Table of Contents

Supplementary Table 1: Summary of risk of bias/quality assessment of included studies 5

Supplementary Table 2: Summary of study characteristics and outcomes for patients with myeloma 11

Supplementary Table 3: Summary of study characteristics and outcomes for patients with chronic lymphocytic leukaemia 16

Supplementary Table 4: Summary of study characteristics and outcomes for patients with lymphoma 20

Supplementary Table 5: Summary of study characteristics and outcomes for patients following haematopoietic stem cell transplant and cellular therapy 22

Supplementary Table 6: Summary of study characteristics and outcomes for patients with acute leukaemia (AML, ALL) and myelodysplastic syndrome (MDS) 24

Supplementary Table 7: Summary of study characteristics and outcomes for patients with myeloproliferative neoplasm and chronic myeloid leukaemia 29

Supplementary Table 8: Summary of study characteristics and outcomes for subgroup analysis active treatment vs. no active treatment.....36

Supplementary Table 9: Summary of study characteristics and outcomes for subgroup analysis CD20 therapy less than 12 months vs. CD20 therapy 12 or more months 40

Supplementary Table 10: Summary of study characteristics and outcomes for subgroup analysis targeted therapy vs. no targeted therapy.....44

Supplementary Table 11: Summary of study characteristics and outcomes for subgroup analysis haematopoietic stem cell transplant within 12 months vs. 12 or more months.....46

Supplementary Table 12: Summary of study characteristics and outcomes for subgroup analysis vaccine type (BNT162b2 vs others) 49

Supplementary Table 13: Summary of seropositivity rates for patients with haematological malignancy following 2 and 1 dose of COVID-19 vaccine by study quality (sensitivity analysis).....50

Additional information: Search strategy 51

Additional information: Abbreviations 53

Study (author, year)	Selection				Comparability	Outcome			Rating
	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure (refers to diagnosis of HM)	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur?	Adequacy of follow up of cohorts (% follow-up rate)	
Addeo et. al. 2021	✵	NA	✵	✵	NA	✵	✵	✵	Good (A)
Agha et. al. 2021	✵	NA			NA	✵	✵	✵	Poor (A)
Avivi et. al. 2021	✵	✵	✵	✵		✵	✵	✵	Poor
Benda et. al. 2021	✵	NA	✵		NA	✵	✵	✵	Fair (A)
Benjamini et. al. 2021	✵	NA	✵		NA	✵	✵	✵	Fair (A)
Bird et. al. 2021	✵	NA	✵		NA	✵		✵	Fair (A)
Caocci et. al. 2021		NA			NA	✵	✵	✵	Poor (A)
Cohen et. al. 2021		NA	✵		NA	✵	✵	✵	Poor (A)
Del Poeta et. al. 2021		NA	✵		NA	✵	✵	✵	Poor (A)
Dhakal et. al. 2021		NA	✵		NA	✵		✵	Poor (A)
Easdale et. al. 2021		NA	✵		NA	✵	✵	✵	Poor (A)
Gavriatopoulou et. al. 2021	✵	✵	✵		✵	✵		✵	Good
Ghandili et. al. 2021	✵	NA	✵	✵	NA	✵		✵	Good (A)

Ghione et. al. 2021	✵	✵	✵	✵		✵		✵	Poor
Greenberger et. al. 2021	✵	NA		✵	NA	✵	✵	✵	Fair (A)
Guglielmelli et. al. 2021	✵			✵				✵	Poor
Gurion et. al. 2021	✵	NA	✵		NA	✵		✵	Fair (A)
Harrington et. al. 2021 (BrJH)	✵	NA	✵		NA	✵		✵	Fair (A)
Harrington et. al. 2021 (Leuk)	✵	NA	✵		NA	✵		✵	Fair (A)
Herishanu et. al. 2021	✵		✵	✵	✵	✵	✵	✵	Good
Herzog Tzarfati et. al. 2021	✵		✵		✵✵	✵	✵	✵	Fair
Iacono et. al. 2021		✵	✵	✵		✵			Poor
Jurgens et. al. 2021	✵	✵	✵			✵	✵	✵	Poor
Lim et. al. 2021	✵	✵	✵	✵ .		✵			Poor
Malard et. al. 2021	✵		✵	✵		✵		✵	Poor
Manekis et. al. 2021	✵	✵	✵	✵	✵	✵			Poor
Monin et. al. 2021	✵	✵	✵	✵		✵	✵		Poor
Ollila et. al. 2021		NA	✵		NA	✵	✵	✵	Poor (A)

Parry et. al. 2021		✸				✸	✸		Poor
Perry et. al. 2021	✸		✸	✸	✸	✸		✸	Good
Pimpinelli et. al. 2021 (PV/ET)	✸	NA	✸	✸	NA	✸		✸	Good (A)
Pimpinelli et. al. 2021 (MM/MPN)	✸		✸	✸		✸		✸	Poor
Ram et. al. 2021		NA	✸	✸	NA	✸		✸	Fair (A)
Ramasamy et. al. 2021	✸	NA			NA	✸			Poor (A)
Re et. al. 2021		NA	✸		NA			✸	Poor (A)
Redjoul et.al. 2021	✸	NA	✸		NA	✸	✸	✸	Fair (A)
Roeker et. al. 2021	✸	NA	✸		NA	✸	✸	✸	Fair (A)
Stampfer et. al. 2021	✸	✸	✸		✸	✸		✸	Good
Strickland et. al. 2021	✸	✸	✸	✸	✸	✸		✸	Good
Tadmor et. al. 2021	✸	NA	✸		NA	✸	✸	✸	Fair (A)
Terpos et. al. 2021 (Blood)	✸	✸	✸	✸	✸	✸		✸	Good
Terpos et. al. 2021 (BCJ)	✸	✸	✸		✸	✸		✸	Good
Thakkar et. al. 2021	✸		✸	✸		✸	✸	✸	Poor
Van Oekelen et. al. 2021	✸	✸	✸		✸	✸	✸	✸	Good

Note: A study can be awarded a maximum of one star (✸) for each numbered item within the selection and outcome domains. A maximum of two stars can be given for comparability domain. A good quality study would score 3 or 4 stars in selection domain, 1 or 2 stars in comparability domain, and 2 or 3 stars in outcome domain. A fair quality study would require 2 stars in selection domain, 1 or 2 stars in comparability domain, and 2 or 3 stars in outcome domain. On the other hand, a study will be regarded as poor quality if it reflects 0 or 1 star in selection domain, or 0 star in comparability domain, or 0 or 1 star in outcome domain. For studies without a control group, item 2 in selection domain and comparability domain are not applicable. Therefore, the rating system proposed by Sharmin et al was adapted accordingly; a good quality study would score 3 stars in selection domain, and 2 or 3 stars in outcome domain. A fair quality study would require 2 stars in selection domain, and 2 or 3 stars in outcome domain. On the other hand, a study will be regarded as poor quality if it reflects 0 or 1 star in selection domain, or 0 or 1 star in outcome domain. In this review, a good or fair quality study is considered of having low risk of bias while a poor quality study is regarded as high risk of bias.

HM: haematological malignancy; PV: Polycythaemia vera; ET: Essential thrombocytosis; MM: multiple myeloma; MPN: myeloproliferative neoplasm; BCJ: Blood Cancer Journal; NA: not applicable; A (adapted)

Supplementary Table 1: Summary of risk of bias/quality assessment of included studies

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Avivi et. al.	Single centre Prospective cohort study Israel	Myeloma Healthy volunteers	171 patients 64 controls	70 years (38-94)	96 Male 75 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 UI/ml = positive	14-21 days post second dose: 133/171 (78%) vs. 63/64 (98%) controls	Not reported	At least one adverse event: 90/161 (53%) vs. 29/53 (55%) controls
Bird et. al.	Single centre retrospective cohort study United Kingdom	Myeloma	93 patients	67 years (47-87)	55 Male 38 Female	BNT162b2 ChAdOx1 52% 48%	SARS-CoV-2 S IgG Ortho clinical ≥1 signal/cut-off = positive	≥ 21 days post first dose: 52/93 (56%)	Not reported	Not reported
Ghandili et. al.	Single centre prospective cohort study Germany	Myeloma	82 patients	68 years (40-85)	49 Male 33 Female	BNT162b2 ChAdOx1 77% 23%	SARS-CoV-2 S IgG DiaSorin ≥ 34 AU/ml = positive	21 days post first dose: 17/74 (23%)	Not reported	Not reported
Ramasamy et. al.	Multicentre web-based prospective cohort study United	Myeloma	105 patients -28 patients sampled	63 years	67 Male 42 Female	BNT162b2 ChAdOx1 42% 58%	SARS-CoV-2 S IgG Abbott COI ≥ 50 =	>21 days post first dose: 17/28 (61%)	Not reported	Not reported

