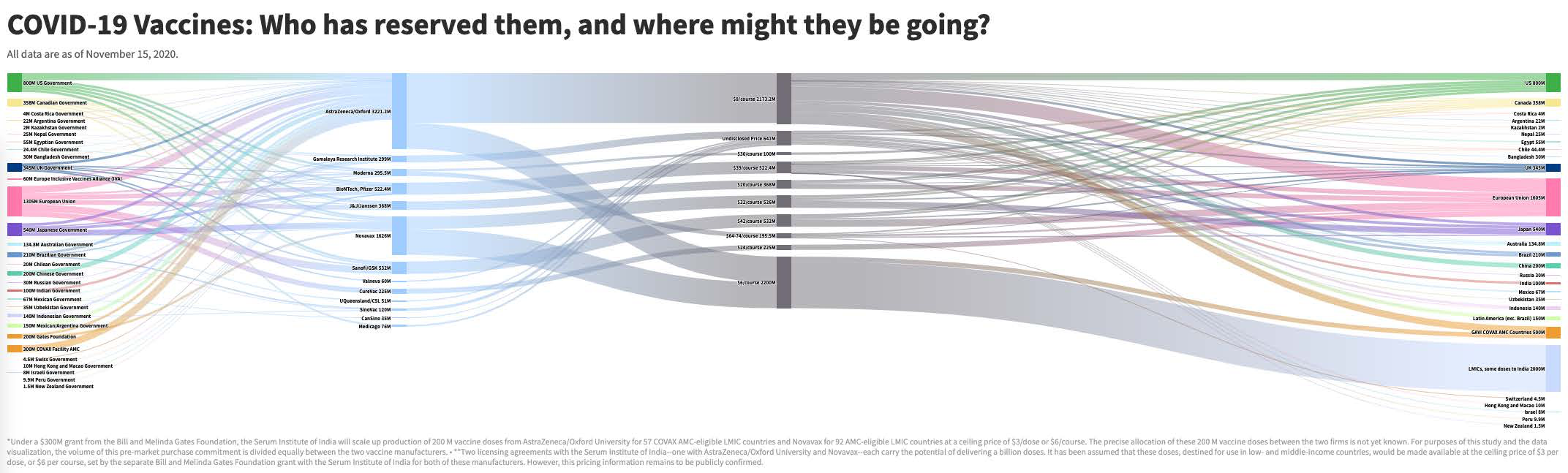
**Figure S1.** COVID-19 Vaccines: Who has reserved them, and

where might they be going?



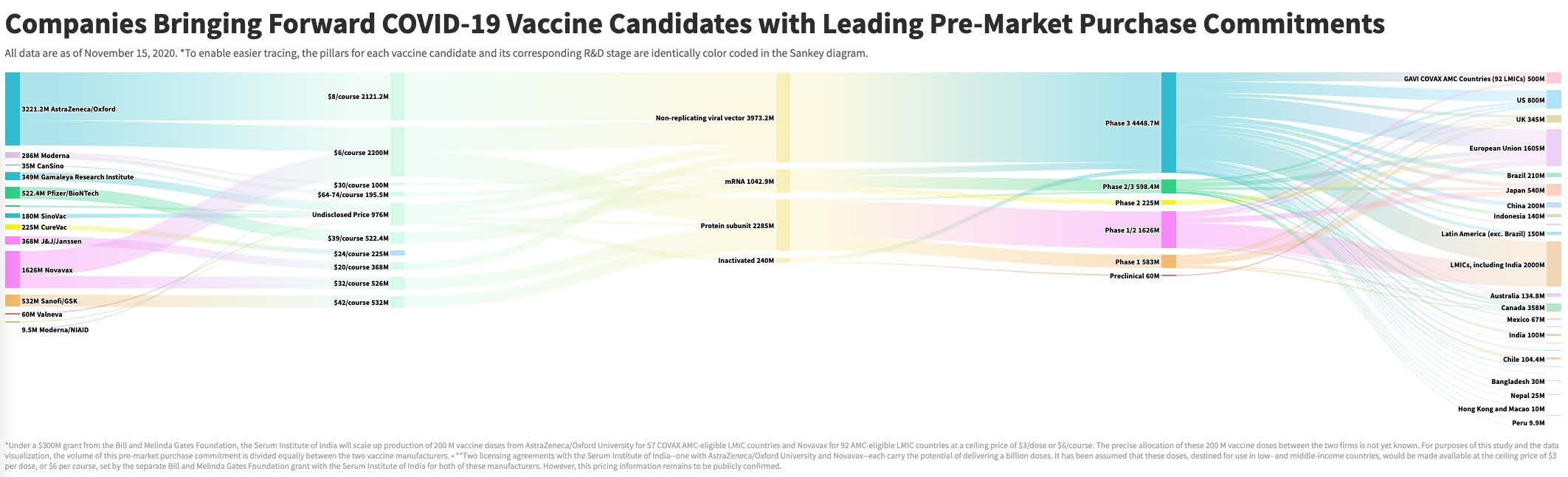
This Sankey diagram maps the flows of publicly known, COVID-19 vaccines pre-market purchase commitments from those who have reserved them, the vaccine manufacturers supplying these doses, the tiered pricing of these vaccine doses, and their potential recipient countries. The full interactive version can be found at <https://www.ignitetheidea.org/covid-reservedvaccines>. This visualization was made using [Flourish](https://flourish.studio/).

Notes:

1. Under a $300M grant from the Bill and Melinda Gates Foundation, the Serum Institute of India will scale up production of 200 M vaccine doses from AstraZeneca/Oxford University for 57 COVAX AMC-eligible LMIC countries and Novavax for 92 AMC-eligible LMIC countries at a ceiling price of $3/dose or $6/course. The precise allocation of these 200 M vaccine doses between the two firms is not yet known. For purposes of this study and the data visualization, the volume of this pre-market purchase commitment is divided equally between the two vaccine manufacturers.
2. Two licensing agreements with the Serum Institute of India--one with AstraZeneca/Oxford University and Novavax--each carry the potential of delivering a billion doses. It has been assumed that these doses, destined for use in low- and middle-income countries, would be made available at the ceiling price of $3 per dose, or $6 per course, set by the separate Bill and Melinda Gates Foundation grant with the Serum Institute of India for both of these manufacturers. However, this pricing information remains to be publicly confirmed.
3. Only publicly disclosed deals are visualized in this diagram; however, the vaccine price is not always known. These are labeled as “Undisclosed Price in the third pillar of the Sankey diagram.
4. The European Inclusive Vaccines Alliance, comprised of France, Italy, Germany and the Netherlands, has secured COVID-19 vaccines for countries in the European Union and beyond. In this data visualization, it is assumed that its pre-market purchase commitments will go to the European Union.

