

Table S1. Clinical characteristics of COVID-19 patients sera used in the study.

	COVID (n= 33)	Mild¹ (n= 5)	Mod² (n=12)	Severe³ (n=16)	p- value
Median Age (IQR)	(27–48)	(26–39)	(27–47)	(41–58)	<0.001
Age group, n (%)	100	15.16	36.36	48.48	<0.001
• < 20	4 (50)	2 (25)	1 (12.5)	1 (12.5)	
• 20–39	17 (50)	1 (2.94)	10 (29,41)	6 (17.64)	
• 40–59	12 (50)	2 (8.33)	1 (4.16)	9 (37.50)	
Male, n (%)	19 (50)	3 (7.89)	7 (18.42)	9 (23.68)	<0.001

¹Mild Illness: Individuals presenting with various signs and symptoms of COVID-19, such as cough, fever, sore throat, malaise, headache, myalgias, nausea, vomiting, gastrointestinal symptoms, and loss of taste and smell. However, they do not exhibit shortness of breath, dyspnea, or abnormal chest imaging. ²Moderate Illness: Individuals who display evidence of lower respiratory disease during clinical assessment or imaging and maintain an oxygen saturation measured by pulse oximetry (SpO₂) of $\geq 94\%$ while breathing room air at sea level. ³Severe Illness: Individuals with a SpO₂ measurement of $<94\%$ on room air at sea level, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen (PaO₂/FiO₂) below 300 mm Hg, a respiratory rate exceeding 30 breaths per minute, or lung infiltrates covering more than 50% of their lung field.

Peptides Spike sequence IgA

Spot	Peptide Sequence	Spot	Peptide Sequence	Spot	Peptide Sequence	Spot	Peptide Sequence
A1	IHLVNNESSSEVIVHK	C17	LSETKCTLSKFTVEK	F9	NCTEVPVAIHADQLT	I1	DSLSTASALGKLQD
A2	GYPKDGNAFNNDRI	C18	CTLKSFTVEKGIYQT	F10	PVAIHADQLTPTWRV	I2	TASALGKLQDVVNQN
A3	KEVPALTAVETGATN	C19	FTVEKGIYQTSNFRV	F11	ADQLTPTWRVYSTGS	I3	GKLQDVVNQNAQALN
A4	YPYDVPDYAGYPYDV	C20	GIYQTSNFRVQPTES	F12	PTWRVYSTGSNVFQT	I4	VVNQNAQALNTLVKQ
A5		C21	SNFRVQPTESIVRFP	F13	YSTGSNVFQTRAGCL	I5	AQALNTLVKQLSSNF
A6	MFVFLVLLPLVSSQC	C22	QPTESIVRFPNITNL	F14	NVFQTRAGCLIGAEH	I6	TLVKQLSSNFGAISS
A7	VLLPLVSSQCVNLTT	C23	IVRFPNITNLCPFGE	F15	RAGCLIGAEHVNNSY	I7	LSSNFGAISSVLNDI
A8	VSSQCVNLTTTRTQLP	C24	NITNLCPFGEVFNAT	F16	IGAEHVNNSYECDIP	I8	GAISSVLNDILSRDL
A9	VNLTTTRTQLPPAYTN	D1	CPFGEVFNATRFASV	F17	VNNSYECDIPIGAGI	I9	VLNDILSRDLKVEAE
A10	RTQLPPAYTNSFTRG	D2	VFNATRFASVYAWNR	F18	ECDIPIGAGICASYQ	I10	LSRLDKVEAEVQIDR
A11	PAYTNSFTRGVYYPD	D3	RFASVYAWNRKRISN	F19	IGAGICASYQTQTNS	I11	KVEAEVQIDRLITGR
A12	SFTRGVYYPDKVFRS	D4	YAWNRKRISNCVADY	F20	CASYQTQTNSPRRAR	I12	VQIDRLITGRLQSLQ
A13	VYYPDKVFRSSVLHS	D5	KRISNCVADYSVLYN	F21	TQTNSPRRARSVASQ	I13	LITGRLQSLQTYVTQ
A14	KVFRSSVLHSTQDLF	D6	CVADYSVLYNSASF	F22	PRRARSVASQSIIAY	I14	LQSLQTYVTQQLIRA
A15	SVLHSTQDLFLPFFS	D7	SVLYNSASFSTFKCY	F23	SVASQSIIAYTMSLG	I15	TYVTQQLIRAAEIRA
A16	TQDLFLPFFSNVTWF	D8	SASFSTFKCYGVSPT	F24	SIIAYTMSLGAENSV	I16	QLIRAAEIRASANLA
A17	LPFFSNVTWFHAIHV	D9	TFKCYGVSPTKLNLD	G1	TMSLGAENSVAYSNN	I17	AEIRASANLAATKMS
A18	NVTWFHAIHVSGTNG	D10	GVSP TKLNLDLCFTNV	G2	AENSVAYSNNIAIP	I18	SANLAATKMSECVLG
A19	HAIHVSGTNGTKRFD	D11	KLNDLCFTNVYADSF	G3	AYSNNIAIPTNFTI	I19	ATKMSECVLGQSKRV
A20	SGTNGTKRFDNPVLP	D12	CFTNVYADSFVIRGD	G4	SIAIPTNFTISVTTE	I20	ECVLGQSKRVDFCGK
A21	TKRFDNPVLPFNDGV	D13	YADSFVIRGDEV RQI	G5	TNFTISVTTEILPVS	I21	QSKRVDFCGKGYHLM
A22	NPVLPFNDGVYFAST	D14	VIRGDEV RQIAPGQT	G6	SVTTEILPVSM TKTS	I22	DFCGKGYHLM SFPQS
A23	FNDGVYFAST EKSNI	D15	EV RQIAPGQTGKIAD	G7	ILPVSM TKTSVDCTM	I23	GYHLM SFPQSAPHGV
A24	YFAST EKSNIIRGWI	D16	APGQTGKIADYNYKL	G8	MTKTSVDCTMYICGD	I24	SFPQSAPHGVVFLHV
B1	EKSNIIRGWIFGTTL	D17	GKIADYNYKL PDDFT	G9	VDCTMYICGDST ECS	J1	APHGVVFLHVTYVPA
B2	IRGWIFGTTLDSKTQ	D18	YNYKL PDDFTGCVIA	G10	YICGDST ECSNLL LQ	J2	VFLHVTYVPAQEKNF
B3	FGTTLDSKTQSL LIV	D19	PDDFTGCVIAWNSNN	G11	ST ECSNLL LQYGSFC	J3	TYVPAQEKNFTTAPA
B4	DSKTQSL LIVNNATN	D20	GCVIAWNSNNLDSKV	G12	NLL LQYGSFCTQLNR	J4	QEKNFTTAPAICH DG

