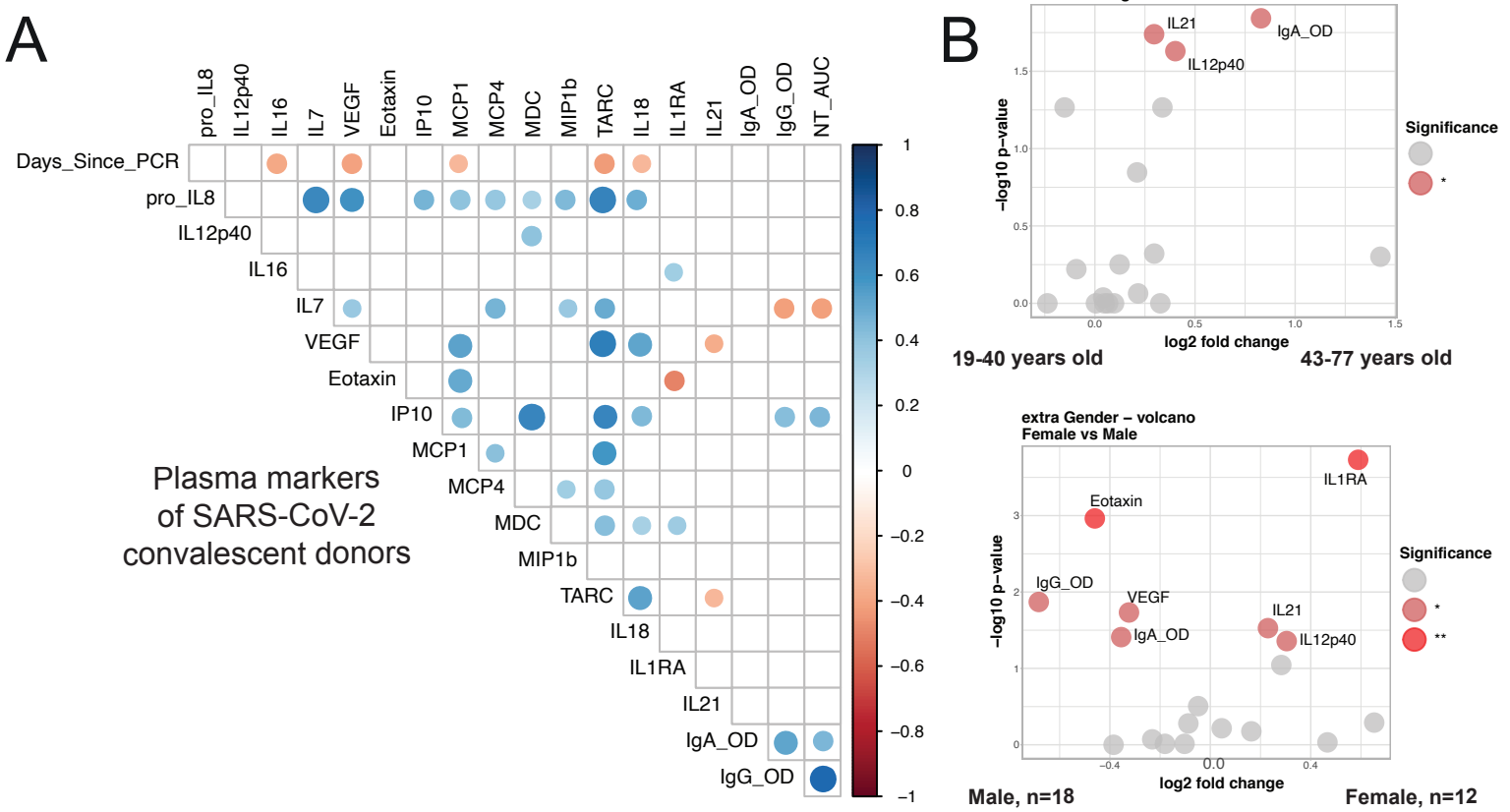
Supplementary Figure 1. Immune correlates in COVID-19 convalescent donors



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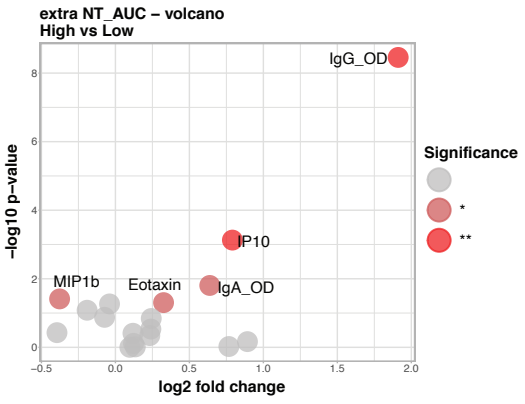
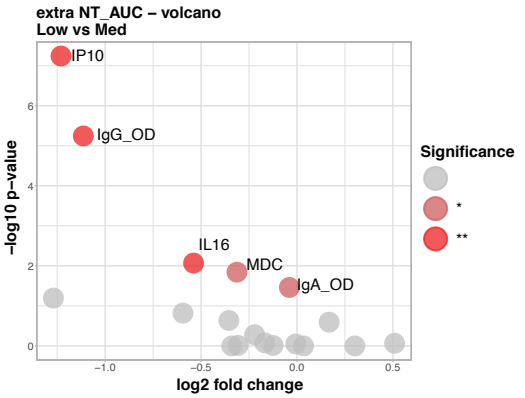
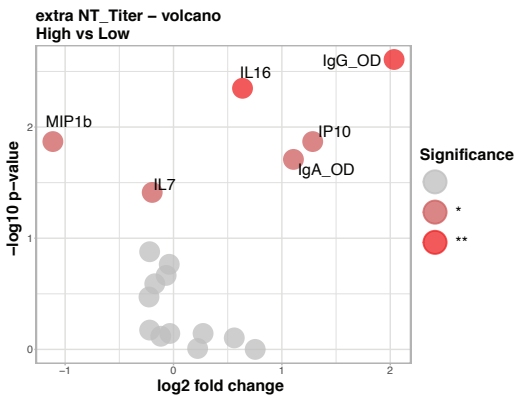


[3.4-19.9] Neutralizing Ab activity [160-836]

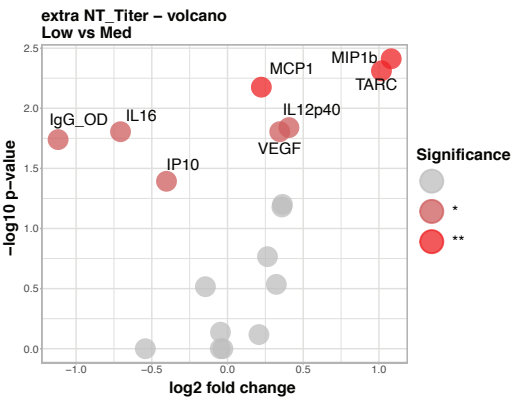


[19.9-160] Neutralizing Ab activity [3.4-19.9]

D

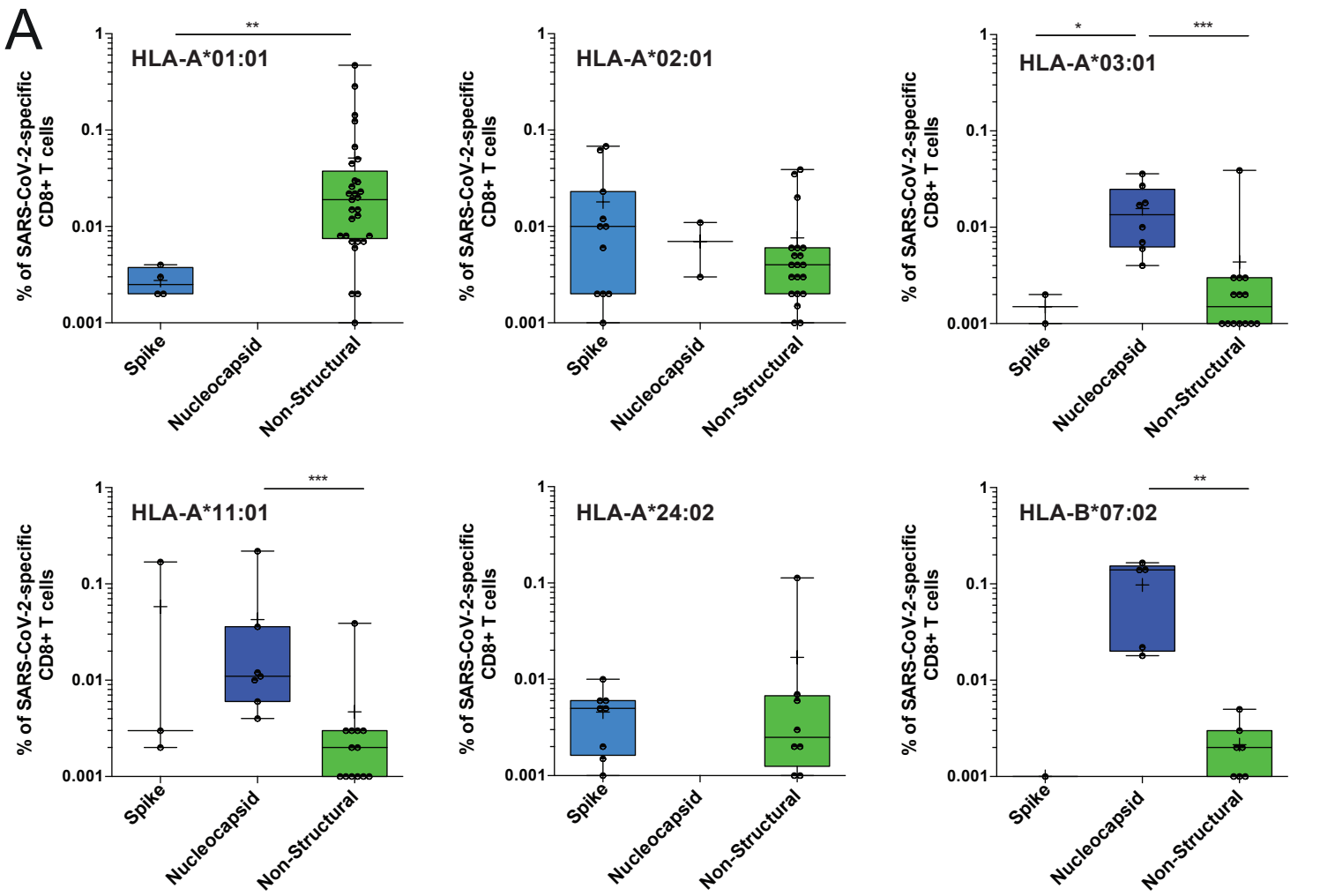


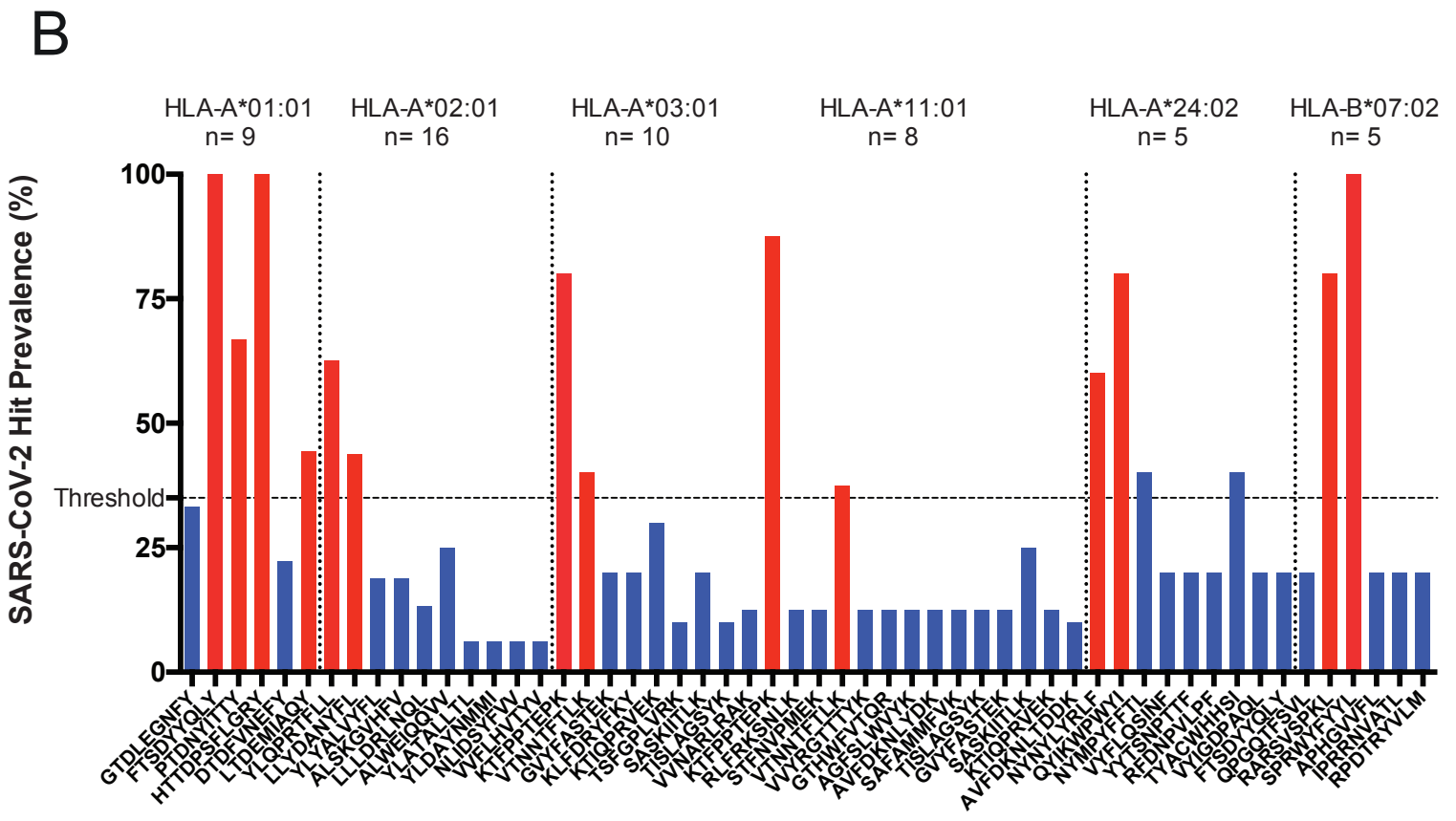
[10-20] Neutralizing Ab titer [80-640]



