

Supplemental information

SARS-CoV-2 variant B.1.1.7 caused

HLA-A2⁺ CD8⁺ T cell epitope mutations

for impaired cellular immune response

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Supplementary Figures

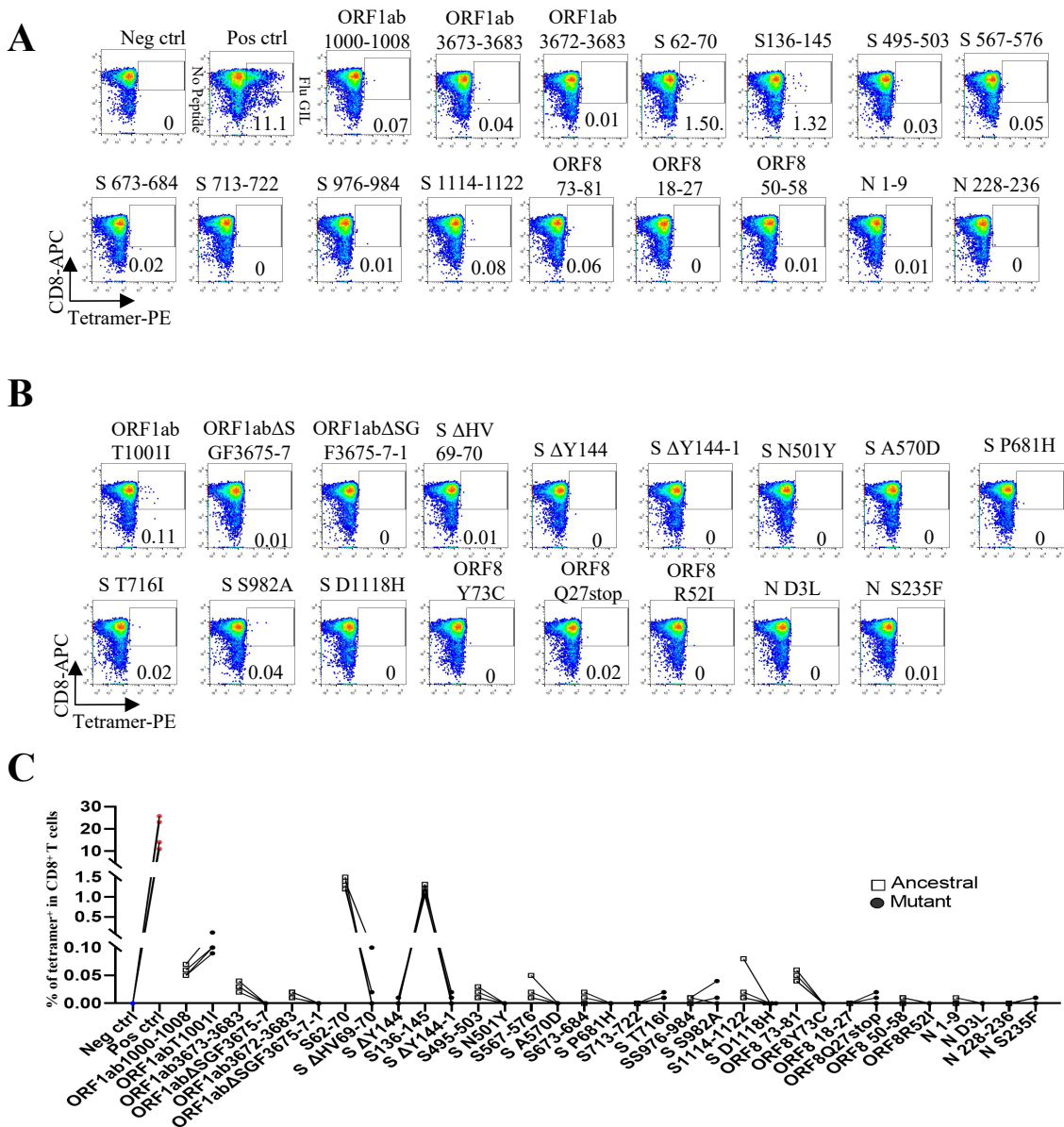


Figure S1 Identification of immunogenicity of HLA-A2 restricted T cell epitope of SARS-CoV-2 variant B.1.1.7. Related to Figure 2D.

Mitomycin pretreated T2A2 cells were loaded with mixed peptides from ancestral or mutant, and incubated with CD8⁺ T cell from health donors at 1:1 ratio, respectively. Epitope specific CD8⁺ T cells were generated after 7 day stimulation. A-C: In the same healthy volunteers, the ancestral (A) and mutated (B) epitopes near the mutation site stimulated healthy CD8⁺ T cells to generate antigen-specific T cells for 7 days. C was the representative plot of A and B (Symbols represent individual person, n = 4 per group). Ancestral: Wuhan strain epitope; Mutant: varian B.1.1.7 epitope. Neg ctrl: T2A2 without peptide loading; Pos ctrl: T2A2 loaded with influenza A M1 peptide GILGFVFTL.