	Kingdom						positive			
Stampfer et. al.	Single centre prospective cohort study United States	Myeloma Healthy controls Pre-COVID-19 controls	103 patients 31 controls 34 controls	68 years (35-88)	61 Male 42 Female	BNT162b2 mRNA-1273 50%/50%	SARS-CoV-2 S IgG 'in house' 50-250 IU/ml = positive (partial response) >250 IU/ml = clinically relevant response	14-21 days post first dose: 20/96 (21%) 14-21 days post second dose: 64/96 (67%) vs. 31/31 (100%) controls >250 IU/ml 14-21 days post first dose: 2/96 (2%) 14-21 days post second dose: 43/96 (45%) vs. 29/31 (94%) controls	Not reported	Not reported
Terpos et. al.	Single centre prospective cohort study Greece	Myeloma Matched Controls	48 patients 102 controls	83 years (59-92)	29 Male 19 Female	BNT162b2	SARS-CoV-2 neutralising Ab Genscript ≥ 30% = positive ≥ 50% = clinically relevant	≥ 30% 22 days post first dose: 12/48 (25%) vs. 57/102 (55%) controls	≥ 50% 22 days post first dose: 4/48 (8%) vs. 21/102 (20%) controls	Not reported

Terpos et. al.	Single centre prospective cohort study Greece	Myeloma Matched Controls	276 patients -77% myeloma -14% sMM -9% MGUS 226 controls	74 years (62-80)	151 Male 125 Female	BNT162b2 ChAdOx1 78% 22%	SARS-CoV-2 neutralising Ab Genscript ≥ 30% = positive ≥ 50% = clinically relevant	Day 22 post first dose: 117/276 (42%) vs. 145/226 (64%) controls Day 50 post first dose: 196/276 (71%) vs. 204/226 (90%) controls	Day 22 post first dose: 55/276 (20%) vs. 73/226 (32%) controls Day 50 post first dose: 158/276 (57%) vs. 183/226 (81%) controls	First dose BNT162b2 71/215 (33%) local reaction 28/215 (13%) systemic reaction ChAdOx1 20/61 (33%) local reaction Second dose BNT162b2 68/215 (32%) local reaction 45/215 (21%) systemic reaction
Van Oekelen et. al.	Single centre prospective and retrospective cohort study United States	Myeloma Matched control health care workers	320 patients -260 sampled 67 controls	68 years (38-93)	185 Male 135 Female	BNT162b2 mRNA-1273 unknown 69% 27% 4%	SARS-CoV-2 S IgG 'in house' ≥ 5 AU/ml = positive	51 days post second dose: 219/260 (84%) vs. 67/67 (100%) controls	Not reported	Not reported

Subset of myeloma patients from other studies										
Agha et. al.	Single centre retrospective cohort study United States	Haematology Myeloma subset	67 patients	71 years (IQR 65-77)	35 Male 32 Female	BNT162b2 mRNA-1273 51%/42% 7% unknown	SARS-CoV-2 S IgG Beckman Coulter ≥1.00 = positive	21 days post second dose: 19/29 (66%)	Not reported	Not reported
Benda et. al.	Single centre prospective cohort study	Haematology Myeloma subset Solid tumour	123 patients -34% myeloma 136 patients	Not reported in haem	Not reported in haem	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	28 days post second dose: 25/34 (74%)	Not reported	Not reported for haem
Cohen et. al.	Single centre retrospective study Israel	Haematology Myeloma subset	54 patients -37% myeloma	69 years (IQR 61-77)	32 Male 22 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	14-21 days post second dose: 16/20 (80%)	Not reported	Not reported
Greenberger et. al.	Multicentre prospective cohort study United States	Haematology Myeloma subset	1445 patients -15% myeloma	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 55% 45%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 204/213 (96%)	Not reported	Not reported
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology Myeloma subset Matched Healthy control	315 patients Myeloma -16% 108 controls	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml = positive	30-60 days post second dose: 40/53 (76%) vs. 107/108 (99%) control	Not reported	Not reported

Ollila et. al.	Single centre retrospective cohort study United States	Haematology Myeloma subset	160 patients -15% plasma cell	72 years (65-79)	86 Male 74 Female	BNT162b2 mRNA-1273 Ad26	SARS-CoV-2 S IgG Abbott Signal/cutoff ratio ≥1.4 = positive	56 days post first dose: 14/24 (58%) myeloma	Not reported	Not reported
Monin et. al.	Multicentre prospective cohort study United Kingdom	Haematology Myeloma subset Health care workers controls	56 patients -68% B cell malignancy -9% T cell malignancy -18% myeloid/ acute leukaemia -5% others 54 controls	73 years (IQR 65-80)	Not extractable for haem	BNT162b2	SARS-CoV-2 Spike IgG ≥ 70 EC50 = positive SARS-CoV-2 specific T cells secreting IFN-gamma and/or IL2 >7 cytokine-secreting cells per 10^6 PBMC = positive	21 days post first dose: 3/9 (33%) vs. 32/34 (94%) Controls 35 days post first dose: 1/7 (14%) vs. 18/21 (86%) controls 35 days post first dose (with second dose): 1/1 (100%) vs. 12/12 controls (100%)	Cellular response 21 days post first dose: 2/3 (66%) vs. 14/17 (82%) controls 35 days post first dose: 1/4 (25%) vs. 9/13 (69%) controls 35 days post first dose (with second dose): 1/1 (100%) vs. 3/3 (100%) controls	Not extractable for haem
Pimpinelli et. al.	Single centre prospective study Italy	Haematology Myeloma subset Older age (> 80 years)	42 patients 36 controls	73 years (47-78)	23 Male 19 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive	21 days post first dose: 9/42 (21%) myeloma vs. 19/36 (53%)	Not reported	Reported with different patient numbers

		control group						controls 14 days post second dose: 33/42 (79%) myeloma vs. 36/36 (100%) controls ≥ 80 AU/ml 14 days post second dose 23/42 (55%) myeloma vs. 34/36 (97%) control		
Re et. al.	Multicentre retrospective cohort study France	Haematology Myeloma subset	102 patients -22% myeloma	76 years (33-93)	67 Male 35 Female	BNT162b2 mRNA-1273 93% 7%	SARS-CoV-2 S IgG Range of commercial platforms	21-28 days post second dose 17/23 (74%)	Not reported	Not reported

Supplementary Table 2: Summary of study characteristics and outcomes for patients with myeloma

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Benjamini et. al.	Multicentre prospective cohort study Israel	CLL patients	373 patients	70 years (40-89)	222 Male 151 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive Abbott >50 U/ml = positive 'in house' >1.1 = positive	14-21 days pot second dose: 160/373 (43%)	Neutralising antibody 14-21 days post second dose: 27/45 (60%)	At least 1 adverse event: 151/331 (47%)
Del Poeta et. al.	Single centre prospective cohort study Italy	CLL patients	46 patients	Not reported	29 Male 17 Female	BNT162b2	SARS-CoV-2 S IgG Maglumi ≥1.1 = positive	14-21 days post second dose: 25/46 (54%)	Not reported	Not reported
Herishanu et. al.	Single centre prospective cohort study Israel	CLL patients Control -age, sex matched	167 patients 52 controls	71 years (63-76)	112 Male 55 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	14-21 days post second dose: 66/167 (40%) patients vs. 52/52 (100%) controls	Not reported	First dose 52/167 (31%) local reaction 21/167 (13%) Systemic reaction Second dose 56/167 (34%) local

										reaction 21/167 (23%) Systemic reaction
Parry et. al.	Single centre prospective cohort study United Kingdom	CLL patients Healthy age matched controls	299 patients 93 controls	69 years (IQR 63-74)	159 Male 140 Female	BNT162b2 ChAxOd1 52%/48%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive Dried blood sampling Roche ratio ≥ 1.0 = positive	43 days post first dose: Serum 29/86 (34%) vs. 89/95 (94%) Control Dried blood 63/267 (24%) vs. 66/93 (71%) control 18 days post second dose: Serum 9/12 (75%) vs. 59/59 (100%) Controls Dried blood 39/55 (71%) vs. 36/37 (97%) controls	Not reported	Not reported
Roeker et. al.	Single centre retrospective cohort study	CLL patients	44 patients	71 years (37-89)	23 Male 21 Female	BNT162b2 mRNA-1273	SARS-CoV-2 S IgG	21 days post second dose: 23/44 (52%)	Not reported	Not reported