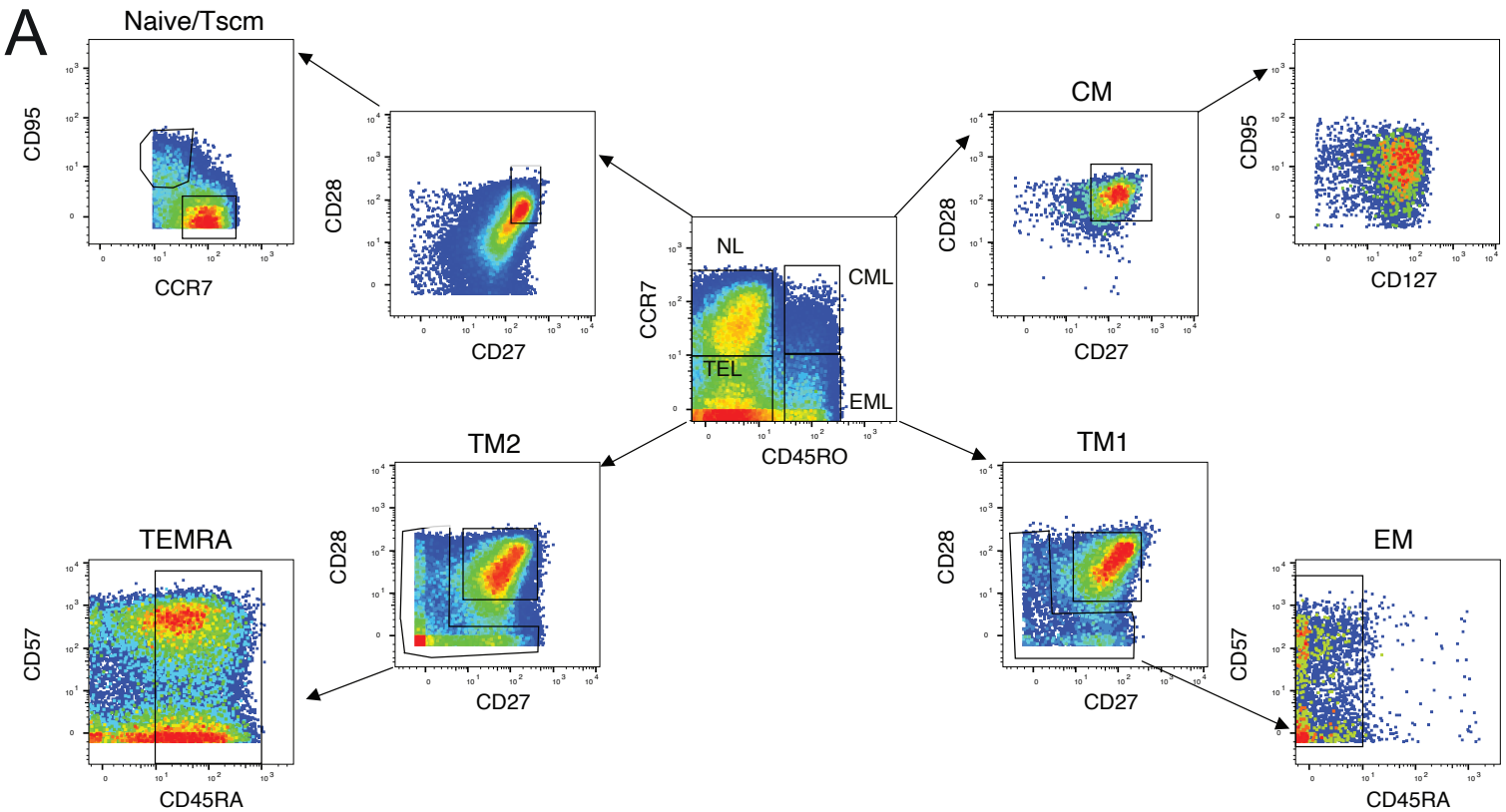
[20-80] Neutralizing Ab titer [10-20]

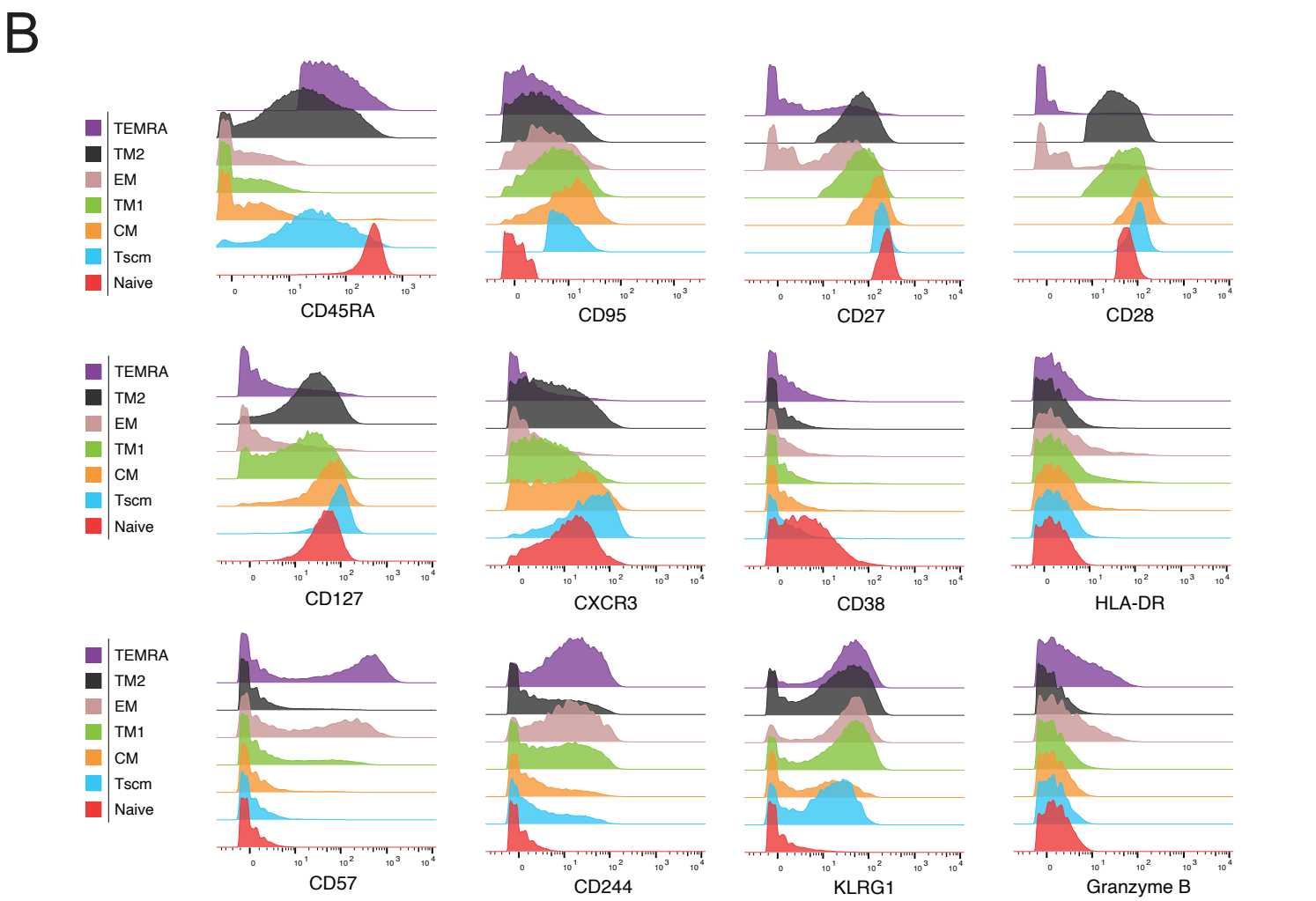
Supplementary Figure 2. SARS-CoV-2-specific T cell reactivities across all HLAs