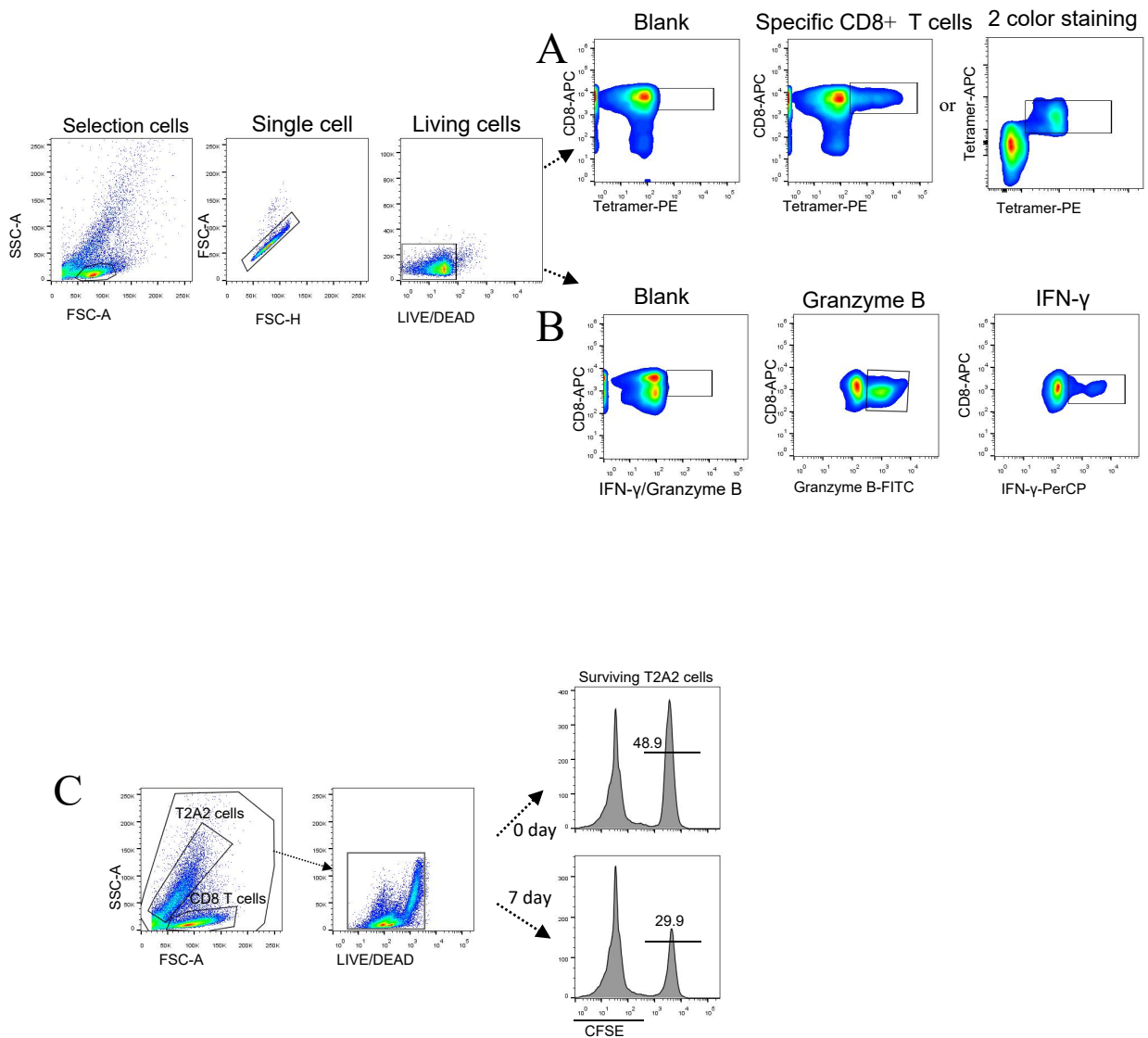


Figure S2 Visualization of representative flow cytometry data and gating strategy. Related to Figure 2,3.

- (A) MHC tetramer staining of human CD8⁺ T cells.
- (B) Intracellular cytokine (IFN- γ and Granzyme B) staining.
- (C) Stimulated T cell-mediated T2A2 killing staining.

Supplementary Tables

Table S1 Raw data of predicted CD8⁺ T cell epitopes for SARS-CoV-2 variant B.1.1.7. Related to STAR Methods.

