
Supplementary information

Evolution of the COVID-19 vaccine development landscape

In the format provided by the authors

Supplementary Table 1 | COVID-19 vaccines in clinical development*

Candidate	Lead partners	Vaccine characteristics	Start of first phase I trial	Current stage	Location (current and upcoming trials)
Viral vector (including replicating and non-replicating)					
Ad5-nCoV	CanSino Biological/ Beijing Institute of Biotechnology	Adenovirus type 5 vector that expresses S protein	17 Mar 20	Phase II (ChiCTR2000031781) Approved for military use in China	CHN, CAN, UAE, PAK, MEX, BRZ, RUS
LV-SMENP-DC	Shenzhen GIMI	DCs modified with lentiviral vector expressing synthetic minigene based on domains of selected viral proteins	24 Mar 20	Phase I/II (NCT04276896)	CHN
AZD1222	AstraZeneca/ Oxford University	ChAdOx1 vector that expresses S protein	23 Apr 20	Phase III (NCT04516746)	BRZ, GBR, ZAF, USA, IND, BGD
Gam-COVID-Vac	Gamaleya Research Institute	Recombinant adenovirus vector based on the human adenovirus type 5, 26, containing S protein	18 Jun 20	Phase III (NCT04530396) Conditional registration in Russia	RUS, KAZ, BLR, BRZ, MEX
Ad26.COVS-2	J&J – Janssen	Adenovirus type 26 vector that expresses S protein	22 Jul 20	Phase I/II (NCT04436276)	USA, BEL, BRZ, CHL, COL, MEX, PER, PHL, ZAF, UKR, ARG
Pathogen-specific aAPC	Shenzhen GIMI	aAPCs modified with lentiviral vector expressing synthetic minigene based on domains of selected viral proteins	Feb 20	Phase I (NCT04299724)	CHN
GRAd-COV2	ReiThera Srl	Gorilla adenovirus vector that expresses S protein	24 Aug 20	Phase I (NCT04528641)	ITA
V591	Merck Sharp & Dohme	Measles virus vector	Aug 20	Phase I (NCT04497298)	USA
DNA					
INO-4800	Inovio Pharmaceuticals	DNA plasmid that encodes S protein delivered by electroporation	06 Apr 20	Phase I/II (NCT04336410)	USA, KOR, CHN
GX-19	Genexine Consortium	DNA vaccine that encodes S protein delivered by electroporation or needle free	19 Jun 20	Phase I/II (NCT04445389)	KOR
AG0301-COVID19	Osaka University/ AnGes	DNA vaccine that encodes S protein	29 Jun 20	Phase I/II (NCT04463472)	JPN
ZyCoV-D	Zydus Cadila	DNA vaccine	15 Jul 20	Phase I/II (CTRI/2020/07/026352)	IND
RNA					
mRNA-1273	Moderna Therapeutics/NIAID	LNP-encapsulated mRNA that encodes S protein	16 Mar 20	Phase III (NCT04470427)	USA
mRNA-BNT162	Pfizer/BioNTech	LNP-encapsulated mRNA that encodes stabilised S antigen	29 Apr 20	Phase II/III (NCT04368728)	USA, GER, ARG, BRZ, CHN and others
CVnCoV	CureVac	LNP-encapsulated mRNA that encodes the S protein	19 Jun 20	Phase I (NCT04449276)	GER, BEL
LNP-nCoVsaRNA	Imperial College London	LNP-encapsulated self-amplifying RNA that encodes the S protein	19 Jun 20	Phase I/II (ISRCTN17072692)	GBR
mRNA	Walvax Biotechnology	mRNA encoding the RBD	25 Jun 20	Phase I (ChiCTR2000034112)	CHN
ARCT-021	Arcturus Therapeutics	LNP-encapsulated self-replicating mRNA that encodes the prefusion S protein	12 Aug 20	Phase I/II (NCT04480957)	SGN

Supplementary Table 1 cont. | COVID-19 vaccines in clinical development*

Candidate	Lead partners	Vaccine characteristics	Start of first phase I trial	Current stage	Location (current and upcoming trials)
Inactivated virus					
Inactivated SARS-CoV-2 vaccine	Wuhan Institute of Biological Products/ Sinopharm	Inactivated novel coronavirus Pneumonia vaccine (Vero cells)	11 Apr 20	Phase III (ChiCTR2000034780)	CHN, UAE, MAR
Adsorbed COVID-19 (inactivated) vaccine	Sinovac Biotech	SARS-CoV-2 inactivated vaccine	16 Apr 20	Phase III (NCT04456595)	CHN, BRZ, BGD, CHL, IND, TUR
Inactivated SARS-CoV-2 vaccine	Beijing Institute of Biotechnology/ Sinopharm	Inactivated novel coronavirus (2019-CoV) vaccine (Vero cells)	28 Apr 20	Phase I/II (ChiCTR2000032459)	CHN
Inactivated SARS-CoV-2 vaccine	Institute of Medical Biology, Chinese Academy of Medical Sciences	SARS-CoV-2 inactivated vaccine	15 May 20	Phase I/II (NCT04470609)	CHN
BBV 152	Bharat Biotech	Whole-virion inactivated	14 July 20	Phase I/II (CTRI/2020/07/026300)	IND
Protein-based (including recombinant protein, virus-like particle, peptide-based)					
NVXCoV2373	Novavax	Stable, prefusion protein, includes MatrixM™ adjuvant	25 May 20	Phase II (NCT04368988)	AUS, USA, ZAF
SCB-2019	Clover Biopharmaceuticals	Recombinant SARS-CoV-2 trimeric S protein subunit vaccine	19 Jun 20	Phase I (NCT04405908)	AUS
Recombinant new coronavirus vaccine (CHO cell)	Anhui Zhifei Longcom Biopharmaceutical/ IMCAS	Recombinant SARS-CoV-2 RBD protein subunit vaccine	22 Jun 20	Phase II (NCT04466085)	CHN
Covax-19	Vaxine Pty/Medytox	Recombinant SARS-COV-2 spike protein with Advax-SM adjuvant	01 July 20	Phase I (NCT04453852)	AUS
UQ-1-SARS-CoV-2-Sclamp	University of Queensland/CSL	Recombinant SARS-COV-2 spike protein 'molecular clamp' plus MF59 adjuvant	13 July 20	Phase I (ACTRN12620000674932p)	AUS
Coronavirus-like particle COVID-19 vaccine	Medicago	Plant-derived virus-like particle with/without ASO3 or CPG1018 adjuvant	13 Jul 20	Phase I (NCT04450004)	CAN
EpiVacCorona	FBRI SRC VB VECTOR	Synthesized peptide antigens of SARS-CoV-2 proteins	27 Jul 20	Phase I/II (NCT04527575)	RUS
Soberana 01	Instituto Finlay de Vacunas	RBD with adjuvant	24 Aug 20	Phase I/II (IFV/COR/04)	CUB
Recombinant SARS-CoV-2 vaccine	Sichuan University	Recombinant SARS-CoV-2 vaccine (Sf9 cell)	28 Aug 20	Phase I (ChiCTR2000037518)	CHN
Adjuvanted recombinant protein-based vaccine	Sanofi / GSK	Recombinant protein-based S protein vaccine together with ASO3	Sep 20	Phase I/II (NCT04537208)	USA

*The table includes candidates that have started dosing the first patient. The candidates are ordered by platform and the start date of the first phase I trial. The data is from 3 September 2020; see Supplementary Box 1 for details. aAPC, artificial antigen-presenting cell, DC, dendritic cell; LNP, lipid nanoparticle; RBD, receptor-binding domain.