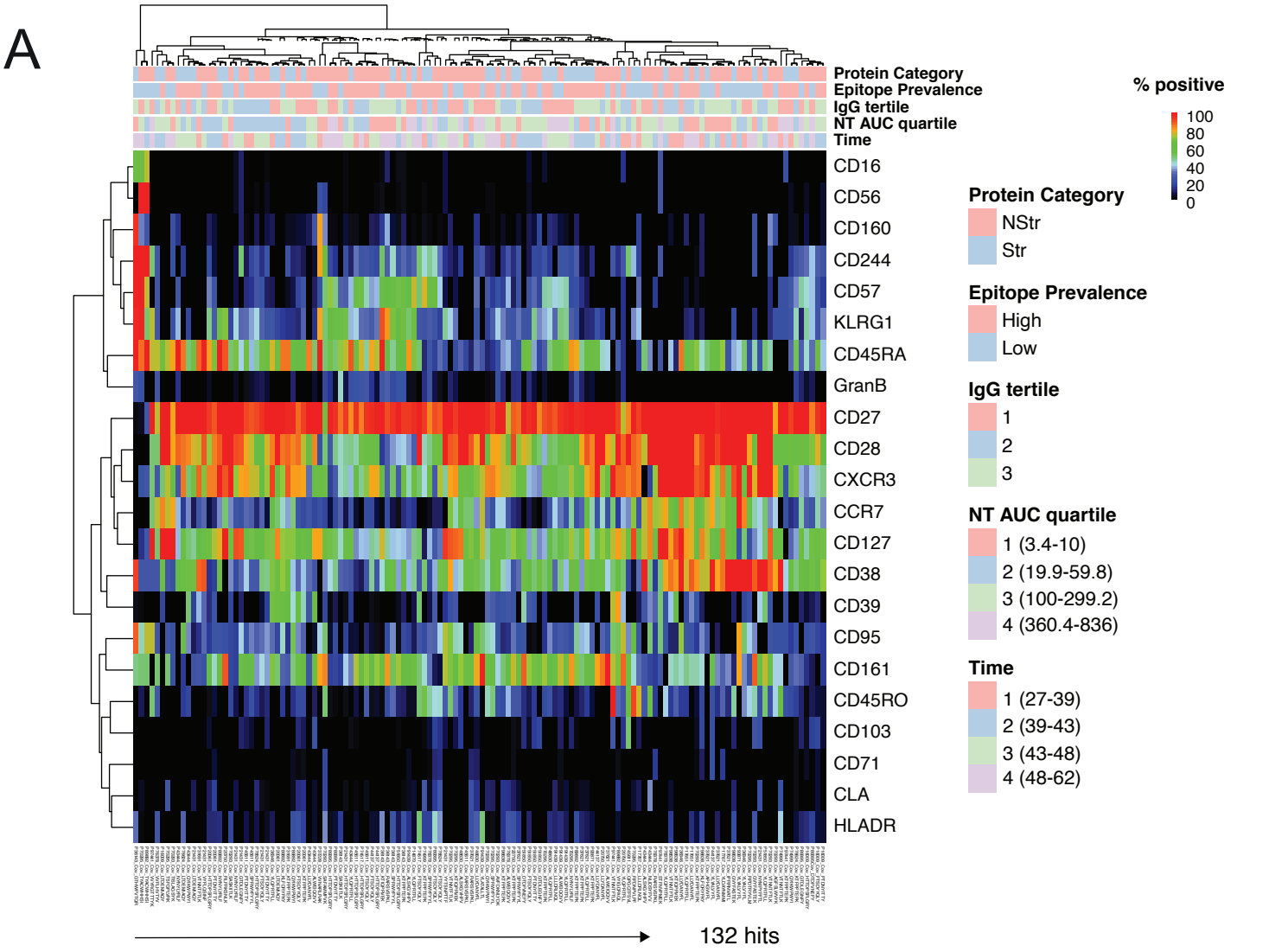


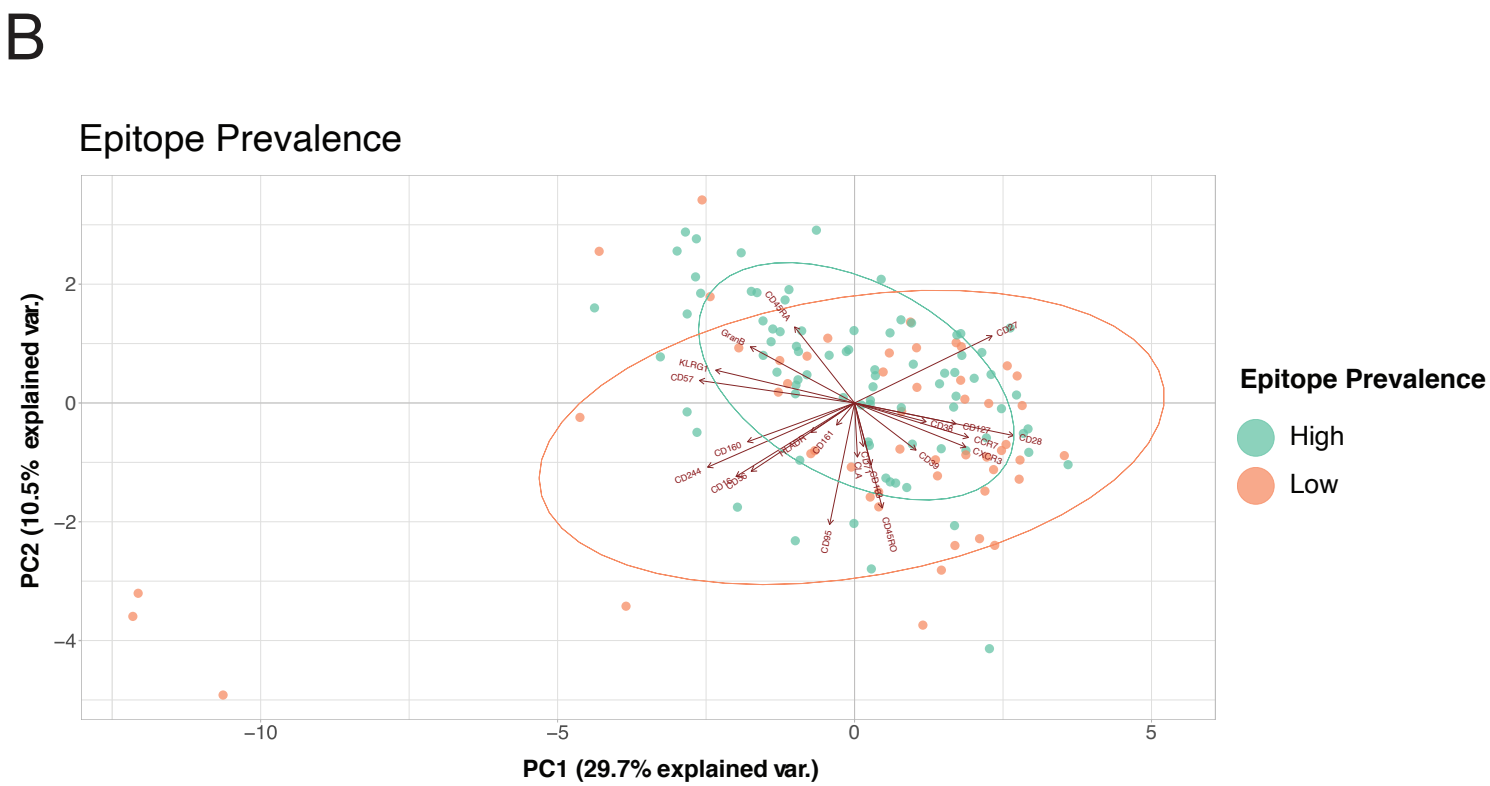
Supplementary Figure 3. Gating scheme for the identification of T cell differentiation states



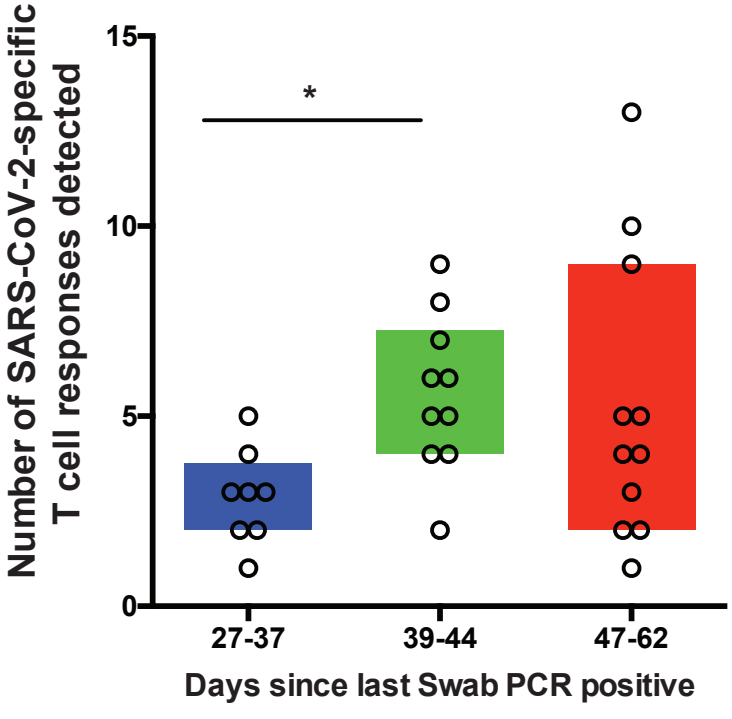


Supplementary Figure 4. Association of SARS-CoV-2-specific CD8+ T cell phenotypes with clinical parameters and epitope categories

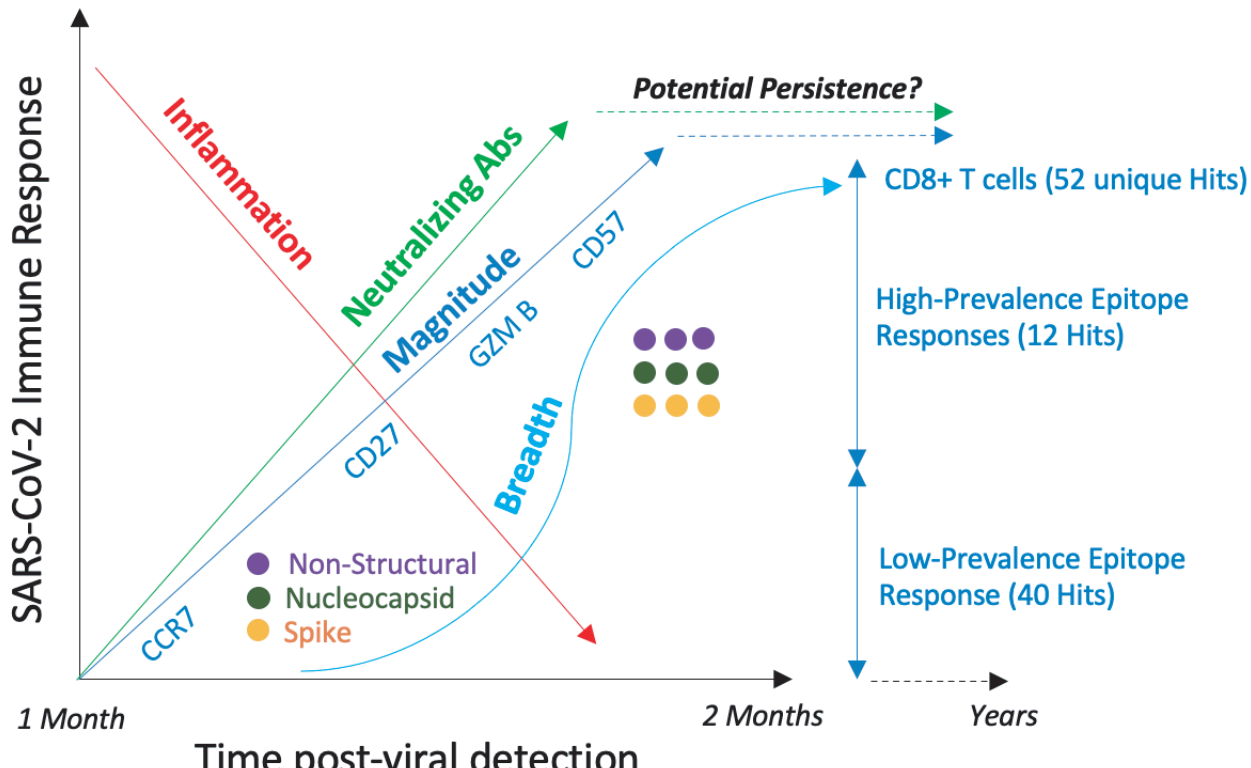




Supplementary Figure 5. Antigen-specific T cell responses detected over time in COVID-19 convalescent individuals



Supplementary Figure 6. Study summary model



Supplementary Figure 1. Immune correlates in COVID-19 convalescent donors. A) Modulation of systemic inflammation over recovery time in COVID-19 convalescent donors. Pro-inflammatory cytokine concentrations, titers and neutralizing activity of anti-spike SARS-CoV-2 antibodies were evaluated in plasma from all donors by Luminex, and/or direct ELISA, and microneutralization (NT) assays, respectively. The correlogram shows the correlation between the concentration of all individual cytokines or chemokines, humoral response (IgG, IgA concentration, O.D.), neutralizing activity of antibodies (NT_AUC) and recovery time (Days since PCR positive). Spearman's correlation coefficients were indicated by a heat scale whereby the blue colour indicates a positive linear correlation, and red colour indicates a negative linear correlation. Only significant correlations are shown (*p<0.05, p-values were adjusted for multiple testing using the Bonferroni method). **B-D)** Clinical characteristics of the convalescent cross-sectional cohort. **(B)** Age, gender and humoral immune response defined by the **(C)** neutralizing antibody activity or **(D)** titers were used to stratify the cohort into young versus old donors, male versus female, and low, median and high neutralizing antibody activity or titers. The fold change and calculated p-values between groups were plotted as volcano plots. *p<0.05, **p<0.01, Wilcoxon rank sum tests.

Supplementary Figure 2. SARS-CoV-2-specific T cell reactivities across all HLAs. A) Frequencies of SARS-CoV-2-specific T cells reactive with epitopes derived from spike, nucleocapsid and non-structural proteins detected for each HLA allele in this cross-sectional sample. Each dot represents one antigen specificity detected. **B)** Definition of SARS-CoV-2-specific T cell prevalence. Events detected in at least three donor samples or in more than 35% of donors for each allele group were defined as SARS-CoV-2 high-prevalence epitope hit responses.

Supplementary Figure 3. Gating scheme for the identification of T cell differentiation states. **A)** T cell subsets were defined by a consecutive gating strategy. CD45RO vs. CCR7 expression was used to identify naïve-like T cells (NL, $CD45RO^{-}CCR7^{+}$), central memory-like T cells (CML, $CD45RO^{+}CCR7^{+}$), effector memory-like T cells (EML, $CD45RO^{+}CCR7^{-}$) and terminal effector-like T cells (TEL, $CD45RO^{-}CCR7^{-}$). CD27 vs. CD28 expression was used to identify central memory (CM), transitional memory 1 (TM1) and transitional memory 2 (TM2) from CML, EML and TEL, respectively. Further downstream gating using CCR7 vs. CD95

expression was used to define naïve ($CCR7^{+}CD95^{-}$) and stem cell memory ($CCR7^{low}CD95^{+}$) CD8 T cells. CD45RA vs CD57 expression was used to further define terminal effector memory re-expressing CD45RA (TEMRA) and effector memory (EM) CD8 T cells, respectively. **B)** Histograms displaying the expression of markers characteristic for each CD8 T cell subset.

Supplementary Figure 4. Association of SARS-CoV-2-specific CD8+ T cell phenotypes with clinical parameters and epitope categories. A) Heatmap summarizing the expression frequencies of all phenotypic markers analyzed among the total pool of SARS-CoV-2-specific CD8+ T cells detected. Antigen-specificities and phenotypic markers were clustered using Pearson correlation coefficients as distance measure. Antigen-specific T cell clustering was associated with the protein category, epitope prevalence, IgG tertiles, neutralizing activity of antibodies (NT AUC quartiles) and time (days since PCR positive). **B)** Principal component analysis displaying a skewing of high-prevalence SARS-CoV-2-specific T cells towards late T cell differentiation (CD57 and CD45RA) and low-prevalence responses towards early differentiation (CD27, CD28, CCR7).

Supplementary Figure 5. Antigen-specific T cell responses detected over time in COVID-19 convalescent individuals. The numbers of SARS-CoV-2-specific CD8+ T cell responses detected were plotted against the recovery time (days since last swab PCR positive).

Supplementary Figure 6. Study summary model. During early recovery from COVID-19 infection, an overall, time-dependent decrease in inflammation is associated with sustained and effective antibody neutralizing activity with progressive differentiation of a broad and functional SARS-CoV-2-specific CD8+ T cell response.