**Figure S2.** Companies bringing forward COVID-19 vaccine candidates

with leading pre-market purchase commitments



This Sankey diagram maps the flows of publicly known, COVID-19 vaccines pre-market purchase commitments from companies with leading pre-market purchase commitments. The full interactive version can be found at <https://www.ignitetheidea.org/covid-reservedvaccines>. This visualization was made using [Flourish](https://flourish.studio/).

Notes:

1. Under a $300M grant from the Bill and Melinda Gates Foundation, the Serum Institute of India will scale up production of 200 M vaccine doses from AstraZeneca/Oxford University for 57 COVAX AMC-eligible LMIC countries and Novavax for 92 AMC-eligible LMIC countries at a ceiling price of $3/dose or $6/course. The precise allocation of these 200 M vaccine doses between the two firms is not yet known. For purposes of this study and the data visualization, the volume of this pre-market purchase commitment is divided equally between the two vaccine manufacturers.
2. Two licensing agreements with the Serum Institute of India--one with AstraZeneca/Oxford University and Novavax--each carry the potential of delivering a billion doses. It has been assumed that these doses, destined for use in low- and middle-income countries, would be made available at the ceiling price of $3 per dose, or $6 per course, set by the separate Bill and Melinda Gates Foundation grant with the Serum Institute of India for both of these manufacturers. However, this pricing information remains to be publicly confirmed.
3. Only publicly disclosed deals are visualized in this diagram; however, the vaccine price is not always known. These are labeled as “Undisclosed Price in the third pillar of the Sankey diagram.

