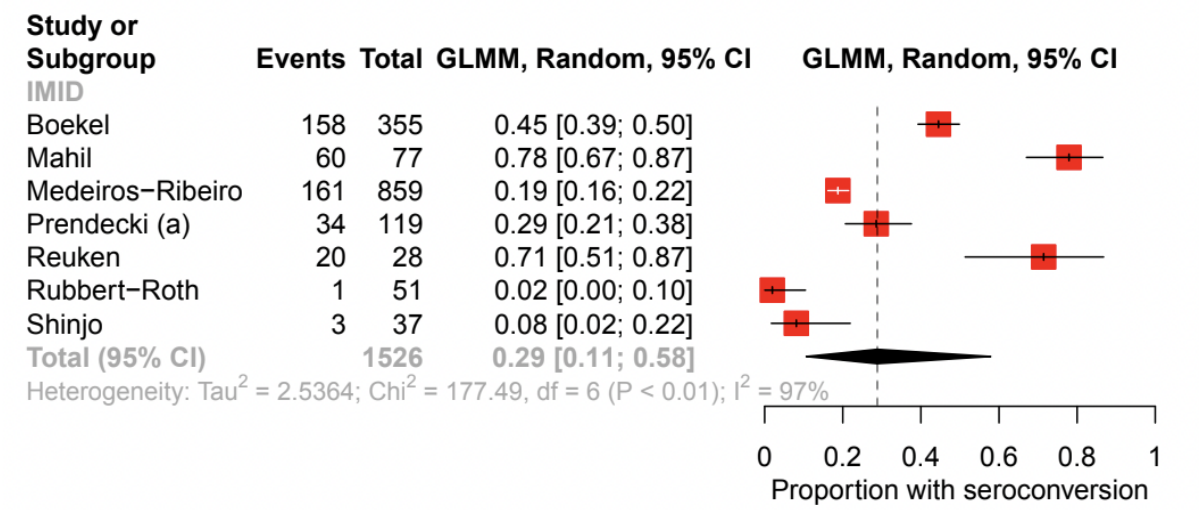
L: Low risk of bias; M: Moderate risk of bias



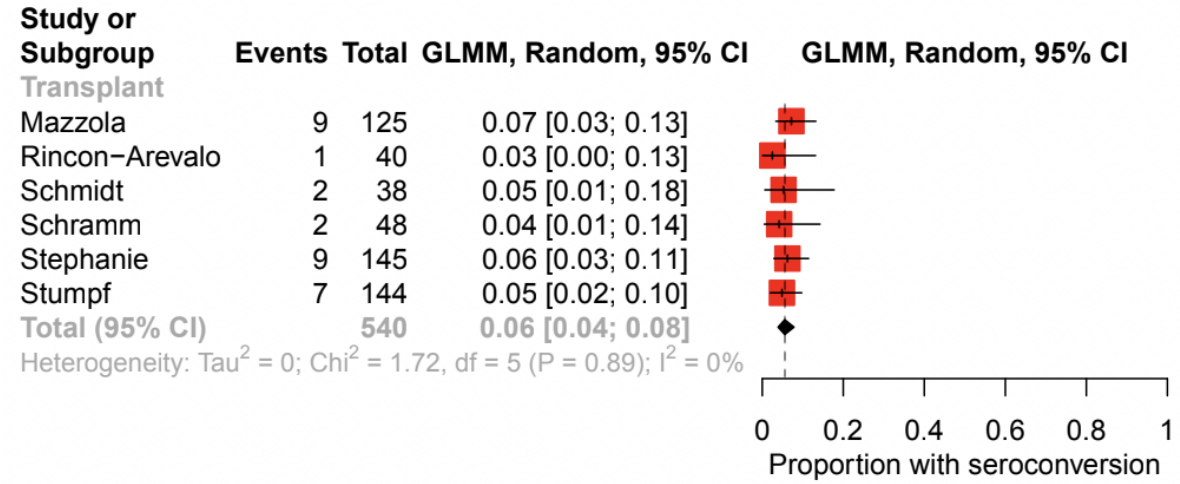
Supplementary figure 5: Absolute risk of seroconversion among patients with solid cancer after first dose



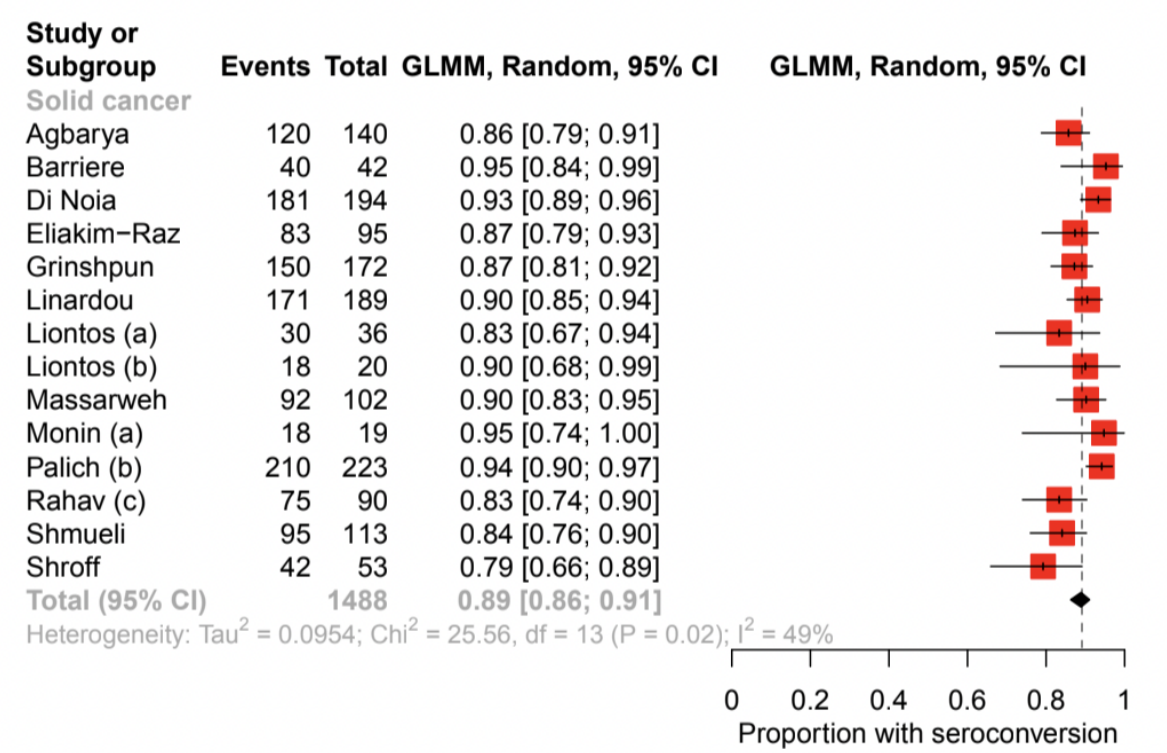
Supplementary figure 6: Absolute risk of seroconversion among patients with haematological cancer after first dose