Supplementary Table 1. Cross-sectional sample characteristics

Supplementary Table 2. Cross-sectional sample HLA types, IgG tertiles, acquired cell numbers and antigen-specific CD8+ T cell detection thresholds

Supplementary Table 3. Peptides used in current study

Supplementary Table 4. Total CD8+ T cell antigen specificities detected in cross-sectional sample (Total CD8+ T cell frequencies and cell numbers)

Supplementary Table 5. Antibody clones and metal tags used in study

Supplementary Table 6. List of unique SARS-CoV-2-specific CD8+ T cell responses detected

Supplementary Table 1. Cross-sectional sample characteristics

Sample	CCP ID	Race	Gender	Age	Hospitalization	Days since swab	IgG OD (pos >0.8)	IgA OD (pos >4)	IgG Avidity IC50	NTAUC	NTtiter
1	CCP602	Hispanic	Male	53	no	48	4.5	2.7	4.1	618.4	320
2	CCP615	white	Male	32	no	41	1.9	4.2	4	139.6	80
3	CCP106	white	Male	28	no	37	1.4	2.4	4	10	20
4	CCP398	white	Female	62	no	42	6.8	3.6	4	30.1	40
5	CCP406	mixed/other/unknown	Female	68	no	30	3.7	3.1	3.9	100	80
6	CCP245	white	Male	29	no	43	4.3	1.8	4.6	19.9	20
7	CCP549	white	Female	61	no	27	0.4	0.4	3.8	10	20
8	CCP706	white	Female	77	no	51	1.9	8.2	3.1	10	20
9	CCP322	white	Male	56	no	37	4.5	3.1	3.8	54.7	40
10	CCP831	white	Female	50	no	33	0.1	0.1	N.A.	3.4	10
11	CCP642	white	Male	43	no	41	1.4	1.9	3.7	3.4	10
12	CCP270	white	Male	19	no	43	4.7	2.1	3.9	169	160
13	CCP618	white	Female	31	no	47	0.6	0.3	4.3	10	20
14	CCP699	white	Male	40	no	37	2.8	3.2	3.6	30.1	40
15	CCP146	white	Male	50	yes (1 day)	47	10.5	6	5.1	541.6	320
16	CCP220	white	Female	61	no	42	3.7	2.5	4.4	139.6	80
17	CCP891	white	Male	32	no	57	2.8	0.8	4.2	3.4	10
18	CCP390	Asian	Female	43	no	50	1.8	1.7	3.5	6.7	20
19	CCP413	white	Male	37	no	48	7.2	3	5.1	240.4	160
20	CCP830	white	Male	28	no	50	2.3	0.9	4.6	59.8	40
21	CCP757	Asian	Male	48	no	35	7.5	9.4	5.5	541.6	320
22	CCP427	white	Male	64	no	40	3.2	1.6	3.9	160	80
23	CCP190	Asian	Female	19	no	44	2.4	0.5	4.1	19.9	20
24	CCP902	white	Male	40	no	52	5.4	3.7	4.5	460	320
25	CCP547	white	Male	37	no	39	1.9	3	3.9	19.9	20
26	CCP959	white	Male	63	no	47	6.7	8.1	3.9	836	640
27	CCP829	mixed/other/unknown	Female	27	N.A.	39	0.8	1	4.1	59.8	40
28	CCP415	white	Female	40	yes (5days)	62	10.2	2.4	7.7	360.4	320
29	CCP463	white	Female	28	no	53	3.1	1.7	4.1	10	20
30	CCP199	white	Male	38	no	32	4.2	1.8	3.4	299.2	160

Supplementary Table 2. Cross-sectional sample HLA types, IgG tertiles, acquired cell numbers and Ag-specific CD8+ T cell detection threshholds

Sample	CCP Number:	IgG tertile	CD45+ cell count	CD8 + T cell count	Detection threshold	HLAA01	HLA A02	HLA A03	HLA A11	HLA A24	HLA B07
1	CCP602	1	1.21E+06	150797	0.0027		HLA A02				
2	CCP615	3	1.17E+06	137450	0.0029	HLAA01					
3	CCP106	3	1.64E+06	391935	0.0010		HLA A02	HLA A03			
4	CCP398	1	1.49E+06	231076	0.0017	HLAA01		HLA A03			
5	CCP406	2	9.66E+05	380733	0.0011		HLA A02		HLA A11		
6	CCP245	2	2.21E+06	570984	0.0007	HLAA01				HLA A24	
7	CCP549	3	2.06E+06	317408	0.0013			HLA A03			
8	CCP706	3	2.84E+06	227223	0.0018			HLA A03	HLA A11		HLA B07
9	CCP322	1	8.82E+05	111437	0.0036		HLA A02				
10	CCP831	3	1.17E+06	295475	0.0014		HLA A02		HLA A11		
11	CCP642	3	1.85E+06	456073	0.0009		HLA A02	HLA A03			HLA B07
12	CCP270	1	1.58E+06	407261	0.0010		HLA A02			HLA A24	
13	CCP618	3	1.05E+06	198594	0.0020	HLAA01	HLA A02				
14	CCP699	2	1.35E+06	536597	0.0007	HLAA01		HLA A03			HLA B07
15	CCP146	1	1.35E+06	116988	0.0034		HLA A02				
16	CCP220	2	1.37E+06	406397	0.0010	HLAA01	HLA A02				
17	CCP891	2	106830	21049	0.0190		HLA A02				
18	CCP390	3	2.10E+06	553930	0.0007			HLA A03	HLA A11		
19	CCP413	1	1.43E+06	490460	0.0008			HLA A03		HLA A24	HLA B07
20	CCP830	2	307309	50622	0.0079	HLAA01	HLA A02				
21	CCP757	1	2.40E+06	460816	0.0009				HLA A11	HLA A24	
22	CCP427	2	1.06E+06	206074	0.0019		HLA A02				HLA B07
23	CCP190	2	1.35E+06	364097	0.0011	HLAA01			HLA A11		
24	CCP902	1	1.02E+06	183830	0.0022	HLAA01					
25	CCP547	3	1.83E+06	649495	0.0006			HLA A03		HLA A24	
26	CCP959	1	8.76E+05	90800	0.0044		HLA A02				
27	CCP829	3	1.09E+06	286262	0.0014		HLA A02		HLA A11		
28	CCP415	1	1.03E+06	135972	0.0029				HLA A11		
29	CCP463	2	1.46E+06	202795	0.0020		HLA A02				
30	CCP199	2	2.83E+06	988116	0.0004			HLA A03			

Supplementary Table 3. Peptides used in current study

Source	Protein name	Sequence	Allele 2	Allele1	Allele 2	Allele 3
SARS-CoV-2	3CL	TSEDMLNPNY	HLA-A*01:01			
SARS-CoV-2	3CL	GTDLEGNFY	HLA-A*01:01			
SARS-CoV-2	Hel	VTDVTQLYL	HLA-A*01:01	HLA-A*03:01		
SARS-CoV-2	Hel	ATEETFKLSY	HLA-A*01:01			
SARS-CoV-2	Hel	TVDSSQGSEY	HLA-A*01:01			
SARS-CoV-2	M	VAGDSGFAAY	HLA-A*01:01			
SARS-CoV-2	M	ATSRTLSYY	HLA-A*11:01	HLA-A*01:01		
SARS-CoV-2	no S no N	FLTENLLLY	HLA-A*01:01			
SARS-CoV-2	no S no N	LTGHMLDMY	HLA-A*01:01			
SARS-CoV-2	nsp15	LAMDEFIERY	HLA-A*01:01			
SARS-CoV-2	nsp2	FIDTKRGVY	HLA-A*01:01			
SARS-CoV-2	nsp2	YTERSEKSY	HLA-A*01:01			
SARS-CoV-2	nsp2	NIFGTVYEK	HLA-A*03:01	HLA-A*11:01	HLA-A*01:01	
SARS-CoV-2	nsp4	HTDFSSEIIGY	HLA-A*01:01			
SARS-CoV-2	nsp4	FSAVGNICY	HLA-A*01:01			
SARS-CoV-2	nsp4	FSNSGSDVLY	HLA-A*01:01			
SARS-CoV-2	nsp8	MADQAMTQMY	HLA-A*01:01			
SARS-CoV-2	nsp9	CTDDNALAY	HLA-A*01:01			
SARS-CoV-2	ORF3a protein	FTSDYYQLY	HLA-A*01:01	HLA-A*24:02		
SARS-CoV-2	ORF8 protein	VVDDPCPIHFY	HLA-A*01:01			
SARS-CoV-2	PLpro	LTENLLLY	HLA-A*01:01			
SARS-CoV-2	PLpro	PTDNYITTY	HLA-A*01:01			
SARS-CoV-2	PLpro	VVDYGARFY	HLA-A*01:01			
SARS-CoV-2	PLpro	HTTDPSFLGRY	HLA-A*01:01			
SARS-CoV-2	PLpro	ITDVFYKENSY	HLA-A*01:01			
SARS-CoV-2	PLpro	FADDLNQLTGY	HLA-A*01:01			
SARS-CoV-2	RdRpol	STDVVYRAFDIY	HLA-A*01:01			
SARS-CoV-2	RdRpol	FVENPDILRVY	HLA-A*01:01			
SARS-CoV-2	RdRpol	ISDYDYYRY	HLA-A*01:01			
SARS-CoV-2	RdRpol	VVDKYFDCY	HLA-A*01:01			
SARS-CoV-2	RdRpol	STDGNKIADKY	HLA-A*01:01			
SARS-CoV-2	RdRpol	DTDFVNEFY	HLA-A*01:01			
SARS-CoV-2	RdRpol	YADVFHLY	HLA-A*01:01			
SARS-CoV-2	RdRpol	LTNDNTSRY	HLA-A*01:01			
SARS-CoV-2	S	WTAGAAAYY	HLA-A*01:01			
SARS-CoV-2	S	TSNQVAVLY	HLA-A*01:01			
SARS-CoV-2	S	LADAGFIKQY	HLA-A*01:01			
SARS-CoV-2	S	LTDEMIAQY	HLA-A*01:01			
SARS-CoV-2	3CL	FLVQAGNVQL	HLA-A*02:01			
SARS-CoV-2	3CL	FLNRFTTTL	HLA-A*02:01			
SARS-CoV-2	envelope protein	SLVKPSFYV	HLA-A*02:01			
SARS-CoV-2	Hel	KLSYGIATV	HLA-A*02:01			

SARS-CoV-2	Hel	TLVPQEHYV	HLA-A*02:01			
SARS-CoV-2	Hel	TYKLNVGDYFV	HLA-A*24:02	HLA-A*02:01		
SARS-CoV-2	M	KLLEQWNLV	HLA-A*02:01			
SARS-CoV-2	M	TLACFVLAAV	HLA-A*02:01			
SARS-CoV-2	M	GLMWLSYFI	HLA-A*02:01			
SARS-CoV-2	M	GLMWLSYFV	HLA-A*02:01			
SARS-CoV-2	N	LLLDRLNQL	HLA-A*02:01			
SARS-CoV-2	N	ALNTPKDHI	HLA-A*02:01			
SARS-CoV-2	N	LQLPQGTTL	HLA-A*02:01			
SARS-CoV-2	N	LALLLLDRL	HLA-A*02:01			
SARS-CoV-2	N	RLNQLESKM	HLA-A*02:01			
SARS-CoV-2	N	GMSRIGMEV	HLA-A*02:01			
SARS-CoV-2	N	RLNQLESKV	HLA-A*02:01			
SARS-CoV-2	N	ILLNKHID	HLA-A*02:01			
SARS-CoV-2	N	LLLDRLNQL	HLA-A*02:01			
SARS-CoV-2	no S no N	KLKDCVMYA	HLA-A*02:01			
SARS-CoV-2	no S no N	NLLKDCPAV	HLA-A*02:01			
SARS-CoV-2	no S no N	LLSAGIFGA	HLA-A*02:01			
SARS-CoV-2	nsp1	GLVEVEKGV	HLA-A*02:01			
SARS-CoV-2	nsp1	VMVELVAEL	HLA-A*02:01			
SARS-CoV-2	nsp1	TLGVLVPHV	HLA-A*02:01			
SARS-CoV-2	nsp10	YLASGGQPI	HLA-A*02:01			
SARS-CoV-2	nsp14	MLSDTLKNL	HLA-A*02:01			
SARS-CoV-2	nsp14	NLSDRVVFV	HLA-A*02:01			
SARS-CoV-2	nsp14	VLWAHGFEL	HLA-A*02:01			
SARS-CoV-2	nsp14	LLADKFPVL	HLA-A*02:01			
SARS-CoV-2	nsp14	YLDAYNMMI	HLA-A*02:01			
SARS-CoV-2	nsp14	MMISAGFSL	HLA-A*02:01			
SARS-CoV-2	nsp15	SLENVAFNV	HLA-A*02:01			
SARS-CoV-2	nsp15	SQLGGLHLL	HLA-A*02:01			
SARS-CoV-2	nsp15	LLLDDFVEII	HLA-A*02:01			
SARS-CoV-2	nsp16	YLNTLTLAV	HLA-A*02:01			
SARS-CoV-2	nsp16	TLIGDCATV	HLA-A*02:01			
SARS-CoV-2	nsp2	GLNDNLLEIL	HLA-A*02:01			
SARS-CoV-2	nsp2	KLNEEIAII	HLA-A*02:01			
SARS-CoV-2	nsp2	RLIDAMMFT	HLA-A*02:01			
SARS-CoV-2	nsp2	YITGGVVQL	HLA-A*02:01			
SARS-CoV-2	nsp2	KLVNKFLAL	HLA-A*02:01			
SARS-CoV-2	nsp2	ALNLGETFV	HLA-A*02:01			
SARS-CoV-2	nsp4	YLITPVHVM	HLA-A*02:01			
SARS-CoV-2	nsp4	FLPRVFSAV	HLA-A*02:01			
SARS-CoV-2	nsp4	KLIEYTDFA	HLA-A*02:01			
SARS-CoV-2	nsp4	IVAGGIVAI	HLA-A*02:01			
SARS-CoV-2	nsp4	FLAHIQWMV	HLA-A*02:01			
SARS-CoV-2	nsp4	FLLNKEMYL	HLA-A*02:01			

