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Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

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APPENDIX 1

Data about leading COVID-19 vaccine candidates

The data presented in this Appendix are up to date as of February 3, 2021.

Selection of leading vaccine candidates

As explained in the text, we define "leading" COVID-19 vaccine candidates as those which have been approved or authorised for human use in one or more countries or which are in phase 3 of clinical development, as listed in the online *COVID-19 Vaccine Development Pipeline Tracker* (London School of Hygiene & Tropical Medicine, 2021). We also searched a database maintained by the science data analytics company Airfinity for any additional vaccine candidates in phase 3 testing and included those with large, ongoing phase 3 studies (Airfinity, 2021); we obtained free access to this database with permission to reuse data.

We further included vaccines from companies which have struck agreements with the Coalition for Epidemic Preparedness Innovations or the COVAX Facility, even if these vaccines have not yet entered phase 3 testing (CEPI, 2021; WHO, 2020b).

We initially included the experimental COVID-19 vaccine developed by the University of Queensland and the one jointly developed by the Institut Pasteur and Merck, both of which were being tested in clinical trials with financial support from the Coalition for Epidemic Preparedness Innovations. However, these clinical trials were discontinued. We subsequently excluded both vaccines from our list of "leading" candidates.

The list of candidates (**Box**) is up to date as of February 3, 2021.

Box. List of companies with vaccine candidates which, as of February 3, 2021, (a) have been approved or authorised for human use in one or more countries, (b) are in phase 3 clinical testing, or (c) are under contract with CEPI or the COVAX Facility.

1. Anhui Zhifei Longcom Biopharmaceutical Institute of Microbiology / Chinese Academy of Sciences (protein subunit) †
2. AnGes / Osaka University / Takara Bio (DNA)
3. AstraZeneca / University of Oxford (non-replicating viral vector)
4. Bharat Biotech (inactivated)
5. Biological E Limited (protein subunit)
6. BioNTech / Fosun Pharma / Pfizer (messenger RNA)
7. CanSino Biological Inc / Beijing Institute of Biotechnology (non-replicating viral vector)
8. Clover Biopharmaceuticals Inc / Dynavax (protein subunit)
9. Covaxx / University of Nebraska (protein subunit)
10. CureVac (messenger RNA)
11. Gamaleya Research Institute (non-replicating viral vector) ††
12. Inovio Pharmaceuticals / International Vaccine Institute (DNA)
13. Institute of Medical Biology / Chinese Academy of Medical Sciences (inactivated) †
14. Johnson & Johnson (Janssen) / Beth Israel Deaconess Medical Center (non-replicating viral vector)
15. Medicago Inc / GlaxoSmithKline / Dynavax (virus-like particle)
16. Moderna / National Institute of Allergy and Infectious Diseases (messenger RNA)
17. Novavax (protein subunit)
18. Research Institute for Biological Safety Problems (Kazakhstan) (inactivated) †††
19. Sanofi / GlaxoSmithKline (protein subunit)
20. Serum Institute of India / Max Planck Institute (live-attenuated bacteria)
21. Sinopharm / Beijing Institute of Biological Products (inactivated) †
22. Sinopharm / Wuhan Institute of Biological Products (inactivated) †
23. Sinovac Pharma (inactivated)
24. SK Biosciences (protein subunit)
25. University of Hong Kong (replicating viral vector)
26. Vector Institute / Rospotrebnadzor (protein subunit) ††

† These are government institutions or state-owned enterprises / laboratories in China.
†† These are state-owned research institutes in Russia.
††† This is a state-owned research institute in Kazakhstan.

Selection of indicators and definition of risk levels

For each vaccine, we compiled data on key characteristics relating to the four dimensions of a global vaccination strategy against COVID-19: development and production; affordability; allocation; and deployment (see Figure 1 in the main manuscript).

For production and development, we compiled data on whether the vaccine has been approved or authorised by a stringent regulatory authority (or pre-qualified by the World Health Organization), efficacy (interim phase 3 results), and estimated production capacity in 2021. For affordability, we compiled data on price per dose and course. For allocation, we gathered data on the percentage of doses pre-purchased by high-income countries based on known deals (2021) and whether the manufacturer has agreed to supply the COVAX Facility. For deployment, we obtained information on dosing regimen and storage requirement during transport.

We use a traffic-light system to identify potential threats to widespread global implementation of each product, with red indicating high risk to widespread vaccination, amber medium risk, and green little or no risk. The cut-off points for efficacy, dosing, and storage are based on the World Health Organization's target product profiles for COVID-19 vaccines, which outline minimal and preferred characteristics for these vaccines, as explained below (WHO, 2020a). Thresholds for the other indicators were set through discussions between the authors.

All data points were independently extracted by two investigators (OJW and MS-K). Disagreements were resolved through discussion. Where information was extracted from "tracker" websites, we verified this information by looking at original sources where possible. We preferred press releases or other communications directly attributable to vaccine developers and organisations running trials, but also considered media reports from reputable sources when direct communications were not available.

Data sources and risk thresholds by indicator

Specific sources for each data point for the vaccines are provided in **Tables A1** through A**7** below.

1. Regulatory approval (Table A1)

Information on regulatory approval was obtained from the *COVID-19 Vaccine Development Pipeline Tracker* (LSHTM, 2021), the World Health Organization list of pre-qualified vaccines (WHO, 2021), the New York Times vaccine tracker (New York Times, 2021), the Bloomberg News vaccine tracker (Bloomberg, 2021), and the Financial Times vaccine tracker (Financial Times, 2021).

Lack of validation of clinical trial results by stringent regulatory authorities or the World Health Organization threatens the uptake of vaccines in countries with weak regulatory environments and may harm confidence in vaccines. Through discussion, the authors agreed on a risk level of green (low) for vaccines which have been authorised or approved by a stringent regulatory authority (based on the list of such authorities maintained by the World Health Organization [WHO, 2020c]) or which have been pre-qualified by the World Health Organization. All other vaccines were given a risk level of red (high risk to widespread implementation). There was no amber risk category for this indicator.

2. Efficacy (Table A2)

Efficacy data were obtained from peer-reviewed publications of phase III trials (where available) or other communications about interim results of phase III trials by the manufacturers or research institutions conducting clinical trials.

The World Health Organization target product profiles for COVID-19 vaccines lists a target of "at least 70% efficacy (on population basis, with consistent results in the elderly)" for preferred candidates, and a minimal efficacy threshold of 50% (WHO, 2020a).