	United States					57% 43%	DiaSorin ≥ 15 AU/ml = positive			
Tadmor et. al.	Multicentre prospective observation study Israel	CLL patients	84 patients	69 years (44-87)	53 Male 29 Female	BNT162b2	SARS-CoV-2 S IgG Abbott ≥ 50 U/ml = positive SARS-CoV-2 RBD IgG >1.1 = positive	22 days post second dose: 49/84 (58%)	Not reported	Not reported
Subset of CLL patients from other haematology studies										
Agha et. al.	Single centre retrospective cohort study United States	Haematology CLL subset	67 patients -19% CLL	71 years (IQR 65-77)	35 Male 32 Female	BNT162b2 mRNA-1273 51% 42% 7% unknown	SARS-CoV-2 S IgG Beckman Coulter ≥1.00 = positive	21 days post second dose: 3/13 (23%)	Not reported	Not reported
Greenberger et. al.	Multicentre prospective cohort study United States	Haematology CLL subset	1445 patients -45% CLL	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 55% 45%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 417/650 (64%)	Not reported	Not reported
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology CLL subset Matched	315 patients -11% CLL 108 controls	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml	30-60 days post second dose: 16/34 (46%) vs.	Not reported	Not reported

		Healthy control					= positive	107/108 (99%) control		
Jurgens et. al.	Single centre prospective cohort study United States	Haematology CLL subset Control health care workers	67 patients -31% CLL 35 controls	71 years (24-90)	36 Male 31 Female	BNT162b2 mRNA-1273 46% 54%	SARS-CoV-2 S IgG 'in house' OD450 ≥ 3 = positive	21 days post second dose: 12/21 (57%) vs. 35/35 (100%) controls	Not reported	Not reported
Monin et. al.	Multicentre prospective cohort study United Kingdom	Haematology CLL subset Health care workers controls	56 patients -68% B cell malignancy -9% T cell malignancy -18% myeloid/ acute leukaemia -5% others 54 controls	73 years (IQR 65-80)	Not extractable for haem	BNT162b2	SARS-CoV-2 Spike IgG ≥ 70 EC50 = positive SARS-CoV-2 specific T cells secreting IFN-gamma and/or IL2 >7 cytokine-secreting cells per 10^6 PBMC = positive	21 days post first dose: 1/6 (17%) vs. 32/34 (94%) Controls 35 days post first dose: 0/6 (0%) vs. 18/21 (86%) controls 35 days post first dose (with second dose): 1/2 (50%) vs. 12/12 (100%) controls	Cellular response 21 days post first dose: 2/5 (40%) vs. 14/17 (82%) controls 35 days post first dose: 1/4 (25%) vs. 9/13 (69%) controls 35 days post first dose (with second dose): 1/1 (100%) vs. 3/3 (100%) controls	Not extractable for haem
Ollila et. al.	Single centre retrospective cohort study	Haematology CLL subset	160 patients -12% CLL	72 years (65-79)	86 Male 74 Female	BNT162b2 mRNA-1273 Ad26	SARS-CoV-2 S IgG Abbott	56 days post first dose: 7/19 (37%) CLL	Not reported	Not reported

	United States						Signal/cutoff ratio ≥1.4 = positive			

Supplementary Table 3: Summary of study characteristics and outcomes for patients with chronic lymphocytic leukaemia

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Ghione et. al.	Single centre prospective cohort study United States	B-cell lymphoma Control age-care, healthcare workers	86 patients 47 controls 154 controls	70 years (35-91)	45 Male 41 Female	BNT162b2 mRNA-1273 Ad26 47% 52% 1%	SARS-CoV-2 S IgG BioRad ≥1.0 = positive	14-56 days post completion of vaccination: 36/86 (42%) patients vs. 43/47 (92%) age-care 154/154 (100%) healthcare	Not reported	Not reported
Gurion et. al.	Multicentre prospective cohort study Israel	Lymphoma	162 patients -88% NHL -12% HL	65 years (52-73)	89 Male 73 Female	BNT162b2	SARS-CoV-2 S IgG Abbott ≥ 50 IU/ml = positive	28 days post second dose: 83/162 (51%)	Not reported	Not reported
Lim et. al.	Multicentre prospective cohort study Interim analysis United Kingdom	Lymphoma	129 patients recruited 119 analysed -66% indolent B-NHL -29% aggressive B-NHL -10% HL -3% other	69 years (IQR 57-74)	81 Male 48 Female	BNT162b2 ChAdOx1	SARS-CoV-2 S IgG Meso Scale Discovery >0.55 BAU/ml = positive RBD IgG >0.73 BAU/ml =	14 days post first dose: 32/59 (54%) patients vs. 65/65 (100%) controls 14-28 days post second dose: 61/86 (71%)	Not reported	Not reported

		Healthy control	150 control				positive	patients vs. 85/85 (100%) controls		
Perry et. al.	Single centre prospective cohort study Israel	Lymphoma -B cell NHL Healthy control	149 patients -53% indolent NHL -47% aggressive NHL 65 controls	64 years (20-92)	88 Male 61 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	14-21 days post second dose: 73/149 (49%) vs. 64/65 (99%) controls 38/80 (48%) indolent NHL 34/69 (49%) aggressive NHL	Not reported	At least 1 adverse event: 60/118 (51%) 44/118 (37%) local AE 23/118 (20%) Systemic AE
Subset of lymphoma patients from other haematology studies										
Agha et. al.	Single centre retrospective cohort study United States	Haematology Lymphoma subset	67 patients -31% lymphoma	71 years (IQR 65-77)	35 Male 32 Female	BNT162b2 mRNA-1273 51%/42% 7% unknown	SARS-CoV-2 S IgG Beckman Coulter ≥1.00 = positive	21 days post second dose: 11/21 (52%)	Not reported	Not reported
Cohen et. al.	Single centre retrospective cohort study Israel	Haematology Lymphoma subset	54 patients -61% lymphoma	69 years (IQR 61-77)	32 Male 22 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	14-21 days post second dose: 17/33 (52%)	Not reported	Not reported
Greenberger et. al.	Multicentre prospective	Haematology Lymphoma	1445 patients	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273	SARS-CoV-2	>14 days post second dose:	Not reported	Not reported

	cohort study United States	subset	-25% NHL -5% HL			55% 45%	S IgG Roche ≥ 0.8 IU/ml = positive	266/363 (73%) NHL 64/65 (98%) HL		
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology Matched Healthy control	315 patient -16% aggressive NHL -13% indolent NHL -5% HL 108 controls	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml = positive	30-60 days post second dose: 36/51 (71%) aggressive NHL 24/40 (60%) Indolent NHL 15/17 (94%) HL vs. 107/108 (99%) control	Not reported	Not reported
Jurgens et. al.	Single centre prospective cohort study United States	Haematology Control health care workers	67 patients -63% NHL -6% HL 35 controls	71 years (24-90)	36 Male 31 Female	BNT162b2 mRNA-1273 46%/54%	SARS-CoV-2 S IgG 'in house' OD450 ≥ 3 = positive	21 days post second dose: 25/42 (60%) NHL 4/4 (100%) HL vs. 35/35 (100%) controls	Not reported	Not reported
Monin et. al.	Multicentre prospective cohort study United Kingdom	Haematology Lymphoma subset	56 patients -68% B cell malignancy -9% T cell malignancy -18% myeloid/	73 years (IQR 65-80)	Not extractable for haem	BNT162b2	SARS-CoV-2 Spike IgG ≥ 70 EC50 = positive	21 days post first dose: 2/15 (13%) vs. 32/34 (94%) Controls	Cellular response 21 days post first dose: 3/3 (100%) vs. 14/17 (82%)	Not extractable for haem