B5	SLLIVNNATNVVIKV	D21	WNSNNLDSKVGGNYN	G13	YGSFCTQLNRALTGI	J5	TTAPAICHDGKAHFP
B6	NNATNVVIKVCEFQF	D22	LDSKVGGNYNYLYRL	G14	TQLNRALTGIAVEQD	J6	ICHDGKAHFPREGVF
B7	VVIKVCEFQFCNDPF	D23	GGNYNYLYRLFRKSN	G15	ALTGIAVEQDKNTQE	J7	KAHFPREGVFSNGT
B8	CEFQFCNDPFLGVYY	D24	YLYRLFRKSNLKPFE	G16	AVEQDKNTQEVFAQV	J8	REGVFVSNGTHWFVT
B9	CNDPFLGVYYHKNNK	E1	FRKSNLKPFERDIST	G17	KNTQEVFAQVKQIYK	J9	VSNGTHWFVTQRNFY
B10	LGVYYHKNNKSWMES	E2	LKPFERDISTEIYQA	G18	VFAQVKQIYKTPPIK	J10	HWFVTQRNFYEPQII
B11	HKNNKSWMESEFRVY	E3	RDISTEIYQAGSTPC	G19	KQIYKTPPIKDFGGF	J11	QRNFYEPQIITTDNT
B12	SWMESFRVYSSANN	E4	EIYQAGSTPCNGVEG	G20	TPPIKDFGGFNFSQI	J12	EPQIITTDNTFVSGN
B13	EFRVYSSANNCTFEY	E5	GSTPCNGVEGFNCYF	G21	DFGGFNFSQILPDPS	J13	TTDNTFVSGNCDVVI
B14	SSANNCTFEYVSQPF	E6	NGVEGFNCYFPLQSY	G22	NFSQILPDPSKPSKR	J14	FVSGNCDVVIGIVNN
B15	CTFEYVSQPF LMDLE	E7	FNCYFPLQSYGFQPT	G23	LPDPSKPSKRSFIED	J15	CDVVIGIVNNTVYDP
B16	VSQPF LMDLE GKQGN	E8	PLQSYGFQPTNGVGY	G24	KPSKRSFIEDLLFNK	J16	GIVNNTVYDPLQPEL
B17	LMDLE GKQGN FKNLR	E9	GFQPTNGVGYQPYRV	H1	SFIEDLLFNKVTLAD	J17	TVYDPLQPELDSFKE
B18	GKQGN FKNLR FVFK	E10	NGVGYPYRVVLSF	H2	LLFNKVTLADAGFIK	J18	LQPELDSFKEELDKY
B19	FKNLR FVFK NIDGY	E11	QPYRVVLSFELLHA	H3	VTLADAGFIKQYGDC	J19	DSFKEELDKYFKNHT
B20	EFVFK NIDGY FKIYS	E12	VVLSFELLHAPATVC	H4	AGFIKQYGDCLGDIA	J20	ELDKYFKNHTSPDVD
B21	NIDGY FKIYS KHTPI	E13	ELLHAPATVCGPKKS	H5	QYGDCLGDIAARDLI	J21	FKNHTSPDVLGDIS
B22	FKIYS KHTPI NLVRD	E14	PATVCGPKKSTNLVK	H6	LGDIAARDLICAQKF	J22	SPDVLGDISGINAS
B23	KHTPI NLVRDLPQGF	E15	GPKKSTNLVKNKCVN	H7	ARDLICAQKFNGLTV	J23	LGDISGINASVVNIQ
B24	NLVRDLPQGFSALEP	E16	TNLVKNKCVNFNFNG	H8	CAQKFNGLTVLPPLL	J24	GINASVVNIQKEIDR
C1	LPQGFSALEPLVDLP	E17	NKCVNFNFNGLTGTG	H9	NGLTVLPPLL TDEMI	K1	VVNIQKEIDRLNEVA
C2	SALEPLVDLP IGINI	E18	FNFNGLTGTGVLTES	H10	LPPLL TDEMIAQYTS	K2	KEIDRLNEVAKNLNE
C3	LVDLPIGINITRFQT	E19	LTGTGVLTESNKKFL	H11	TDEMIAQYTSALLAG	K3	LNEVAKNLNESLIDL
C4	IGINITRFQTL LALH	E20	VLTESNKKFLPFQQF	H12	AQYTSALLAGTITSG	K4	KNL NESLIDLQELGK
C5	TRFQTL LALHRSYLT	E21	NKKFLPFQQFGRDIA	H13	ALLAGTITSGWTFGA	K5	SLIDLQELGKYEQYI
C6	LLALHRSYLT PGDSS	E22	PFQQFGRDIADTTDA	H14	TITSGWTFGAGAALQ	K6	QELGKYEQYIKWPWY
C7	RSYLT PGDSSSGWTA	E23	GRDIADTTDAVRDPQ	H15	WTFGAGAALQIPFAM	K7	YEQYIKWPWYIWLGF
C8	PGDSSSGWTAGAAAY	E24	DTTDAVRDPQTLEIL	H16	GAALQIPFAMQMAYR	K8	KWPWYIWLGFIAGLI
C9	SGWTAGAAAYYVGYL	F1	VRDPQTLEILDITPC	H17	IPFAMQMAYRFNGIG	K9	IWLGFIAGLIAIVMV
C10	GAAAYYVGYLQPRTF	F2	TLEILDITPCSFGGV	H18	QMAYRFNGIGVTQNV	K10	IAGLIAIVMVTIMLC