In accordance with these target profiles, we classified vaccines as red risk level if they had efficacy levels <50% based on the interim phase 3 results, amber (medium risk) if they had efficacy levels of 50-69%, and green (low risk) if they had efficacy levels of 70% or higher.

If a developer reported a range of efficacy results for its experimental vaccine from more than one phase 3 trial, we presented the range and classified the vaccine based on the lowest reported efficacy result. Clinical trial designs, including efficacy endpoints, differed for the various vaccine candidates; the efficacy figures might therefore not be perfectly comparable. Some of the results are first interim analyses from phase 3 studies. Due to the emergence of new variants of the virus, the conditions under which trials take place vary, and not all vaccines are tested against the same variants.

3. Production capacities (Table A3)

The production capacities represent target figures set by manufacturers for 2021. We searched the websites of research institutions and other organisation that maintain databases ("trackers") of leading COVID-19 vaccine candidates for relevant information in the public domain. We complemented this with information obtained from press releases and other communications by the manufacturers of the vaccines. We also checked the Airfinity database for consistency (Airfinity, 2021).

Low supply capabilities threaten the global availability of vaccines. Through discussion, the authors agreed on a risk level of green (low) for vaccines developed by manufacturers who have estimated their production capacity to be 2 billion doses or more for 2021, amber (medium) for vaccines by manufactures with estimated production capacities of 1 billion to 1.9 billion doses, and red (high) for vaccines which have been developed by firms with estimated production capacities under 1 billion doses.

For the assignment of risk levels, we treat a single dose of a 1-dose vaccine as equivalent to two doses of a 2-dose vaccine. For example, 1 billion doses of production capacity for Johnson & Johnson, which is developing a one-dose vaccine, was treated as 2 billion doses to ensure comparability to the production capacities reported by other firms.

4. Prices (Table A4)

Data on prices per dose were sourced from UNICEF (2021). We also searched the websites of research institutions and other organisation that maintain databases ("trackers") of leading COVID-19 vaccine candidates for relevant information in the public domain. We complemented this with information obtained from press releases and other communications by the manufacturers of the vaccines. We then checked the Airfinity database for consistency (Airfinity, 2021).

It is important to note, that, in general, data on prices were difficult to find because not all prices agreed to in pre-purchase deals are publicly disclosed. The data on prices may therefore be incomplete.

Based on the number doses needed in a course, we calculated the price per course for vaccine candidates with available data. Where prices were only available as ranges, we used the midpoint of the upper and lower bound.

Higher prices threaten the affordability and financing of these vaccines in low- and middle-income countries. Through discussion, the authors agreed on a risk level of green (low) for vaccines with the lowest price per course was under $10 (USD), amber (medium) for vaccines with a price of $10-$19, and red (high) for vaccines which were priced at $20 or more.

5. Pre-orders (Table A5)

Data on pre-orders were sourced from the Duke Global Health Innovation Center (2020) and So and Woo (2020). In case of discrepancies between these two sources, we used the higher figure, which was more likely to reflect the current situation, as pre-purchase orders for leading vaccine candidates are expected to be increasing, rather

than decreasing. The total number of doses agreed to in supply deals with governments were obtained for each candidate. The proportion of these doses that were secured by high-income countries were then calculated. Countries were grouped by income level based on the World Bank country classification system (World Bank, 2021).

The greater the proportion of doses which have been pre-ordered by high-income countries, the greater the threat to global access. Through discussion, the authors agreed on a risk level of green (low) if the percentage of doses pre-purchased by high-income countries based on known deals was ≤33%, amber (medium) if it was 34-66%, and red (high) if it was 67% or more. In this way, the range (0-100) was split into parts of roughly equal size.

6. COVAX supply agreements (Table A6)

Information on supply agreements with COVAX were sourced from the Coalition for Epidemic Preparedness Innovations (CEPI, 2021) and the World Health Organization (WHO, 2020b).

Lack of supply agreements with a multilateral initiative like COVAX may threaten the timely availability of vaccines in low- and middle-income countries. Through discussion, the authors agreed on a risk level of green (low) for vaccines developed by manufacturers which have struck a non-binding supply agreement with COVAX, and red (high) for all other vaccines. There was no amber risk category for this indicator.

7. Number of doses needed and storage requirements (Table A7)

Information on the number of doses, transport and storage requirements was obtained from the Airfinity database (Airfinity, 2021). We checked various other websites for consistency, including the trackers maintained by Bloomberg News (2021), Financial Times (2021), and London School of Hygiene & Tropical Medicine (LSHTM, 2021).

The World Health Organization target product profiles for COVID-19 vaccines lists single-dose vaccines and "higher storage temperatures and higher thermostability" as being preferrable, since both would enhance vaccine distribution and availability. The World Health Organization lists a "shelf life of at least 6-12 month [at temperatures] as low as -60-70°C" as minimal requirements.

In accordance with these target profiles, we classified vaccines as red risk level if they require ultra-cold supply chains (below 2°C) or more than 2 doses, amber if they require cold supply chains (2-8°C) or two doses, and green if they can be kept at temperatures above 8°C or only require one dose.

Table A1: Data sources for information on regulatory approval by stringent regulatory authority or pre-qualified by the WHO [a]

Lead developers	Stringent regulatory authority or WHO authorisation	Source
AnGes / Osaka	?	"The company initially aimed to receive approval for the vaccine next spring. But the timing is now uncertain as it needs to consider a trial covering several tens of thousands of people." https://www.japantimes.co.jp/news/2020/12/04/national/japanese-coronavirus-vaccines-2022/
Anhui Zhifei / CAMS	?	Phase III trials underway; vaccine not approved in any country as of 3 February 2021. (Financial Times, 2021)
AstraZeneca / Oxford	Yes	Granted emergency authorisation or approval in the European Union and United Kingdom. (Financial Times, 2021)
Bharat Biotech	No	Emergency use authorized in India, which is not on the WHO list of stringent regulatory authorities. (Financial Times, 2021)
Biological E	?	In phase I/II testing as of 3 February 2021. https://cepi.net/news_cepi/cepi-partners-with-biological-e-limited-to-advance-development-and-manufacture-of-covid-19-vaccine-candidate/