Table S1. COVID-19 Vaccines: Key Characteristics of

Pre-Market Purchase Commitments

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Vaccine Company | R&D Phase | Vaccine Platform | Pricing | Procurement Agent | Recipient Country | Doses Reserved | Intermediary |
| AstraZeneca/Oxford\* | Phase 2/31 | Non-replicating viral vector1 | $8/course2 \*\*\* | U.S. Government3,4 | U.S.3,4 | 300 million3,4 |  |
|  |  |  | $8/course\*\*\* | UK Government79,5,6 | UK79,5,6 | 100 million79,5,6 |  |
|  |  |  | $8/course\*\*\* | Europe Inclusive Vaccines Alliance (IVA)7,8 \*\* | European Union7,8 | 300 million7,8 |  |
|  |  |  | $8/course\*\*\* | European Union9,10,11 | European Union9,10,11 | 300 million9,10,11 |  |
|  |  |  | $8/course\*\*\* | Japanese Government12 | Japan12 | 120 million12 |  |
|  |  |  | $8/course\*\*\* | Canadian Government13,28 | Canada13,28 | 20 million13,28 |  |
|  |  |  | $8/course\*\*\* | Australian Government14 | Australia14 | 33.8 million14 | CSL14 |
|  |  |  | $8/course\*\*\* | Brazilian Government15 | Brazil15 | 100 million15 | Oswaldo Cruz Foundation15 |
|  |  |  | $8/course\*\*\* | Chinese Government16 | China16 | 200 million16 | Shenzhen Kangtai Biological Products16 |
|  |  |  | $8/course\*\*\* | Mexican/Argentina Government17 | Latin America (excluding Brazil)17 | 150 million17 | mAbxience (INSUD Group)17 |
|  |  |  | $8/course\*\*\* | Indonesian Government56 | Indonesia56 | 100 million56 |  |
|  |  |  | $8/course\*\*\* | Egyptian Government57,92 | Egypt57,92 | 30 million57,92 | Vaccira57 |
|  |  |  | $8/course\*\*\* | Costa Rica Government90 | Costa Rica90 | 1 million90 |  |
|  |  |  | $8/course\*\*\* | Argentina Government91 | Argentina91 | 22 million91 |  |
|  |  |  | $8/course\*\*\* | Chile Government93 | Chile93 | 14.4 million93 |  |
|  |  |  | $8/course\*\*\* | Bangladesh Government94 | Bangladesh94 | 30 million94 | Beximco Pharmaceuticals |
|  |  |  | $6/course20 | Gates Foundation18,19,20 | GAVI COVAX AMC Countries18,19,20 | 200 million split between AZ/Oxford and Novavax18,19,20 | Serum Institute of India18,19,20 |
|  |  |  | $6/course21 | COVAX Facility AMC21,22 | GAVI COVAX AMC Countries21,22 | 300 million21,22 |  |
|  |  |  | $6/course22\*\*\*\* | -- | LMICs, some doses to India22,23\*\*\*\* | 1 billion22 | Serum Institute of India22 |
| Gamaleya Research Institute | Phase 31 | Non-replicating viral vector1 | Undisclosed | Russian Government54 | Russia54 | 30 million54 |  |
|  |  |  | Undisclosed | Indian Government68, 54 | India68, 54 | 100 million68, 54 | Dr. Reddy’s Laboratories61 |
|  |  |  | Undisclosed | Brazilian Government68, 54 | Brazil68, 54 | 50 million68, 54 |  |
|  |  |  | Undisclosed | Mexican Government68, 61 | Mexico68, 61 | 32 million68, 61 | Landsteiner Scientific61 |
|  |  |  | Undisclosed | Uzbekistan Government68, 61 | Uzbekistan68, 61 | 35 million68, 61 | Laxisam61 |
|  |  |  | Undisclosed | Vietnamese Government55 | Vietnam55 † | 50-150 million55 |  |
|  |  |  | Undisclosed | Kazakhstan Government82 | Kazakhstan82 | 2 million81 |  |
|  |  |  | Undisclosed | Nepal Government83 | Nepal83 | 25 million83 |  |
|  |  |  | Undisclosed | Egyptian Government84 | Egypt84 | 25 million84 |  |
| Moderna | Phase 31 | mRNA1 | $30/course24 | U.S. Government80,25 | U.S.80,25 | 100 million80,25 |  |
|  |  |  | $64-74/course2,40 | European Union26 | European Union26 | 80 million26 |  |
|  |  |  | $64-74/course2,40 | Japanese Government27 | Japan27 | 50 million63 | Takeda Pharmaceutical27 |
|  |  |  | $64-74/course2,40 | Canadian Government28 | Canada28 | 56 million28 |  |
|  |  |  | $64-74/course2,40 | Switzerland70 | Switzerland70 | 4.5 million70 |  |
|  |  |  | $64-74/course2,40 | United Kingdom76,77 | United Kingdom76,77 | 5 million77 |  |
| SinoVac | Phase 31 | Inactivated1 | Undisclosed | Brazilian Government29 | Brazil29 | 60 million29 |  |
|  |  |  | Undisclosed | Indonesian Government74,30 | Indonesia74,30 | 40 million74,30 |  |
|  |  |  | Undisclosed | Chile Government66 | Chile66 | 20 million66 |  |
| Pfizer/BioNTech | Phase 2/31 | mRNA1 | $39/course31,40 | U.S. Government32 | U.S.32 | 100 million32 |  |
|  |  |  | $39/course31,40 | UK Government79,33 | UK79,33 | 30 million79,33 |  |
|  |  |  | $36.68/course67 | European Union34 | European Union34 | 200 million34 |  |
|  |  |  | $39/course31,40 | Japanese Government12,35 | Japan12,35 | 120 million12,35 |  |
|  |  |  | $39/course31,40 | Canadian Government28,36 | Canada28,36 | 20 million28,36 |  |
|  |  |  | $39/course31,40 | Hong Kong and Macao Government71 | Hong Kong and Macao71 | 10 million71 |  |
|  |  |  | $39/course31,40 | Australian Government85 | Australia85 | 10 million85 |  |
|  |  |  | $39/course31,40 | Israeli Government87 | Israel87 | 8 million87 |  |
|  |  |  | $39/course31,40 | Peru Government88 | Peru88 | 9.9 million88 |  |
|  |  |  | $39/course31,40 | New Zealand Government89 | New Zealand89 | 1.5 million89 |  |
|  |  |  | $39/course31,40 | Costa Rica Government90 | Costa Rica90 | 3 million90 |  |
|  |  |  | $39/course31,40 | Chile Government93 | Chile93 | 10 million93 |  |
| Johnson & Johnson/  Janssen‡ | Phase 31 | Non-replicating viral vector1 | $20/course2,40 | U.S. Government37 | U.S.37 | 100 million37 |  |
|  |  |  | $20/course2,40 | UK Government78,38,39 | UK78,38,39 | 30 million78,38,39 |  |
|  |  |  | $20/course2,40 | European Union41 | European Union41 | 200 million41 |  |
|  |  |  | $20/course2,40 | Canadian Government28,42 | Canada28,42 | 38 million28,42 |  |
| Novavax | Phase 31 | Protein subunit1 | $32/course40 | U.S. Government43 | U.S.43 | 100 million43 |  |
|  |  |  | $32/course40 | UK Government78,38,39 | UK78,38,39 | 60 million78,38,39 |  |
|  |  |  | $32/course40 | Japanese Government12,44,45 | Japan12,44,45 | 250 million12,44,45 | Takeda Pharmaceutical |
|  |  |  | $32/course40 | Canadian Government28,42 | Canada28,42 | 76 million28,42 |  |
|  |  |  | $32/course40 | Australian Government60 | Australia60 | 40 million60 |  |
|  |  |  | $6/course20 | -- | LMICs, some doses to India58,59 \*\*\*\* | 1 billion58,59 | Serum Institute of India58,59 |
|  |  |  | $6/course20 | Gates Foundation18,19,20 | GAVI COVAX AMC Countries18,19,20 | 200 million split between AZ/Oxford and Novavax18,19,20 | Serum Institute of India18,19,20 |
| CanSino**‡** | Phase 31 | Non-replicating viral vector1 | Undisclosed | Mexican Government72,64 | Mexico72,64 | 35 million72,64 |  |
| Medicago | Phase 2/31 | Protein subunit1 | Undisclosed | Canadian Government65 | Canada65 | 76 million65 |  |
| Sanofi/GSK | Phase 1/21 | Protein subunit1 | $42/course46 | U.S. Government47 | U.S.47 | 100 million47 |  |
|  |  |  | $42/course46 | UK Government77,48 | UK77,48 | 60 million77,48 |  |
|  |  |  | $42/course46 | European Union49 | European Union49 | 300 million49 |  |
|  |  |  | $42/course46 | Canadian Government28,50 | Canada28,50 | 72 million28,50 |  |
| CureVac | Phase 21 | mRNA1 | $23.68/course67 | European Union51 | European Union51 | 225 million51 |  |
| University of Queensland/CSL | Phase 11 | Protein subunit1 | Undisclosed | Australian Government73,14 | Australia73,14 | 51 million73,14 |  |
| Valneva | Preclinical1 | Inactivated1 | Undisclosed | UK Government69,52,53 | UK69,52,53 | 60 million69,62,52,53 |  |

Note: All data are updated as of November 15, 2020.

\*On November 23, 2020, AstraZeneca/Oxford published clinical results showing 90% efficacy when their vaccine candidate was given as a half dose, followed by a full dose at least one month apart. However, as more data are needed to support this dosing regimen, two doses per course were assumed for this vaccine for all calculations in this study. [Source: AstraZeneca. “AZD1222 vaccine met primary efficacy endpoint in preventing COVID-19.” Press release, November 23, 2020. Available at: <https://www.astrazeneca.com/media-centre/press-releases/2020/azd1222hlr.html>.]

\*\* The European Inclusive Vaccines Alliance brings together France, Italy, Germany and the Netherlands in a partnership to secure enough COVID-19 vaccines for countries in the European Union and beyond. [Source: Government of the Netherlands. “France, Germany, Italy and the Netherlands working together to find a vaccine for countries in Europe and beyond.” Press release, June 3, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-vaccines-price/eu-governments-to-pay-750-million-euros-for300-million-doses-of-astrazeneca-vaccine-italy-idUSKBN23M1F0>.]