SARS-CoV-2	nsp4	FYLTNDVSF	HLA-A*24:02	HLA-A*02:01		
SARS-CoV-2	nsp4	FLPGVYSVIY	HLA-A*02:01			
SARS-CoV-2	nsp6	ILTSLLVLV	HLA-A*02:01			
SARS-CoV-2	nsp6	WLDMVDTSL	HLA-A*02:01			
SARS-CoV-2	nsp6	TLMNVLTLV	HLA-A*02:01			
SARS-CoV-2	nsp6	SMWALIISV	HLA-A*02:01			
SARS-CoV-2	nsp6	MFLARGIVF	HLA-A*24:02	HLA-A*02:01		
SARS-CoV-2	nsp6	FLLPSLATV	HLA-A*02:01			
SARS-CoV-2	nsp7	VLLSVLQQL	HLA-A*02:01			
SARS-CoV-2	nsp7	KLWAQCVQL	HLA-A*02:01			
SARS-CoV-2	nsp8	ALWEIQQVV	HLA-A*02:01			
SARS-CoV-2	nsp9	ALLSDLQDL	HLA-A*02:01			
SARS-CoV-2	ORF10 protein	NVFAFPFTI	HLA-A*02:01			
SARS-CoV-2	ORF3a protein	ALSKGVHFV	HLA-A*02:01			
SARS-CoV-2	ORF3a protein	TVYSHLLLV	HLA-A*02:01			
SARS-CoV-2	ORF3a protein	YLYALVYFL	HLA-A*02:01			
SARS-CoV-2	ORF3a protein	LLYDANYFL	HLA-A*02:01			
SARS-CoV-2	ORF6 protein	HLVDFQVTI	HLA-A*02:01			
SARS-CoV-2	ORF7a protein	KLFIRQEEV	HLA-A*02:01			
SARS-CoV-2	ORF8 protein	QYIDIGNYTV	HLA-A*02:01			
SARS-CoV-2	PLpro	YLKLTDNVYIK	HLA-A*02:01	HLA-A*03:01		
SARS-CoV-2	PLpro	YLFDESGEFKL	HLA-A*02:01	HLA-A*24:02		
SARS-CoV-2	PLpro	FLKKDAPYI	HLA-A*02:01			
SARS-CoV-2	PLpro	TLNDLNETL	HLA-A*02:01			
SARS-CoV-2	PLpro	YLDGADVTKI	HLA-A*02:01			
SARS-CoV-2	PLpro	YLATALLTL	HLA-A*02:01			
SARS-CoV-2	PLpro	YLNSTNVTI	HLA-A*02:01			
SARS-CoV-2	PLpro	YVWKSYVHV	HLA-A*02:01			
SARS-CoV-2	PLpro	ILLLDQALV	HLA-A*02:01			
SARS-CoV-2	PLpro	AYILFTRFF	HLA-A*24:02	HLA-A*02:01		
SARS-CoV-2	PLpro	FELDERIDKVL	HLA-A*02:01			
SARS-CoV-2	RdRpol	YLPYPDPSRIL	HLA-A*02:01	HLA-B*07:02		
SARS-CoV-2	RdRpol	NLIDSYFVV	HLA-A*02:01			
SARS-CoV-2	RdRpol	YTMADLVYA	HLA-A*02:01			
SARS-CoV-2	RdRpol	SLLMPILTL	HLA-A*02:01			
SARS-CoV-2	RdRpol	KIFVDGVPFV	HLA-A*02:01			
SARS-CoV-2	RdRpol	RLANECAQV	HLA-A*02:01			
SARS-CoV-2	RdRpol	LMIERFVSL	HLA-A*02:01			
SARS-CoV-2	RdRpol	MLDMYSVML	HLA-A*02:01			
SARS-CoV-2	S	VLNDILSRL	HLA-A*02:01	HLA-A*11:01		
SARS-CoV-2	S	YLQPRTFLL	HLA-A*02:01			
SARS-CoV-2	S	KIADYNYKL	HLA-A*02:01			
SARS-CoV-2	S	SIIAYTMSL	HLA-A*02:01			
SARS-CoV-2	S	LLFNKVTLA	HLA-A*02:01			
SARS-CoV-2	S	RLDKVEAEV	HLA-A*02:01			

SARS-CoV-2	S	RLQSLQTYV	HLA-A*02:01			
SARS-CoV-2	S	HLMSFPQSA	HLA-A*02:01			
SARS-CoV-2	S	FIAGLIAIV	HLA-A*02:01			
SARS-CoV-2	S	KLPDDFTGCV	HLA-A*02:01			
SARS-CoV-2	S	ALNTLVKQL	HLA-A*02:01			
SARS-CoV-2	S	LITGRLQSL	HLA-A*02:01			
SARS-CoV-2	S	RLNEVAKNL	HLA-A*02:01			
SARS-CoV-2	S	NLNESLIDL	HLA-A*02:01			
SARS-CoV-2	S	KLPDDFMGCV	HLA-A*02:01			
SARS-CoV-2	S	SIVAYTMSL	HLA-A*02:01			
SARS-CoV-2	S	FIAGLIAIV	HLA-A*02:01			
SARS-CoV-2	S	VLNDILSRL	HLA-A*02:01			
SARS-CoV-2	S	VVFLHVTYV	HLA-A*02:01			
SARS-CoV-2	3CL	AMRPNFTIK	HLA-A*03:01			
SARS-CoV-2	Hel	VTDVTQLYL	HLA-A*01:01	HLA-A*03:01		
SARS-CoV-2	Hel	KLFAAETLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	Hel	YVFTGYRVTK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	Hel	VVYRGTTTYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	Hel	VVNARLRAK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	Hel	ALKYLPIDK	HLA-A*03:01			
SARS-CoV-2	Hel	STLQGPPGTGK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	M	RIAGHHLGR	HLA-A*03:01			
SARS-CoV-2	N	KSAAEASKK	HLA-A*03:01			
SARS-CoV-2	N	KTFPPTEPK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	no S no N	MSYYCKSHK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	ITPVHVMSK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	YSYATHSDK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	LLNKEMYLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	RQFHQKLLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	IQITISSFK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	IMASLVLAR	HLA-A*03:01			
SARS-CoV-2	nsp1	SLVPGFNEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp10	FAVDAAKAYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp14	RLISMMGFK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp14	SMMGFKMNY	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp14	VLHDIGNPK	HLA-A*03:01			
SARS-CoV-2	nsp15	IINNTVYTK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp15	GLQPSVGPK	HLA-A*03:01			
SARS-CoV-2	nsp16	GVAMPNLYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp16	ALGGSVAIK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp16	KMQRMLLEK	HLA-A*03:01			
SARS-CoV-2	nsp2	NIFGTVYEK	HLA-A*03:01	HLA-A*11:01	HLA-A*01:01	
SARS-CoV-2	nsp2	KTIQPRVEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp2	VTNNTFTLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp2	KVTKGKAKK	HLA-A*03:01			

SARS-CoV-2	nsp2	IIIGGAKLK	HLA-A*03:01			
SARS-CoV-2	nsp2	TLKGGAPTK	HLA-A*03:01			
SARS-CoV-2	nsp2	TFFKLVNKF	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	nsp4	TIFKDASGK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp4	ALCTFLLNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp4	AVLQSGFRK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	nsp4	VYSVIYLYL	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	nsp7	SMQGAVDINK	HLA-A*03:01			
SARS-CoV-2	nsp8	VVIPDYNTYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp8	KLKKSLNVAK	HLA-A*03:01			
SARS-CoV-2	nsp8	TMLFTMLRK	HLA-A*03:01			
SARS-CoV-2	nsp8	ALRANSAVK	HLA-A*03:01			
SARS-CoV-2	nsp9	ALAYYNTTK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	ORF3a protein	RIFTIGTVTLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	ORF3a protein	SASKIITLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	ORF3a protein	ASKIITLKK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	YLKLTDNVYIK	HLA-A*02:01	HLA-A*03:01		
SARS-CoV-2	PLpro	TVIEVQGYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	RIDKVLNEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	HVVGPNVNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	AVFDKNLYDK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	AIVSTIQRK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	TISLAGSYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	VVENPTIQK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	ASMPTTIAK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	ATAEAELAK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	RQVVNVVTTK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	VVTTKIALK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	VLSGHNLAK	HLA-A*03:01			
SARS-CoV-2	PLpro	KLMPVCVETK	HLA-A*03:01			
SARS-CoV-2	PLpro	AVMYMGTLSY	HLA-A*03:01			
SARS-CoV-2	PLpro	SLREVRTIKVF	HLA-A*03:01			
SARS-CoV-2	PLpro	TTIKPVTYK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	PLpro	STFNVPMEK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	RdRpol	KVAGFAKFLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	AVAKHDFFK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	KLFDRYFKY	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	TSFGPLVRK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	TVKPGNFNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	KSAGFPFNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	RLYYDSMSY	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	MTNRQFHQK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	ATVVIGTSK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	LVASIKNFK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	AIDAYPLTK	HLA-A*03:01	HLA-A*11:01		

SARS-CoV-2	RdRpol	LLKDCPAVAK	HLA-A*03:01			
SARS-CoV-2	RdRpol	RVYANLGER	HLA-A*03:01			
SARS-CoV-2	RdRpol	HLYLQYIRK	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	S	GVYFASTEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	GVYYHKNNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	TLKSFTVEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	RLFRKSNLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	TLADAGFIK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	ASANLAATK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	VTYVPAQEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	MTSCCSCLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	KVFRSSVLH	HLA-A*03:01			
SARS-CoV-2	S	RQIAPGQTGK	HLA-A*03:01			
SARS-CoV-2	S	QIYKTPPIK	HLA-A*03:01			
SARS-CoV-2	3CL	AVLDMCASLK	HLA-A*11:01			
SARS-CoV-2	3CL	VTFQSAVKR	HLA-A*11:01			
SARS-CoV-2	Hel	KLFAAETLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	Hel	YVFTGYRVTK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	Hel	VVYRGTTTYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	Hel	VVNARLRAK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	Hel	STLQGPPGTGK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	Hel	SSNVANYQK	HLA-A*11:01			
SARS-CoV-2	M	ATSRTLSYY	HLA-A*11:01	HLA-A*01:01		
SARS-CoV-2	M	GTITVEELK	HLA-A*11:01			
SARS-CoV-2	N	KTFPPTEPK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	N	ASAFFGMSR	HLA-A*11:01			
SARS-CoV-2	no S no N	MSYYCKSHK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	ITPVHVMSK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	YSYATHSDK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	LLNKEMYLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	RQFHQKLLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	IQITISSFK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	no S no N	AGFSLWVYK	HLA-A*11:01			
SARS-CoV-2	no S no N	AQCFKMFYK	HLA-A*11:01			
SARS-CoV-2	no S no N	HLMGWDYPK	HLA-A*11:01			
SARS-CoV-2	no S no N	KVKYLYFIK	HLA-A*11:01			
SARS-CoV-2	no S no N	LLMPLKAPK	HLA-A*11:01			
SARS-CoV-2	no S no N	QTFFKLVNK	HLA-A*11:01			
SARS-CoV-2	no S no N	YIATNGPLK	HLA-A*11:01			
SARS-CoV-2	nsp1	SLVPGFNEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp10	FAVDAAKAYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp14	RLISMMGFK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp14	SMMGFKMNY	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp14	ASCDAIMTR	HLA-A*11:01			
SARS-CoV-2	nsp15	IINNTVYTK	HLA-A*03:01	HLA-A*11:01		

SARS-CoV-2	nsp15	KTQFNYYKK	HLA-A*11:01			
SARS-CoV-2	nsp16	GVAMPNLYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp16	ALGGSVAIK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp16	SSYSLFDMSK	HLA-A*11:01	HLA-A*24:02		
SARS-CoV-2	nsp16	HSWNADLYK	HLA-A*11:01			
SARS-CoV-2	nsp2	NIFGTVYEK	HLA-A*03:01	HLA-A*11:01	HLA-A*01:01	
SARS-CoV-2	nsp2	KTIQPRVEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp2	VTNNTFTLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp2	STSAFVETVK	HLA-A*11:01			
SARS-CoV-2	nsp2	RVVRSIFSR	HLA-A*11:01			
SARS-CoV-2	nsp2	TFFKLVNKF	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	nsp4	TIFKDASGK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp4	ALCTFLLNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp4	AVLQSGFRK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	nsp4	GAMDTTSYR	HLA-A*11:01			
SARS-CoV-2	nsp4	FSSEIIGYKAI	HLA-A*11:01			
SARS-CoV-2	nsp4	VYSVIYLYL	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	nsp6	SAFAMMFVK	HLA-A*11:01			
SARS-CoV-2	nsp8	VVIPDYNTYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	nsp8	QTMLFTMLR	HLA-A*11:01			
SARS-CoV-2	nsp9	ALAYYNTTK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	ORF3a protein	RIFTIGTVTLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	ORF3a protein	SASKIITLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	ORF3a protein	ASKIITLKK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	TVIEVQGYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	RIDKVLNEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	HVVGPNVNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	AVFDKNLYDK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	AIVSTIQRK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	TISLAGSYK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	VVENPTIQK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	ASMPTTIAK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	ATAEAELAK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	RQVVNVVTTK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	VVTTKIALK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	PLpro	TTIKPVTYK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	PLpro	STFNVPMEK	HLA-A*11:01	HLA-A*03:01		
SARS-CoV-2	PLpro	VVNAANVYLK	HLA-A*11:01			
SARS-CoV-2	PLpro	LVSDIDITFLK	HLA-A*11:01			
SARS-CoV-2	PLpro	LTAVVIPTK	HLA-A*11:01			
SARS-CoV-2	PLpro	STQLGIEFLK	HLA-A*11:01			
SARS-CoV-2	PLpro	GTLSYEQFK	HLA-A*11:01			
SARS-CoV-2	PLpro	TSNSFDVLK	HLA-A*11:01			
SARS-CoV-2	PLpro	TTIAKNTVK	HLA-A*11:01			
SARS-CoV-2	RdRpol	KVAGFAKFLK	HLA-A*03:01	HLA-A*11:01		