BioNTech / Pfizer	Yes	Granted emergency use authorisation by several stringent regulatory authorities (European Union, United Kingdom, United States). (WHO, 2021)
CAMS / IMB	?	(WHO, 2021)
CanSino	?	Limited use authorized in China, which is not on the WHO list of stringent regulatory authorities. (Financial Times, 2021)
Clover / Dynavax	?	"A global phase 2/3 trial evaluating the safety and efficacy of the S-Trimer vaccine candidate in combination with GSK's pandemic adjuvant system is expected to begin in December 2020 funded by the Coalition for Epidemic Preparedness Innovations (CEPI)". https://www.cloverbiopharma.com/index.php?m=content&c=index&a=show&catid=11&id=53
Covaxx / University of Nebraska	?	Phase III trial was due to start in February 2021. (LSHTM, 2021) https://clinicaltrials.gov/ct2/show/NCT04683224
CureVac	?	(Financial Times, 2021)

Gamaleya	Yes	Limited use authorized in Russia, Belarus, and Argentina, none of which are on the WHO list of stringent regulatory authorities. (Financial Times, 2021) The vaccine has been issued a temporary authorisation by the Hungarian authorities; the Hungarian National Institute of Pharmacy and Nutrition is considered a stringent authority. https://ogyei.gov.hu/ogyei_issued_a_temporary_authorization_for_distribution_of_the_product_for_emergency_use
Inovio	?	Phase I was completed at the end of December 2020, with subsequent phases starting. http://ir.inovio.com/news-releases/news-releases-details/2020/INOVIO-Announces-Publication-of-Phase-1-Data-from-its-COVID-19-DNA-Vaccine-Candidate-INO-4800-in-The-Lancets-EClinicalMedicine/default.aspx
Johnson & Johnson	?	Submission for approval in the US expected in early 2021. (Financial Times, 2021)
Medicago	?	In phase II/III as of 3 February 2021. (Financial Times, 2021)
Moderna	Yes	Granted emergency use authorisation by several stringent regulatory authorities (Canada, European Union, United Kingdom, United States). (Financial Times, 2021)
Novavax	?	(Financial Times, 2021)

Research Institute for Biological Safety Problems	No	Authorised for temporary use in Kazakhstan, which is not on the WHO list of stringent regulatory authorities. https://astanatimes.com/2021/01/kazakhstans-qazcovid-in-vaccine-receives-temporary-registration-for-nine-months/ https://primeminister.kz/en/news/kazakstan-ush-myn-eriktige-qazcovid-in-otandyk-vakcinasyn-eguge-kirisedi-19114458
Sanofi / GSK	?	"Product availability now expected in Q4 2021 pending successful completion of the development plan." https://www.gsk.com/en-gb/media/press-releases/sanofi-and-gsk-announce-a-delay-in-their-adjuvanted-recombinant-protein-based-covid-19-vaccine-programme-to-improve-immune-response-in-the-elderly/
Serum Institute of India / Max Planck Institute	?	In phase III testing. https://clinicaltrials.gov/ct2/show/NCT04435379 https://clinicaltrials.gov/ct2/show/NCT04439045
Sinopharm / Beijing Inst.	Yes	The Hungarian authorities (considered a stringent regulatory authority by WHO) issued an emergency authorisation for this vaccine on 29 January 2021. https://www.reuters.com/article/us-health-coronavirus-hungary-vaccine/hungary-approves-chinese-sinopharms-covid-vaccine-first-in-european-union-idUSKBN29Y0OD

		The product has also been approved or authorised in China, Bahrain, and United Arab Emirates, none of which are on the WHO list of stringent regulatory authorities. (Financial Times, 2021)
Sinopharm / Wuhan Inst.	No	Emergency use authorized in China, which is not on the WHO list of stringent regulatory authorities. (Financial Times, 2021) It also has limited use authorisation in the United Arab Emirates (New York Times, 2021)
Sinovac	No	Limited use authorized in China, which is not on the WHO list of stringent regulatory authorities. (Financial Times, 2021)
SK Biosciences	?	In pre-clinical stage. A decision on listing under pre-qualification status is expected in February 2021 at the earliest. (WHO, 2021)
University of Hong Kong	?	In pre-clinical stage. https://fightcovid19.hku.hk/hkus-covid-19-vaccine-candidate-approved-for-human-clinical-trials/
Vector Institute / Rospotrebnadzor	No	In phase III testing. Approved in Russia, which is not on the WHO list of stringent regulatory authorities. (New York Times, 2021)

CAMS= Chinese Academy of Medical Sciences. GSK=GlaxoSmithKline. IMB=Institute of Medical Biology (China). WHO=World Health Organization.

[a] Question marks indicate that either the data are unavailable, or it is too early to know (for vaccines in the earlier stages of development

Table A2: Data sources for information on efficacy [a]

Lead developers	Efficacy in phase 3 trials	Source
AnGes / Osaka	?	Phase III ongoing as of 3 February 2021. (LSHTM, 2021)
Anhui Zhifei / CAMS	?	Phase III ongoing as of 3 February 2021. (LSHTM, 2021)
AstraZeneca / Oxford	62%	Main analysis of the intended dosing regimen showed efficacy of 62.1%, which is the dosing regimen authorised in the UK by the Medicines and Healthcare products Regulatory Agency. In a group that received a lower dose followed by the standard dose, efficacy was 90.0%. Across the two dosing regimens, the average efficacy was 70.4%. (Voysey et al., 2020)
Bharat Biotech	?	Phase I/II recruiting as of 3 February 2021. The vaccine was approved in India despite no data on efficacy being available. https://www.sciencemag.org/news/2021/01/scientists-criticize-rushed-approval-indian-covid-19-vaccine-without-efficacy-data
Biological E	?	Phase III studies not started as of 3 February 2021. (LSHTM, 2021)
BioNTech / Pfizer	95%	(Polack et al., 2020)
CAMS / IMB	?	Phase III ongoing as of 3 February 2021. (LSHTM, 2021)

CanSino	?	Phase III ongoing as of 3 February 2021. (LSHTM, 2021)
Clover / Dynavax	?	Phase I completed as of 3 February 2021; phase II/III trial not yet recruiting.
Covaxx / University of Nebraska	?	Phase III was due to start in February 2021. (LSHTM, 2021)
CureVac	?	Phase III ongoing as of 3 February 2021. (LSHTM, 2021)
Gamaleya	92%	(Logunov et al., 2021)
Inovio	?	Phase III ongoing as of 3 February 2021. (LSHTM, 2021)
Johnson & Johnson	66%	In a press release from 29 January 2021, the developers reported an overall efficacy of 66%. This result has not yet been published in peer-reviewed journals (as of February 3, 2021). https://www.jnj.com/johnson-johnson-announces-single-shot-janssen-covid-19-vaccine-candidate-met-primary-endpoints-in-interim-analysis-of-its-phase-3-ensemble-trial
Medicago	?	Phase III ongoing as of 3 February 2021. (LSHTM, 2021)
Moderna	94%	(Baden et al., 2021)