\*\*\*Based on the announced U.S. deal with AstraZeneca to provide 300 million doses for $1.2 billion, the per dose price of the AstraZeneca/Oxford University vaccine for the United States has been implicitly estimated at $4 per dose, or $8 per course [Loftus P, Covid-19 Vaccine Makers Signal Prices. *Wall Street Journal*, August 5, 2020. Available at: <https://www.wsj.com/articles/covid-19-vaccine-makers-signal-prices-11596648639>]. It has also been reported that the AstraZeneca/Oxford University vaccine is priced at about $3-$4 per dose [Mancini DP, AstraZeneca vaccine document shows limit of no-profit pledge. *Financial Times*, October 7, 2020. Available at: <https://www.ft.com/content/c474f9e1-8807-4e57-9c79-6f4af145b686>]. For purposes of the Sankey diagram visualization and Table S1, apart from the doses provided through the Serum Institute under the Bill and Melinda Gates Foundation or through the COVAX Facility, the per dose cost for the AstraZeneca/Oxford University vaccine has been assumed to be $4 per dose, or $8 per course.

\*\*\*\* Both AstraZeneca/Oxford University and Novavax have signed licensing agreements to scale production of their respective vaccines through the Serum Institute of India. Each of these licensing agreements comes to 1 billion doses. While these deals are not pre-market purchase commitments signed at a specific price, these deals were included here because they are signed agreements. It has been assumed that these doses, destined for use in low- and middle-income countries, would be made available at the ceiling price of $3 per dose, or $6 per course, set by the separate Bill and Melinda Gates Foundation grant with the Serum Institute of India for both of these manufacturers. However, this pricing information remains to be publicly confirmed.

†Vietnam reached a commitment for 50-150 million doses from the Gamaleya Research Institute. For calculations of vaccine doses per capita and manufacturing capacity calculations, the lower limit (i.e., 50 million) was used; however, the full range is listed here.

‡ The CanSino vaccine plans a one-dose per course regimen. The Johnson & Johnson/Janssen vaccine candidate is currently in trials as a one- OR two-dose course. For all calculations, two doses per course were assumed for the Johnson & Johnson/Janssen vaccine.

\*\*\*\* Both AstraZeneca/Oxford University and Novavax have signed licensing agreements to scale production of their respective vaccines through the Serum Institute of India. Each of these licensing agreements comes to 1 billion doses. While these deals are not pre-market purchase commitments signed at a specific price, these deals were included here because they are signed agreements. It has been assumed that these doses, References:

[1] World Health Organization. “DRAFT landscape of COVID-19 candidate vaccines,” November 12, 2020. Available at: <https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines>.

[2] The Wall Street Journal. Vaccine Makers Signal Prices, August 5, 2020. Available at: <https://www.wsj.com/articles/covid-19-vaccine-makers-signal-prices-11596648639>.

[3] U.S. Department of Health & Human Services. Trump Administration’s Operation Warp Speed Accelerates AstraZeneca COVID-19 Vaccine to be Available Beginning in October, May 21, 2020. Available at: <https://www.hhs.gov/about/news/2020/05/21/trump-administration-accelerates-astrazeneca-covid-19-vaccine-to-be-available-beginning-in-october.html>.

[4] Reuters. U.S. secures 300 million doses of potential AstraZeneca COVID-19 vaccine, May 21, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-astrazeneca/us-secures-300-million-doses-of-potential-astrazeneca-covid-19-vaccine-idUSKBN22X0J9>.

[5] FiercePharma. With AstraZeneca deal, Wockhardt joins U.K.'s coronavirus vaccine manufacturing push, August 4, 2020. Available at: <https://www.fiercepharma.com/manufacturing/az-taps-indian-pharma-wockhardt-for-u-k-shot-finishing>.

[6] Fortune. AstraZeneca aims for 30 million doses of COVID-19 vaccine by September, May 18, 2020. Available at:

<https://fortune.com/2020/05/18/astrazeneca-vaccine-doses-september-covid19/>.

[7] AstraZeneca. AstraZeneca to supply Europe with up to 400 million doses of Oxford University’s vaccine at no profit, June 13, 2020. Available at: <https://www.astrazeneca.com/media-centre/press-releases/2020/astrazeneca-to-supply-europe-with-up-to-400-million-doses-of-oxford-universitys-vaccine-at-no-profit.html>.

[8] Reuters. EU governments to pay 750 million euros for 300 million doses of AstraZeneca vaccine: Italy, June 15, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-vaccines-price/eu-governments-to-pay-750-million-euros-for-300-million-doses-of-astrazeneca-vaccine-italy-idUSKBN23M1F0>.

[9] European Commission. Coronavirus: Commission reaches first agreement on a potential vaccine, August 14, 2020. Available at: <https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1438>.

[10] European Commission. Coronavirus vaccines strategy. Available at: <https://ec.europa.eu/info/live-work-travel-eu/health/coronavirus-response/public-health/coronavirus-vaccines-strategy_en>.

[11] AstraZeneca. AstraZeneca concludes agreement with the European Commission for the supply of up to 400 million doses of AZD1222 COVID-19 vaccine, August 14, 2020. Available at: <https://www.astrazeneca.com/content/astraz/media-centre/press-releases/2020/astrazeneca-concludes-agreement-with-the-european-commission-for-the-supply-of-up-to-400-million-doses-of-azd1222-covid-19-vaccine.html>.

[12] Reuters. Japan in deals with AstraZeneca, Novavax for COVID-19 vaccines, August 7, 2020. Available at: <https://uk.reuters.com/article/uk-health-coronavirus-japan-astrazeneca/japan-in-deals-with-astrazeneca-novavax-for-covid-19-vaccines-idUKKCN2531EY>.

[13] Reuters. Canada joins countries in real-time AstraZeneca COVID vaccine review, October 2, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-canada-astrazeneca/canada-joins-countries-in-real-time-astrazeneca-covid-vaccine-review-idUSKBN26N2CA>.

[14] Reuters. Australia to receive first batch of AstraZeneca COVID-19 vaccine in Jan 2021 – PM to say, September 15, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-australia-idUSKBN25X0HU>.

[15] FiercePharma. AstraZeneca bumps up vaccine deal with Brazil to $360M with more doses, licensing rights, August 11, 2020. <https://www.fiercepharma.com/manufacturing/astrazeneca-bumps-up-vaccine-deal-brazil-to-360m-more-doses-licensing-rights>.

[16] FiercePharma. AstraZeneca takes COVID-19 vaccine to China with BioKangtai deal for 200M-dose capacity by 2021, August 6, 2020. Available at: <https://www.fiercepharma.com/manufacturing/astrazeneca-takes-covid-19-vaccine-to-china-biokangtai-deal-for-200m-dose-capacity-by>.

[17] Reuters. Argentina, Mexico to produce AstraZeneca COVID-19 vaccine, August 12, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-argentina-vaccine/argentina-and-mexico-to-produce-astrazeneca-covid-19-vaccine-idUSKCN25903P>.