C11	YVGYLQPRTFLLKYN	F3	DITPCSFGGVSVITP	H19	FNGIGVTQNVLYENQ	K11	AIVMVTIMLCCMTSC
C12	QPRTFLLKYNENGTI	F4	SFGGVSVITPGTNTS	H20	VTQNVLYENQKLIAN	K12	TIMLCCMTSCCCLK
C13	LLKYNENGTITDAVD	F5	SVITPGTNTSNQVAV	H21	LYENQKLIANQFNSA	K13	CMTSCCCLKGCCSC
C14	ENGTITDAVDCALDP	F6	GTNTSNQVAVLYQDV	H22	KLIANQFNSAIGKIQ	K14	CSCLKGCCSCGSCCK
C15	TDAVDCALDPLSETK	F7	NQVAVLYQDVNCTEV	H23	QFNSAIGKIQDSLSS	K15	GCCSCGSCCKFDEDD
C16	CALDPLSETKCTLKS	F8	LYQDVNCTEVPVAIH	H24	IGKIQDSLSTASAL	K16	GSCCKFDEDDSEPV
						K17	FDEDDSEPVKGVKL
						K18	DDSEPVKGVKLHYT

Spot	Peptides	Spot	Peptides	Spot	Peptides
A1	GGGCVADYSVLYNGG	B1	GGGCVADYSVLYNGG	C1	GGGCVADYSVLYNGG
A2	GGGYADSFVIRGDGG	B2	GGGYADSFVIRGDGG	C2	GGGYADSFVIRGDGG
A3	GGGYNYKLPDDFTGG	B3	GGGYNYKLPDDFTGG	C3	GGGYNYKLPDDFTGG
A4	WNSNNLDSKVGGNYN	B4	WNSNNLDSKVGGNYN	C4	WNSNNLDSKVGGNYN
A5	GGGLKPFERDISTGG	B5	GGGLKPFERDISTGG	C5	GGGLKPFERDISTGG
A6	PLQSYGFQPTNGVGY	B6	PLQSYGFQPTNGVGY	C6	PLQSYGFQPTNGVGY
A7	PLRSYSFRPPYGVGH	B7	PLRSYSFRPPYGVGH	C7	PLRSYSFRPPYGVGH
A8	PLQSYGFRPTYGVGH	B8	PLQSYGFRPTYGVGH	C8	PLQSYGFRPTYGVGH
A9	YPGEFADYEELREQL	B9	YPGEFADYEELREQL	C9	YPGEFADYEELREQL
A10	KEVPALTAVETGATN	B10	KEVPALTAVETGATN	C10	KEVPALTAVETGATN
A11	GGGQEVRYKGGG	B11	GGGQEVRYKGGG	C11	GGGQEVRYKGGG

	
	10 20 30 40 50
HCoV-NL63	--MKLFLILL VLPLASCFF- ----TCNS-N ANLS---ML QLGVPDNSST
HCoV-229E	-----
HCoV-HKU1	-----MFLII FILPT-TLAV IGDFNCTNSF IN-----DY NKTIPRISED
HCoV-OC43	----MFLILL ISLPT-AFAV IGDLKCTSDN IN-----DK DTGPPPISTD
MERS-CoV	MIHSVFLLMF LLTPTESYVD VGPDSVKSCAC IEVDIQQTFF DKTWPRP---
SARS-CoV-2	----MFVFLV LLPLV-S--- -----SQC VN--LTT--R TQLPPAY---
SARS-CoV	----MFIFLL FLTLT-S--- -----GSD LD--RCTTFD DVQAPNY---

	
	60 70 80 90 100
HCoV-NL63	IVTGLLPTHW FCANQSTSVY SANGFFYIDV GNHRSALFALH TGYDAN---
HCoV-229E	-----
HCoV-HKU1	-----VVDVS LGLGTYIVLN RVYLNTTLLE TGYFPKSGAN
HCoV-OC43	-----TVDVT NGLGTYIVLD RVYLNTTLFL NGYPTSGST
MERS-CoV	-----IDVS KADGLIYPQG RTYSNITITY QGLE-PYQGD
SARS-CoV-2	-----TNS FTRGVYYPDK VFRSSVLHST QDLFLPFYSN
SARS-CoV	-----TQHTS SMRGVYYPDE IFRSDTLYLT QDLFLPFYSN

	
	110 120 130 140 150
HCoV-NL63	--QYYIYVTN EIGLNASVTL KICKFSRNTT FDFLSNASSS FDCIVNLLFT
HCoV-229E	-----
HCoV-HKU1	FRDL----- --ALKGSKYL STLW---YK PPFLSDFNNG IFSKV---K
HCoV-OC43	YRNM----- --ALKGSVLL SRLW---FK PPFLSDFING IFAKV---K
MERS-CoV	HGDMYVYS-- --AGHATGTT PQKLFVANYS QD-VKQFANG FVVRI---G
SARS-CoV-2	VT---WFH-- --AIHVSQTN GTKR---FD NP-VLPFNDG VYFAS---T
SARS-CoV	VT---GFH-- --TIN----- --HT---FG NP-VIPFKDG IYFAA---T