SARS-CoV-2	RdRpol	AVAKHDFFK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	KLFDRYFKY	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	TSFGPLVRK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	TVKPGNFNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	KSAGFPFNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	RLYYDSMSY	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	MTNRQFHQK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	ATVVIGTSK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	LVASIKNFK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	AIDAYPLTK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	RdRpol	GTSTDVVYR	HLA-A*11:01			
SARS-CoV-2	RdRpol	RAFDIYNDK	HLA-A*11:01			
SARS-CoV-2	RdRpol	HLYLQYIRK	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	S	VLNDILSRL	HLA-A*02:01	HLA-A*11:01		
SARS-CoV-2	S	GVYFASTEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	GVYYHKNNK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	TLKSFTVEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	RLFRKSNLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	TLADAGFIK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	ASANLAATK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	VTYVPAQEK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	MTSCCSCLK	HLA-A*03:01	HLA-A*11:01		
SARS-CoV-2	S	NSASFSTFK	HLA-A*11:01			
SARS-CoV-2	S	TEILPVSMTK	HLA-A*11:01			
SARS-CoV-2	S	SSTASALGK	HLA-A*11:01			
SARS-CoV-2	S	GTHWFVTQR	HLA-A*11:01			
SARS-CoV-2	Hel	TYKLNVGDYFV	HLA-A*24:02	HLA-A*02:01		
SARS-CoV-2	Hel	VYIGDPAQL	HLA-A*24:02			
SARS-CoV-2	M	YFIASFRLF	HLA-A*24:02			
SARS-CoV-2	N	NFKDQVILL	HLA-A*24:02			
SARS-CoV-2	N	QFKDNVILL	HLA-A*24:02			
SARS-CoV-2	no S no N	TYACWHHSI	HLA-A*24:02			
SARS-CoV-2	no S no N	KYTQLCQYL	HLA-A*24:02			
SARS-CoV-2	no S no N	IYLYLTFYL	HLA-A*24:02			
SARS-CoV-2	no S no N	WSMATYYLF	HLA-A*24:02			
SARS-CoV-2	no S no N	VQSTQWSLF	HLA-A*24:02			
SARS-CoV-2	no S no N	RYMNSQGLL	HLA-A*24:02			
SARS-CoV-2	no S no N	TFTYASALW	HLA-A*24:02			
SARS-CoV-2	no S no N	SYFIASFRL	HLA-A*24:02			
SARS-CoV-2	nsp1	SYGADLKSF	HLA-A*24:02			
SARS-CoV-2	nsp14	SYATHSDKF	HLA-A*24:02			
SARS-CoV-2	nsp14	KFTDGVCLF	HLA-A*24:02			
SARS-CoV-2	nsp14	LYLDAYNMM	HLA-A*24:02			
SARS-CoV-2	nsp14	VYKQFDTYNLW	HLA-A*24:02			
SARS-CoV-2	nsp14	DYVYNPFMI	HLA-A*24:02			

SARS-CoV-2	nsp14	TYNLWNTF	HLA-A*24:02			
SARS-CoV-2	nsp15	RYKLEGYAF	HLA-A*24:02			
SARS-CoV-2	nsp16	SSYSLFDMSK	HLA-A*11:01	HLA-A*24:02		
SARS-CoV-2	nsp16	VPYNMRVIHF	HLA-B*07:02	HLA-A*24:02		
SARS-CoV-2	nsp2	TFFKLVNKF	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	nsp4	FYLTNDVSF	HLA-A*24:02	HLA-A*02:01		
SARS-CoV-2	nsp4	VYSVIYLYL	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	nsp4	NYLKRRVVF	HLA-A*24:02			
SARS-CoV-2	nsp4	YYRSLPGVF	HLA-A*24:02			
SARS-CoV-2	nsp4	MFTPLVPFW	HLA-A*24:02			
SARS-CoV-2	nsp4	VFNGVSFSTF	HLA-A*24:02			
SARS-CoV-2	nsp4	LYQPPQTSI	HLA-A*24:02			
SARS-CoV-2	nsp6	MFLARGIVF	HLA-A*24:02	HLA-A*02:01		
SARS-CoV-2	nsp6	VYMPASWVM	HLA-A*24:02			
SARS-CoV-2	nsp6	MYASAVVLL	HLA-A*24:02			
SARS-CoV-2	nsp6	YDYLVSTQEF	HLA-A*24:02			
SARS-CoV-2	nsp8	TYASALWEI	HLA-A*24:02			
SARS-CoV-2	ORF10 protein	AFPFTIYSL	HLA-A*24:02			
SARS-CoV-2	ORF3a protein	FTSDYYQLY	HLA-A*01:01	HLA-A*24:02		
SARS-CoV-2	ORF3a protein	LYLYALVYF	HLA-A*24:02			
SARS-CoV-2	ORF3a protein	VYFLQSINF	HLA-A*24:02			
SARS-CoV-2	ORF3a protein	YYQLYSTQL	HLA-A*24:02			
SARS-CoV-2	ORF3a protein	PYNSVTSSI	HLA-A*24:02			
SARS-CoV-2	PLpro	YLFDESGEFKL	HLA-A*02:01	HLA-A*24:02		
SARS-CoV-2	PLpro	AYILFTRFF	HLA-A*24:02	HLA-A*02:01		
SARS-CoV-2	PLpro	QGYKSVNITF	HLA-A*24:02			
SARS-CoV-2	PLpro	DYQGKPLEF	HLA-A*24:02			
SARS-CoV-2	PLpro	LYDKLVSSF	HLA-A*24:02			
SARS-CoV-2	PLpro	YYTSNPTTF	HLA-A*24:02			
SARS-CoV-2	PLpro	YYHTTDPSF	HLA-A*24:02			
SARS-CoV-2	PLpro	SYLFQHANL	HLA-A*24:02			
SARS-CoV-2	PLpro	YYKKDNSYF	HLA-A*24:02			
SARS-CoV-2	PLpro	DYKHYTPSF	HLA-A*24:02			
SARS-CoV-2	PLpro	NYMPYFFTL	HLA-A*24:02			
SARS-CoV-2	PLpro	FFASFYYVW	HLA-A*24:02			
SARS-CoV-2	PLpro	VYANGGKGF	HLA-A*24:02			
SARS-CoV-2	PLpro	KMFDAYVNTF	HLA-A*24:02			
SARS-CoV-2	PLpro	AYVNTFSSTF	HLA-A*24:02			
SARS-CoV-2	PLpro	MYMGTLSYEQF	HLA-A*24:02			
SARS-CoV-2	PLpro	TYKPNTWCI	HLA-A*24:02			
SARS-CoV-2	RdRpol	HLYLQYIRK	HLA-A*24:02	HLA-A*03:01	HLA-A*11:01	
SARS-CoV-2	RdRpol	FYGGWHNML	HLA-A*24:02			
SARS-CoV-2	RdRpol	IYNDKVAGF	HLA-A*24:02			
SARS-CoV-2	RdRpol	SYFVVKRHTF	HLA-A*24:02			
SARS-CoV-2	RdRpol	NFNKDFYDF	HLA-A*24:02			

SARS-CoV-2	RdRpol	AYANSVFNI	HLA-A*24:02			
SARS-CoV-2	RdRpol	SYEDQDALFAY	HLA-A*24:02			
SARS-CoV-2	S	PFFSNVTWF	HLA-A*24:02			
SARS-CoV-2	S	RFDNPVLPF	HLA-A*24:02			
SARS-CoV-2	S	VYSSANNCTF	HLA-A*24:02			
SARS-CoV-2	S	EYVSQPFLM	HLA-A*24:02			
SARS-CoV-2	S	YYVGYLQPRTF	HLA-A*24:02			
SARS-CoV-2	S	LYNSASFSTF	HLA-A*24:02			
SARS-CoV-2	S	NYNYLYRLF	HLA-A*24:02			
SARS-CoV-2	S	YFPLQSYGF	HLA-A*24:02			
SARS-CoV-2	S	PYRVVVLSF	HLA-A*24:02			
SARS-CoV-2	S	VYSTGSNVF	HLA-A*24:02			
SARS-CoV-2	S	IYKTPPIKDF	HLA-A*24:02			
SARS-CoV-2	S	TYVPAQEKNF	HLA-A*24:02			
SARS-CoV-2	S	QYIKWPWYI	HLA-A*24:02			
SARS-CoV-2	S	YYHKNNKSW	HLA-A*24:02			
SARS-CoV-2	S	RFPNITNLCPF	HLA-A*24:02			
SARS-CoV-2	3CL	QPGQTFSVL	HLA-B*07:02			
SARS-CoV-2	3CL	SPSGVYQCAM	HLA-B*07:02			
SARS-CoV-2	3CL	RPNFTIKGSF	HLA-B*07:02			
SARS-CoV-2	Hel	TPHTVLQAV	HLA-B*07:02			
SARS-CoV-2	Hel	MPLSAPTL	HLA-B*07:02			
SARS-CoV-2	Hel	IPARARVECF	HLA-B*07:02			
SARS-CoV-2	Hel	APRTLLTKGTL	HLA-B*07:02			
SARS-CoV-2	Hel	RPQIGVVREF	HLA-B*07:02			
SARS-CoV-2	Hel	RNPAWRKAVF	HLA-B*07:02			
SARS-CoV-2	Hel	IPRRNVATL	HLA-B*07:02			
SARS-CoV-2	M	VPLHGTIL	HLA-B*07:02			
SARS-CoV-2	N	KFPRGQGVPI	HLA-B*07:02			
SARS-CoV-2	N	SPRWYFYYL	HLA-B*07:02			
SARS-CoV-2	nsp1	RTAPHGHVM	HLA-B*07:02			
SARS-CoV-2	nsp1	APHGHVMVEL	HLA-B*07:02			
SARS-CoV-2	nsp1	VPHVGEIPVAY	HLA-B*07:02			
SARS-CoV-2	nsp10	VPANSTVLSF	HLA-B*07:02			
SARS-CoV-2	nsp10	HPNPKGFCDL	HLA-B*07:02			
SARS-CoV-2	nsp14	HPTQAPTHL	HLA-B*07:02			
SARS-CoV-2	nsp14	TPAFDKSAF	HLA-B*07:02			
SARS-CoV-2	nsp15	LPVNVAFEL	HLA-B*07:02			
SARS-CoV-2	nsp15	KPVPEVKIL	HLA-B*07:02			
SARS-CoV-2	nsp15	APAHISTI	HLA-B*07:02			
SARS-CoV-2	nsp15	KPRSQMEI	HLA-B*07:02			
SARS-CoV-2	nsp16	VPYNMRVIHF	HLA-B*07:02	HLA-A*24:02		
SARS-CoV-2	nsp16	LPKGIMMNV	HLA-B*07:02			
SARS-CoV-2	nsp16	KPREQIDGYVM	HLA-B*07:02			
SARS-CoV-2	nsp2	QPRVEKKKL	HLA-B*07:02			

SARS-CoV-2	nsp2	MPLKAPKEI	HLA-B*07:02			
SARS-CoV-2	nsp2	APKEIIFL	HLA-B*07:02			
SARS-CoV-2	nsp4	VVPGLPGTIL	HLA-B*07:02			
SARS-CoV-2	nsp4	VPYCYDTNVL	HLA-B*07:02			
SARS-CoV-2	nsp4	RPDTRYVLM	HLA-B*07:02			
SARS-CoV-2	nsp4	TPLIQPIGAL	HLA-B*07:02			
SARS-CoV-2	nsp6	LPFAMGIIAM	HLA-B*07:02			
SARS-CoV-2	nsp8	IPLTTAAKL	HLA-B*07:02			
SARS-CoV-2	nsp8	SPNLAWPLI	HLA-B*07:02			
SARS-CoV-2	nsp9	SPVALRQM	HLA-B*07:02			
SARS-CoV-2	nsp9	TPKGPKVKYL	HLA-B*07:02			
SARS-CoV-2	ORF3a protein	IPIQASLPF	HLA-B*07:02			
SARS-CoV-2	ORF3a protein	APFLYLYAL	HLA-B*07:02			
SARS-CoV-2	ORF7a protein	RARSVSPKL	HLA-B*07:02			
SARS-CoV-2	PLpro	APLLSAGIF	HLA-B*07:02			
SARS-CoV-2	PLpro	APYIVGDVV	HLA-B*07:02			
SARS-CoV-2	PLpro	YPQVNGLTSI	HLA-B*07:02			
SARS-CoV-2	PLpro	KPASRELKVTF	HLA-B*07:02			
SARS-CoV-2	PLpro	TPSFKKGAKL	HLA-B*07:02			
SARS-CoV-2	PLpro	KPANNSLKI	HLA-B*07:02			
SARS-CoV-2	PLpro	KKPNELSRVL	HLA-B*07:02			
SARS-CoV-2	PLpro	MPYFFTLLL	HLA-B*07:02			
SARS-CoV-2	PLpro	TPRDLGACI	HLA-B*07:02			
SARS-CoV-2	PLpro	VAKSHNIAL	HLA-B*07:02			
SARS-CoV-2	PLpro	NVPMEKLKTL	HLA-B*07:02			
SARS-CoV-2	PLpro	TKPVETSNSF	HLA-B*07:02			
SARS-CoV-2	PLpro	AEIPKEEVKPF	HLA-B*07:02			
SARS-CoV-2	RdRpol	YLPYPDPSRIL	HLA-A*02:01	HLA-B*07:02		
SARS-CoV-2	RdRpol	MVPHISRQRL	HLA-B*07:02			
SARS-CoV-2	RdRpol	MPILTLTRAL	HLA-B*07:02			
SARS-CoV-2	RdRpol	KPYIKWDLL	HLA-B*07:02			
SARS-CoV-2	RdRpol	IPTITQMNL	HLA-B*07:02			
SARS-CoV-2	S	LPFNDGVYF	HLA-B*07:02			
SARS-CoV-2	S	TPINLVRDL	HLA-B*07:02			
SARS-CoV-2	S	LPQGFSAL	HLA-B*07:02			
SARS-CoV-2	S	KPFERDISTEI	HLA-B*07:02			
SARS-CoV-2	S	QPYRVVVL	HLA-B*07:02			
SARS-CoV-2	S	GPKKSTNLV	HLA-B*07:02			
SARS-CoV-2	S	SPRRARSVA	HLA-B*07:02			
SARS-CoV-2	S	IPTNFTISV	HLA-B*07:02			
SARS-CoV-2	S	APHGVVFL	HLA-B*07:02			
SARS-CoV-2	S	SEPVLKGVKL	HLA-B*07:02			
TAA	MSLN	TLDTLTAFY	HLA-A*01:01			
TAA	Survivin	FTELTLGEF	HLA-A*01:01			
TAA	WT1	TSEKRPFMCAY	HLA-A*01:01			