[18] Gavi, the Vaccine Alliance. New collaboration makes further 100 million doses of COVID-19 vaccine available to low- and middle-income countries. Available at: <https://www.gavi.org/news/media-room/new-collaboration-makes-further-100-million-doses-covid-19-vaccine-available-low>.

[19] Gavi, the Vaccine Alliance. Up to 100 million COVID-19 vaccine doses to be made available for low- and middle-income countries as early as 2021. Available at: <https://www.gavi.org/news/media-room/100-million-covid-19-vaccine-doses-available-low-and-middle-income-countries-2021>.

[20] Vox. Bill Gates is spending $150 million to try to make a coronavirus vaccine as cheap as $3, August 8, 2020. Available at: <https://www.vox.com/recode/2020/8/8/21359227/bill-gates-foundation-coronavirus-vaccine-serum-astrazeneca-novavax>.

[21] Gavi, the Vaccine Alliance. Gavi launches innovative financing mechanism for access to COVID-19 vaccines. Available at: <https://www.gavi.org/news/media-room/gavi-launches-innovative-financing-mechanism-access-covid-19-vaccines>.

[22] AstraZeneca. AstraZeneca takes next steps towards broad and equitable access to Oxford University’s COVID-19 vaccine, June 4, 2020. Available at: <https://www.astrazeneca.com/content/astraz/media-centre/press-releases/2020/astrazeneca-takes-next-steps-towards-broad-and-equitable-access-to-oxford-universitys-covid-19-vaccine.html>.

[23] Bloomberg Businessweek. The World’s Best Hope for Enough Covid-19 Vaccine Comes from India, August 11, 2020. Available at: <https://www.bloomberg.com/features/2020-covid-vaccine-serum-india/>.

[24] Biopharma-Reporter. Moderna lands US COVID-19 vaccine contract worth up to $8bn, August 13, 2020. Available at: <https://www.biopharma-reporter.com/Article/2020/08/13/Moderna-lands-US-COVID-19-vaccine-contract-worth-up-to-8bn>.

[25] Aljazeera. US in $1.5bn deal with Moderna for potential coronavirus vaccine, August 12, 2020. Available at: <https://www.aljazeera.com/economy/2020/08/12/us-in-1-5bn-deal-with-moderna-for-potential-coronavirus-vaccine/>.

[26] European Commission. Coronavirus: Commission expands talks to a fifth vaccine manufacturer, August 24, 2020. Available at: <https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1513>.

[27] Moderna. Moderna Confirms Discussions with the Ministry of Health, Labour and Welfare to Supply Japan with 40 Million Doses of mRNA Vaccine Against COVID-19 (mRNA-1273), August 28, 2020. Available at: <https://investors.modernatx.com/news-releases/news-release-details/moderna-confirms-discussions-ministry-health-labour-and-welfare?utm_campaign=pharmalittle&utm_medium=email&_hsmi=94133261&_hsenc=p2ANqtz--uHtPes9ZpBPBnBqBP1k5ezOUnRU_K5b_byX9TpNdkyaRB8HfBhwHjiCnG3NI1-HmvTbJ62YRpkRCuQbdbWc_mCoZTYQ&utm_content=94133261&utm_source=hs_email>.

[28] CBC News. A closer look at the vaccines Canada is betting on to stem the spread of COVID-19, September 23, 2020. Available at: <https://www.cbc.ca/news/health/covid-vaccines-canada-profiles-1.5708240>.

[29] Reuters. Brazil, hotbed for COVID-19 vaccine testing, may struggle to produce its own, August 4, 2020. Available at:

<https://www.reuters.com/article/us-health-coronavirus-brazil-vaccine-ana/brazil-hotbed-for-covid-19-vaccine-testing-may-struggle-to-produce-its-own-idUSKCN25028L>.

[30] BusinessWire. Sinovac Signs Agreement with Bio Farma Indonesia for COVID-19 Vaccine Cooperation, August 25, 2020. Available at: <https://www.businesswire.com/news/home/20200825005451/en/Sinovac-Signs-Agreement-Bio-Farma-Indonesia-COVID-19>.

[31] FiercePharma. Pfizer, BioNTech's U.S. supply deal price tag leaves room for 'decent' profit on COVID-19 shot: analyst, July 23, 2020. Available at:<https://www.fiercepharma.com/pharma/pfizer-biontech-s-u-s-supply-deal-price-tag-leaves-room-for-decent-profit-covid-19-shot>.

[32] Pfizer. Pfizer and BioNTech announce an agreement with U.S. government for up to 600 million doses of mRNA-based vaccine candidate against SARS-CoV-2, July 22, 2020. Available at: <https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-announce-agreement-us-government-600>.

[33] Pfizer. Pfizer and BioNTech announce agreement with the United Kingdom for 30 million doses of mRNA-based vaccine candidate against SARS-CoV-2, July 20, 2020. Available at: <https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-announce-agreement-united-kingdom-30>.

[34] Pfizer. Pfizer and BioNTech to potentially supply the EU with 200 million doses of mRNA-based vaccine candidates against SARS-CoV-2, September 9, 2020. Available at: <https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-potentially-supply-eu-200-million-doses>.

[35] Pfizer. Pfizer and BioNTech to supply Japan with 120 million doses of their BNT162 mRNA-based vaccine candidate, July 31, 2020. Available at: <https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-supply-japan-120-million-doses-their>.

[36] Pfizer. Pfizer and BioNTech to supply Canada with their BNT162 mRNA-based vaccine candidate, August 5, 2020. Available at: <https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-supply-canada-their-bnt162-mrna-based>.

[37] Johnson & Johnson. Johnson & Johnson Announces Agreement with U.S. Government for 100 Million Doses of Investigational COVID-19 Vaccine, August 5, 2020. Available at: <https://www.jnj.com/johnson-johnson-announces-agreement-with-u-s-government-for-100-million-doses-of-investigational-covid-19-vaccine>.

[38] FiercePharma. U.K. books COVID-19 vaccine doses from J&J and Novavax and backs new clinical trials, August 14, 2020. Available at: <https://www.fiercepharma.com/pharma/uk-books-90m-covid-19-vaccine-doses-from-j-j-and-novavax-and-backs-new-clinical-trials>.