	
	160 170 180 190 200
HCoV-NL63	EQLGAPLGIT ISGETVRLHL YNVTTFYVP AAYKLTKL-S VKCYFNYSCV
HCoV-229E	-----
HCoV-HKU1	N-TKLYVNNT -----L YSEFSTIVIG SVFVNTSY-----TIV
HCoV-OC43	N-TKVIKDRV -----M YSEFPAITIG STFVNTSY-----SVV
MERS-CoV	A-AANSTGTV IISPSTSATI RKIYPAFMLG SSVGNFSDGK MGRFFNHTLV
SARS-CoV-2	E-----K SNIIRGWIFG TTLDSTQ-----SLL
SARS-CoV	E-----K SNVVRGWVFG STMNKSQ-----SVI

	
	210 220 230 240 250
HCoV-NL63	FSVVNATVTV NVTTHNG--- --RVVNYTVC DDCNGYTDNI FSVQDGRIP
HCoV-229E	YA---LLHIA GCQTNG--- --LNTSYSVC NGCVGYSENV FAVESGGYIP
HCoV-HKU1	V---QPH-- -----NGILEITAC Q-----
HCoV-OC43	V---QPRTI NST-QDGDNK LQGLLEVSVQ Q-----
MERS-CoV	L---LPD-- -----G---CGTLLRAF-----
SARS-CoV-2	I---VNN-- -----A---TNVVIKVC E-----
SARS-CoV	I---INN-- -----S---TNVVIRAC N-----

	
	260 270 280 290 300
HCoV-NL63	NGFPFNNWFL LTNGSTLVDG VSRLYQPLRL TCLWPVPGLK SSTGFVYF--
HCoV-229E	SDFAFNNWFL LTNTSSVVDG VVRSFQPLLL NCLWSVSGLR FTTGFVYF--
HCoV-HKU1	-----YT MCEYPHTVCK S-KGSIRN--
HCoV-OC43	-----YN MCEYPQTICH PNLGNHRK--
MERS-CoV	-----Y CILEPRSGNH CPAGNSYTSF

SARS-CoV-2	-----	-----	-----FQ	FCNDPFLGVY	YHKNN-----
SARS-CoV	-----	-----	-----FE	LCDNPFFAVS	KPMGT-----

					
	310	320	330	340	350
HCoV-NL63	---NATGSDV	NCNGYQHNSV	VD-----VMR	YNLNFSANSL	---DNLKSG-
HCoV-229E	---NGTGR-G	DCKGFSSDVL	SD-----VIR	YNLNFEF---	----NLRRG-
HCoV-HKU1	-----	-----ESWH	IDSSE-PLCL	FKKNFTYNVS	A-----DWL
HCoV-OC43	-----	-----ELWH	LDTGV-VSCL	YKRNFYDVN	A-----DYL
MERS-CoV	ATYHTPATDC	SDGNYNRNAS	LNSFKEYFNL	RNCTFMYTYN	ITEDEILEWF
SARS-CoV-2	-----	-----KSWM	ESEFRVYSSA	NNCTFEYVSQ	PFLMDLEGKQ
SARS-CoV	-----	-----	QTHMIFDNA	FNCTFEYISD	AFSLDVSEKS

					
	360	370	380	390	400
HCoV-NL63	-----VIV	FKTLQYDVLF	YCSNSSSGV-	-----	-LDTTIPFGP
HCoV-229E	-----TIL	FKTSYGVVVF	YCTNNTLVS-	-----	-GDAHIFPGT
HCoV-HKU1	-----YFH	FYQERG VFYA	YYADV--G--	-----MP-T	TFLFSLYLGT
HCoV-OC43	-----YFH	FYQEGGTFYA	YFTDT--G--	-----VV-T	KFLFNVYLG M
MERS-CoV	GITQTAQG-V	HLFSSRYVDL	YGGN-----	-----M	FQFATLPVYD
SARS-CoV-2	GNFKNLREFV	FKNIDGYFKI	YSKHTPINLV	RDL PQGFSAL	EPLVDLP IGI
SARS-CoV	GNFKHLREFV	FKNKDGF LYV	YKGYQPIDVV	RDLPSGFNTL	KPIFKLPLGI

					
	410	420	430	440	450
HCoV-NL63	SSQPY YCFIN	STINTTHVST	FVGILPPTVR	EIVVARTGQF	YINGFKYFDL
HCoV-229E	VLGNFYCFVN	TTIGNET TSA	FVGALPKTVR	EFVISRTGHF	YINGRYFTL
HCoV-HKU1	ILSHYYVM--	-----	-----PLTCK	-----	-----
HCoV-OC43	ALSHYYVM--	-----	-----PLTCN	-----	-----
MERS-CoV	TIKYYSII--	-----	-----PHSIR	-----	-----SI
SARS-CoV-2	NITRFQTL--	-----	-----LALHR	SYL-----	-----TP
SARS-CoV	NITNFRAL--	-----	-----LTAFS	-----	-----

					
	460	470	480	490	500
HCoV-NL63	GFIEAVNENV	TTASATDEWT	VAFATFVDVL	VNVSATNIQN	LLYCD-SPFE
HCoV-229E	GNVEAVNENV	TTAETTDECT	VALASYADVL	VNVSQTSIAN	IIYCN-SVIN
HCoV-HKU1	-A-----ISSN	TDNETLEYWV	TPLSRRQYLL	NFDEHGVITN	AVDCSSSFLS
HCoV-OC43	-S-----	--KLITLEYWV	TPLTSRQYLL	AFNQDGIIFN	AEDCMSDFMS
MERS-CoV	QS-----DRKA	W---AAFYV	YKLQPLTFLL	DFSVDGYIRR	AIDCGFNDLS
SARS-CoV-2	GD-----SSSG	WTAGAAAYYV	GYLQPRTFLL	KYNENGTITD	AVDCALDPLS
SARS-CoV	-P-----AQDI	WGTSAAAYFV	GYLKPTTFML	KYDENG TITD	AVDCSQNPLA