		Health care workers controls	acute leukaemia -5% others 54 controls				SARS-CoV-2 specific T cells secreting IFN-gamma and/or IL2 >7 cytokine-secreting cells per 10^6 PBMC = positive	35 days post first dose: 1/10 (10%) vs. 18/21 (86%) controls 35 days post first dose (with second dose): 0/1 (0%) vs. 12/12 (100%) controls	controls 35 days post first dose: 1/3 (33%) vs. 9/13 (69%) controls 35 days post first dose (with second dose): 0/1 (0%) vs. 3/3 (100%) controls	
Ollila et. al.	Single centre retrospective cohort study United States	Haematology Lymphoma subset	160 patients -36% aggressive lymphoma -21% indolent lymphoma - 9% other lymphoma	72 years (65-79)	86 Male 74 Female	BNT162b2 mRNA-1273 Ad26	SARS-CoV-2 S IgG Abbott Signal/cutoff ratio ≥1.4 = positive	56 days post first dose: 27/107 (25%) Total lymphoma 9/58 (16%) Aggressive lymphoma 12/34 (35%) indolent lymphoma 6/15 (40%) Other lymphoma	Not reported	Not reported

Supplementary Table 4: Summary of study characteristics and outcomes for patients with lymphoma

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Easdale et. al.	Single centre retrospective cohort study United Kingdom	Allogeneic HCT >3 months	55 patients	50 years (18-73)	34 Male 21 Female	BNT162b2 ChAdOx1 38% 62%	SARS-CoV-2 S IgG Ortho clinical ≥1 signal/cut-off = positive	42 days post first dose: 21/55 (38%)	Not reported	Not reported
Redjoul et. al.	Single centre retrospective cohort study France	Allogeneic HCT	88 patients	Not reported	47 Male 41 Female	BNT162b2	SARS-CoV-2 S IgG Abbott >21 AU/ml = positive >4160 AU/ml = neutralisation	28 days post second dose: 69/88 (78%) >4160 AU/ml 28 days post second dose: 52/88 (59%)	Not reported	Not reported
Ram et. al.	Single centre prospective cohort study Israel	Allogeneic HCT and CAR-T >3 months	80 patients -83% alloHCT -17% CAR-T	65 years (23-83)	44 Male 37 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 U/ml = positive SARS-CoV-2 specific cells	7 to 14 days post second dose: 47/63 (75%) alloHCT 5/14 (36%) CAR-T	Cellular 7 to 14 days post second dose: 7/37 (19%) alloHCT 6/12 (50%) CAR-T	At least 1 adverse event: First dose 11/80 (14%) 3/80 (4%) GvHD Second dose 18/74 (24%)

							ELISPOT, (IFN, IL2) 4 spots/well = positive			3/74 (4%) GvHD
Dhakal et. al.	Single centre retrospective cohort study United States	Autologous Allogeneic HCT CAR-T	130 patients -45 autoHCT -71 alloHCT -14 CAR-T	autoHCT 65 years (45-75) alloHCT 64 years (25-77) Age not specified for CAR-T	Not reported	BNT162b2 mRNA-1273 Ad26 59% 36% 5%	SARS-CoV-2 S IgG EUROIMMUN ≥1.1 signal/cut-off = positive	14 days post completion of vaccination: 27/45 (60%) autoHCT 49/71 (38%) alloHCT 3/14 (21%) CAR-T	Not reported	Not reported
Subset of HCT patients from other haematology studies										
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology Autologous HCT subset Matched Healthy control	315 patients 108 controls	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml = positive	30-60 days post second dose: 17/21 (81%) autoHCT vs. 107/108 (99%) control	Not reported	Not reported
Greenberger et. al.	Multicentre prospective cohort study United States	Haematology HCT and CAR-T subset	1445 patients	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 45% 55%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 65/73 (89%) HCT 5/12 (42%) CAR-T	Not reported	Not reported

Supplementary Table 5: Summary of study characteristics and outcomes for patients following haematopoietic stem cell transplant and cellular therapy

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Subset of acute leukaemia and myelodysplastic syndrome patients from other haematology studies										
Benda et. al.	Single centre prospective cohort study	Haematology AML subset Solid tumour	123 patients -28% AML/MDS/ MPN 136 patients	Not reported in haem	Not reported in haem	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	28 days post second dose: 33/34 (97%)	Not reported	Not reported for haem
Greenberger et. al.	Multicentre prospective cohort study United States	Haematology Acute leukaemia subset	1445 patients -4% acute leukaemia	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 55% 45%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 46/51 (90%)	Not reported	Not reported
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology Acute leukaemia MDS subset Matched Healthy control	315 patients -5% Acute leukemia -5% MDS 108 controls	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml = positive	30-60 days post second dose: 12/15 (80%) acute leukaemia 15/16 (94%) MDS vs. 107/108 (99%) control	Not reported	Not reported
Monin et. al.	Multicentre prospective cohort study	Haematology Acute leukaemia subset	56 patients -18% myeloid, leukaemia	73 years (IQR 65-80)	Not extractable for haem	BNT162b2	SARS-CoV-2 Spike IgG ≥ 70 EC50	21 days post first dose: 0/3 (0%) vs.	Cellular response 21 days post first dose:	Not extractable for haem

	United Kingdom	Health care workers controls	-5% others 54 controls				= positive SARS-CoV-2 specific T cells secreting IFN-gamma and/or IL2 >7 cytokine-secreting cells per 10^6 PBMC = positive	32/34 (94%) Controls 35 days post first dose: 0/3 (0%) vs. 18/21 (86%) controls	0/1 (0%) vs. 14/17 (82%) controls 35 days post first dose: 1/2 (50%) vs. 9/13 (69%) controls	
Ollila et. al.	Single centre retrospective cohort study United States	Haematology Myeloid subset	160 patients - 6% myeloid	72 years (65-79)	86 Male 74 Female	BNT162b2 mRNA-1273 Ad26	SARS-CoV-2 S IgG Abbott Signal/cutoff ratio ≥1.4 = positive	56 days post first dose: 5/10 (50%) myeloid malignancies	Not reported	Not reported
Re et. al.	Multicentre retrospective cohort study France	Haematology AML/MDS subset	102 patients -13% MDS/AML	76 years (33-93)	67 Male 35 Female	BNT162b2 mRNA-1273 93%/7%	SARS-CoV-2 S IgG Range of commercial kits utilising their threshold	21-28 days post second dose 11/13 (85%)	Not reported	Not reported

Supplementary Table 6: Summary of study characteristics and outcomes for patients with acute leukaemia (AML, ALL) and myelodysplastic syndrome (MDS)

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Caocci et. al.	Single centre prospective cohort study Italy	MPN	20 patients -65% MF -30% ET -5% PV	66 years (48-82)	Not reported	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive	42 days post second dose: 13/20 (65%)	Not reported	Not reported
Chowdhury et. al.	Single centre retrospective cohort United Kingdom	CML and MPN Healthcare workers > 60 years old	59 patients 232 controls	62 years (IQR 52-73)	27 Male 32 Female	BNT162b2 ChAdOx1 37% 63%	SARS-CoV-2 S IgG Abbott ≥ 50 AU/mL = positive	≥ 2 weeks post first dose: 34/59 (57%) 224/232 (97%)	Not reported	Not reported
Guglielmelli et. al.	Single centre prospective cohort study Italy	MPN Healthy controls	30 patients -43% MF -33% PV -23% ET 14 controls	Not reported overall	10 Male 20 Female	BNT162b2 mRNA-1273 83% 17%	SARS-CoV-2 S/RBD IgG Not specified	21 to 28 days post first dose: 18/30 (60%) vs. 14/14 (100%) controls	21 to 28 days post first dose: 13/30 (43%) vs. 14/14 (100%) controls	Not reported
Harrington et. al.	Single centre prospective cohort study United Kingdom	MPN	16 patients -CML	45 years (23-74)	12 Male 4 Female	BNT162b2	SARS-CoV-2 S IgG 'in house' 1:25 = positive SARS-CoV-2	21 days post first dose: 14/16 (88%)	Neutralising antibody 21 days post first dose: 6/16 (38%) Cellular: 14/15 (80%)	Local adverse events: 8/16 (50%) Systemic adverse events: 9/16 (56%)

							neutralising 'in house' ID50 = positive SARS-CoV-2 T cells ICS (IFN, IL2) 3 fold increase = positive			
Harrington et. al.	Single centre prospective cohort study United Kingdom	MPN	21 patients	58 years (36-72)	7 Male 21 Female	BNT162b2	SARS-CoV-2 S IgG 'in house' 1:25 = positive SARS-CoV-2 neutralising 'in house' ID50 = positive SARS-CoV-2 T cells ICS (IFN, IL2) 3 fold increase = positive	21 days post first dose: 16/21 (76%)	Neutralising antibody 21 days post first dose: 18/21 (86%) Cellular (CD4): 15/20 (75%)	At least 1 adverse event: 12/21 (57%) local 10/21 (48%) systemic
Pimpinelli et. al.	Single centre prospective cohort study	MPN	42 patients -40% ET -36% PV -24% MF	72 years (52-82)	20 Male 22 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml	21 days post first dose: 23/42 (55%)	Not reported	Not reported