[39] The Wall Street Journal. Novavax, J&J Ink Covid-19 Vaccine Deals with U.K. for Tens of Millions of Doses, August 14, 2020. Available at: <https://www.wsj.com/articles/novavax-inks-covid-19-vaccine-deal-with-u-k-for-60-million-doses-11597381320>.

[40] Observer. Here’s How Much COVID-19 Vaccines Will Cost From the 5 Frontrunners, August 5, 2020. Available at: <https://observer.com/2020/08/covid19-vaccine-price-comparison-moderna-pfizer-novavax-johnson-astrazeneca/>.

[41] European Commission. Coronavirus: Commission concludes further talks to secure future vaccine, August 13, 2020. Available at: <https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1481>.

[42] Reuters. Canada wants to be at 'front of line' for coronavirus vaccines, signs deals with Novavax and Johnson & Johnson, August 31, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-novavax-canada/canada-wants-to-be-at-front-of-line-for-coronavirus-vaccines-signs-deals-with-novavax-and-johnson-johnson-idUSKBN25R1SX>.

[43] Novavax. Novavax Announces $1.6 Billion Funding from Operation Warp Speed, July 7, 2020. Available at: <https://ir.novavax.com/news-releases/news-release-details/novavax-announces-16-billion-funding-operation-warp-speed>.

[44] Takeda. Novavax and Takeda Announce Collaboration for Novavax’ COVID-19 Vaccine Candidate in Japan, August 7, 2020. Available at: <https://www.takeda.com/newsroom/newsreleases/2020/novavax-and-takeda-announce-collaboration-for-novavax-covid-19-vaccine-candidate-in-japan/>.

[45] Reuters. Takeda to make Novavax’s COVID-19 vaccine candidate in Japan, August 7, 2020. Available at: <https://www.reuters.com/article/us-health-coroanvirus-novavax-takeda-pha/takeda-to-make-novavaxs-covid-19-vaccine-candidate-in-japan-idUSKCN2531DU>.

[46] Reuters. U.S. to pay $2.1 billion to Sanofi, GSK, in COVID-19 vaccine deal, July 31, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-vaccine/u-s-to-pay-2-1-billion-to-sanofi-gsk-in-covid-19-vaccine-deal-idUSKCN24W1PB>.

[47] GSK. Sanofi and GSK selected for Operation Warp Speed to supply United States Government with 100 million doses of COVID-19 vaccine, July 31, 2020. Available at: <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/>.

[48] GSK. Sanofi and GSK agree with the UK government to supply up to 60 million doses of COVID-19 vaccine, July 29, 2020. Available at: <https://www.gsk.com/en-gb/media/press-releases/sanofi-and-gsk-agree-with-the-uk-government-to-supply-up-to-60-million-doses-of-covid-19-vaccine/>.

[49] European Commission. Coronavirus: Commission concludes talks to secure future coronavirus vaccine for Europeans, July 31, 2020. Available at: <https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1439>.

[50] GSK. Sanofi and GSK sign agreements with the Government of Canada to supply up to 72 million doses of adjuvanted COVID-19 vaccine, September 22, 2020. Available at: <https://www.gsk.com/en-gb/media/press-releases/sanofi-and-gsk-sign-agreements-with-the-government-of-canada-to-supply-up-to-72-million-doses-of-adjuvanted-covid-19-vaccine/>.

[51] European Commission. Coronavirus: Commission continues expanding future vaccines portfolio with new talks, August 20, 2020. Available at: <https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1494>.

[52] Valneva. Valneva confirms participation in UK government COVID-19 vaccine response program, July 20, 2020. Available at: <https://valneva.com/press-release/valneva-confirms-participation-in-uk-government-covid-19-vaccine-response-program/>.

[53] FiercePharma. Niche vaccine player Valneva, U.K. tie up in coronavirus R&D and manufacturing deal, July 20, 2020. Available at: <https://www.fiercepharma.com/vaccines/valneva-united-kingdom-tie-up-covid-19-vaccine-r-d-and-manufacturing-deal>

[54] Wall Street Journal. Russia strikes deals to sell its coronavirus vaccine internationally, September 20, 2020. Available at: <https://www.wsj.com/articles/russia-strikes-deals-to-sell-its-coronavirus-vaccine-internationally-11600610554>.

[55] Reuters. Vietnam to buy Russian COVID-19 vaccine, August 14, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-vietnam-vaccine/vietnam-to-buy-russian-covid-19-vaccine-idUSKCN25A0M0>.

[56] Reuters. Astrazeneca to provide Indonesia 100 million COVID-19 vaccines next year- foreign minister, October 14, 2020. Available at: <https://nationalpost.com/pmn/health-pmn/astrazeneca-to-provide-indonesia-100-million-covid-19-vaccines-next-year-foreign-minister>.

[57] Ibraham, Farah. Egypt Secures 30 million Doses of Oxford’s COVID-19 Vaccine. Cairo Scene, July 19, 2020. Available at: <https://cairoscene.com/Buzz/Egypt-Secures-30-Million-Doses-of-Oxford-s-COVID-19-Vaccine>.

[58] Novavax. Novavax announces COVID-19 vaccine manufacturing agreement with Serum Institute of India, increasing Novavax’ global production capacity to over 2 billion doses annually, September 15, 2020. Available at: <https://ir.novavax.com/news-releases/news-release-details/novavax-announces-covid-19-vaccine-manufacturing-agreement-serum>.

[59] Keown, Alex. Novavax and SIPL to develop 1 billion COVID-19 vaccine doses for India, other countries. BioSpace, August 7, 2020. Available at: <https://www.biospace.com/article/novavax-strikes-covid-19-vaccine-collaboration-with-india-s-sipl/>.

[60] Novavax. Novavax and Commonwealth of Australia announce agreement in principle for acquisition of Novavax COVID-19 vaccine, November 4, 2020. Available at: <https://ir.novavax.com/news-releases/news-release-details/novavax-and-commonwealth-australia-announce-agreement-principle>.

[61] Reuters. FACTBOX-Russia strikes global deals to make, sell coronavirus vaccine, October 2, 2020. Available at: <https://www.reuters.com/article/health-coronavirus-russia-vaccine/factbox-russia-strikes-global-deals-to-make-sell-coronavirus-vaccine-idUSL4N2GS24X>.

[62] Valneva. Valneva announces major COVID-19 vaccine partnership with U.K. government, September 14, 2020. Available at: <https://valneva.com/press-release/valneva-announces-major-covid-19-vaccine-partnership-with-u-k-government/>.