Novavax	89%	In a press release from 28 January 2021, the developers reported an overall efficacy of 89% from a phase 3 trial conducted in the UK. The company reported a lower efficacy level in a smaller phase 2b clinical trial in South Africa (49%). These results have not yet been published in peer-reviewed journals (as of February 3, 2021) https://ir.novavax.com/news-releases/news-release-details/novavax-covid-19-vaccine-demonstrates-893-efficacy-uk-phase-3
Research Institute for Biological Safety Problems	?	Phase III ongoing as of 3 February 2021. (LSHTM, 2021)
Sanofi / GSK	?	Phase I/II studies ongoing as of 3 February 2021. (LSHTM, 2021)
Serum Institute of India / Max Planck Institute	?	In phase III testing as of 3 February 2021. https://clinicaltrials.gov/ct2/show/NCT04435379 https://clinicaltrials.gov/ct2/show/NCT04439045
Sinopharm / Beijing Inst.	79%	In a press release from 30 December 2020, the developers reported an overall efficacy of 79%. This result has not yet been published in a peer-reviewed journal. http://www.bjbpi.com/news_list.asp?id=787
Sinopharm / Wuhan Inst.	?	In phase III testing as of 3 February 2021. (LSHTM, 2021)

Sinovac	50% to 91%	Sinovac and its research partners have reported a range of efficacy levels based on phase 3 trials conducted in Brazil (50%), Indonesia (65%), Turkey (91%), and the United Arab Emirates (86%). None of these results have been published in peer-reviewed journals. https://www.reuters.com/article/healthcoronavirus-brazil-coronavirus/chinas-sinovac-vaccine-has-general-efficacy-of-50-4-in-brazil-trials-says-butantan-idUSE5N2HA01G https://www.bloomberg.com/news/articles/2021-01-07/sinovac-covid-shot-78-effective-in-brazil-trial-folha-reports https://www.bloomberg.com/news/articles/2021-01-12/china-vaccine-going-global-with-four-different-efficacy-rates https://www.ft.com/content/9c59ea99-6da1-4fe3-ade4-19d3ef98596f
SK Biosciences	?	In pre-clinical stage as of 3 February 2021. (LSHTM, 2021)
University of Hong Kong	?	In pre-clinical stage as of 3 February 2021. (LSHTM, 2021)
Vector Institute / Rospotrebnadzor	?	No phase III trial was conducted prior to authorisation in Russia. A post-marketing trial was launched in November 2020. https://www.thepharmaletter.com/article/russia-s-epivaccorona-vaccine-post-registration-trials-started

CAMS= Chinese Academy of Medical Sciences. GSK=GlaxoSmithKline. IMB=Institute of Medical Biology (China).

[a] Question marks indicate that either the data are unavailable (e.g., not yet published in a peer-reviewed journal or disclosed in a press release), or it is too early to know (for vaccines in the earlier stages of development). Note that clinical trial designs, including efficacy endpoints, differed for the various vaccine candidates. Some of these efficacy figures may therefore not be perfectly comparable.

Table A3: Data sources for information on estimated production capacity (2021) [a]

Lead developers	Estimated production capacity for 2021	Source
AnGes / Osaka	?	A planned capacity of 1m doses for 2021 had previously been estimated, but these plans are unlikely to materialise given that phase III testing is still ongoing, with an unclear timeline for approval. The company eventually aims to be able to produce 30 million doses per year. https://www.japantimes.co.jp/news/2020/12/04/national/japanese-coronavirus-vaccines-2022/
Anhui Zhifei / CAMS	300m	(Financial Times, 2021)
AstraZeneca / Oxford	3bn	https://www.astrazeneca.com/media-centre/press-releases/2020/astrazenecas-covid-19-vaccine-authorised-in-uk.html
Bharat Biotech	700m	https://www.reuters.com/article/us-health-coronavirus-india-vaccine/indias-bharat-biotech-aims-to-make-700-million-doses-of-covid-19-vaccine-in-2021-idUSKBN2991JD?edition-redirect=uk
Biological E	?	(Airfinity, 2021)
BioNTech / Pfizer	2bn	(Financial Times, 2021)
CAMS / IMB	?	(Airfinity, 2021)

CanSino	320m (treated as 640m for the risk level assessment, since it is a single-dose vaccine)	(Airfinity, 2021)
Clover / Dynavax	1bn	https://www.cloverbiopharma.com/index.php?m=content&c=index&a=show&catid=11&id=53
Covaxx / University of Nebraska	1bn	https://www.covaxx.com/vaccine
CureVac	300m	https://www.curevac.com/en/2020/11/17/curevac-establishes-european-based-network-to-ramp-up-manufacturing-of-its-covid-19-vaccine-candidate-cvncov/
Gamaleya	1bn	https://www.sciencemag.org/news/2020/11/more-data-its-covid-19-vaccine-russia-institute-offers-new-evidence-success
Inovio	100m	http://ir.inovio.com/news-releases/news-releases-details/2021/INOVIO-and-Advaccine-Announce-Exclusive-Partnership-To-Commercialize-COVID-19-DNA-Vaccine-Candidate-INO-4800-in-Greater-China/default.aspx
Johnson & Johnson	1bn (treated as 2bn for the risk level assessment, since it is a single-dose vaccine)	https://www.jnj.com/innovation/questions-about-johnson-johnson-investigational-covid-19-vaccine