CMV	UL44	VTEHDTLLY	HLA-A*01:01
CMV	pp65	YSEHPTFTSQY	HLA-A*01:01
Hepatitis	Polyprotein	ATDALMTGY	HLA-A*01:01
Influenza	NP	CTELKLSDY	HLA-A*01:01
Virus	VP1	SADNNNSEY	HLA-A*01:01
Influenza	PB1	VSDGGPNLY	HLA-A*01:01
Adenovirus	Hexon	TDLGQNLLY	HLA-A*01:01
HCV	NS3	ATDALMTGF	HLA-A*01:01
CMV	pp65	NLVPMVATV	HLA-A*02:01
CMV	IE-1	VLEETSVML	HLA-A*02:01
EBV	BALF4	FLDKGTYTL	HLA-A*02:01
EBV	BMLF1	GLCTLVAML	HLA-A*02:01
EBV	BMRF1	TLDYKPLSV	HLA-A*02:01
EBV	BRLF1	YVLDHLIVV	HLA-A*02:01
EBV	EBNA 3B	LLDFVRFMGV	HLA-A*02:01
EBV	LMP-2A	CLGGLLTMV	HLA-A*02:01
EBV	LMP-1	YLLEMLWRL	HLA-A*02:01
EBV	LMP-1	YLQQNWWTL	HLA-A*02:01
EBV	LMP-2A	FLYALALLL	HLA-A*02:01
Influenza	MP	GILGFVFTL	HLA-A*02:01
Influenza	MP	ILGFVFTLTV	HLA-A*02:01
Influenza	BNP	KLGEFYNQMM	HLA-A*02:01
Influenza	Nucleocapsid	LVWMACHSA	HLA-A*02:01
HBV	Core	FLPSDFFPSV	HLA-A*02:01
TAA	MART-1	ELAGIGILTV	HLA-A*02:01
TAA	NY-ESO-1	SLLMWITQC	HLA-A*02:01
TAA	MAGE-A1	KVLEYVIKV	HLA-A*02:01
TAA	MAGE-A3	FLWGPRALV	HLA-A*02:01
EBV	EMNA 3A	RLRAEAQVK	HLA-A*03:01
HPV	E6	KLCLRFLSK	HLA-A*03:01
Hepatitis	Polyprotein	VTLTHPITK	HLA-A*03:01
Cancer	BCL-2L1	RIAAWMATY	HLA-A*03:01
Cancer	gp100	ALLAVGATK	HLA-A*03:01
Cancer	HMOX1	QVLKKIAQK	HLA-A*03:01
Cancer	hTERT	SVLNYERARR	HLA-A*03:01
Cancer	MCL-1	RLLFFAPTR	HLA-A*03:01
Cancer	RhoC	RLGLQVRKNK	HLA-A*03:01
CMV	IE-1	KLGGALQAK	HLA-A*03:01
Influenza	PR8	ILRGSVAHK	HLA-A*03:01
HCV	NS5B	RVCEKMALY	HLA-A*03:01
Influenza	MP	SIIPSGPLK	HLA-A*11:01
Influenza	MP1	RMVLASTTAK	HLA-A*11:01
Influenza	MP2	KSMREEYRK	HLA-A*11:01
EBV	EBNA 3B	AVFDRKSDAK	HLA-A*11:01
EBV	EBNA 3B	IVTDFSVIK	HLA-A*11:01

HIV	NEF	AVDLSHFLK	HLA-A*11:01
HPV	E6	NTLEQTVKK	HLA-A*11:01
EBV	BRLF1	ATIGTAMYK	HLA-A*11:01
EBV	EBNA-4	IVTDFSVIK	HLA-A*11:01
EBV	LMP-2	SSCSSCPLSK	HLA-A*11:01
HBV	core	YVNVNMGLK	HLA-A*11:01
CMV	pp65	QYDPVAALF	HLA-A*24:01
CMV	pp65	VYALPLKML	HLA-A*24:01
CMV	IE-1	AYAQKIFKI	HLA-A*24:01
EBV	LMP2	PYLFWLAAI	HLA-A*24:01
EBV	LMP2	TYGPVFMSL	HLA-A*24:01
EBV	BRLF1	DYCNVLNKEF	HLA-A*24:01
EBV	LMP-2	TYGPVFMCL	HLA-A*24:01
HIV	Env	RYLKDQQLL	HLA-A*24:01
HIV	Env	RYLRDQQLL	HLA-A*24:01
HIV	NEF	RYPLTFGWCF	HLA-A*24:01
HBV	Polymerase	KYTSFPWLL	HLA-A*24:01
Adenovirus	Hexon 37-45	TYFSLNNKF	HLA-A*24:01
HBV	core	EYLVSFGVW	HLA-A*24:01
HCV	NS3	AYSQQTRGL	HLA-A*24:01
CMV	pp65	RPHERNGFTVL	HLA-B*07:02
CMV	pp65	TPRVTGGGAM	HLA-B*07:02
EBV	BMRF1	RPQGGSRPEFV	HLA-B*07:02
EBV	EBNA 3A	RPPIFIRRL	HLA-B*07:02
EBV	EBNA 6	QPRAPIRPI	HLA-B*07:02
HPV	E7	KPTLKEYVL	HLA-B*07:02
Virus	VP1	GPLCKADSL	HLA-B*07:02
Virus	VP1	APTKRKGEC	HLA-B*07:02
Virus	VP1	APKKPKEPV	HLA-B*07:02
Virus	VP1	NPTAQSQVM	HLA-B*07:02
Virus	VP1	VPQYGYLTL	HLA-B*07:02
Virus	VP1	SPERKMLPC	HLA-B*07:02
Influenza	NP	SPIVPSFDM	HLA-B*07:02
Influenza	PB1	QPEWFRNVL	HLA-B*07:02
Adenovirus	Hexon114	KPYSGTAYNAL	HLA-B*07:02

Supplementary Table 4. Total CD8+ T cell antigen specificities detected in cross-sectional sample (Total CD8+ T cell frequencies and cell numbers)