Protein	Allele	Start	End	Length	Sequence	Rank	ann_ic 50	ann_ra nk	smm_ic 50	smm_r ank
ORF1ab	HLA-A *02	1000	1008	9	TTIQTIVEV	1.39	22.3	0.27	77.37	2.5
	HLA-A *02	1707	1716	10	AANFCALILA	9.55	359.03	2.1	1210.35	17
	HLA-A *02	2225	2234	10	KLINIIWFL	0.13	7.29	0.05	6.45	0.2
	HLA-A *02	2230	2238	9	IIFWLLLSV	0.4	19.01	0.21	18.84	0.4
	HLA-A *02	3673	3683	11	SLSGFKLKDCV	4.55	2410.71	7.7	166.31	1.4
	HLA-A *02	3672	3683	12	TLSLGFKLKDC V	9.4	3380.3	9.4	-	-
Spike	HLA-A *02	62	70	9	VTWFHAIHV	1.02	74.83	0.75	37.89	1.3
	HLA-A *02	136	145	10	CNDPFLGVYY	43	25302.0 5	44	21952.3	42
	HLA-A *02	495	503	9	YGFQPTNGV	2.6	736.15	3.2	59.23	2
	HLA-A *02	567	576	10	RDIADTTDAV	0.03	845	8	-	2.5
	HLA-A *02	673	684	12	SYQTQTNSPRR A	14306 .68	28	-	-	-
	HLA-A *02	713	722	10	AIPTNFTISV	1.4	118.96	1.2	89.93	1.6
	HLA-A *02	976	984	9	VLNDILSRL	1.1	33.57	0.38	58.36	1.1
	HLA-A *02	1114	1122	9	IITDNTFV	2.35	131.91	1.3	104.6	3.4
ORF8	HLA-A *02	73	81	9	YIDIGNYTV	0.957 895	0.01	-	-	-
	HLA-A *02	18	27	10	QECSLQSQCTQ	1.50E -05	84	-	-	-
	HLA-A *02	50	58	9	GARKSAPLI	0.004 488	15	-	-	-
N	HLA-A *02	1	9	9	MSDNGPQNQ	0.000 733	22	-	-	-
	HLA-A *02	228	236	9	NQLESKMSG	14	7010.51	16	462.97	12

Table S2 Clinical characteristics of convalescent COVID-19 patients. Related to Figure 4.

Donor code	SARS CoV-2 PCR	Data of sample collection	Sex	Age	HLA-A2 restriction	Symptoms	% of tetramer+ cells					
							ORF1ab	ORF1ab	ORF1ab	ORF1ab	ORF1ab	ORF1ab
							1707-1716	A1708D	2225-2234	I2230T-1	2230-2238	I2230T-2
Case 1	Positive	Apr12, 2020	Male	54	Yes	-	7.32	4.24	38.7	15.8	8.29	5.84
Case 2	Positive	May 20, 2020	Female	31	No	-	-	-	-	-	-	-
Case 3	Positive	May 20, 2020	Female	38	No	-	-	-	-	-	-	-
Case 4	Positive	May 20, 2020	Female	53	No	-	-	-	-	-	-	-
Case 5	Positive	June 8, 2020	Male	50	No	-	-	-	-	-	-	-
Case 6	Positive	June 8, 2020	Female	23	No	-	-	-	-	-	-	-
Case 7	Positive	June 17, 2020	Male	35	No	-	-	-	-	-	-	-
Case 8	Positive	June 17, 2020	Male	30	No	-	-	-	-	-	-	-
Case 9	Positive	June 17, 2020	Male	31	No	-	-	-	-	-	-	-
Case 10	Positive	June 17, 2020	Male	29	No	-	-	-	-	-	-	-
Case 11	Positive	June 17, 2020	Male	35	No	-	-	-	-	-	-	-
Case 12	Positive	Sept 19, 2020	Male	64	No	Mild	-	-	-	-	-	-
Case 13	Positive	Sept 19, 2020	Female	54	No	Mild	-	-	-	-	-	-
Case 14	Positive	Sept 19, 2020	Female	63	No	Mild	-	-	-	-	-	-
Case 15	Positive	Oct 18, 2020	Female	66	No	Mild	-	-	-	-	-	-
Case 16	Positive	Oct 18, 2020	Female	57	Yes	Mild	4.28	3.04	9.67	7.97	7.17	6.48
Case17	Positive	Oct 18, 2020	Female	54	Yes	Mild	3.49	3.22	11.2	10.3	7.7	5.32
Case 18	Positive	Oct 23, 2020	Male	61	No	Mild	-	-	-	-	-	-
Case 19	Positive	Oct 23, 2020	Female	57	Yes	Mild	3.69	2.94	10.2	7.06	8.37	6.2
Case 20	Positive	Nov 9, 2020	Female	74	No	Mild	-	-	-	-	-	-
Case 21	Positive	Nov 9, 2020	Female	64	No	Mild	-	-	-	-	-	-
Case 22	Positive	Nov 9, 2020	Female	49	No	Mild	-	-	-	-	-	-
Case 23	Positive	Dec 6, 2020	Female	77	No	Severe	-	-	-	-	-	-
Case 24	Positive	Dec 6, 2020	Male	60	No	Severe	-	-	-	-	-	-
Case 25	Positive	Dec 17, 2020	Female	65	No	Severe	-	-	-	-	-	-

Table S3 Clinical characteristics of SARS-CoV-2 vaccinees. Related to Figure 5.