Medicago	80m	(Airfinity, 2021)
Moderna	1bn	https://investors.modernatx.com/news-releases/news-release-details/moderna-provides-covid-19-vaccine-supply-update
Novavax	2bn	https://ir.novavax.com/news-releases/news-release-details/novavax-announces-covid-19-vaccine-manufacturing-agreement-serum
Research Institute for Biological Safety Problems	60m	https://primeminister.kz/en/news/kazakstan-ush-myn-eriktige-qazcovid-in-otandyk-vakcinasyn-eguge-kirisedi-19114458
Sanofi / GSK	?	Production capacity for 2021 currently unclear. While a planned capacity of 1bn doses had been communicated previously, this is unlikely to hold with product launch now not expected until the fourth quarter of 2021. https://www.gsk.com/en-gb/media/press-releases/sanofi-and-gsk-announce-a-delay-in-their-adjuvanted-recombinant-protein-based-covid-19-vaccine-programme-to-improve-immune-response-in-the-elderly/ https://www.sanofi.com/en/media-room/press-releases/2020/2020-09-18-12-52-46
Serum Institute of India / Max Planck Institute	?	(Airfinity, 2021)
Sinopharm / Beijing Inst.	1bn	https://www.scmp.com/news/china/science/article/3116562/coronavirus-china-says-it-can-produce-1-billion-doses-sinopharm

Sinopharm / Wuhan Inst.	600m	https://www.globaltimes.cn/page/202101/1212482.shtml
Sinovac	1bn	https://www.reuters.com/article/us-health-coronavirus-vaccine-sinovac/chinas-sinovac-to-double-annual-covid-19-vaccine-capacity-to-1-billion-doses-idUSKBN29I0YN
SK Biosciences	?	(Airfinity, 2021)
University of Hong Kong	?	(Airfinity, 2021)
Vector Institute / Rospotrebnadzor	11m	(Airfinity, 2021)

CAMS= Chinese Academy of Medical Sciences. GSK=GlaxoSmithKline. IMB=Institute of Medical Biology (China).

[a] Question marks indicate that either the data are unavailable, or it is too early to know (for vaccines in the earlier stages of development).

Table A4: Data sources for information on vaccine prices (USD/course) [a]

Lead developers	Known prices (USD/dose)	Lowest price offered (USD$ per course, roundest to the nearest $)	Source	Median prices by country group shown in Figure 3 (in the main text)
AnGes / Osaka	?	?		
Anhui Zhifei / CAMS	?	?		
AstraZeneca / Oxford	$3 (EU) $2.5 (Philippines) $2.5 (COVAX) $4 (UK) $4 (US) $3.16 (Brazil – deal with AstraZeneca) $5.25 (Brazil – purchase from Serum Institute of India) $2.72 (India) $4 (Bangladesh) $3 (African Union) $5.25 (South Africa) $5.25 (Saudi Arabia)	$5	The EU was initially reported to have paid €1.78 (or $2.2) based on a leaked a list of prices for COVID vaccines agreed by the European Commission (UNICEF, 2021). However, a subsequent news report indicated that the real price paid by the EU was closer to $3; we included this price point. https://www.reuters.com/article/us-health-coronavirus-vaccines-europe-in-idUKKBN2A50I1 https://pia.gov.ph/news/articles/1062393 https://www.bbc.co.uk/news/world-asia-china-55212787 https://portal.fiocruz.br/en/news/covid-19-vaccine-fiocruz-discloses-its-technological-order-agreement-astrazeneca https://www.bloomberg.com/news/articles/2020-11-13/india-to-get-100-million-astra-shots-next-month-says-serum-head	Self-procuring high-income countries include EU, Saudi Arabia, UK, and US (median price per dose = $4). Self-procuring middle-income countries include Bangladesh, Brazil (both price points), India, Philippines, and South Africa (median price per dose = $3.58). UNICEF/Gavi include prices offered to African Union (mostly low-income countries) and COVAX (median price per dose = $2.75)

			https://www.nasdaq.com/articles/exclusive-indias-serum-to-sell-astrazeneca-vaccine-to-bangladesh-at-%244-dose-sources-2021 https://www.reuters.com/article/us-health-coronavirus-bangladesh-vaccine/exclusive-bangladeshs-beximco-could-start-private-sales-of-astrazeneca-vaccine-next-month-idUKKBN29H1YC https://www.reuters.com/article/us-health-coronavirus-bangladesh-india/bangladesh-signs-deal-with-india-for-30-million-doses-of-covid-19-vaccine-idUSKBN27L1CD https://www.reuters.com/article/uk-health-coronavirus-india-saudi-idUSKBN29U26K https://www.reuters.com/article/idUSKBN29P0LL https://www.reuters.com/article/uk-health-coronavirus-safrica-vaccines-idUKKBN29Q28N https://www.reuters.com/article/us-health-coronavirus-vaccine-india/india-to-buy-11-million-doses-of-astrazeneca-vaccine-from-serum-institute-report-idINKBN29G122 https://www.reuters.com/article/health-coronavirus-india-saudi-exclusive/exclusive-saudi-arabia-to-get-three-million-astrazeneca-shots-in-about-a-week-from-india-idUSKBN29V0DE https://www.reuters.com/article/uk-health-coronavirus-uganda/uganda-orders-18-million-doses-of-astrazenecas-covid-19-vaccine-idUSKBN2A30YB (Knoll and Wonodi, 2021)	

Bharat Biotech	₹206 = $2.8 (India)	$6	https://www.livemint.com/news/india/at-what-cost-is-govt-sourcing-serum-s-covishield-bharat-biotech-s-covaxin-explained-11610450615485.html	Self-procuring middle-income countries includes India (price per dose = $2.8)
Biological E	?	?		
BioNTech / Pfizer	$10 (South Africa) €12 = $14.7 (EU) $19.5 (US) $28 (Israel) $6.75 (African Union) $7 (Tunisia)	$14	The source of the EU data point is a leaked list of prices for COVID vaccines agreed by the European Commission. (UNICEF, 2021) https://www.bloomberg.com/news/articles/2021-01-04/pfizer-has-offered-south-africa-discounted-covid-19-vaccines? https://www.i24news.tv/en/news/israel/1605518593-israel-to-pay-more-than-us-eu-for-pfizer-coronavirus-vaccine-report https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-supply-us-100-million-additional-doses https://www.reuters.com/article/idUSKBN29P0LL https://www.forbesmiddleeast.com/industry/healthcare/tunisia-to-get-2m-doses-of-covid-vaccine-from-pfizer	Self-procuring high-income countries include EU, Israel, and US (median price per dose = $19.5). Self-procuring middle-income countries includes South Africa and Tunisia (median price per dose = $8.5). UNICEF/Gavi includes prices offered to African Union (mostly low-income countries) (price per dose = $6.75).
CAMS / IMB	?	?		