				HLA-A01		HLA-A11	HLA-A02						HLA-A02/HLA-A11			HLA-A01/HLA-A02			HLA-A03		HLA-A01/HLA-A03	HLA-A01/HLA-A03/HLA-B07	HLA-A02/HLA-A03	HLA-A02/HLA-A24	HLA-A02/HLA-B07	HLA-A01/HLA-A24	HLA-11/HLA-A24	HLA-A01/HLA-A11	HLA-A03/HLA-A11/HLA-B07	HLA-A03/HLA-A11	HLA-A02/HLA-A03/HLA-B07	HLA-A03/HLA-A24/HLA-B07	HLA-A03/HLA-A24
Allele	Peptides	Str/NStr	Protein	CCP902	CCP615	CCP415	CCP602	CCP463	CCP322	CCP146	CCP891	CCP959	CCP406	CCP829	CCP831	CCP618	CCP220	CCP830	CCP549	CCP199	CCP398	CCP699	CCP106	CCP270	CCP427	CCP245	CCP757	CCP190	CCP706	CCP390	CCP642	CCP413	CCP547
HLA-A01	GTDLEGNFY	ORF1a/NStr	3CL	0.006 (11)													0.001 (6)									0.002 (10)								
HLA-A01	FTSDYYQLY	NStr	ORF3a protein	0.471 (865)	0.013 (18)											0.022 (45)	0.012 (50)	0.008 (4)			0.03 (68)	0.007 (37)					0.007 (39)		0.019 (69)					
HLA-A01	PTDNYITTY	ORF1a/NStr	P.pro	0.029 (53)	0.015 (21)												0.008 (54)				0.008 (19)	0.015 (79)				0.02 (113)							
HLA-A01	HTTDPSFLGRY	ORF1a/NStr	P.pro	0.285 (524)	0.045 (62)											0.05 (100)	0.067 (271)	0.026 (13)			0.143 (330)	0.124 (666)					0.023 (132)		0.022 (79)					
HLA-A01	DTDFVNEFY	ORF1b/NStr	RdRpol	0.007 (13)													0.002 (9)																	
HLA-A01	LTDEMIAQY	Str	S		0.004 (6)																0.003 (6)					0.002 (13)		0.002 (7)					
HLA-A02	YLQPRTFLL	Str	S				0.068 (103)	0.01 (21)	0.011 (13)	0.023 (27)		0.062 (56)	0.002 (8)				0.001 (4)							0.01 (4)	0.002(5)							0.006 (28)		
HLA-A02	LLYDANYFL	NStr	ORF3a protein					0.004 (9)	0.006 (7)	0.02 (23)			0.002 (7)			0.003 (5)							0.003 (13)								0.005 (24)		
HLA-A02	YLYALVYFL	NStr	ORF3a protein						0.005 (6)					0.002 (5)		0.003 (5)																	
HLA-A02	ALSKGVHFV	NStr	ORF3a protein							0.006 (7)		0.035 (32)												0.001 (4)									
HLA-A02	LLLDRLNQL	Str	N									0.011 (10)											0.003 (13)										
HLA-A02	ALWEIQDVV	ORF1a/NStr	NSP8									0.039 (35)												0.006 (24)	0.004 (8)						0.001 (5)		
HLA-A02	YLATALLTL	ORF1a/NStr	P.pro									0.004 (4)																					
HLA-A02	YLDAYNMMI	ORF1b/NStr	NSP14																				0.002 (7)										
HLA-A02	NLIDSYFVV	ORF1b/NStr	RdRpol																					0.0015 (6)									
HLA-A02	VVFLHVTYV	Str	S																						0.002 (4)								
HLA-A03	KTFPPTEPK	Str	N																0.018 (57)	0.006 (58)	0.017 (39)								0.036 (81)	0.01 (54)	0.007 (32)	0.004 (22)	0.027 (176)	
HLA-A03	VTNNTFTLK	ORF1a/NStr	NSP2																0.003 (8)	0.002 (21)										0.002 (9)		0.002 (10)		
HLA-A03	GVYFASTEK	Str	S																	0.001 (11)										0.002 (9)				
HLA-A03	KLFDRYFKY	ORF1b/NStr	RdRpol																	0.001 (12)													0.001 (7)	
HLA-A03	KTIQPRVEK	ORF1a/NStr	NSP2																	0.001 (11)								0.039 (89)				0.003 (16)		
HLA-A03	TSFGPLVRK	ORF1b/NStr	RdRpol																													0.001 (4)		
HLA-A03	SASRIITLK	NStr	ORF3a protein																									0.003 (7)	0.001 (6)					
HLA-A03	TISLAGSYK	ORF1a/NStr	P.pro																										0.001 (5)					
HLA-A03	AVFDKNLYDK	ORF1a/NStr	P.pro																										0.001 (5)					
HLA-A11	VVNARLRAK	ORF1b/NStr	Hel												0.002 (5)																			
HLA-A11	KTFPPTEPK	Str	N			0.004 (5)							0.012 (45)	0.006 (18)													0.219 (1011)	0.011 (39)	0.036 (81)	0.01 (54)				
HLA-A11	RLFRKSNLK	Str	S										0.003 (10)																					
HLA-A11	STFNVPMEK	ORF1a/NStr	P.pro			0.003 (4)																												
HLA-A11	VTNNTFTLK	ORF1a/NStr	NSP2			0.003 (4)																					0.001 (5)			0.002 (9)				
HLA-A11	VVYRGTTTYK	ORF1b/NStr	Hel			0.003 (4)																												
HLA-A11	GTHWFVTQR	Str	S																										0.169 (383)					
HLA-A11	AGFSLWVYK	ORF1a/NStr	P.pro																											0.001 (5)				
HLA-A11	AVFDKNLYDK	ORF1a/NStr	P.pro																											0.001 (5)				
HLA-A11	SAFAMMFVK	ORF1a/NStr	NSP6																											0.001 (6)				
HLA-A11	TISLAGSYK	ORF1a/NStr	P.pro																											0.001 (5)				
HLA-A11	GVYFASTEK	Str	S																											0.002 (9)				
HLA-A11	SASRIITLK	NStr	ORF3a protein																									0.003 (7)		0.001 (6)				
HLA-A11	KTIQPRVEK	ORF1a/NStr	NSP2																									0.039 (89)						
HLA-A24	NYNYLYRLF	Str	S																					0.002 (8)		0.006 (32)								0.001 (9)
HLA-A24	QYIKWPWYI	Str	S																					0.0015 (6)			0.006 (27)					0.01 (50)		0.005 (31)
HLA-A24	NYMPYFFTL	ORF1a/NStr	P.pro																							0.001 (5)						0.002 (11)		
HLA-A24	VYFLQSINF	NStr	ORF3a protein																							0.002 (10)								
HLA-A24	KYTSNPTTF	ORF1a/NStr	P.pro																							0.003 (15)								
HLA-A24	RFDNPVLPF	Str	S																													0.005 (24)		
HLA-A24	TYACWHBI.	ORF1a/NStr	P.pro																													0.113 (554)		0.001 (4)
HLA-A24	VYEQDPAQL	ORF1b/NStr	Hel																							0.007 (39)								0.006 (41)
HLA-A24	FTSDYYQLY	NStr	ORF3a protein																															
HLA-B07	QPGQTFSVL	ORF1a/NStr	3CL																			0.001 (6)												
HLA-B07	RARSVSPKL	NStr	ORF7a protein																			0.001 (6)			0.003 (7)				0.005 (11)		0.002 (10)			
HLA-B07	SPRWYFYYL	Str	N																			0.022 (118)			0.14 (281)				0.141 (321)		0.166 (758)	0.018 (90)		
HLA-B07	APHGVVFL	Str	S																												0.001 (4)			
HLA-B07	IPRRNVATL	ORF1b/NStr	Hel																												0.002 (9)			
HLA-B07	RPDTRYVLM	ORF1a/NStr	NSP4																													0.001 (5)		
HLA-A01	CTELKLSDY	Influenza	NP														0.006 (24)					0.006 (33)												
HLA-A01	VSDGGPNLY	Influenza	B1	0.106 (194)	0.017 (23)													0.04 (20)								0.009 (51)		0.05 (181)						
HLA-A02	GILGFVFTL	Influenza	M1				0.05 (76)	0.007 (14)	0.05 (56)	0.044 (51)		0.036 (33)	0.025 (97)	0.045 (130)	0.033(98)	0.014 (28)		0.071 (36)						0.038 (156)							0.008 (37)			
HLA-A03	ILRGSVAHK	Influenza	NP																0.038 (122)	0.01 (104)	0.022 (51)	0.015 (78)	0.06 (246)						0.01 (22)	0.138 (766)	0.019 (85)	0.017 (85)	0.001 (6)	
HLA-A11	KSMREEYRK.	Influenza	MP2																											0.001 (6)				
HLA-A24	TYQWIIRNW.	Influenza	PB2																													0.002 (8)		
HLA-B07	SPVIPSFDM	Influenza	NP																												0.001 (5)			
HLA-A02	TLDYKPLSV	EBV	BMRF1									0.018 (16)				0.003 (5)																		
HLA-A02	YLLEMLWRL	EBV	LMP1									0.013 (12)				0.003 (5)	0.003 (13)								0.007 (14)									
HLA-A02	YVLDHLIVV	EBV	BRF1					0.11 (223)	0.057 (64)	0.034 (40)		0.065 (59)				0.088 (175)	0.007 (28)							0.076 (310)	0.51 (1053)									
HLA-A02	LLDFVRFMGV	EBV	EBNA 6					0.019 (39)	0.022 (24)		0.033 (7)	0.264 (240)																						
HLA-A02	CLGGLLTMV	EBV	LMP2					0.028 (56)				0.172 (156)				0.003 (5)	0.001 (6)							0.05 (186)									
HLA-A02	FLYALALLL	EBV	LMP2					0.048 (98)		0.021 (24)	0.029 (6)	0.052 (47)	0.009 (35)	0.005 (15)	0.005 (15)	0.027 (54)	0.003 (14)							0.014 (59)	0.004(8)						0.011 (52)			
HLA-A03	RLRAEAQVK	EBV	ENBA 3A																0.042 (134)	0.005 (53)	0.016 (36)	0.004 (23)	0.007 (27)							0.035 (195)	0.004 (19)			0.001 (5)
HLA-A11	SCCSSCPLSK	EBV	LMP2										0.005 (20)														0.006 (26)	0.037 (133)	0.003 (6)	0.048 (264)				
HLA-A11	AVFDRKSDAK	EBV	ENBA 3B			0.075 (102)							0.004 (17)	0.161 (462)	0.005 (14)												0.009 (42)	0.181 (658)		0.062 (344)				
HLA-A11	IVTDFSVIK	EBV	ENBA 3B			1.074 (1460)								0.255 (731)	0.259 (766)													0.028 (102)						
HLA-A24	PYLFWLAAI.	EBV	LMP2																							0.002 (13)								
HLA-B07	RPPIFIRRL	EBV	ENBA 3A																			0.11 (595)			0.02 (40)				0.052 (118)		0.367 (1673)	0.196 (961)		
HLA-A01	VTEHDTLLY	CMV	pp50														0.772 (3141)					1.67 (8957)				0.306 (1748)								
HLA-A01	YSEHPTFTSQY	CMV	pp65														0.09 (364)					0.008 (41)				1.797 (10259)								
HLA-A02	NLVPMVATV	CMV	pp65					0.643 (1304)					0.842 (3206)				0.63 (2557)																	
HLA-A02	VLEETSVML	CMV	IE1					0.493 (999)																										
HLA-A03	KLGGALQAK	CMV	IE1																			0.122 (657)												
HLA-A24	AYAQKIFKL	CMV	IE1																							0.002 (11)	0.001 (4)					0.003 (13)		0.002 (13)
HLA-A24	QYDPVAALF	CMV	pp65																							0.017 (98)	0.082 (380)					0.003 (15)		0.053 (341)
HLA-B07	RPHERNGFTVL	CMV	pp65																			0.951 (5102)										4.244 (20816)		
HLA-A02	ELAGIGILTV	Melanoma	MART-1					0.04 (82)	0.035 (39)			0.022 (20)		0.013 (38)		0.015 (30)								0.009 (35)	0.006 (12)						0.005 (25)			
HLA-A01	TDLGQNLLY	Adenovirus	Hexon													0.015 (31)										0.004 (23)								
HLA-A24	TYFSLNNKF	Adenovirus	Hexon																					0.05 (221)										

Supplementary Table 5. Antibody clones and metal tags used in study

Metal	Antibody	Clone	Provider
Y-89	CD45	HI30	*Fluidigm*
Cd-112/114	CD14	TUK4	*Invitrogen*
Cd-112/114	CD19	SJ25-C1	*Life Technologies*
In-115	CD57	*HCD57*	*Biolegend*
Pr-141	CD103	*B-Ly7*	*eBiosciences*
Nd-142	CD56	*NCAM 16.2*	*BD*
Nd-143	HLA-DR	*L243*	*Biolegend*
Nd-144	CD3	*UCHT1*	*Biolegend*
Nd-145	CD4	*SK3*	*Biolegend*
Nd-146	CD8	*SK1*	*Biolegend*
Sm-147	CD45RA	HI100	*Biolegend*
Nd-148	CD45RO	*UCLH1*	*Biolegend*
Sm-149	CD160	MAB6700	R&D
Nd-150	Granzyme B	*CLB-GB11*	*ABCAM*
Sm-152	CD38	*HIT2*	*Biolegend*
Eu-153	KLRG1	*13F12F2*	*eBiosciences*
Gd-155*	CLA	*HECA-452*	*Biolegend*
Gd-158	CD27	*LG.7F9*	*eBiosciences*
Tb-159	CXCR3	MAB160-100	R&D
Dy-161*	CD161	*HP-3G10*	*Biolegend*
Dy-162*	CD95	DX2	*Biolegend*
Dy-163*	CD127	*A019D5*	*Biolegend*
Er-168	CCR7	*150503*	R&D
Er-170	CD244	*C1.7*	*Biolegend*
Yb-173*	CD28	*CD28.2*	*Biolegend*
Yb-174	CD71	CY1G4	*Biolegend*
Yb-176	CD39	*A1*	*Biolegend*
Bi-209	CD16	3g8	*Fluidigm*

Supplementary Table 6. List of unique SARS-CoV-2-specific CD8+ T cell responses detected

Allele	Peptides	Str/NStr	Protein	T cell responses previously reported
HLA-A01	GTDLEGNFY	ORF1a/NStr	3CL	Ferretti et al.
HLA-A01	FTSDYYQLY	NStr	ORF3a protein	Ferretti et al.; Gangaev et al.; Snyder et al.; Schulien et al.
HLA-A01	PTDNYITTY	ORF1a/NStr	PLpro	Ferretti et al.; Gangaev et al.; Snyder et al.
HLA-A01	HTTDPSFLGRY	ORF1a/NStr	PLpro	Ferretti et al.; Snyder et al.
HLA-A01	DTDFVNEFY	ORF1b/NStr	RdRpol	Ferretti et al.; Gangaev et al.; Snyder et al; Schulien et al.
HLA-A01	LTDEMIAQY	Str	S	Snyder et al.; Schulien et al.
HLA-A02	YLQPRTFLL	Str	S	Ferretti et al.; Gangaev et al.; Shomuradova et al.; Snyder et al.; Habel et al.
HLA-A02	LLYDANYFL	NStr	ORF3a protein	Ferretti et al.; Sekine et al.; Snyder et al.; Schulien et al.
HLA-A02	YLYALVYFL	NStr	ORF3a protein	Snyder et al.; Schulien et al.
HLA-A02	ALSKGVHFV	NStr	ORF3a protein	Sekine et al.; Snyder et al.
HLA-A02	LLLDRLNQL	Str	N	Ferretti et al.; Sekine et al.; Quadeer et al.; Snyder et al.; Schulien et al.
HLA-A02	ALWEIQQVV	ORF1a/NStr	NSP8	Ferretti et al.; Snyder et al.
HLA-A02	YLATALLTL	ORF1a/NStr	Plpro	
HLA-A02	YLDAYNMMI	ORF1b/NStr	NSP14	Snyder et al.
HLA-A02	NLIDSYFVV	ORF1b/NStr	RdRpol	
HLA-A02	VVFLHVTYV	Str	S	Quadeer et al.; Snyder et al.
HLA-A03	KTFPPTEPK	Str	N	Ferretti et al.; Snyder et al.
HLA-A03	VTNNTFTLK	ORF1a/NStr	NSP2	
HLA-A03	GVYFASTEK	Str	S	Snyder et al.
HLA-A03	KLFDRYFKY	ORF1b/NStr	RdRpol	
HLA-A03	KTIQPRVEK	ORF1a/NStr	NSP2	Ferretti et al.
HLA-A03	TSFGPLVRK	ORF1b/NStr	RdRpol	
HLA-A03	SASKIITLK	NStr	ORF3a protein	
HLA-A03	TISLAGSYK	ORF1a/NStr	PLpro	
HLA-A11	VVNARLRAK	ORF1b/NStr	Hel	
HLA-A11	KTFPPTEPK	Str	N	Ferretti et al.; Snyder et al.
HLA-A11	RLFRKSNLK	Str	S	Snyder et al.
HLA-A11	STFNVPMEK	ORF1a/NStr	PLpro	Snyder et al.; Schulien et al.
HLA-A11	VTNNTFTLK	ORF1a/NStr	NSP2	
HLA-A11	VVYRGTTTYK	ORF1b/NStr	Hel	Schulien et al.
HLA-A11	GTHWFVTQR	Str	S	Snyder et al.,
HLA-A11	AGFSLWVYK	ORF1ab/NStr	ORF1ab	
HLA-A11	AVFDKNLYDK	ORF1a/NStr	PLpro	
HLA-A11	SAFAMMFVK	ORF1a/NStr	NSP6	Schulien et al.
HLA-A11	TISLAGSYK	ORF1a/NStr	PLpro	
HLA-A11	GVYFASTEK	Str	S	Snyder et al.
HLA-A11	SASKIITLK	NStr	ORF3a protein	
HLA-A11	KTIQPRVEK	ORF1a/NStr	NSP2	
HLA-A24	NYNYLYRLF	Str	S	Snyder et al.
HLA-A24	QYIKWPWYI	Str	S	Ferretti et al.; Gangaev et al.; Snyder et al.
HLA-A24	NYMPYFFTL	ORF1a/NStr	PLpro	
HLA-A24	VYFLQSINF	NStr	ORF3a protein	Ferretti et al.; Snyder et al.
HLA-A24	YYTSNPTTF	ORF1a/NStr	PLpro	
HLA-A24	RFDNPVLPF	Str	S	Snyder et al.
HLA-A24	TYACWHHSI	ORF1ab/NStr	ORF1ab	
HLA-A24	VYIGDPAQL	ORF1b/NStr	Hel	Ferretti et al.
HLA-B07	QPGQTFSVL	ORF1a/NStr	3CL	
HLA-B07	RARSVSPKL	NStr	ORF7a protein	Snyder et al.
HLA-B07	SPRWYFYYL	Str	N	Ferretti et al.; Sekine et al.; Peng et al.; Snyder et al.; Schulien et al
HLA-B07	APHGVVFL	Str	S	Snyder et al.
HLA-B07	IPRRNVATL	ORF1b/NStr	Hel	Ferretti et al.; Snyder et al.; Schulien et al.
HLA-B07	RPDTRYVLM	ORF1a/NStr	NSP4	Ferretti et al.