[63] Takeda. Takeda expands COVID-19 vaccine supply in Japan through partnership with Moderna and Government of Japan, October 29, 2020. Available at: <https://www.takeda.com/newsroom/newsreleases/2020/takeda-expands-covid-19-vaccine-supply-in-japan-through--partnership-with-moderna-and-government-of-japan/>.

[64] Harrup, Anthony. Mexico signs agreements to buy potential COVID-19 vaccines. The Wall Street Journal, October 13, 2020. Available at: <https://www.wsj.com/articles/mexico-signs-agreements-to-buy-potential-covid-19-vaccines-11602607544>.

[65] Medicago. Medicago signs agreements with the government of Canada to supply up to 76 million doses of its recombinant plant-derived COVID-19 vaccine, October 23, 2020. Available at: <https://www.medicago.com/en/newsroom/medicago-signs-agreements-with-the-government-of-canada-to-supply-up-to-76-million-doses-of-its-recombinant-plant-derived-covid-19-vaccine/>.

[66] Laing, Aislinn. CORRECTED (OFFICIAL)-Chilean president hails Pfizer success, and his country’s vaccine purchase agreement. Reuters, November 9, 2020. Available at: <https://www.reuters.com/article/health-coronavirus-chile-pfizer/corrected-chilean-president-hails-pfizer-success-and-his-countrys-vaccine-purchase-agreement-idUSL1N2HV1WD>.

[67] Guarascio, Francesco. Exclusive: EU could pay over $10 billion for Pfizer and CureVac vaccines – source. Reuters, November 20, 2020. Available at: <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>.

[68] Sputnik V. RDIF and Laxisam agree to supply up to 35 million doses of Sputnik V vaccine to Uzbekistan, Septeber 25, 2020. Available at: <https://sputnikvaccine.com/newsroom/pressreleases/rdif-and-laxisam-agree-to-supply-up-to-35-million-doses-of-sputnik-v-vaccine-to-uzbekistan/>.

[69] UK Government. UK government invests in Livingston facility to bolster vaccine manufacturing capacity. Press release, August 5, 2020. Available at: <https://www.gov.uk/government/news/uk-government-invests-in-livingston-facility-to-bolster-vaccine-manufacturing-capacity>.

[70] Moderna. Moderna announces first commercial organization outside North America in Switzerland. Press release, September 16, 2020. Available at: <https://investors.modernatx.com/news-releases/news-release-details/moderna-announces-first-commercial-organization-outside-north>.

[71] FosunPharma. BioNTech and Fosun Pharma to potentially supply 10 million doses of BioNTech’s BNT162 mRNA-based vaccine candidate against SARS-CoV-2 to Hong Kong SAR and Macao SAR. Press release, August 28, 2020. Available at: <https://www.fosunpharma.com/en/news/news-details-3813.html>.

[72] CanSinoBIO. CanSinoBIO announces a supply agreement with Mexico on the advance purchase for COVID-19 vaccine. Press release, October 2020. Available at: <http://www.cansinotech.com/html/1///179/180/556.html>.

[73] CSL. CSL finalizes agreement to supply 51 million doses of UQ COVID-19 vaccine candidate to Australia. Press release, October 8, 2020. Available at: <https://www.csl.com/news/2020/20201008-csl-finalises-agreement-to-supply-51mil-doses-of-uq-covid19-vaccine>.

[74] SinoVac. Sinovac signs agreement with Bio Farma Indonesia for COVID-19 vaccine cooperation. Press release, August 25, 2020. Available at: <http://www.sinovac.com/?optionid=754&auto_id=908>.

[75] Government of Chile. Government meets with Sinovac for first COVID-19 vaccine clinical trial in Chile. Press release, October 13, 2020. Available at: <https://www.gob.cl/en/news/government-meets-sinovac-first-covid-19-vaccine-clinical-trial-chile/>.

[76] UK Government. Government secures 5 million doses of Moderna vaccine. Press release, November 16, 2020. Available at: <https://www.gov.uk/government/news/government-secures-5-million-doses-of-moderna-vaccine>.

[77] UK Government. Government further boosts chances of UK receiving COVID-19 vaccine. Press release, July 29, 2020. Available at: <https://www.gov.uk/government/news/government-further-boosts-chances-of-uk-receiving-covid-19-vaccine>.

[78] UK Government. UK government secures new COVID-19 vaccines and backs global clinical trial. Press release, August 14, 2020. Available at: <https://www.gov.uk/government/news/uk-government-secures-new-covid-19-vaccines-and-backs-global-clinical-trial>.

[79] UK Government. Millions could be vaccinated against COVID-19 as UK secures strong portfolio of promising vaccines. Press release, July 20, 2020. Available at: <https://www.gov.uk/government/news/millions-could-be-vaccinated-against-covid-19-as-uk-secures-strong-portfolio-of-promising-vaccines>.

[80] Moderna. Moderna announces supply agreement with U.S. government for initial 100 million doses of mRNA vaccine against COVID-19 (mRNA-1273). Press release, August 11, 2020. Available at: <https://investors.modernatx.com/news-releases/news-release-details/moderna-announces-supply-agreement-us-government-initial-100>.

[81] Burki, Talha Khan. The Russian vaccine for COVID-19. *The Lancet*, 8:11; E85-E86. doi.org/10.1016/S2213-2600(20)30402-1.

[82] Russian Direct Investment Fund. RDIF and SK-Pharmacy agree to supply Sputnik V vaccine to Kazakhstan. Press release, August 26, 2020. Available at: <https://rdif.ru/Eng_fullNews/5705/>.

[83] Sputnik V. RDIF and Trinity Pharmaceuticals agree to supply 25 million doses of Sputnik V vaccine to Nepal. Press release, September 29, 2020. Available at: <https://sputnikvaccine.com/newsroom/pressreleases/rdif-and-trinity-pharmaceuticals-agree-to-supply-25-million-doses-of-sputnik-v-vaccine-to-nepal/>.

[84] Sputnik V. RDIF and Pharco agree to supply 25 million doses of Sputnik V vaccine to Egypt. Press release, September 30, 2020. Available at: <https://sputnikvaccine.com/newsroom/pressreleases/rdif-and-pharco-agree-to-supply-25-million-doses-of-sputnik-v-vaccine-to-egypt/>.