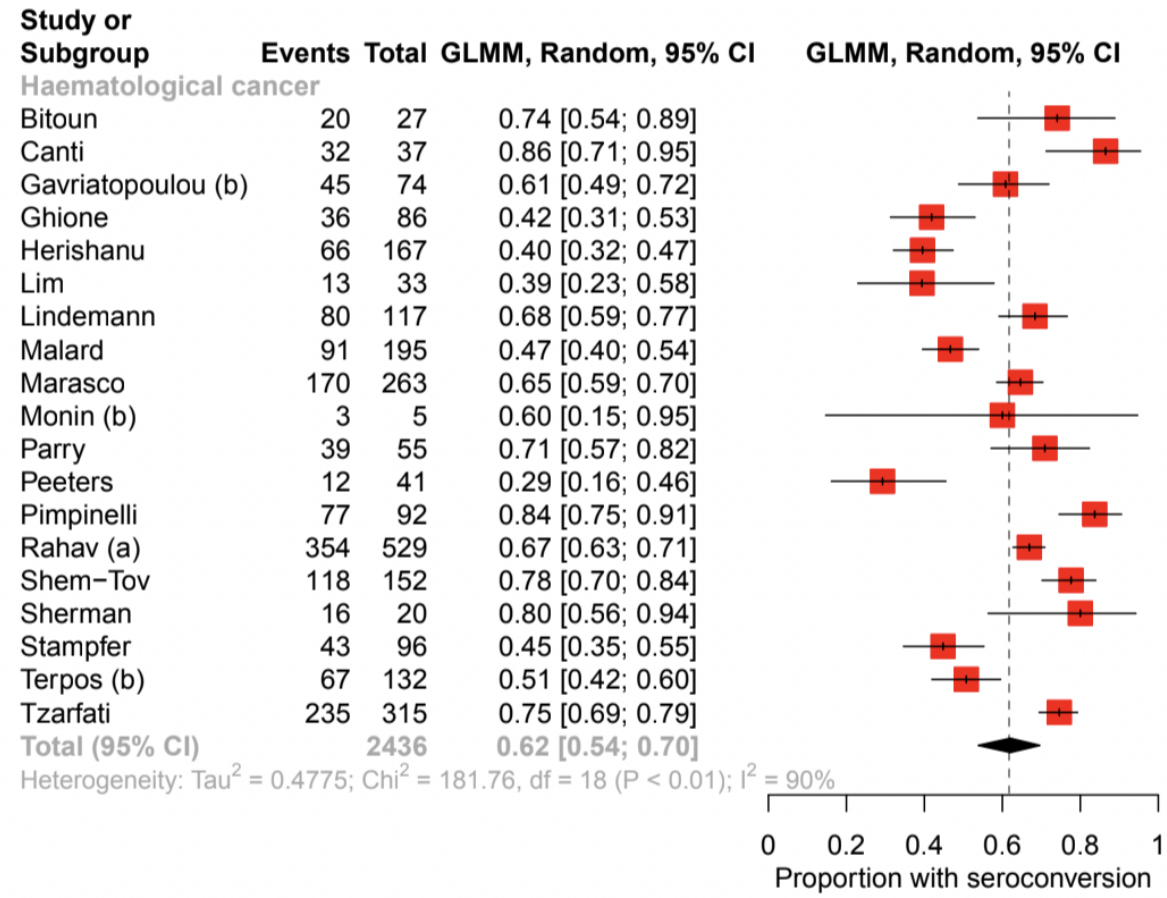
Supplementary figure 7: Absolute risk of seroconversion among IMID patients after first dose