CanSino	?	?		
Clover / Dynavax	?	?		
Covaxx / University of Nebraska	?	?		
CureVac	€10 = $11.8 (EU)	$24	The source of the EU data point is a leaked list of prices for COVID vaccines agreed by the European Commission. (UNICEF, 2021) https://www.reuters.com/article/us-health-coronavirus-eu-pfizer-exclusiv/exclusive-eu-could-pay-over-10-billion-for-pfizer-and-curevac-vaccines-source-idINKBN2800IC	Self-procuring high-income countries include EU (price per dose = $11.8)
Gamaleya	$3 (Latin America) $10 (Global, excluding Russia) ₽1942 = $26.3 (maximum price)	$6	https://www.reuters.com/article/idUSKBN27F2OO https://www.bbc.co.uk/news/world-asia-china-55212787 https://bankstoday.net/last-news/1942-stolko-budet-stoit-sputnik-v-dlya-rossiyan-vaktsina-budet-besplatnoj-no-s-proizvodstvom-problemy https://sputnikvaccine.com/newsroom/pressreleases/the-cost-of-one-dose-will-be-less-than-10-for-international-markets/	Self-procuring middle-income countries include Latin America and the Global price point (median price per dose = $6.5). We did not show the maximum price.
Inovio	?	?		

Johnson & Johnson	$8.5 (EU) $10 (US) $10 (African Union)	$9	The source of the EU data point is a leaked list of prices for COVID vaccines agreed by the European Commission. (UNICEF, 2021) https://www.jnj.com/johnson-johnson-announces-agreement-with-u-s-government-for-100-million-doses-of-investigational-covid-19-vaccine https://www.reuters.com/article/idUSKBN29P0LL	Self-procuring high-income countries include EU and US (median price per dose = $9.25). UNICEF/Gavi includes prices offered to African Union (mostly low-income countries) (price per dose = $10).
Medicago	?	?		
Moderna	$15.25 (US) $18 (EU) $34.5 (high-income countries, incl. Switzerland, outside the US/EU)	$31	https://investors.modernatx.com/news-releases/news-release-details/moderna-announces-supply-agreement-us-government-initial-100 https://www.reuters.com/article/idUSKBN28S1S0 https://www.reuters.com/article/us-health-coronavirus-moderna-pricing/moderna-prices-covid-19-vaccine-at-32-37-per-dose-for-smaller-volume-deals-idUSKCN2511UL	Self-procuring high-income countries include EU, US, and the price point for other high-income countries (incl. Switzerland) (median price per dose = $18).
Novavax	$3 (Gates / COVAX / Serum Institute of India) $16 (US)	$6	https://www.gavi.org/news/media-room/new-collaboration-makes-further-100-million-doses-covid-19-vaccine-available-low https://www.statnews.com/2020/07/31/operation-warp-speed-sanofi-gsk-covid19-vaccine/	Self-procuring high-income countries include USA (price per dose = $16). UNICEF/Gavi includes Gates/COVAX/Serum Institute of India (price per dose = $3).

Research Institute for Biological Safety Problems	?	?		
Sanofi / GSK	€7.56 = $9.3 (EU) $10.5 (US)	$19	The source of the EU data point is a leaked list of prices for COVID vaccines agreed by the European Commission. (UNICEF, 2021) https://www.gsk.com/en-gb/media/press-releases/sanofi-and-gsk-selected-for-operation-warp-speed-to-supply-united-states-government-with-100-million-doses-of-covid-19-vaccine/	Self-procuring high-income countries include EU and US (median price per dose = $9.9)
Serum Institute of India / Max Planck Institute	?	?		
Sinopharm / Beijing Inst.	¥300 = $44 (undisclosed provinces in China) ¥200 = $31 (Jiangsu, Zhejiang, and Sichuan Provinces, China)	$62	https://www.scmp.com/news/china/society/article/3102410/coronavirus-chinese-drug-firm-aims-roll-out-us88-vaccine-year https://www.globaltimes.cn/content/1210093.shtml	Self-procuring middle-income countries include both price points from the various Chinese provinces (median price per dose = $37.5).
Sinopharm / Wuhan Inst.	¥300 = $44 (undisclosed provinces in China) ¥200 = $31 (Jiangsu, Zhejiang, and Sichuan Provinces, China)	$62	https://www.scmp.com/news/china/society/article/3102410/coronavirus-chinese-drug-firm-aims-roll-out-us88-vaccine-year https://www.globaltimes.cn/content/1210093.shtml	Self-procuring middle-income countries include both price points from the various Chinese provinces (median price per dose = $37.5).

Sinovac	$10.3 (Brazil) $13.6 (Indonesia) $29.75 (China)	$21	https://www.reuters.com/article/health-coronavirus-brazil/brazil-aims-to-vaccinate-entire-population-against-covid-19-in-2021-idUSKBN28K1IK https://www.reuters.com/article/idUSKBN2710UQ	Self-procuring middle-income countries include Brazil, China, and Indonesia (median price per dose = $13.6)
SK Biosciences	?	?		
University of Hong Kong	?	?		
Vector Institute / Rospotrebnadzor	?	?		

CAMS= Chinese Academy of Medical Sciences. EU=European Union. GSK=GlaxoSmithKline. IMB=Institute of Medical Biology (China). UK=United Kingdom. UNICEF=United Nations Children's Fund. US=United States. USD=United States dollar.

[a] Question marks indicate that either the data are unavailable, or it is too early to know (for vaccines in the earlier stages of development).

Table A5: Data sources for information on % of doses pre-purchased by high-income countries based on known deals (2021) [a]

Lead developers	Number of doses pre-purchased by HICs	Total number of doses pre-purchased (by all countries)	Percentage of doses pre-purchased by HICs for 2021 (based on known deals)	Source
AnGes / Osaka	?	?	?	
Anhui Zhifei / CAMS	?	?	?	
AstraZeneca / Oxford	1,046.8m	3,834.1m	27%	Pre-purchase commitments for 32 countries/blocs were identified from the Duke Global Health Innovation Center (2021). Two additional commitments (1 for China and 1 for LMICs) were identified from So and Woo (2020).
Bharat Biotech	0	17.5m	0%	Pre-purchase commitments for 2 middle-income countries (Brazil and India) were identified from the Duke Global Health Innovation Center (2021).
Biological E	?	?	?	