	Italy						= positive	14 days post second dose: 36/42 (86%)		
Subset of myeloproliferative neoplasm and chronic myeloid leukaemia patients from other haematology studies										
Benda et. al.	Single centre prospective cohort study	Haematology MPN subset Solid tumour	123 patients -28% AML/MDS/ MPN 136 patients	Not reported in haem	Not reported in haem	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	28 days post second dose: 33/34 (97%)	Not reported	Not reported for haem
Greenberger et. al.	Multicentre prospective cohort study United States	Haematology CML subset	1445 patients -2% CML	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 55% 45%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 33/34 (97%)	Not reported	Not reported
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology Matched Healthy control	315 patients -22% MPN -7% CML 108 controls	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml = positive	30-60 days post second dose: 57/68 (84%) MPN 20/22 (91%) CML vs. 107/108 (99%) control	Not reported	Not reported
Monin et. al.	Multicentre prospective cohort study United Kingdom	Haematology MPN subset	56 patients -68% B cell -9% T cell -18% myeloid, leukaemia -5% others	73 years (IQR 65-80)	Not extractable for haem	BNT162b2	SARS-CoV-2 Spike IgG ≥ 70 EC50 = positive SARS-CoV-2 specific T	21 days post first dose: 1/5 (20%) vs. 32/34 (94%) Controls 35 days post	Cellular response 21 days post first dose: 1/3 (33%) vs. 14/17 (82%) controls	Not extractable for haem

		Health care workers controls	54 controls				cells secreting IFN-gamma and/or IL2 >7 cytokine-secreting cells per 10^6 PBMC = positive	first dose: 1/4 (25%) vs. 18/21 (86%) controls 35 days post first dose (with second dose): 1/1 (100%) vs. 12/12 (100%) controls	35 days post first dose: 1/2 (50%) vs. 9/13 (69%) controls 35 days post first dose (with second dose): 1/1 (100%) vs. 3/3 (100%) controls	
Pimpinelli et. al.	Single centre prospective study Italy	Haematology MPN subset Older age (> 80 years) control group	50 patients -40% CML -22% ET -22% PV -16% MF 36 controls	70 years (28-80)	26 Male 24 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive	21 days post first dose: 26/50 (52%) MPN vs. 19/36 (53%) controls 14 days post second dose: 44/50 (88%) MPN vs. 36/36 (100%) controls ≥ 80 AU/ml 14 days post second dose 42/50 (84%) MPN vs.	Not reported	Reported with different patient numbers

								34/36 (97%) control		
Re et. al.	Multicentre retrospective cohort study France	Haematology MPN subset	102 patients -45% lymphoma -22% myeloma -13% MDS/AML -10% CLL -10% MPN	76 years (33-93)	67 Male 35 Female	BNT162b2 mRNA-1273 93%/7%	SARS-CoV-2 S IgG Range of commercial kits utilising their threshold	21-28 days post second dose 8/10 (80%)	Not reported	Not reported

Supplementary Table 7: Summary of study characteristics and outcomes for patients with myeloproliferative neoplasm and chronic myeloid leukaemia

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Avivi et. al.	Single centre Prospective cohort study Israel	Myeloma / Healthy volunteers	171 patients vs. 64 controls	70 years (range 38-94)	96 male 75 female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 UI/ml = positive	14-21 days post second dose: 110/147 (75%) active treatment	Not reported	At least one adverse event: 90/161 (53%) vs. 29/53 (55%) controls
Bird et. al.	Retrospective cohort study United Kingdom/ Europe	Myeloma	93 patients	67 years (47-87)	55 Male 38 Female	BNT162b2 ChAdOx1 52% 48%	SARS-CoV-2 S IgG Ortho clinical ≥1 signal/cut-off = positive	≥ 21 days post first dose: 32/66 (48%) on active therapy 20/27 (74%) not on active therapy	Not reported	Not reported
Terpos et. al.	Single centre prospective cohort study Greece	Myeloma Matched Controls	48 patients 102 controls	83 years (59-92)	29 Male 19 Female	BNT162b2	SARS-CoV-2 neutralising Ab Genscript ≥ 30% = positive ≥ 50% = clinically relevant	Not reported	≥ 50% 22 days post first dose: 4/13(31%) no active therapy	Not reported
Terpos et. al.	Single centre prospective cohort study	Myeloma	276 patients -77% myeloma	74 years (62-80)	151 Male 125 Female	BNT162b2 ChAdOx1	SARS-CoV-2 neutralising	Not reported for active treatment	Day 50 post first dose: 23/34 (68%)	First dose BNT162b2 71/215

	Greece	Matched Controls	-14% sMM -9% MGUS 226 controls			78%/22%	Ab Genscript ≥ 30% = positive ≥ 50% = clinically relevant		no active treatment	(33%) local reaction 28/215 (13%) systemic reaction ChAdOx1 20/61 (33%) local reaction Second dose BNT162b2 68/215 (32%) local reaction 45/215 (21%) systemic reaction
Van Oekelen et. al.	Single centre prospective and retrospective cohort study United States	Myeloma Matched control health care workers	320 patients -260 sampled 67 controls	68 years (38-93)	185 Male 135 Female	BNT162b2 mRNA-1273 unknown 69% 27% 4%	SARS-CoV-2 S IgG ≥ 5 AU/ml = positive	51 days post second dose: 43/44 (98%) no active treatment	Not reported	Not reported
Benjamini et. al.	Multicentre prospective cohort study Israel	CLL patients	373 patients	70 years (40-89)	222 Male 151 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive	14-21 days pot second dose: 16/120 (13%) active treatment	Neutralising antibody 14-21 days post second dose: 27/45 (60%)	At least 1 adverse event: 151/331 (47%)

							Abbott >50 U/ml = positive 'in house' >1.1 = positive	143/253 (57%) no active treatment		
Del Poeta et. al.	Single centre prospective cohort study Italy	CLL patients	46 patients	Not reported	29 Male 17 Female	BNT162b2	SARS-CoV-2 S IgG Maglumi ≥1.1 = positive	14-21 days post second dose: 12/29 (41%) on active treatment	Not reported	Not reported
Herishanu et. al.	Single centre prospective cohort study Israel	CLL patients Control -age, sex matched	167 patients 52 controls	71 years (63-76)	112 Male 55 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	14-21 days post second dose: 23/58 (55%) treatment naïve patients 12/75 (16%) Patients on active treatment	Not reported	First dose 52/167 (31%) local reaction 21/167 (13%) Systemic reaction Second dose 56/167 (34%) local reaction 21/167 (23%) Systemic reaction
Roeker et. al.	Single centre retrospective cohort study	CLL patients	44 patients	71 years (37-89)	23 Male 21 Female	BNT162b2 mRNA-1273	SARS-CoV-2 S IgG	21 days post second dose: 6/26 (23%)	Not reported	Not reported