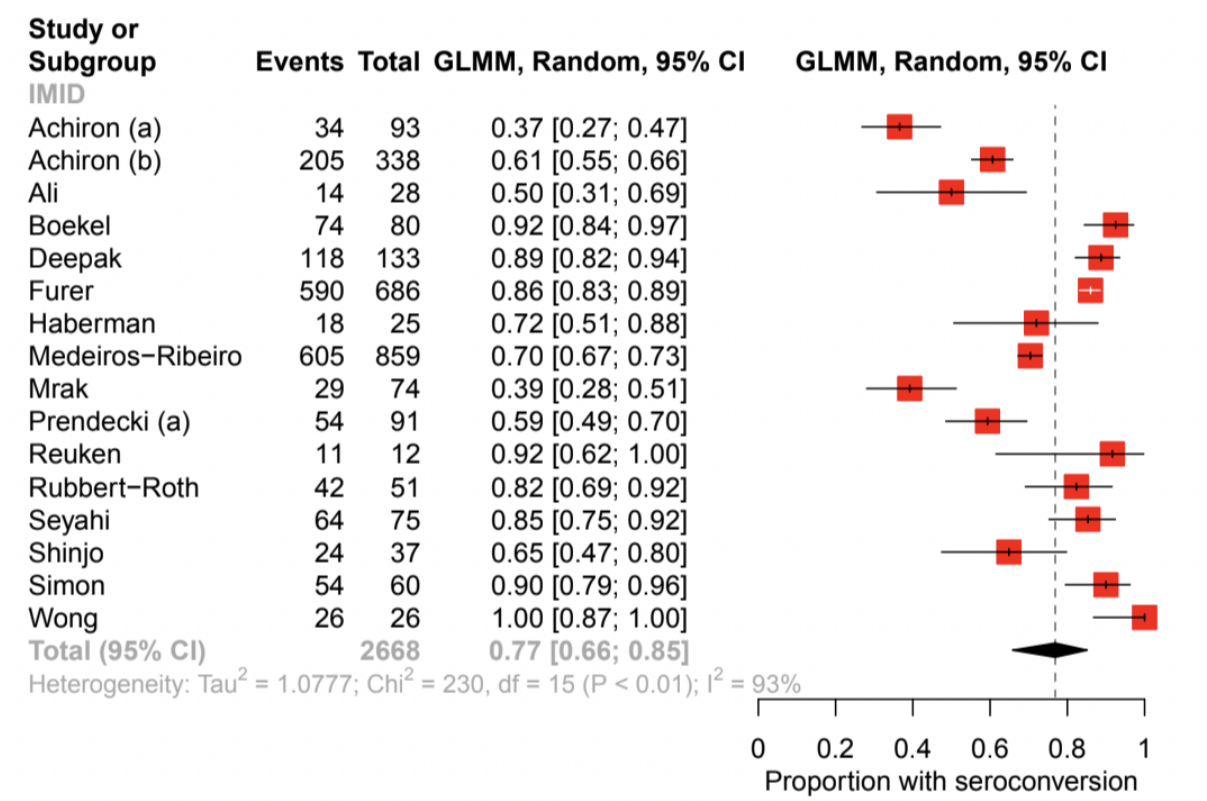
Supplementary figure 8: Absolute risk of seroconversion among transplant recipients after first dose



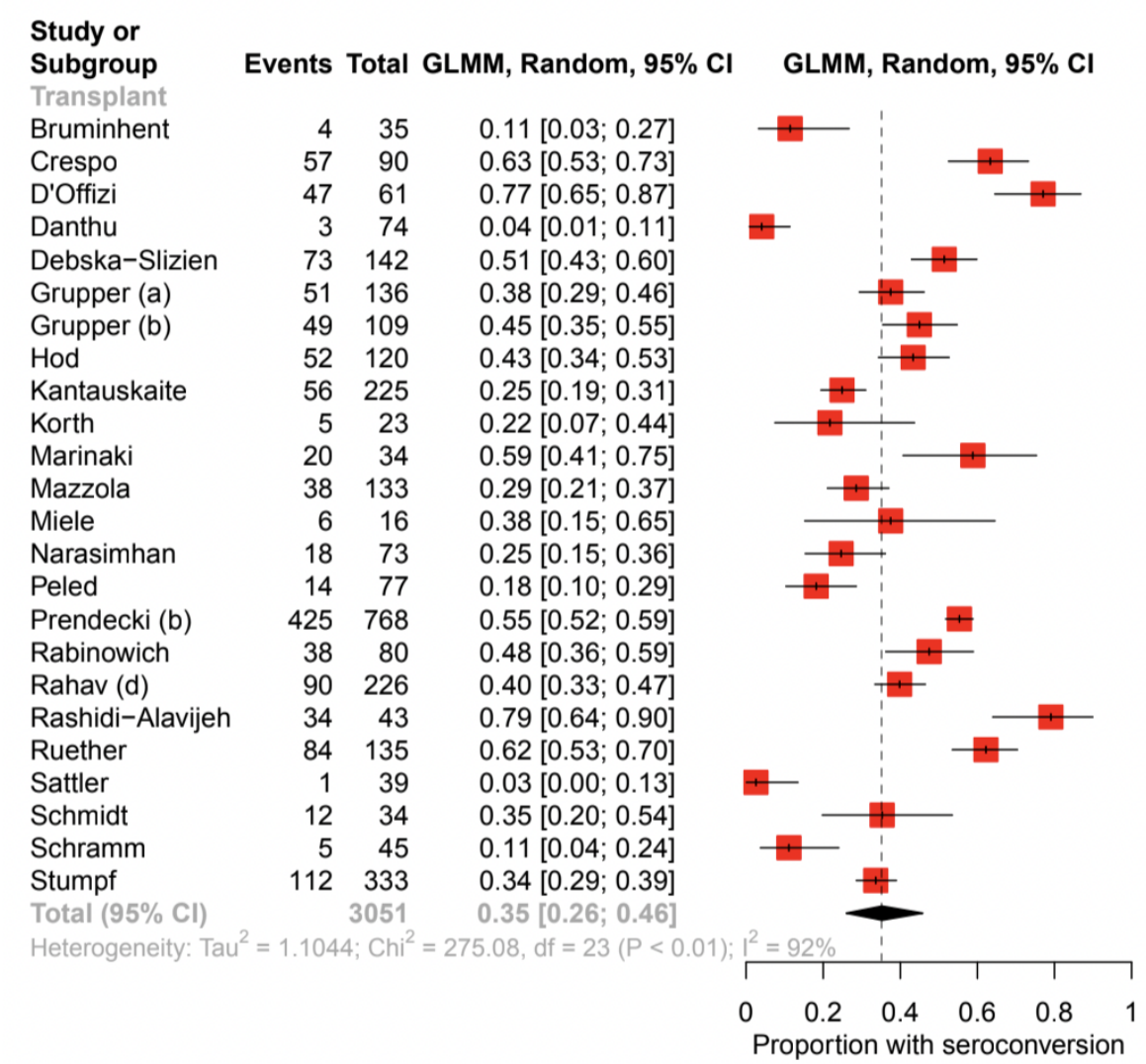
Supplementary figure 9: Absolute risk of seroconversion among patients with solid cancer after second dose