BioNTech / Pfizer	926.4m	1,206.5m	77%	Pre-purchase commitments for 34 countries/blocs were identified from the Duke Global Health Innovation Center (2021).
CAMS / IMB	?	?	?	
CanSino	0	70m	0%	Two pre-purchase commitments from Indonesia and Pakistan were identified from the Duke Global Health Innovation Center (2021), and another for Mexico from So and Woo (2020).
Clover / Dynavax	?	?	?	
Covaxx / University of Nebraska	0	140m	0%	A pre-purchase commitment from Ecuador was identified from the Duke Global Health Innovation Center (2021). Further research showed the country had struck pre-purchase agreements for 140m doses with emerging countries, including with Brazil, Ecuador, and Peru. https://covaxx.reportablenews.com/pr/covaxx-to-deliver-2-8-billion-in-vaccine-advance-purchase-commitments-110-million-doses-to-emerging-countries

CureVac	225m	225m	100%	A pre-purchase commitment for the EU was identified from the Duke Global Health Innovation Center (2021).
Gamaleya	2m	469m	0.4%	Pre-purchase commitments for 13 countries were identified from the Duke Global Health Innovation Center (2021). Two additional commitments from Russia and Vietnam were identified from So and Woo (2020).
Inovio	?	?	?	
Johnson & Johnson	380m	1,009m	38%	Pre-purchase commitments for 9 countries/blocs and one for COVAX were identified from the Duke Global Health Innovation Center (2021).
Medicago	76m	76m	100%	One deal for Canada was identified from the Duke Global Health Innovation Center (2021).
Moderna	616.5m	636.5m	97%	Pre-purchase commitments for 9 countries/blocs were identified from the Duke Global Health Innovation Center (2021).

Novavax	533.7m	1,713.7m	31%	Pre-purchase commitments for 7 countries/blocs were identified from the Duke Global Health Innovation Center (2021). One additional commitment from Japan, and 2 for LMICs and COVAX were identified from So and Woo (2020).
Research Institute for Biological Safety Problems	?	?	?	
Sanofi / GSK	532m	732m	73%	Pre-purchase commitments for 4 countries/blocs and 1 for COVAX were identified from the Duke Global Health Innovation Center (2021).
Serum Institute of India / Max Planck Institute	?	?	?	
Sinopharm / Beijing Inst.	8m	98.7m	8%	Pre-purchase commitments for 7 countries were identified from the Duke Global Health Innovation Center (2021). The same figure was extracted for both Sinopharm candidates due to lack of details in the database and linked media reports on which candidate the doses were ordered for.

Sinopharm / Wuhan Inst.	8m	98.7m	8%	Pre-purchase commitments for 7 countries were identified from the Duke Global Health Innovation Center (2021). The same figure was extracted for both Sinopharm candidates due to lack of details in the database and linked media reports on which candidate the doses were ordered for.
Sinovac	69.2m	391.5m	18%	Pre-purchase commitments for 11 countries were identified from the Duke Global Health Innovation Center (2021).
SK Biosciences	?	?	?	
University of Hong Kong	?	?	?	
Vector Institute / Rospotrebnadzor	?	?	?	

CAMS= Chinese Academy of Medical Sciences. EU=European Union. GSK=GlaxoSmithKline. HIC=high-income country. IMB=Institute of Medical Biology (China). LMIC=low- and middle-income countries.

[a] Question marks indicate that either the data are unavailable, or it is too early to know (for vaccines in the earlier stages of development). Any doses secured by COVAX were not included in the count for high-income countries; while high-income countries are able to procure doses through COVAX, the facility is likely to largely supply low- and middle-income countries.

Table A6: Data sources for information on non-binding supply agreement with COVAX

Lead developers	Supply agreement with COVAX	Source
AnGes / Osaka	No	(WHO, 2020b)
Anhui Zhifei / CAMS	No	(WHO, 2020b)
AstraZeneca / Oxford	Yes	(WHO, 2020b)
Bharat Biotech	No	(WHO, 2020b)
Biological E	No	(WHO, 2020b)
BioNTech / Pfizer	Yes	https://www.who.int/news/item/22-01-2021-covax-announces-new-agreement-plans-for-first-deliveries
CAMS / IMB	No	(WHO, 2020b)
CanSino	No	(WHO, 2020b)
Clover / Dynavax	No	(WHO, 2020b)
Covaxx / University of Nebraska	No	(WHO, 2020b)
CureVac	No	(WHO, 2020b)
Gamaleya	No	(WHO, 2020b)
Inovio	No	(WHO, 2020b)
Johnson & Johnson	Yes	(WHO, 2020b)
Medicago	No	(WHO, 2020b)

Moderna	No	(WHO, 2020b)
Novavax	Yes	(WHO, 2020b)
Research Institute for Biological Safety Problems	No	(WHO, 2020b)
Sanofi / GSK	Yes	(WHO, 2020b)
Serum Institute of India / Max Planck Institute	No	(WHO, 2020b)
Sinopharm / Beijing Inst.	No	(WHO, 2020b)
Sinopharm / Wuhan Inst.	No	(WHO, 2020b)
Sinovac	No	(WHO, 2020b)
SK Biosciences	No	(WHO, 2020b)
University of Hong Kong	No	(WHO, 2020b)
Vector Institute / Rospotrebnadzor	No	(WHO, 2020b)

CAMS= Chinese Academy of Medical Sciences. GSK=GlaxoSmithKline. IMB=Institute of Medical Biology (China). WHO=World Health Organization.

Table A7: Data sources for information on number of doses needed and storage requirements during transport [a]

Lead developers	Number of doses	Storage requirement during transport	Source
AnGes / Osaka	2	-70°C	(Airfinity, 2021)
Anhui Zhifei / CAMS	2-3	2°C to 8°C	(Airfinity, 2021)
AstraZeneca / Oxford	2	2°C to 8°C	(Airfinity, 2021) https://www.astrazeneca.com/media-centre/press-releases/2020/astrazenecas-covid-19-vaccine-authorised-in-uk.html
Bharat Biotech	2	2°C to 8°C	(Airfinity, 2021)
Biological E	2	2°C to 8°C	(Airfinity, 2021)
BioNTech / Pfizer	2	-70°C	(Airfinity, 2021) https://www.gov.uk/government/publications/regulatory-approval-of-pfizer-biontech-vaccine-for-covid-19/conditions-of-authorisation-for-pfizerbiontech-covid-19-vaccine
CAMS / IMB	2	2°C to 8°C	(Airfinity, 2021)
CanSino	1	2°C to 8°C	(Financial Times, 2021) (Airfinity, 2021)
Clover / Dynavax	2	2°C to 8°C	(Airfinity, 2021)
Covaxx / University of Nebraska	2	2°C to 8°C	(Airfinity, 2021)
CureVac	2	5°C	(Airfinity, 2021)