Donor code	HLA-A2 restriction	Sex	Age	BMI (kg/m ²)	First vaccination time	Time for booster immunization	Blood collection time	Symptoms
# 1	Yes	Female	22	19.83	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 2	NO	Female	40	23.43	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 3	NO	Female	32	20.82	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 4	Yes	Female	36	18.49	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 5	NO	Female	21	16.90	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 6	NO	Female	23	17.63	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 7	NO	Female	42	25.39	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	Slight fatigue
# 8	NO	Female	45	31.25	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 9	NO	Female	30	22.31	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 10	Yes	Female	33	20.57	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 11	NO	Male	29	22.34	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 12	NO	Male	23	28.04	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 13	Yes	Female	51	25.63	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	Local redness and swelling
# 14	Yes	Male	55	25.35	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 15	NO	Female	24	21.89	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 16	NO	Female	27	23.80	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 17	NO	Male	24	28.41	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 18	Yes	Male	58	22.49	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 19	NO	Female	54	25.76	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 20	NO	Female	57	21.09	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 21	NO	Male	31	23.36	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 22	NO	Female	33	27.40	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	Slight dizziness
# 23	Yes	Female	28	20.76	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 24	Yes	Female	53	20.43	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	Slight dizziness
# 25	NO	Male	27	20.04	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 26	NO	Female	28	18.07	Sept 25, 2020	Oct 20, 2020	Jan 23, 2021	NO
# 27	NO	Female	36	22.03	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 28	Yes	Male	21	22.49	Dec 23, 2020	Jan 18, 2021	Jan 23, 2021	NO
# 25	NO	Female	46	21.48	Sept 25, 2020	Oct 20, 2020	Jan 23, 2021	NO
# 26	NO	Male	35	23.56	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 27	NO	Male	25	22.60	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 28	NO	Male	42	24.22	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 30	NO	Female	40	22.27	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 31	Yes	Male	22	23.39	Dec 23, 2020	Jan 18, 2021	Jan 23, 2021	NO
# 32	NO	Male	40	24.09	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 33	NO	Female	22	23.03	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 34	NO	Female	43	23.79	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 35	NO	Male	56	27.68	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 36	Yes	Male	38	24.42	Dec 24, 2020	Jan 18, 2021	Jan 23, 2021	NO

# 37	NO	Female	46	27.34	Dec 24, 2020	Jan 18, 2021	Jan 23, 2021	NO
# 38	NO	Female	52	25.88	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 39	NO	Female	23	18.83	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 40	NO	Female	26	24.80	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 41	NO	Female	41	31.25	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 42	NO	Female	46	21.87	Sept 3, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 43	Yes	Male	22	22.94	Dec 23, 2020	Jan 20, 2021	Jan 23, 2021	NO
# 44	NO	Female	33	20.57	Dec 23, 2020	Jan 20, 2021	Jan 23, 2021	NO
# 45	NO	Female	40	18.98	Dec 23, 2020	Jan 20, 2021	Jan 23, 2021	NO
# 46	NO	Male	26	24.17	Dec 23, 2020	Jan 20, 2021	Jan 23, 2021	NO
# 47	NO	Female	30	23.43	Dec 23, 2020	Jan 20, 2021	Jan 23, 2021	NO
# 48	NO	Female	54	20.38	Dec 23, 2020	Jan 20, 2021	Jan 23, 2021	NO
# 49	Yes	Female	42	23.07	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 50	NO	Female	23	17.79	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 51	NO	Female	37	25.53	Sept25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 52	Yes	Male	39	27.78	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 53	Yes	Female	53	25.34	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 54	NO	Female	50	25.71	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 55	NO	Female	35	24.97	Sept 25, 2020	Sept 25, 2020	Jan 23, 2021	NO
# 56	Yes	Female	21	19..36	Dec 23, 2020	Jan 18, 2021	Jan 23, 2021	NO
# 57	NO	Female	26	21.22	Dec 23, 2020	Jan 18, 2021	Jan 23, 2021	NO
# 58	NO	Female	36	22.58	Dec 23, 2020	Jan 18, 2021	Jan 23, 2021	NO
# 59	Yes	Male	43	23.14	Dec 23, 2020	Jan 18, 2021	Jan 23, 2021	NO
# 60	NO	Female	54	27.73	Dec 23, 2020	Jan 18, 2021	Jan 23, 2021	NO