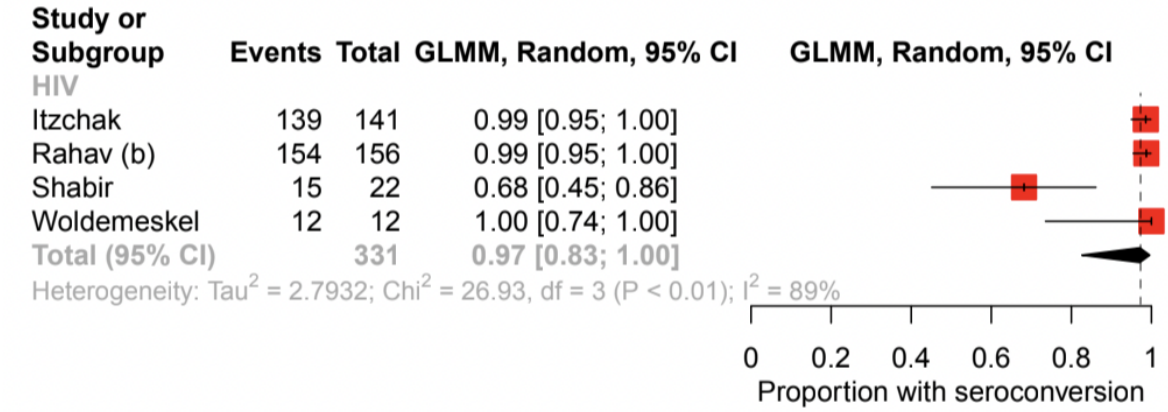
Supplementary figure 10: Absolute risk of seroconversion among patients with haematological after second dose



Supplementary figure 11: Absolute risk of seroconversion among IMID patients after second dose

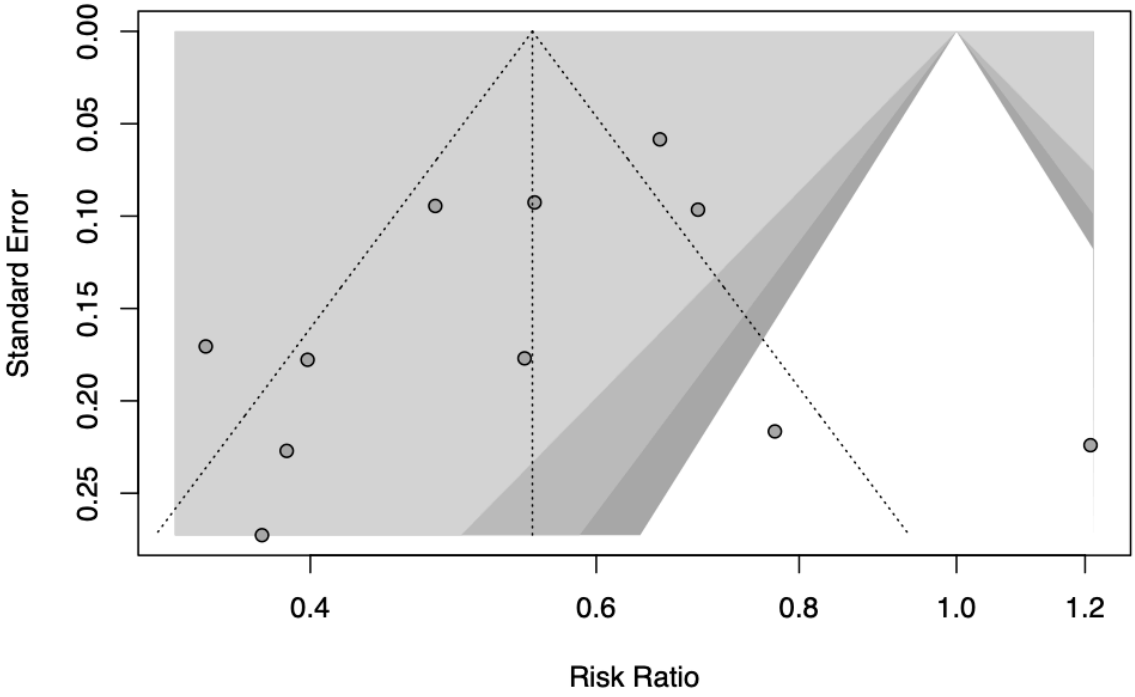


Supplementary figure 12: Absolute risk of seroconversion among transplant recipients after second dose



Supplementary figure 13: Absolute risk of seroconversion among HIV patients after second dose

Supplementary figure 14: Funnel plot with trim-and-fill imputation of potentially missing studies after first dose in solid cancer patients



