

Supplemental materials

Neutralization against Omicron sublineages (BA.2/BA.5/BQ.1.1/XBB/XBB.1.5) in bivalent BNT162b2-vaccinated HCWs with or without risk factors, or following BT infection with Omicron

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Table S1. Alternation profiles of gMean-NT₅₀ observed in post 2nd, 3rd, 4th, and 5th-BNT162b2 doses sera against SARS-CoV-2^{Wuhan}.

Time points when sera were obtained	gMean-NT ₅₀ against SCoV2 ^{Wuhan}	
	HCWs with risk factors (n=23)	HCWs without risk factor (n=90)
Day-28; 2-weeks post 2 nd -dose	283	416
Day-300; 2-weeks post 3 rd -dose	2,009	2,540
Days-490/-550; 2-weeks post 4 th -dose	1,820 (day-490)	2,029 (day-550)
Day-650; 2-weeks post 5 th -dose	1,966	2,117

Geometric mean (gMean) NT₅₀ titers of the peak values post 2nd/3rd/4th-doses of monovalent BNT162b2 (^{mv}BNT) and 5th-dose of bivalent BNT162b2 (^{bv}BNT) of sera obtained from participants with risk factors (n=23) and participants without risk factor (n=90) against SARS-CoV-2^{Wuhan} (SCoV2^{Wuhan}) are indicated. NT₅₀ values were determined in cell-based assays using infectious SARS-CoV-2^{Wuhan} strain and VeroE6TMPRSS2 cells.

Table S2. Symptoms of each symptomatic BT-infected participant.

BT-infection ID	Days of symptoms continued (within 10 days from onset)							
	Fever	General fatigue	Sore throat	Cough	Runny nose	Headache	Digestive symptoms	Others
Sym#1	1	1	3	0	1	1	0	-
Sym#2	0	2	0	0	0	0	0	-
Sym#3	5	10	9	10	0	6	0	-
Sym#4	6	6	4	6	0	0	0	Lumbago dysgeusia
Sym#5	6	8	8	10	4	8	5	-
Sym#7	4	7	6	10	1	4	3	-
Sym#8	10	8	6	6	10	10	0	dysgeusia
Sym#10	2	10	6	5	4	3	0	-
Sym#11	1	3	3	0	0	0	0	-
Sym#13	3	5	3	4	5	5	0	-

Symptoms observed in each symptomatic BT-infected participant within 10 days from onset are shown.

Table S3. Neutralization activity against Omicron BA.5 of sera obtained from HCWs who had received booster dose of SARS-CoV-2 vaccines and experienced breakthrough infection during Omicron wave

(A) Participants without risk factors; swab PCR positive cases All values are NT₅₀ of sera against BA.5.

BT-infect ID	provider of 4th dose vaccine	2 weeks post 2nd dose		2 weeks post 3rd dose	Date of PCR positive	1 week pre 4th dose		Date of PCR positive	2 weeks post 4th dose	1 week pre 5th dose		2 weeks post 5th dose
Sym#1	Moderna	<20	3rd dose	39	23-Jul	462	4th dose	24-Aug	1219	169	5th dose	2,635
Sym#2	Moderna	<20		98	21-Apr	1,557			1513	553		1,767
Sym#3	Pfizer	<20		198	28-Jul	-			2238	2,094		1,907
Sym#4	Moderna	27		20	23-May	913			993	491		2,356
Sym#5	-*	23		26	25-Jul	1,593			1205	666		3,809
Sym#6	Moderna	<20		887	26-May	2,229			2080	803		2,306
Sym#7	-*	<20		371	29-Jul	-			-	679		3,792
Sym#8	Pfizer	<20		42	18-Jul	520			621	192		1,580
Sym#9	Pfizer	<20		192	14-Jul	830			3383	1,272		2,804
Sym#10	Moderna	<20		36		20			327	2,013		8,030
gMean-NT ₅₀		21		91		614			1242	666		2,751

* Not received.

Participants with risk factors; swab PCR positive cases All values are NT₅₀ of sera against BA.5.

BT-infect ID	provider of 4th dose vaccine	2 weeks post 2nd dose		2 weeks post 3rd dose	Date of PCR positive	1 week pre 4th dose		2 weeks post 4th dose	Date of PCR positive	10 weeks post 4th dose	1 week pre 5th dose		2 weeks post 5th dose
Sym#12	Pfizer	<20	3rd dose	225	23-Apr	<20	4th dose	358	26-Jul	3,705	1,191	5th dose	2,550
Sym#13	Pfizer	<20		36		33		789		1,149	468		1,924
Sym#14	Pfizer	<20		31		<20		32	15-Aug	404	109		3,269
gMean-NT ₅₀		20		225		24		208		1198	393		2,522

Table S3. Neutralization activity against Omicron BA.5 of sera obtained from HCWs who had received booster dose of SARS-CoV-2 vaccines and experienced breakthrough (BT) infection during Omicron wave

(B) Participants without risk factors; **serum N-IgG positive cases**

All values are NT₅₀ of sera against BA.5.

BT-infection ID	provider of 4th dose vaccine	2 weeks post 2nd dose		2 weeks post 3rd dose	1 week pre 4th dose		2 weeks post 4th dose	1 week pre 5th dose		2 weeks post 5th dose
Asym#1	Pfizer	<20	3rd dose	141	<20	4th dose	531	49	5th dose	576
Asym#2	Moderna	<20		479	1,317		2,631	924		2,843
Asym#3	Pfizer	30		792	4,172		11,559	2,277		16,031
Asym#4	Pfizer	<20		39	149		1,597	402		2,087
Asym#5	Pfizer	<20		164	133		535	2,624		10,386
Asym#6	Pfizer	<20		127	<20		84	573		2,318
Asym#7	Pfizer	<20		361	629		2,133	430		1,557
Asym#8	Pfizer	<20		174	116		1,772	101		1,331
Asym#9	Pfizer	<20		329	662		1,858	1,884		2,440
Asym#10	Moderna	<20		155	<20		72	279		1,106
Asym#11	Pfizer	<20		480	43		82	1,563		8,301
Asym#12	Pfizer	<20		108	<20		98	426		7,084
Asym#13	Pfizer	<20		<20	433		1,006	326		2,233
gMean-NT ₅₀		21		171	164		663	537		2,887

Participants with risk factors; **serum N-IgG positive cases**

All values are NT₅₀ of sera against BA.5.

BT-infection ID	provider of 4th dose	2 weeks post 2nd dose		2 weeks post 3rd dose	1 week pre 4th dose		2 weeks post 4th dose	10 weeks post 4th dose	1 week pre 5th dose		2 weeks post 5th dose
Asym#14	Pfizer	<20	3rd dose	364	<20	4th dose	165	2,273	584	5th dose	4,960
Asym#15	Pfizer	<20		115	<20		31	25	388		6,802
Asym#16	Pfizer	32		648	32		928	1,935	2,756		7,111
Asym#17	Pfizer	<20		158	22		60	511	282		2,115
gMean-NT ₅₀		<20		256	21		130	487	648		4,746

Red colored columns indicate time points when serum anti-Nucleocapsid-IgG were proved to be positive.