					
	510	520	530	540	550
HCoV-NL63	KLQCEHLQFG	LQDGFYSANF	LDDNVLPEY	VALPIY----	-----
HCoV-229E	RLRCDQLSFD	VPDGFYSTSP	IQSVELPVS	VS L P V Y----	-----
HCoV-HKU1	EIQCKTQSFA	PNTGVYDL SG	FTVKPVATVY	RRIPNL PDCD	IDNWLNNVSV
HCoV-OC43	EIKCKTQSIA	PPTGVYELNG	YTVQPIADVY	RRKPNLPNCN	IEAWLNDKSV
MERS-CoV	QLHCSYESFD	VESGVYSVSS	FEAKPSGSV	EQAEG-VECD	FSPLLSG-TP
SARS-CoV-2	ETKCTLKSFT	VEKGIYQTSN	FRVQPTESIV	RFPNITNLCP	FGEVFNATRF
SARS-CoV	ELKCSVKSFE	IDKGIYQTSN	FRVPSGDV	RFPNITNLCP	FGEVFNATKF

					
	560	570	580	590	600
HCoV-NL63	-----YQHT	DINFT-----	-----	-----ATASF	GGSCYVCKPH
HCoV-229E	-----HKHT	FIVLYV-----	-----	-----DFKPQSG	GGKCFNCYPA

HCoV-HKU1	PSPLNWERRI	FSNCNFNLS	LLRLVHVDSF	SCNNLDKSKI	FGSCFNSI--
HCoV-OC43	PSPLNWERKT	FSNCNFMSS	LMSFIQADSF	TCNNIDAANK	YGMCFSSI--
MERS-CoV	PQVYNFKRLV	FTNCNYNLTK	LLSLFSVNDF	TCSQISPAAI	ASNCYSSL--
SARS-CoV-2	ASVYAWNRRK	ISNCVADYSV	LYNSASFSTF	KCYGVSPTKL	NDLCTFNV--
SARS-CoV	PSVYAWERKK	ISNCVADYSV	LYNSTFFSTF	KCYGVSATKL	NDLCFSNV--

	610	620	630	640	650
HCoV-NL63	QVNISLNG--	NTSVC	VRTSHFSIRY	IYNRVKSGSP	GDSSWHIYLK
HCoV-229E	GVNITLANFN	ET--	KGPLC	VDTSHTTKY	VAVYA----
HCoV-HKU1	----TVDKFA	IPNRRRDDLQ	LGSSGFLQSS	NYKIDISSSS	CQLYYSLPLV
HCoV-OC43	----TIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIDTTATS	CQLYYNLPA
MERS-CoV	----ILDYFS	YPLSMKSDL	VSSAGPISQF	NYKQSFSNPT	CLILATVPHN
SARS-CoV-2	----YADSFV	IRGDEVROIA	PGQTGKIADY	NYKLPPDFTG	CVIAWNSNNL
SARS-CoV	----YADSFV	VKGDPVRQIA	PGQTGVIADY	NYKLPPDFMG	CVLAWNTRNI

	660	670	680	690	700
HCoV-NL63	--SGTCPF--	-----SFS	KLNNFQ----	-----KF	KTICFSTVEV
HCoV-229E	--TGNCPF--	-----SFG	KVNNFV----	-----KF	GSVCFSLKDI
HCoV-HKU1	NVTINN-FNP	SSWNRRYGF	SFN-----	--VSSYDVVY	SDHCFSVNSD
HCoV-OC43	NVSISR-FNP	STWNKRFGFI	EDSVFKPRPA	GVLTNHVDVY	AQHCFKAPKN
MERS-CoV	LTTITKPLKY	SYINKCSRFL	SD-----DRT	E-----V	PQLVNA--NQ
SARS-CoV-2	DSKVGGNINY	LYRLFRKSNL	KP-----FER	D-----I	STEIYQ--AG
SARS-CoV	DATSTGNINY	KYRYLRHGKL	RP-----FER	D-----I	SNVPFS--PD

	710	720	730	740	750
HCoV-NL63	P-----	GSCNF----	-----	-----	-----
HCoV-229E	P-----	GGCAM----	-----	-----	-----
HCoV-HKU1	FCPCADPSVV	NSCVKSKP--	--LSAICPAG	TKYRHCDLDT	TLYVNNWCRC
HCoV-OC43	FCPCKLN---	GSCVGSPPGK	NNGIGTCPAG	TNYLTCD---	-----N
MERS-CoV	YSPCVSIVP-	ST-VW----	-----EDG	DYYRK----	-----
SARS-CoV-2	STPCNGVEG-	FNCYF----	-----	-----	-----
SARS-CoV	GKPCTP-PA-	LNCYW----	-----	-----	-----

	760	770	780	790	800
HCoV-NL63	----PLEAT	WHYT-----	-----	-----	----SYTIV
HCoV-229E	----PIVAN	WAYS-----	-----	-----	----KYITI
HCoV-HKU1	SCLPDPISTY	SPNTCPQKKV	VVGIGEHCPCG	LGINEECCGT	QLNHSSSCSCS
HCoV-OC43	LCTPDPIFTT	GTYKCPQTKS	LVGIGEHCSCG	LAVKSDYCGG	----NSCTCR
MERS-CoV	--QLSPLEGG	GWLV-----	-----	-----	----ASGSTVA
SARS-CoV-2	----PLQSY	GFQP-----	-----	-----	----TNGVGYQ
SARS-CoV	----PLNDY	GFYT-----	-----	-----	----TTGIGYQ