Linear regression test of funnel plot asymmetry

Test result: t = -1.00, df = 9, p-value = 0.3420

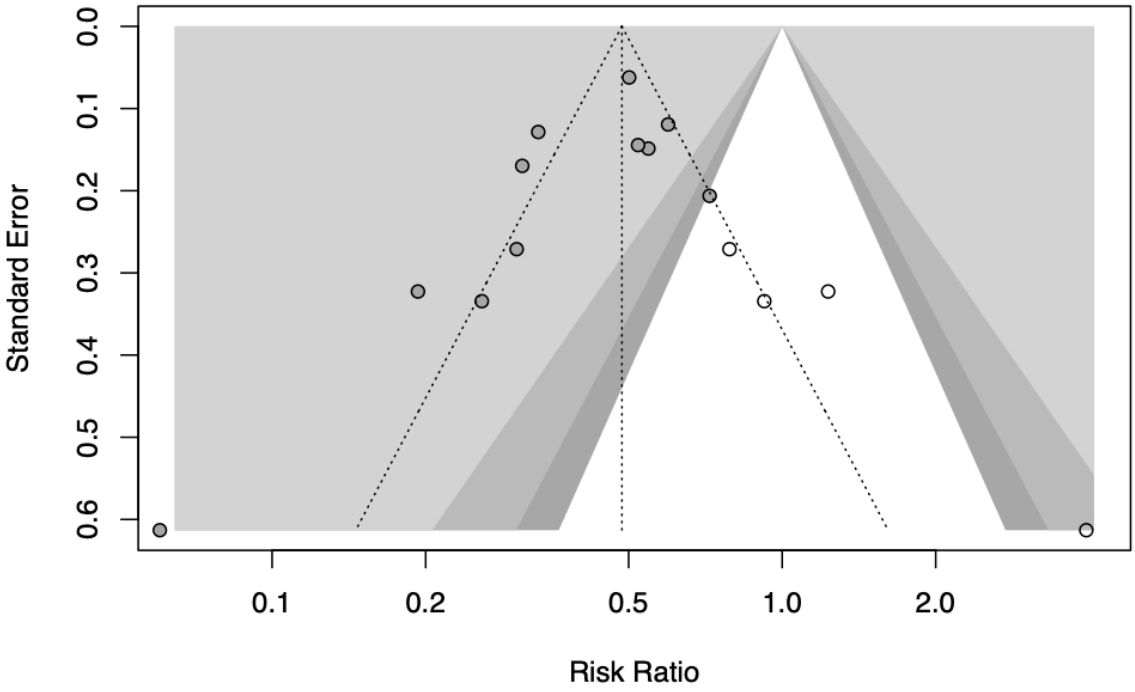
Number of studies combined: k = 11 (with 0 added studies)

Using random effects model:
Risk ratio: 0.5481
95%-CI: 0.4636; 0.6479

Quantifying heterogeneity:
tau^2 = 0.0541 [0.0270; 0.3125]; tau = 0.2326 [0.1644; 0.5590]
I^2 = 77.6% [60.2%; 87.4%]; H = 2.11 [1.58; 2.82]

Test of heterogeneity:
Q: 44.67
d.f.: 10
P-value < 0.0001

Supplementary figure 15: Funnel plot with trim-and-fill imputation of potentially missing studies after first dose in haematological cancer patients



Linear regression test of funnel plot asymmetry

Test result: t = -2.23, df = 9, p-value = 0.0525

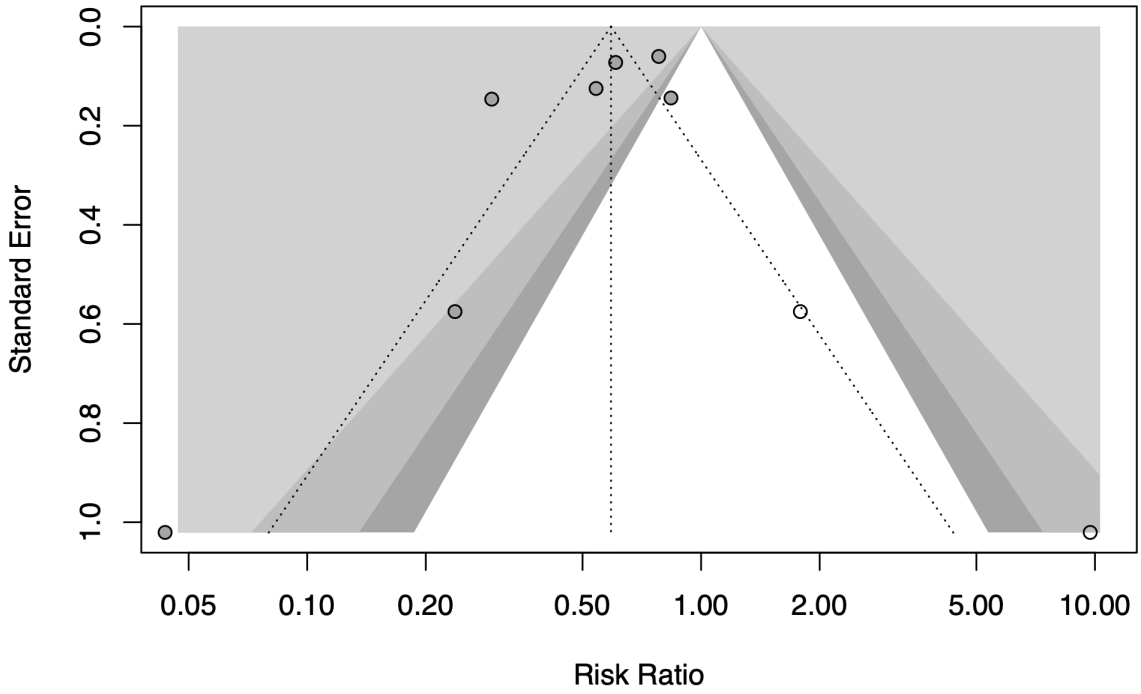
Number of studies combined: k = 15 (with 4 added studies)

Using random effects model:
Risk ratio: 0.4851
95%-CI: 0.3875; 0.6072

Quantifying heterogeneity:
tau^2 = 0.1322 [0.1426; 0.9787]; tau = 0.3636 [0.3776; 0.9893]
I^2 = 81.8% [71.0%; 88.5%]; H = 2.34 [1.86; 2.95]

Test of heterogeneity:
Q: 76.83
d.f.: 14
P-value < 0.0001

Supplementary figure 16: Funnel plot with trim-and-fill imputation of potentially missing studies after first dose in IMID patients