	United States					57%/43%	DiaSorin ≥ 15 AU/ml = positive	not on active treatment 17/18 (94%) treatment naïve		
Tadmor et. al.	Multicentre prospective observation study Israel	CLL patients	84 patients	Not reported overall	53 Male* 29 Female	BNT162b2	SARS-CoV-2 S IgG Abbott ≥ 50 U/ml = positive SARS-CoV-2 RBD IgG >1.1 = positive	Day 22 post second dose: 6/21 (29%) on active treatment 43/63 (68%) not on active treatment	Not reported	Not reported
Lim et. al.	Multicentre prospective cohort study United Kingdom	Lymphoma Healthy control	129 patients recruited 119 analysed -66% indolent B-NHL -29% aggressive B-NHL -10% HL -3% other 150 control	69 years (IQR 57-74)	81 Male 48 Female	BNT162b2 ChAdOx1	SARS-CoV-2 S IgG Meso Scale Discovery >0.55 BAU/ml = positive RBD IgG >0.73 BAU/ml = positive	14 days post first dose: 9/31 (28%) on active treatment 23/28 (82%) not on active treatment 14-28 days post second dose: 13/33 (39%) on active treatment 48/53 (91%) not on active	Not reported	Not reported

								treatment		
Agha et. al.	Single centre retrospective cohort study United States	Haematology	67 patients	71 years (IQR 65-77)	35 Male 32 Female	BNT162b2 mRNA-1273 51%/42% 7% unknown	SARS-CoV-2 S IgG Beckman Coulter ≥1.00 = positive	21 days post second dose: 15/29 (52%) Active treatment 21/38 (55%) not on active treatment	Not reported	Not reported
Greenberger et. al.	Multicentre prospective cohort study United States	Haematology	1445 patients -45% CLL -25% NHL -5% HL -15% myeloma -4% acute leukaemia -2% CML -2% MPN -2% others	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 55% 45%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 669/747 (90%) not on active treatment	Not reported	Not reported
Harrington et. al.	Single centre prospective cohort study United Kingdom	MPN	21 patients	58 years (36-72)	7 Male 21 Female	BNT162b2	SARS-CoV-2 S IgG 1:25 = positive SARS-CoV-2 neutralising ID50 = positive SARS-CoV-2 T cells	21 days post first dose: 4/7 (57%) active treatment 12/14 (86%) not on active treatment	Not reported	At least 1 adverse event: 12/21 (57%) local 10/21 (48%) systemic

							ICS (IFN, IL2) 3 fold increase = positive			
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology Matched Healthy control	315 patients -22% MPN -17% Myeloma -16% aggressive NHL -13% indolent NHL -11% CLL -7% CML -5% HL -5% Acute leukemia -5% MDS 108 controls	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml = positive	30-60 days post second dose: 130/151 (86%) not on active treatment	Not reported	Not reported
Jurgens et. al.	Single centre prospective cohort study United States	Haematology Control health care workers	67 patients -31% CLL -63% NHL -6% HL 35 controls	71 years (24-90)	36 Male 31 Female	BNT162b2 mRNA-1273 46% 54%	SARS-CoV-2 S IgG 'in house' OD450 ≥ 3 = positive	21 days post second dose: 9/29 (31%) on active treatment	Not reported	Not reported
Ollila et. al.	Single centre retrospective cohort study United States	Haematology	160 patients -36% aggressive lymphoma -21%	72 years (65-79)	86 Male 74 Female	BNT162b2 mRNA-1273 Ad26	SARS-CoV-2 S IgG Abbott Signal/cuto	56 days post first dose: 10/15 (67%) in patients under	Not reported	Not reported

			indolent lymphoma -15% plasma cell -12% CLL - 9% other lymphoma - 6% myeloid				ff ratio ≥1.4 = positive	observation/no treatment 31/63 (49%) patients in remission post treatment		
Re et. al.	Multicentre retrospective cohort study France	Haematology	102 patients -45% lymphoma -22% myeloma -13% MDS/AML -10% CLL -10% MPN	76 years (33-93)	67 Male 35 Female	BNT162b2 mRNA-1273 93%/7%	SARS-CoV-2 S IgG Range of commercial kits utilising their threshold	21-28 days post second dose 31/47 (66%) no active treatment	Not reported	Not reported

Supplementary Table 8: Summary of study characteristics and outcomes for subgroup analysis active treatment vs. no active treatment

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Benjamini et. al.	Multicentre prospective cohort study Israel	CLL patients	373 patients	70 years (40-89)	222 Male 151 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive Abbott >50 U/ml = positive 'in house' >1.1 = positive	14-21 days pot second dose: 2/39 (5%) CD20 <12 months 32/92 (35%) CD20 >12 months	Neutralising antibody 14-21 days post second dose: 27/45 (60%)	At least 1 adverse event: 151/331 (47%)
Herishanu et. al.	Single centre prospective cohort study Israel	CLL patients Control -age, sex matched	167 patients 52 controls	71 years (63-76)	112 Male 55 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	14-21 days post second dose: 0/22 (0%) treatment with CD20 < 12 months 25/55 (46%) if CD20 ≥ 12 months	Not reported	First dose 52/167 (31%) local reaction 21/167 (13%) Systemic reaction Second dose 56/167 (34%) local reaction 21/167 (23%) Systemic reaction

Roeker et. al.	Single centre retrospective cohort study United States	CLL patients	44 patients	71 years (37-89)	23 Male 21 Female	BNT162b2 mRNA-1273 57%/43%	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive	21 days post second dose: 2/14 (14%) if CD20 < 12 months	Not reported	Not reported
Tadmor et. al.	Multicentre prospective observation study Israel	CLL patients	84 patients	Not reported overall	53 Male* 29 Female	BNT162b2	SARS-CoV-2 S IgG Abbott ≥ 50 U/ml = positive SARS-CoV-2 RBD IgG >1.1 = positive	Day 22 post second dose: 18/22 (82%) if CD20 > 12 months 0/22 (0%) CD20 <12 months	Not reported	Not reported
Gurion et. al.	Multicentre prospective cohort study Israel	Lymphoma	162 patients -88% NHL -12% HL	65 years (52-73)	89 Male 73 Female	BNT162b2	SARS-CoV-2 S IgG Abbott ≥ 50 IU/ml = positive	28 days post second dose: 25/66 (38%) CD20 < 12 months 17/21 (81%) if CD20 > 12 months	Not reported	Not reported
Easdale et. al.	Single centre retrospective cohort study United Kingdom	Allogeneic HCT >3 months	55 patients	50 years (18-73)	34 Male 21 Female	BNT162b2 ChAdOx1 38%/62%	SARS-CoV-2 S IgG Ortho clinical ≥1 signal/cut-off =	42 days post first dose: 2/10 (20%) if CD20 < 12 months	Not reported	Not reported

							positive			
Agha et. al.	Single centre retrospective cohort study United States	Haematology	67 patients	71 years (IQR 65-77)	35 Male 32 Female	BNT162b2 mRNA-1273 51% 42% 7% unknown	SARS-CoV-2 S IgG Beckman Coulter ≥1.00 = positive	21 days post second dose: 2/9 (22%) CD20 < 12 months	Not reported	Not reported
Greenberger et. al.	Multicentre prospective cohort study United States	Haematology	1445 patients -45% CLL -25% NHL -5% HL -15% myeloma -4% acute leukaemia -2% CML -2% MPN -2% others	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 55% 45%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 97/263 (37%) on CD20	Not reported	Not reported
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology	315 patients -22% MPN -17% Myeloma -16% aggressive NHL -13% indolent NHL -11% CLL -7% CML -5% HL -5% Acute leukemia -5% MDS	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml = positive	30-60 days post second dose: 0/28 (0%) on CD20	Not reported	Not reported

		Matched Healthy control	108 controls							
Jurgens et. al.	Single centre prospective cohort study United States	Haematology Control health care workers	67 patients -31% CLL -63% NHL -6% HL 35 controls	71 years (24-90)	36 Male 31 Female	BNT162b2 mRNA-1273 46%/54%	SARS-CoV-2 S IgG 'in house' OD450 ≥ 3 = positive	21 days post second dose: 0/8 (0%) on CD20	Not reported	Not reported
Re et. al.	Multicentre retrospective cohort study France	Haematology	102 patients -45% lymphoma -22% myeloma -13% MDS/AML -10% CLL -10% MPN	76 years (33-93)	67 Male 35 Female	BNT162b2 mRNA-1273 93%/7%	SARS-CoV-2 S IgG Range of commercial kits utilising their threshold	21-28 days post second dose 1/17 (6%) if on CD20 14/22 (64%) if CD20 ≥ 12 months	Not reported	Not reported
Thakkar et. al.	Single centre prospective and retrospective cohort study United States	Haematology Solid tumours Healthy control	66 patients -39% lymphoid -27% myeloid -33% plasma cell 134 patients 26 controls	Not reported for haem	Not reported for haem	BNT162b2 mRNA-1273 Ad26	SARS-CoV-2 S IgG Abbott ≥ 50 AU/ml = positive	29 days post completion (2 doses for mRNA, 1 dose for Ad26): 4/5 (80%) CD20 < 12 months 12/18 (67%) CD20 > 12 months	Not reported	Not reported for haem

Supplementary Table 9: Summary of study characteristics and outcomes for subgroup analysis CD20 therapy less than 12 months vs. CD20 therapy 12 or more months