	810	820	830	840	850
HCoV-NL63	GALYVTWSEG	NSITGV----	-----	PYPV-----S	GIREFSNLVL
HCoV-229E	GSLYVSWSDG	DGITGV----	-----	PQPV-----E	GVSSFMNVTI
HCoV-HKU1	PDAFLGWSFD	SCISNNRCNI	FSNFIFNGIN	SGTTCSN--D	LLYSNTEVST
HCoV-OC43	PQAFLGWSAD	SCLQGDKNIC	FANFILHDVN	SGLTCST--D	LQKANTDIIL
MERS-CoV	MTEQLQMGFG	IT-----	----VQYGT	TNSVCPKLEF	ANDTKIASQL
SARS-CoV-2	PYRVVVLSE	LL-----	-----HA	PATVCGP---	--KKSTNLVK
SARS-CoV	PYRVVVLSE	LL-----	-----NA	PATVCGP---	--KLSTDLIK

	860	870	880	890	900
HCoV-NL63	NNCTKYNIYD	YVGTGIIRSS	NQSLAGGIT-	-YVSNSGNLL	G-FKNVSTGN
HCoV-229E	DKCTKYNIYD	VSGVGIVRVS	NDTFLNGIT-	-YTSTSGNLL	G-FKDVTKGT
HCoV-HKU1	GVCVNYDLYG	ITGQGIFKEV	SAAYYNNWQN	LLYDSNGNII	G-FKDFLTNK
HCoV-OC43	GVCVNYDLYG	ILGQGIFVEV	NATYYNSWQN	LLYDSNGNLY	G-FRDYIINR
MERS-CoV	GNCVEYSLYG	VSGRGVFQNC	TAVG-VRQOR	FVYDAYQNLV	GYYSDD-DGN
SARS-CoV-2	NKCVNFNFNG	LTGTGVLTES	NKKF-LPFQQ	FGRDIADTT-	DAVRDPQTLE
SARS-CoV	NQCVNFNFNG	LTGTGVLTPS	SKRF-QPFQQ	FGRDVSDFT-	DSVRDPKTS

	910	920	930	940	950
HCoV-NL63	IFIVTPCNQP	DQVAVYQQ--	-----	SIIGAMTAVN	ESRYGLQ---
HCoV-229E	IYSITPCNPP	DQLVVYQQ--	-----	AVVGAMLSN	FTSYGFS---
HCoV-HKU1	TYTILPCYSG	RVSAAFY-Q	NSSSPALLYR	NLKCSYVLNN	IS--FIS---
HCoV-OC43	TFMIRSCYSG	RVSAAFH-A	NSSEPALLFR	NIKCNVVFNN	SLTRQLQ---
MERS-CoV	YYCLRACVSV	PVSVIYD-K	ETKTHATLFG	SVACEHISST	MSQYSRSTRS
SARS-CoV-2	ILDITPCSFQ	GVSVITPGTN	TSNQVAVLYQ	DVNCTEVPVA	IHADQLT--P
SARS-CoV	ILDISPCSFQ	GVSVITPGTN	ASSEVAVLYQ	DVNCTDVSTA	IHADQLT--P

	960	970	980	990	1000
HCoV-NL63	--NILQLPNF	YYVSNGG---	--NNCT----	TAVMTYSNFG	ICADGSLIP-
HCoV-229E	--NVVELPKF	FYASNGT---	--YNCT----	DAVLTYSSFG	VCADGSIIA-
HCoV-HKU1	-----QPF	YFDSYLGCVL	NAVNLTSYSV	SSCDLRMSG	FCIDYALPSS
HCoV-OC43	-----PIN	YFDSYLGCVV	NAYNSTAISV	QTCDLTVGSG	YCVDYSK--N
MERS-CoV	MLKRRDSTYG	PLQTPVGCVL	GLVNSS-LFV	EDCKLPLGQS	LCALPDTPST
SARS-CoV-2	TWRVYSTGSN	VFQTRAGCLI	GAEHVN--NS	YECDIPIGAG	ICASYQTQT-
SARS-CoV	AWRIYSTGNN	VFQTAGACLI	GAEHVD--TS	YECDIPIGAG	ICASYHTVS-

	1010	1020	1030	1040	1050
HCoV-NL63	VRPR--NSS	DNGIS-----	-----	-AIITANLSI	PSNWTTSVQV
HCoV-229E	VQPR--NVS	YDSVS-----	-----	-AIVTANLSI	PSNWTTSVQV
HCoV-HKU1	RRKRRGISSP	YRFVT-FEPF	NVSFVNDSVE	TVGGLFEIQI	PTNFTIAGHE
HCoV-OC43	RRSRGAITTG	YRFTN-FEPF	TVNSVNDSLE	PVGGLYEIQI	PSEFTIGNMV
MERS-CoV	LTPRSVRSVP	GEMRLASIAF	NHPIQ-V-DQ	LNSSYFKLSI	PTNFSEGVQT
SARS-CoV-2	NSPRRARSVA	SQSI---IAY	TMSLG-AENS	VAYSNNIAI	PTNFTISVTT
SARS-CoV	L----LRSTS	QKSI---VAY	TMSLG-ADSS	IAYSNNITAI	PTNFISITTT

	1060	1070	1080	1090	1100
HCoV-NL63	EYLQITSTPI	VVDCATYVCN	GNPRCKNLLK	QYTSACKTIE	DALRLSAHLE
HCoV-229E	EYLQITSTPI	VVDCSTYVCN	GNVRCVELLK	QYTSACKTIE	DALRNSARLE
HCoV-HKU1	EFIQTSSPKV	TIDCSAFVCS	NYAACHDLLS	EYGTFCDNIN	SILNEVNDLL
HCoV-OC43	EFIQTSSPKV	TIDCAAFVCG	DYAACKSQLV	EYGSFCDNIN	AILTEVNELL
MERS-CoV	EYIQTTIQKV	TVDCQYVCN	GFQKCEQLLR	EYGFQCSKIN	QALHGANLRQ
SARS-CoV-2	EILPVSMTKT	SVDCTMYICG	DSTECNLLL	QYGSFCTQLN	RALTGIAVEQ
SARS-CoV	EVMPVSMMAKT	SVDCNMYICG	DSTECANLLL	QYGSFCTQLN	RALSGIAAEQ