Linear regression test of funnel plot asymmetry

Test result: t = -1.85, df = 5, p-value = 0.1236

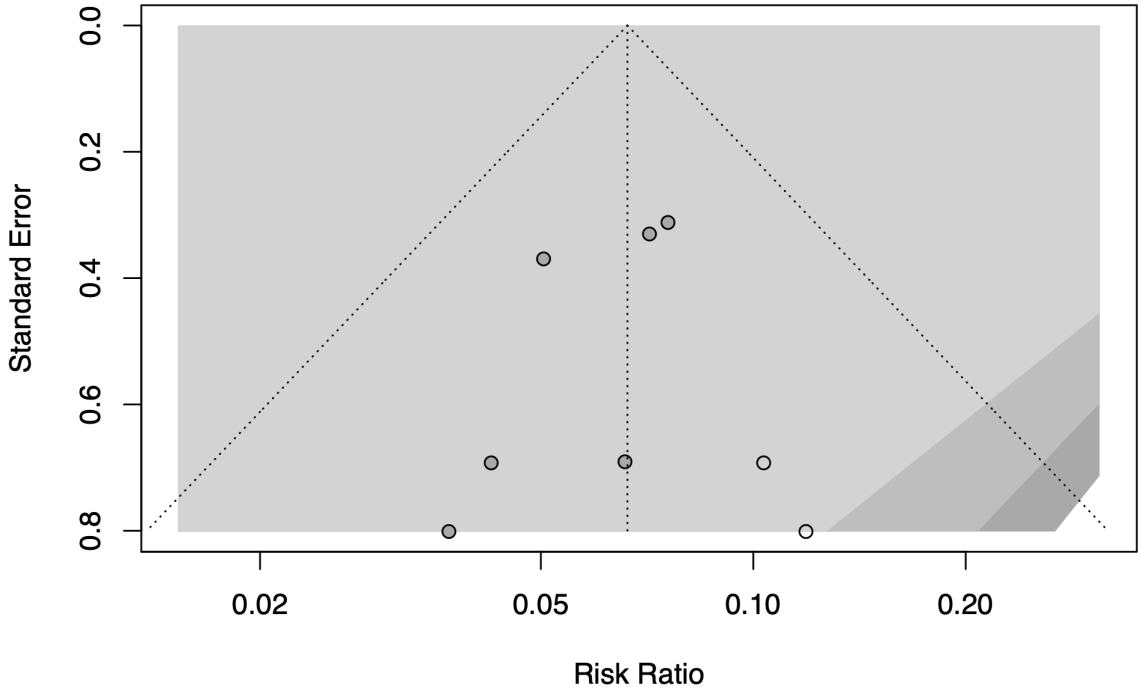
Number of studies combined: k = 9 (with 2 added studies)

Using random effects model:
Risk ratio: 0.4847
95%-CI: 0.3836; 0.6126

Quantifying heterogeneity:
tau^2 = 0.1288 [0.1423; 2.3222]; tau = 0.3589 [0.3773; 1.5239]
I^2 = 87.7% [78.8%; 92.9%]; H = 2.85 [2.17; 3.74]

Test of heterogeneity:
Q: 64.98
d.f.: 8
P-value < 0.0001

Supplementary figure 17: Funnel plot with trim-and-fill imputation of potentially missing studies after first dose in transplant patients



Linear regression test of funnel plot asymmetry

Test result: t = -1.85, df = 4, p-value = 0.1378

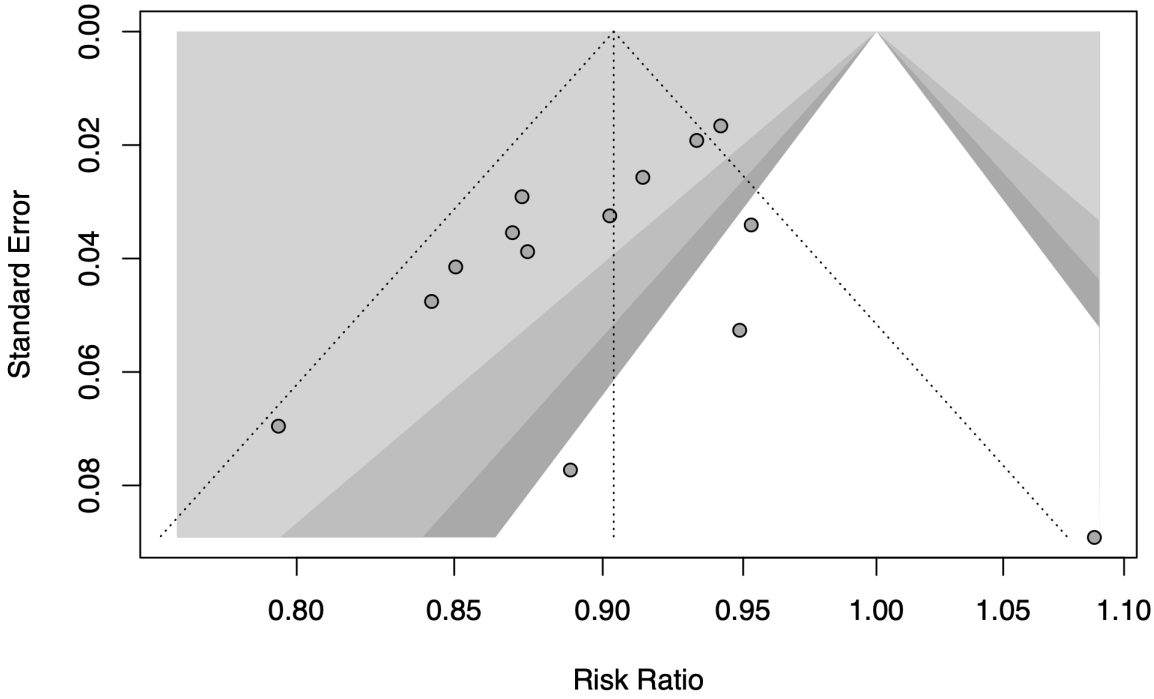
Number of studies combined: k = 8 (with 2 added studies)