			https://www.curevac.com/en/2020/11/12/curevacs-covid-19-vaccine-candidate-cvncov-suitable-for-standard-fridge-temperature-logistics/
Gamaleya	2	-18°C	(Airfinity, 2021)
Inovio	2	2°C to 8°C	(Airfinity, 2021) http://ir.inovio.com/news-releases/news-releases-details/2020/INOVIO-Announces-Publication-of-Phase-1-Data-from-its-COVID-19-DNA-Vaccine-Candidate-INO-4800-in-The-Lancets-EClinicalMedicine/default.aspx
Johnson & Johnson	1 (also testing 2-dose vaccine)	2°C to 8°C	(Airfinity, 2021)
Medicago	2	2°C to 8°C	(Airfinity, 2021)
Moderna	2	-20°C	(Airfinity, 2021)
Novavax	2	2°C to 8°C	(Airfinity, 2021)
Research Institute for Biological Safety Problems	2	2°C to 8°C	(Airfinity, 2021)
Sanofi / GSK	2	2°C to 8°C	(Airfinity, 2021)
Serum Institute of India / Max Planck Institute	?	-50°C to -15°C	(Airfinity, 2021)
Sinopharm / Beijing Inst.	2	2°C to 8°C	(Airfinity, 2021)
Sinopharm / Wuhan Inst.	2	2°C to 8°C	(Airfinity, 2021)
Sinovac	2	Room temperature	(Airfinity, 2021)

SK Biosciences	?	2°C to 8°C	(Airfinity, 2021)
University of Hong Kong	?	-50°C to -15°C	(Airfinity, 2021)
Vector Institute / Rospotrebnadzor	2	2°C to 8°C	(Airfinity, 2021)

CAMS= Chinese Academy of Medical Sciences. GSK=GlaxoSmithKline. IMB=Institute of Medical Biology (China).

[a] Question marks indicate that it is too early to know (e.g., for vaccines in the pre-clinical stages of development).

References

Airfinity (2021) *COVID-19 Vaccines*. Available at: https://science.airfinity.com/covid-19-vaccines (Accessed: 3 February 2021).

Baden et al. (2021). 'Efficacy and Safety of the mRNA-1273 SARS-CoV-2 Vaccine.' *N Engl J Med*, 384: 403-416. DOI: 10.1056/NEJMoa2035389.

Bloomberg (2021) *Covid-19 Vaccine Tracker*. Available at: https://www.bloomberg.com/graphics/covid-vaccine-tracker-global-distribution/ (Accessed: 3 February 2021).

Coalition for Epidemic Preparedness Innovations (2021) *Our portfolio – CEPI*. Available at: https://cepi.net/research_dev/our-portfolio/ (Accessed: 3 February 2021).

Duke Global Health Innovation Center (2021) *COVID-19 Launch and Scale Speedometer*. Available at: https://launchandscalefaster.org/COVID-19#Interactive tables and charts - COVID-19 Vaccine Advance Market Commitments (Accessed: 3 February 2021).

Financial Times (2021) *Covid vaccine tracker: The shots available and the doses administered*. Available at: https://www.ft.com/content/ac5e5ef8-bccb-482b-9f8d-0dab5cac6f9a (Accessed: 3 February 2021)

Knoll, M. D. and Wonodi, C. (2020) 'Oxford–AstraZeneca COVID-19 vaccine efficacy', *The Lancet*, 397(10269), pp. 72–74. doi: 10.1016/S0140-6736(20)32623-4.

Logunov et al. (2021). 'Safety and efficacy of an rAd26 and rAd5 vector-based heterologous prime-boost COVID-19 vaccine: an interim analysis of a randomised controlled phase 3 trial in Russia.' *The Lancet* (online first). https://doi.org/10.1016/S0140-6736(21)00234-8.

London School of Hygiene & Tropical Medicine (2021) *COVID-19 vaccine tracker*. Available at: https://vac-lshtm.shinyapps.io/ncov_vaccine_landscape/ (Accessed: 3 February 2021).

New York Times (2021) *Coronavirus Vaccine Tracker*. Available at: https://www.nytimes.com/interactive/2020/science/coronavirus-vaccine-tracker.html (Accessed: 3 February 2021).

Polack, F. P. *et al.* (2020) 'Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine', *New England Journal of Medicine*, 383(27), pp. 2603–2615. doi: 10.1056/nejmoa2034577.

So, A. D. and Woo, J. (2020) 'Reserving coronavirus disease 2019 vaccines for global access: Cross sectional analysis', *The BMJ*, 371. doi: 10.1136/bmj.m4750.

UNICEF (2021) *COVID-19 Vaccine Market Dashboard*. Available at: https://www.unicef.org/supply/covid-19-vaccine-market-dashboard (Accessed: 3 February 2021).

Voysey, M. *et al.* (2020) 'Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK', *The Lancet*, 397(10269), p. 2021. doi: 10.1016/S0140-6736(20)32661-1.

World Bank (2021). *World Bank Country and Lending Groups.* Washington, D.C. Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (Accessed: 3 February 2021).

World Health Organization WHO (2021) *Status of COVID-19 Vaccines within WHO EUL/PQ evaluation process*. Geneva. Available at: https://extranet.who.int/pqweb/sites/default/files/documents/Status_COVID_VAX.pdf (Accessed: 3 February 2021).

World Health Organization (WHO) (2020a) *WHO Target Product Profiles for COVID-19 Vaccines*. Geneva. Available at: https://www.who.int/docs/default-source/blue-print/who-target-product-profiles-for-covid-19-vaccines.pdf?sfvrsn=1d5da7ca_5 (Accessed: 3 February 2021).

World Health Organization (WHO) (2020b) *COVAX Announces additional deals to access promising COVID-19 vaccine candidates; plans global rollout starting Q1 2021*. Available at: https://www.who.int/news/item/18-12-2020-covax-announces-additional-deals-to-access-promising-covid-19-vaccine-candidates-plans-global-rollout-starting-q1-2021 (Accessed: 3 February 2021).

World Health Organization (WHO) (2020c) *List of Stringent Regulatory Authorities (SRAs)*. Available at: https://www.who.int/medicines/regulation/sras/en/ (Accessed: 3 February 2021).