	1110	1120	1130	1140	1150
HCoV-NL63	TNDVSSMLTF	DSNAFSLAN-	----VTSFGD	-YNLSSVLPQ	RNIRSSRIAG
HCoV-229E	SADVSEMLTF	DKKAFTLAN-	----VSSFGD	-YNLSSVIPS	LPTSGSRVAG
HCoV-HKU1	DITQLQVANA	LMQGVTLSSN	LNTNLHSDVD	NIDFKSLLGC	LGSQCGS-SS
HCoV-OC43	DTTQLQVANS	LMNGVTLSK	LKDGVNFNVD	DINFSPVLGC	LGSECSKASS
MERS-CoV	DDSVRNLFAS	VKSSQSSPI-	----IPGFGG	DFNLTLLPE-	VSISTGSRSA

SARS-CoV-2	DKNTQEVFAQ	VKQIYKTPP-	----	IKDFGG	F-NFSQILP-	DP----	SKPSK
SARS-CoV	DRNTREVFAQ	VKQMYKTPT-	----	LKVFGG	F-NFSQILP-	DP----	IKPTK

							
		1160	1170	1180	1190	1200	
HCoV-NL63	RSAL	EDLLFS	KVVT	SGLGT	V D	VDYK	SC--
HCoV-229E	RSAL	EDILFS	KLVT	SGLGT	V D	DYKK	CT--
HCoV-HKU1	RSLL	EDLLFN	KVKL	SDVGF	V E	-AYNN	CT--
HCoV-OC43	RSAI	EDLLFD	KVKL	SDVGF	V E	-AYNN	CT--
MERS-CoV	RSAL	EDLLFD	KVTI	ADPG	YV Q	-GYDD	CMQQ
SARS-CoV-2	RSFI	EDLLFN	KVTI	ADAG	FI K	-QYGD	CL--
SARS-CoV	RSFI	EDLLFN	KVTI	ADAG	FM K	-QYGE	CL--

							
		1210	1220	1230	1240	1250	
HCoV-NL63	PGVAD	AERMA	MYTG	SLIG	GM V	LGGL	TSA--
HCoV-229E	PGVAD	AERMA	MYTG	SLIG	GI A	LGGL	TSA--
HCoV-HKU1	PPIL	SETQIS	GYTT	AATV	AA M	FP	WSAA--
HCoV-OC43	PPLL	SENQIS	GYTT	AATS	AS L	FP	PWTAA--
MERS-CoV	PPLM	DVNMEA	AYTS	SLLS	GI A	GV	WTAGLS
SARS-CoV-2	PPLL	TDEMIA	QYTS	ALLAG	T I	TS	GWTFGAG
SARS-CoV	PPLL	TDDMIA	AYTA	ALVSG	T A	TA	GWTFGAG

							
		1260	1270	1280	1290	1300	
HCoV-NL63	QTDV	LQENQK	ILAAS	FNKAI	NNIV	ASFSSV	NDAITQTAE
HCoV-229E	QTDV	LQENQK	ILAAS	FNKAI	TNIV	DAFTGV	NDAITQTSQA
HCoV-HKU1	TMDV	LKNKNQK	LIANA	FNKAL	LSIQ	NGFTAT	N-----
HCoV-OC43	TMDV	LSQNQK	LIANA	FNNAL	YAIQ	EGFDAT	N-----
MERS-CoV	TQQV	LSQENQK	LIANK	FNQAL	GAMQ	TGFTTT	N-----
SARS-CoV-2	TQNV	LYENQK	LIANQ	FNSAI	GKIQ	DSLST	A-----
SARS-CoV	TQNV	LYENQK	QIANQ	FNKAI	SQIQ	ESLTTT	S-----

							
		1310	1320	1330	1340	1350	
HCoV-NL63	IQDV	VNQGS	ALNHL	TSQ	LR H	NFQAIS	NSI QAIYDRLDSI
HCoV-229E	IQDV	VNQGN	SLNHL	TSQ	LR Q	NFQAIS	SSI QAIYDRLDTI
HCoV-HKU1	IQSV	VNANAQ	ALNS	LLQ	QLF N	KFGAIS	SSL QEILSRLDNL
HCoV-OC43	IQAV	VNANAQ	ALNN	LLQ	QLS N	RFGAIS	SASL QEILSRLDAL
MERS-CoV	VQDA	VNNNAQ	ALSK	LASE	LS N	TFGAIS	SASI GDIIQRLDVL
SARS-CoV-2	LQDV	VNQNAQ	ALNT	LVK	QLS S	NFGAIS	SVL NDILSRLDKV
SARS-CoV	LQDV	VNQNAQ	ALNT	LVK	QLS S	NFGAIS	SVL NDILSRLDKV

							
		1360	1370	1380	1390	1400	
HCoV-NL63	TGRL	AALNAF	VSQV	LNKY	TE V	RGSRR	LAQQ KINECVKSQS
HCoV-229E	TGRL	AALNVF	VSHL	TLKY	TE V	RASRQ	LAQQ KVNECVKSQS
HCoV-HKU1	NGRL	TALNAY	VSQ	LSDI	TL I	KAGAS	RAIE KVNECVKSQS
HCoV-OC43	NGRL	TALNAY	VSQ	LSDI	TL I	KFSAA	QAME KVNECVKSQS
MERS-CoV	NGRL	TTLNAF	VAQ	QLVR	SES A	ALSAQ	LAKD KVNECVKAQS
SARS-CoV-2	TGRL	QSLQTY	VTQ	QLIRA	AE I	RASAN	LAAT KMSECVLGQS
SARS-CoV	TGRL	QSLQTY	VTQ	QLIRA	AE I	RASAN	LAAT KMSECVLGQS