Using random effects model:
Risk ratio: 0.0663
95%-CI: 0.0479; 0.0919

Quantifying heterogeneity:
tau^2 = 0 [0.0000; 0.2098]; tau = 0 [0.0000; 0.4580]
I^2 = 0.0% [0.0%; 67.6%]; H = 1.00 [1.00; 1.76]

Test of heterogeneity:
Q: 2.66
d.f.: 7
P-value < 0.9148

Supplementary figure 18: Funnel plot with trim-and-fill imputation of potentially missing studies after second dose in solid cancer patients



Linear regression test of funnel plot asymmetry

Test result: t = -1.49, df = 12, p-value = 0.1608

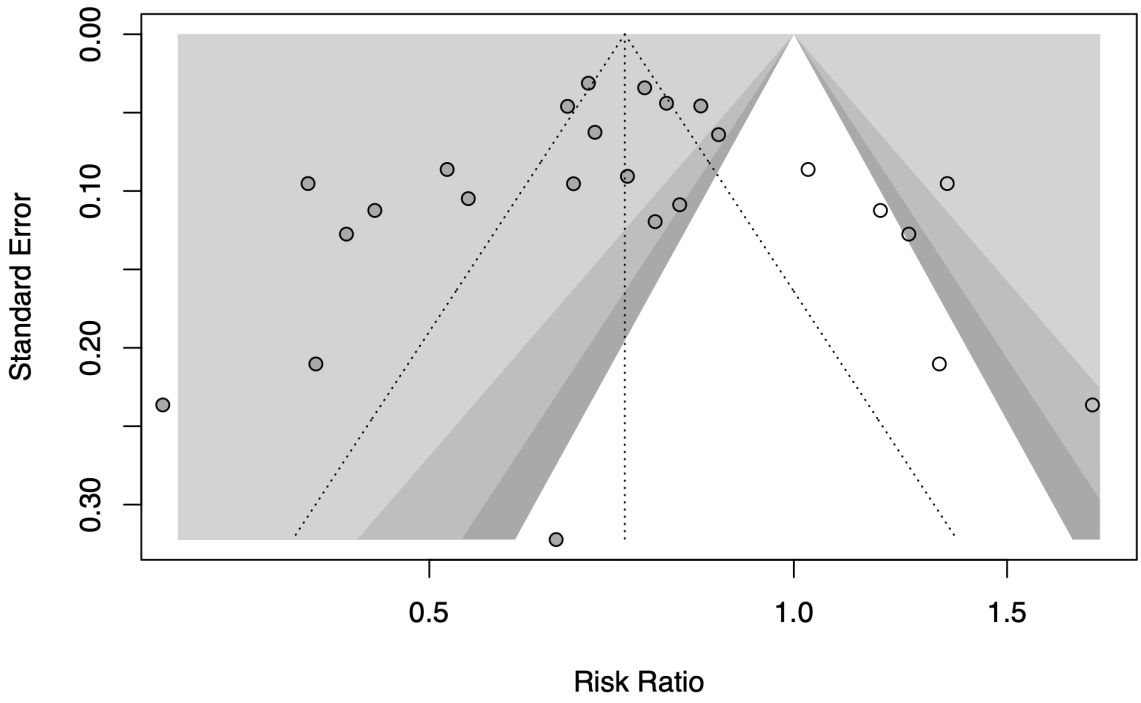
Number of studies combined: k = 14 (with 0 added studies)

Using random effects model:
Risk ratio: 0.9038
95%-CI: 0.8804; 0.9279

Quantifying heterogeneity:
tau^2 = 0.0011 [0.0001; 0.0073]; tau = 0.0330 [0.0078; 0.0855]
I^2 = 50.7% [9.0%; 73.3%]; H = 1.42 [1.05; 1.93]

Test of heterogeneity:
Q: 26.36
d.f.: 13
P-value < 0.0152

Supplementary figure 19: Funnel plot with trim-and-fill imputation of potentially missing studies after second dose in haematological cancer patients



Linear regression test of funnel plot asymmetry

Test result: t = -2.57, df = 17, p-value = 0.0198

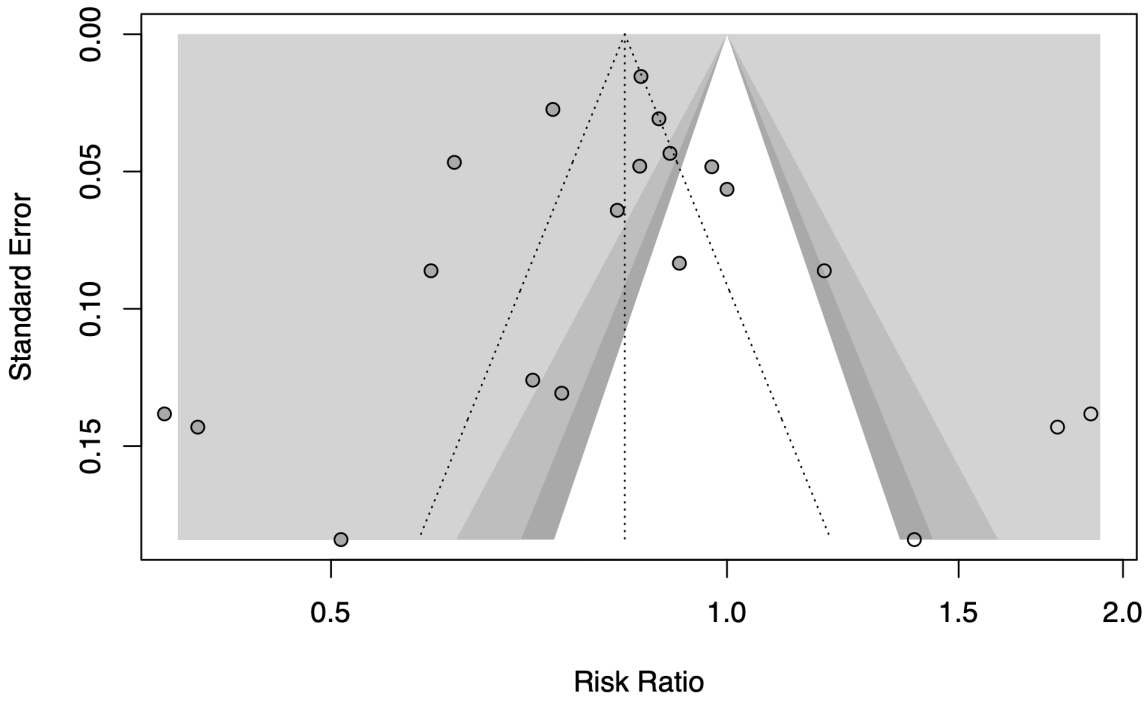
Number of studies combined: k = 25 (with 6 added studies)