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Benjamini et. al.	Multicentre prospective cohort study Israel	CLL patients	373 patients	70 years (40-89)	222 Male 151 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive Abbott >50 U/ml = positive 'in house' >1.1 = positive	14-21 days pot second dose: 14/79 (18%) BTKi 2/34 (6%) venetoclax 7/49 (14%) venetoclax plus CD20	Neutralising antibody 14-21 days post second dose: 27/45 (60%)	At least 1 adverse event: 151/331 (47%)
Del Poeta et. al.	Single centre prospective cohort study Italy	CLL patients	46 patients	Not reported	29 Male 17 Female	BNT162b2	SARS-CoV-2 S IgG Maglumi ≥1.1 = positive	14-21 days post second dose: 8/21 (38%) BTKi 2/8 (25%) Venetoclax	Not reported	Not reported
Herishanu et. al.	Single centre prospective cohort study Israel	CLL patients Control -age, sex matched	167 patients 52 controls	71 years (63-76)	112 Male 55 Female	BNT162b2	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	14-21 days post second dose: 8/50 (16%) BTKi 3/20 (14%) venetoclax +/- CD20 2/5 (40%) venetoclax	Not reported	First dose 52/167 (31%) local reaction 21/167 (13%) Systemic reaction Second dose

										56/167 (34%) local reaction 21/167 (23%) Systemic reaction
Parry et. al.	Single centre prospective cohort study United Kingdom	CLL patients Healthy age matched controls	299 patients 93 controls	69 years (IQR 63-74)	159 Male 140 Female	BNT162b2 ChAxOd1 52% 48%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	43 days post first dose: Serum 2/18 (11%) BTKi	Not reported	Not reported
Roeker et. al.	Single centre retrospective cohort study United States	CLL patients	44 patients	71 years (37-89)	23 Male 21 Female	BNT162b2 mRNA-1273 57%/43%	SARS-CoV-2 S IgG DiaSorin ≥ 15 AU/ml = positive	21 days post second dose: 3/14 (21%) BTKi 0/7 (0%) Venetoclax	Not reported	Not reported
Tadmor et. al.	Multicentre prospective observation study Israel	CLL patients	84 patients	Not reported overall	53 Male 29 Female	BNT162b2	SARS-CoV-2 S IgG Abbott ≥ 50 U/ml = positive SARS-CoV-2 RBD IgG >1.1 = positive	Day 22 post second dose: 4/11 (36%) BTKi 1/6 (17%) venetoclax	Not reported	Not reported

Greenberger et. al.	Multicentre prospective cohort study United States	Haematology	1445 patients -45% CLL -25% NHL -5% HL -15% myeloma -4% acute leukaemia -2% CML -2% MPN -2% others	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 55% 45%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 136/286 (48%) BTKi 11/28 (39%) venetoclax	Not reported	Not reported
Herzog Tzarfati et. al.	Single centre prospective cohort study Israel	Haematology Matched Healthy control	315 patients -22% MPN -17% Myeloma -16% aggressive NHL -13% indolent NHL -11% CLL -7% CML -5% HL -5% Acute leukemia -5% MDS 108 controls	70 years (IQR 61-77)	223 Male 200 Female	BNT162b2	SARS-CoV-2 S IgG DiaSorin ≥ 12 AU/ml = positive	30-60 days post second dose: 2/5 (60%) BTKi 1/4 (25%) venetoclax	Not reported	Not reported
Jurgens et. al.	Single centre prospective cohort study United States	Haematology	67 patients -31% CLL -63% NHL -6% HL	71 years (24-90)	36 Male 31 Female	BNT162b2 mRNA-1273 46% 54%	SARS-CoV-2 S IgG 'in house' OD450 ≥ 3	21 days post second dose: 6/10 (60%) BTKi	Not reported	Not reported

		Control health care workers	35 controls				= positive			
Re et. al.	Multicentre retrospective cohort study France	Haematology	102 patients -45% lymphoma -22% myeloma -13% MDS/AML -10% CLL -10% MPN	76 years (33-93)	67 Male 35 Female	BNT162b2 mRNA-1273 93% 7%	SARS-CoV-2 S IgG Range of commercial kits utilising their threshold	21-28 days post second dose 27/36 (75%) if on targeted therapy	Not reported	Not reported

Supplementary Table 10: Summary of study characteristics and outcomes for subgroup analysis targeted therapy vs. no targeted therapy

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Bird et. al.	Single centre retrospective cohort study United Kingdom/ Europe	Myeloma	93 patients	67 years (47-87)	55 Male 38 Female	BNT162b2 ChAdOx1 52%/48%	SARS-CoV-2 S IgG Ortho clinical ≥1 signal/cut-off = positive	≥ 21 days post first dose: 6/8 (75%) HCT </= 12 months 37/69 (54%) HCT > 12 months	Not reported	Not reported
Dhakal et. al.	Single centre retrospective cohort study United States	Autologous Allogeneic HCT CAR-T	130 patients -45 autoHCT -71 alloHCT -14 CAR-T	65 years (45-75) 64 years (25-77)	Not reported	BNT162b2 mRNA-1273 Ad26	SARS-CoV-2 S IgG EUROIMMUN ≥1.1 signal/cut-off = positive	14 days post completion of vaccination: AutoHCT 11/15 (73%) < 12 months 16/30 (53%) ≥ 12 months AlloHCT 11/19 (58%) < 12 months 38/52 (73%) ≥ 12 months	Not reported	Not reported
Thakkar et. al.	Single centre prospective and retrospective cohort study	Haematology	66 patients -39% lymphoid -27% myeloid	Not reported for haem	Not reported for haem	BNT162b2 mRNA-1273 Ad26	SARS-CoV-2 S IgG Abbott ≥ 50 AU/ml	29 days post completion (2 doses for mRNA, 1 dose for	Not reported	Not reported for haem

	United States	Solid tumours Healthy control	-33% plasma cell 134 patients 26 controls				= positive	Ad26): 2/3 (67%) if HCT < 12 months 17/23 (74%) HCT > 12 months		
Van Oekelen et. al.	Single centre prospective and retrospective cohort study United States	Myeloma Matched control health care workers	320 patients -260 sampled 67 controls	68 years (38-93)	185 Male 135 Female	BNT162b2 mRNA-1273 unknown 69% 27% 4%	SARS-CoV-2 S IgG ≥ 5 AU/ml = positive	51 days post second dose: 9/9 (100%) if HCT < 12 months	Not reported	Not reported

Supplementary Table 11: Summary of study characteristics and outcomes for subgroup analysis haematopoietic stem cell transplant within 12 months vs. 12 or more months

Study	Type /Location	Study population/ Comparator	Number of participants (analysed)	Age Median	Male/ Female	Vaccine type	Analysis	Seropositivity	Rate of positive neutralising antibody/ cellular response	Adverse events
Agha et. al.	Single centre retrospective cohort study United States	Haematology	67 patients	71 years (IQR 65-77)	35 Male 32 Female	BNT162b2 mRNA-1273 51% 42% 7% unknown	SARS-CoV-2 S IgG Beckman Coulter ≥1.00 = positive	21 days post second dose: 15/34 (44%) BNT162b2 16/28 (57%) mRNA-1273	Not reported	Not reported
Bird et. al.	Retrospective cohort study United Kingdom/ Europe	Myeloma	93 patients	67 years (47-87)	55 Male 38 Female	BNT162b2 ChAdOx1 52% 48%	SARS-CoV-2 S IgG Ortho clinical ≥1 signal/cut-off = positive	≥ 21 days post first dose: 26/48 (54%) BNT162b2 26/45 (58%) ChAdOx1	Not reported	Not reported
Chowdhury et. al.	Single centre retrospective cohort United Kingdom	CML and MPN Healthcare workers > 60 years old	59 patients 232 controls	62 years (IQR 52-73)	27 Male 32 Female	BNT162b2 ChAdOx1 37% 63%	SARS-CoV-2 S IgG Abbott ≥ 50 AU/mL = positive	≥ 2 weeks post first dose: 12/22 (55%) BNT162b2 22/37 (59%) ChAdOx1	Not reported	Not reported
Easdale et. al.	Single centre retrospective cohort study United Kingdom	Allogeneic HCT >3 months	55 patients	50 years (18-73)	34 Male 21 Female	BNT162b2 ChAdOx1 38% 62%	SARS-CoV-2 S IgG Ortho clinical ≥1	42 days post first dose: 4/21 (19%) BNT162b2	Not reported	Not reported