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      ....|....| ....|....| ....|....| ....|....| ....|....|
      1410      1420      1430      1440      1450
HCoV-NL63 HIFSIVNSAP DGLLFLHTVL LPTDYKNVKA WSGICVDGIY --GYVLRQPN
HCoV-229E HIFSIVNAAP EGLVFLHTVL LPTQYKDVEA WSGLCVDGTN --GYVLRQPN
HCoV-HKU1 HILSLVQAP YGLLFIHFSY KPTSFKTVLV SPGLCLSGDR --GIAPKQGY
HCoV-OC43 HIISLVQAP YGLYFIHFSY VPTKYVTARV SPGLCIAGDR --GIAPKSGY
MERS-CoV HIVSFVVNAP NGLYFMHVG YPSNHIEVVS AYGLCDAANP TNCIAPVNGY
SARS-CoV-2 HLMSFPQSAP HGVVFLHVTY VPAQEKNTTT APAICHDGKA ---HFPREGV
SARS-CoV HLMSFPQAAP HGVVFLHVTY VPSQERNFTT APAICHEGKA ---YFPREGV

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      ....|....| ....|....| ....|....| ....|....| ....|....|
      1460      1470      1480      1490      1500
HCoV-NL63 LVLY---SDN GVFRVTSRVM FQPRLPVLS FVQIYNCNVT FVNISRVEL-
HCoV-229E LALY---KEG NYYRITSRIM FEPRIPTMAD FVQIENCNVT FVNISRSEL-
HCoV-HKU1 FIKQ-----N DSWMFTGSS YYPEPISDKN VVFMNSCSVN FTKAPFIYL-
HCoV-OC43 FVNV-----N NTWMTGSGY YYPEPITENN VVMSTCAVN YTKAPYVML-
MERS-CoV FIKTNNTTRIV DEWSTGSSF YAPEPITSLN TKYVAPQVTY QN-ISTNLPP
SARS-CoV-2 FVSN-----G THWFVTQRNF YEQIITTDN TFSVGNCDVV IGI VNN TVYD
SARS-CoV FVFN-----G TSWFITQRNF FSPQIITTDN TFSVGNCDVV IGI VNN TVYD

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      ....|....| ....|....| ....|....| ....|....| ....|....|
      1510      1520      1530      1540      1550
HCoV-NL63 -HTVIPDYVD VNKTLQEFAQ NLPKYVKPNF -DLTPFNLT Y LNLSSSELKQL
HCoV-229E -QTIVPEYID VNKTLQELSY KLPNYTVPDL -VVEQYNQTI LNLTSSEISTL
HCoV-HKU1 -NNSIPNLS DFEAEFSLWFK NHTSI-APNL TFNSHINATF LDLYY-----
HCoV-OC43 -NTSIPNLPD FKEELDQWFK NQTSV-APDL SLD-YINVT F LDLQV-----
MERS-CoV PLLGNSTGID FQDELDEFFK NVSTS-IPNF GSLTQINTTL LDLYY-----
SARS-CoV-2 PLQ--PELDS FKEELDKYFK NHTSP-DVDL GDISGINASV VNIQK-----
SARS-CoV PLQ--PELDS FKEELDKYFK NHTSP-DVDL GDISGINASV VNIQK-----

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      ....|....| ....|....| ....|....| ....|....| ....|....|
      1560      1570      1580      1590      1600
HCoV-NL63 EAKTASLFQT TVELOGLIDQ INSTYVDLKL LNRFFENYIKW PWWVWLIISV
HCoV-229E ENKSAELNYT VQKLOTLIDN INSTLVDLKW LNRVETYIKW PWWVWLCISV
HCoV-HKU1 -----E MNVIQESIKS LNSSFINKL IGTYEMYVKW PWYIWLIVI
HCoV-OC43 -----E MNRLQEAIVK LNQSYINLKD IGTYEYVVKW PWYVWLLICL
MERS-CoV -----E MLSLQQVVKV LNESYIDLKE LGNYTYYNKW PWYIWLGFIA
SARS-CoV-2 -----E IDRLNEVAKN LNESLIDLQE LGKYEQYIKW PWYIWLGFIA
SARS-CoV -----E IDRLNEVAKN LNESLIDLQE LGKYEQYIKW PWYVWLG FIA

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      ....|....| ....|....| ....|....| ....|....| ....|....|
      1610      1620      1630      1640      1650
HCoV-NL63 VFVVL LSLLV FCCLSTGCCG CCNCLTSSMR GCCDCGSTKL PYYEFKVVHV
HCoV-229E VLIFVVSMLL LCCCSTGCCG FFSCFASSIR GCCE--STKL PYYDVEKIHI
HCoV-HKU1 LFIIFLMILF FICCTGCGS ACF----- S--KCHNCCD EYGGHND FVI
HCoV-OC43 AGVAMLVLLF FICCTGCGT SCF----- K--KCGCCD DYTGYQELVI
MERS-CoV GLVALALCVF FILCCTGCGT NCM----- GKLKCNRCCD RYEEYDLEPH
SARS-CoV-2 GLIAIVMTI MLCCMTSCCS CLK----- GCCSCGSCCK F-DEDDSEPV
SARS-CoV GLIAIVMTI LLCCMTSCCS CLK----- GACSCGSCCK F-DEDDSEPV

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HCoV-NL63 Q-----
HCoV-229E Q-----
HCoV-HKU1 K-ASHDD--
HCoV-OC43 K-TSHDD--
MERS-CoV KVHVH----
SARS-CoV-2 LKGVKLHYT
SARS-CoV LKGVKLHYT

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Figure S3: Best fit of several coronaviruses, with marking of the amino acids of the IgA epitopes (see Table 1); HCoV-NL63 (YP_003767.1), HCoV-229E (NP_073551.1), HCoV-HKU1 (Q14EB0.1), HCoV-OC43 (P36334.1), MERS-CoV (YP_007188579.1), SARS-CoV-2 (BCN86353.1), and SARS-CoV (P59594.1)