Using random effects model:
Risk ratio: 0.7251
95%-CI: 0.6551; 0.8026

Quantifying heterogeneity:
tau^2 = 0.0534 [0.0540; 0.2184]; tau = 0.2311 [0.2324; 0.4673]
I^2 = 91.2% [88.2%; 93.4%]; H = 3.37 [2.92; 3.89]

Test of heterogeneity:
Q: 272.61
d.f.: 24
P-value < 0.0001

Supplementary figure 20: Funnel plot with trim-and-fill imputation of potentially missing studies after second dose in IMID patients



Linear regression test of funnel plot asymmetry

Test result: t = -1.86, df = 14, p-value = 0.0841

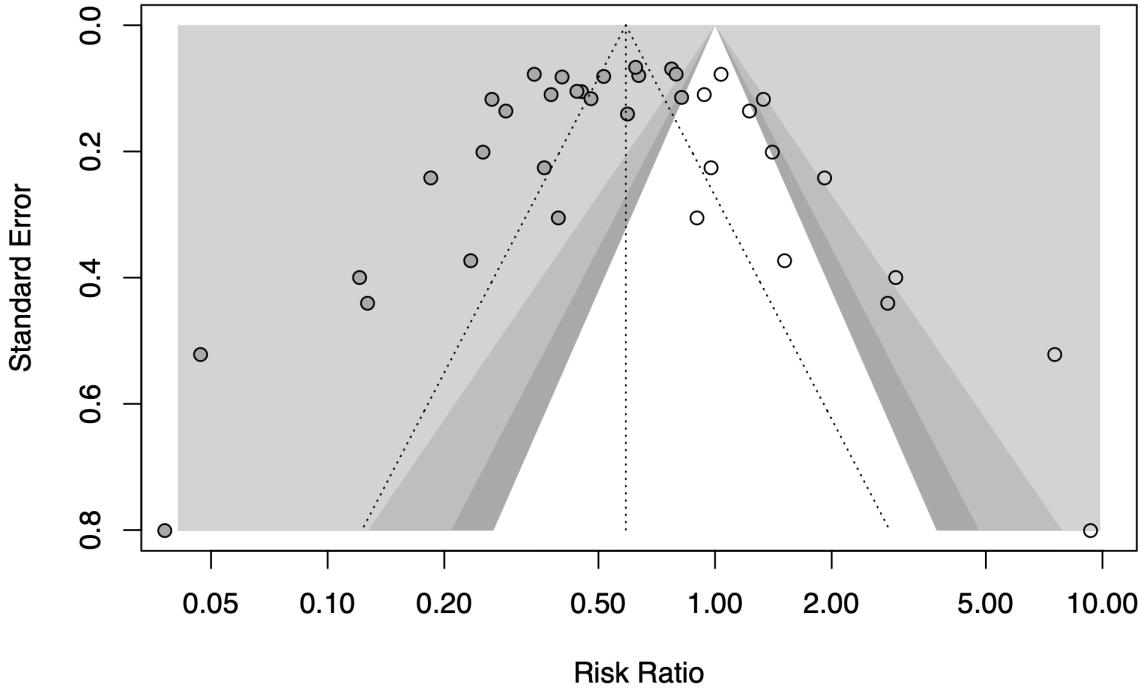
Number of studies combined: k = 20 (with 4 added studies)

Using random effects model:
Risk ratio: 0.8361
95%-CI: 0.7647; 0.9142

Quantifying heterogeneity:
tau^2 = 0.0327 [0.0398; 0.2030]; tau = 0.1808 [0.1994; 0.4505]
I^2 = 92.9% [90.4%; 94.8%]; H = 3.75 [3.22; 4.37]

Test of heterogeneity:
Q: 267.10
d.f.: 19
P-value < 0.0001

Supplementary figure 21: Funnel plot with trim-and-fill imputation of potentially missing studies after second dose in organ transplant patients



Linear regression test of funnel plot asymmetry

Test result: t = -3.76, df = 22, p-value = 0.0011

Number of studies combined: k = 37 (with 13 added studies)

Using random effects model:
Risk ratio: 0.5883
95%-CI: 0.4913; 0.7046

Quantifying heterogeneity:
tau^2 = 0.2528 [0.3044; 0.9380]; tau = 0.5028 [0.5517; 0.9685]
I^2 = 94.1% [92.7%; 95.2%]; H = 4.10 [3.69; 4.55]

Test of heterogeneity:
Q: 605.25
d.f.: 36
P-value < 0.0001