							signal/cut-off = positive	17/34 (50%) ChAdOx1		
Greenberger et. al.	Multicentre prospective cohort study United States	Haematology	1445 patients -45% CLL -25% NHL -5% HL -15% MM -4% acute leukaemia -2% CML -2% MPN -2% others	68 years (16-110)	574 Male 871 Female	BNT162b2 mRNA-1273 55% 45%	SARS-CoV-2 S IgG Roche ≥ 0.8 IU/ml = positive	>14 days post second dose: 585/793 (74%) BNT162b2 505/652 (77%) mRNA-1273	Not reported	Not reported
Lim et. al.	Multicentre prospective cohort study United Kingdom	Lymphoma Subset off treatment Healthy control	129 patients recruited 119 analysed -66% indolent B-NHL -29% aggressive B-NHL -10% HL -3% other 150 control	69 years (IQR 57-74)	81 Male 48 Female	BNT162b2 ChAdOx1	SARS-CoV-2 S IgG Meso Scale Discovery >0.55 BAU/ml = positive RBD IgG >0.73 BAU/ml = positive	14 days post first dose: 14/18 (78%) BNT162b2 9/10 (90%) ChAdOx1 14-28 days post second dose: 31/35 (89%) BNT162b2 17/18 (94%) ChAdOx1	Not reported	Not reported
Van Oekelen et. al.	Single centre prospective and retrospective cohort study	Myeloma	320 patients -260 sampled	68 years (38-93)	185 Male 135 Female	BNT162b2 mRNA-1273 unknown 69% 27%	SARS-CoV-2 S IgG ≥ 5 AU/ml = positive	51 days post second dose: 144/147 (98%) BNT162b2	Not reported	Not reported

	United States	Matched control health care workers	67 controls			4%		68/76 (89%) mRNA-1273		

Supplementary Table 12: Summary of study characteristics and outcomes for subgroup analysis vaccine type (BNT162b2 vs others)

	All studies (n=44)			**Good and fair quality studies (n=23)**		
	Single arm studies Pooled response rate (95% CI)	Intervention arm of comparator studies Pooled response rate (95% CI)	Intervention vs. control cohort Odds ratio (95% CI) Heterogeneity *p*-value	Single arm studies Pooled response rate (95% CI)	Intervention arm of comparator studies Pooled response rate (95% CI)	Intervention vs. control cohort Odds ratio (95% CI) Heterogeneity *p*-value
Following second dose	0.62 (0.55-0.75) $I^2 = 92\%$, $p<0.01$	0.66 (0.57-0.75) $I^2 = 93\%$, $p<0.01$	OR 0.04 (0.02-0.08) $p<0.01$ $I^2 = 70\%$, $p<0.01$	0.65 (0.54-0.75) $I^2 = 95\%$, $p<0.01$	0.64 (0.47-0.82) $I^2 = 96\%$, $p<0.01$	OR 0.05 (0.01-0.20) $P<0.01$ $I^2 = 74\%$, $p<0.01$
Following first dose	0.51 (0.38-0.64) $I^2 = 92\%$, $p<0.01$	0.37 (0.23-0.51) $I^2 = 90\%$, $p<0.01$	OR 0.10 (0.04-0.29) $p<0.01$ $I^2 = 86\%$, $p<0.01$	0.53 (0.33-0.73) $I^2 = 93\%$, $p<0.01$	0.35 (0.04-0.65) $I^2 = 93\%$, $p<0.01$	OR 0.17 (0.04-0.75) $p=0.03$ $I^2 = 87\%$, $p<0.01$

Supplementary Table 13: Summary of seropositivity rates for patients with haematological malignancy following 2 and 1 dose of COVID-19 vaccine by study quality (sensitivity analysis)

Additional information: Search strategy

Database: Ovid MEDLINE(R) ALL <1946 to August 31, 2021>
Search Strategy:
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1 exp hematologic neoplasms/ or exp leukemia/ or exp lymphoma/ or exp multiple myeloma/ or exp myeloproliferative disorders/ or exp myelodysplastic-myeloproliferative diseases/ or exp Stem Cell Transplantation/ or exp bone marrow transplantation/ (554418)
2 ((h?ematologic* or hematopoietic or blood or bone marrow) adj3 (cancer* or neoplasm* or malignan* or carcinoma*)).mp. (56690)
3 (leuk?emia* or lymphoma* or myeloma* or hodgkin* or myelodysplastic or myeloproliferative or polycythemia vera or stem cell transplant* or bone marrow transplant* or chimeric antigen receptor therap* or CAR-T).mp. (723006)
4 1 or 2 or 3 (758330)
5 exp COVID-19 vaccines/ or ((exp vaccines/ or exp immunization/) and (COVID-19/ or SARS-CoV-2/)) (6448)
6 ((covid* or SARS-CoV-2 or coronavirus or BNT162b2 or ChAdOx1 or AZD 1222, or mRNA-1273 or Ad26* or Ad5* or NVX-CoV2373 or pfizer or astrazeneca or astra-zeneca or oxford or novavax or moderna or johnson) adj2 (vaccin* or immuniz* or immunis*)).mp. (9371)
7 5 or 6 (11023)
8 4 and 7 (191)
9 limit 8 to english language (185)
10 limit 9 to yr="2020 -Current" (185)

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Database: Embase <1974 to 2021 August 31>
Search Strategy:
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1 exp hematologic malignancy/ or exp leukemia/ or exp lymphoma/ or exp myeloma/ or exp myeloproliferative disorder/ or exp myelodysplastic syndrome/ or exp Stem Cell Transplantation/ or exp bone marrow transplantation/ (867821)
2 ((h?ematologic* or hematopoietic or blood or bone marrow) adj3 (cancer* or neoplasm* or malignan* or carcinoma*)).mp. (95692)
3 (leuk?emia* or lymphoma* or myeloma* or hodgkin* or myelodysplastic or myeloproliferative or polycythemia vera or stem cell transplant* or bone marrow transplant* or chimeric antigen receptor therap* or CAR-T).mp. (1032174)
4 1 or 2 or 3 (1097575)
5 exp SARS-CoV-2 vaccine/ or ((exp vaccine/ or exp immunization/) and (exp coronavirus disease 2019/ or exp Severe acute respiratory syndrome coronavirus 2/)) (12263)
6 ((covid* or SARS-CoV-2 or coronavirus or BNT162b2 or ChAdOx1 or AZD 1222, or mRNA-1273 or Ad26* or Ad5* or NVX-CoV2373 or pfizer or astrazeneca or astra-zeneca or oxford or novavax or moderna or johnson) adj2 (vaccin* or immuniz* or immunis*)).mp. (9360)
7 5 or 6 (14554)
8 4 and 7 (339)
9 limit 8 to english language (333)
10 limit 9 to yr="2020 -Current" (329)

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Cochrane CENTRAL

Search Name: Covid-19 vaccine haem SR
Last Saved: 31/08/2021 13:15:41

ID	Search
#1	(h?ematologic* or hematopoietic or blood or bone marrow) near/3 (cancer* or neoplasm* or malignan* or carcinoma*)
#2	(leuk?emia* or lymphoma* or myeloma* or hodgkin* or myelodysplastic or myeloproliferative or polycythemia vera or stem cell transplant* or bone marrow transplant* or chimeric antigen receptor therap* or CAR-T)
#3	#1 or #2
#4	(covid* or SARS-CoV-2 or coronavirus or BNT162b2 or ChAdOx1 or AZD 1222, or mRNA-1273 or Ad26* or Ad5* or NVX-CoV2373 or pfizer or astrazeneca or astra-zeneca or oxford or novavax or moderna or johnson) near/2 (vaccin* or immuniz* or immunis*)
#5	#3 and #4 with Cochrane Library publication date in The last 2 years

Additional information: Abbreviations

CLL: chronic lymphocytic leukaemia; NHL: non hodgkins lymphoma; HL: hodgkins lymphoma; AML: acute myeloid leukaemia; MDS: myelodysplastic syndrome; MM: myeloma; MGUS: monoclonal gammopathy of unknown significance; WG: Waldenstrom's magroglobulinaemia; HCT: haematopoietic stem cell transplantation; CAR-T: chimeric antigen receptor T cell; MPN: myeloproliferative neoplasm; CML: chronic myeloid leukaemia; ET: Essential thrombocytosis; PV: polycythaemia vera; MF: myelofibrosis; AU: arbitrary unit

BNT162b2: Tozinameran (Pfizer); mRNA1273: Spikevax (Moderna); ChAdOx1: Vaxzevria (AstraZeneca); Ad26: Janssen