[85] Prime Minister of Australia. Australia secures a further 50 million doses of COVID-19 vaccine. Press release, November 5, 2020. Available at: <https://www.pm.gov.au/media/australia-secures-further-50-million-doses-covid-19-vaccine>.

[86] MercoPress. Chilean president pledges “sufficient and timely” access to Covid vaccines. November 9, 2020. Available at: <https://en.mercopress.com/2020/11/09/chilean-president-pledges-sufficient-and-timely-access-to-covid-vaccines>.

[87] Vella, Lauren. Israel contracted to buy enough Pfizer COVID-19 vaccine for 4 million people. The Hill, November 13, 2020. Available at: <https://thehill.com/policy/international/middle-east-north-africa/525865-israel-contracted-to-buy-enough-pfizer-covid-19>.

[88] Government of Peru. Pfizer y BioNTech suministrarán 9.9 millones de dosis de su vacuna candidate contra el COVID-19 al Perü. September 17, 2020. Available at: <https://www.gob.pe/institucion/rree/noticias/303072-pfizer-y-biontech-suministraran-9-9-millones-de-dosis-de-su-vacuna-candidata-contra-el-covid-19-al-peru>.

[89] Reuters. New Zealand signs deal with Pfizer, BioNTech for COVID-19 vaccine. Press release, October 11, 2020. Available at: <https://www.reuters.com/article/health-coronavirus-newzealand-int/new-zealand-signs-deal-with-pfizer-biontech-for-covid-19-vaccine-idUSKBN26X0AC>.

[90] TeleSUR. Costa Rica signs deal with AstraZeneca on COVID-19 vaccines. November 13, 2020. Available at: <https://www.telesurenglish.net/news/Costa-Rica-signs-deal-with-AstraZeneca-on-COVID-19-vaccines-20201113-0014.html>.

[91] Reuters. Argentina agrees deal for 22 million doses of AstraZeneca-Oxford COVID-19 vaccine. November 7, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-argentina-astrazen/argentina-agrees-deal-for-22-million-doses-of-astrazeneca-oxford-covid-19-vaccine-idUSKBN27N0UQ>.

[92] Egyptian Streets. In hopes of a coronavirus vaccine in Egypt: The details so far. August 8, 2020. Available at: <https://egyptianstreets.com/2020/08/08/in-hopes-of-a-coronavirus-vaccine-in-egypt-the-details-so-far/>.

[93] Laing, Aislinn. Chilean president says regulators okay AstraZeneca COVID vaccine trial. Reuters, November 4, 2020. Available at: <https://www.reuters.com/article/health-coronavirus-chile-vaccines/chilean-president-says-regulators-okay-astrazeneca-covid-vaccine-trial-idUSL1N2HQ37M>.

[94] Paul, Ruma. Bangladesh signs deal with India for 30 million doses of COVID-19 vaccine. Reuters, November 5, 2020. Available at: <https://www.reuters.com/article/us-health-coronavirus-bangladesh-india/bangladesh-signs-deal-with-india-for-30-million-doses-of-covid-19-vaccine-idUSKBN27L1CD>.

**Table S2.** Vaccine doses reserved in pre-market purchase commitments compared against country population and COVID-19 cases

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **COVID-19 cases1** | **Country Population2** | **Reserved Vaccine Doses3** |
| World | 54,296,615 | 7,674,000,000 | 7,481,100,000 |
| United States | 11,022,584 | 328,239,520 | 800,000,000 |
| United Kingdom | 1,372,884 | 66,834,400 | 345,000,000 |
| European Union | 9,256,496 | 447,512,040 | 1,605,000,000 |
| Japan | 118,601 | 126,264,930 | 540,000,000 |
| Canada | 299,246 | 37,589,260 | 358,000,000 |
| Australia | 27,711 | 25,364,310 | 134,800,000 |
| Brazil | 5,848,959 | 211,049,530 | 210,000,000 |
| Indonesia | 467,113 | 270,625,570 | 140,000,000 |

**Note:** All data are updated as of November 15, 2020.Data from this table were used to make the calculation that the United States has reserved 800M doses, but accounts for a fifth of all COVID-19 cases globally, while Japan, Australia, and Canada have collectively reserved more than 1B doses and do not account for even 1% of current global COVID-19 cases globally.

**References:**

[1] Johns Hopkins University COVID-19 Dashboard, as of November 15, 2020. Available at: <https://coronavirus.jhu.edu/map.html>

[2] 2019 World Bank Population, as of November 15, 2020. Available at: <https://data.worldbank.org/indicator/SP.POP.TOTL>

[3] The number of reserved vaccine doses represents the total from pre-market purchase commitments from the vaccine manufacturers, by country, identified in **Table S1.** COVID-19 Vaccines: Key Characteristics of Pre-Market Purchase Commitments.

Table S3. Per capita COVID-19 vaccine courses

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **Reserved Vaccine Courses1** | **Country Population2** | **Per Capita Reservations3 In Courses** |
| World | 3,740,550,000 | 7,674,000,000 | 0.49 |
| Canada | 179,000,000 | 37,589,260 | 4.76 |
| Australia | 67,400,000 | 25,364,310 | 2.66 |
| United Kingdom | 172,500,000 | 66,834,400 | 2.58 |
| Japan | 270,000,000 | 126,264,930 | 2.14 |
| European Union | 802,500,000 | 447,512,040 | 1.79 |
| United States | 400,000,000 | 328,239,520 | 1.22 |
| Brazil | 105,000,000 | 211,049,530 | 0.50 |
| Indonesia | 70,000,000 | 270,625,570 | 0.26 |

**Note**: All data are updated as of November 15, 2020. All of the vaccine candidates identified in Table 1 are undergoing clinical testing as two-dose courses, except CanSino which has a one-dose course regimen. Johnson & Johnson/Janssen is undergoing clinical testing for one-dose or two-dose course application, but in this analysis, is being counted as a two-dose per course regimen.

**References:**

[1] The number of reserved vaccine doses represents the total from pre-market purchase commitments from the vaccine manufacturers, by country, identified in **Table S1.** COVID-19 Vaccines: Key Characteristics of Pre-Market Purchase Commitments.

[2] 2019 World Bank Population, as of November 15, 2020. Available at: <https://data.worldbank.org/indicator/SP.POP.TOTL>

[3] Displayed in doses and calculated by the given formula:

Table S4. COVID-19 vaccine projected manufacturing capacity,

by company, by the end of 2021

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Projected Manufacturing Capacity by end of 2021 (in courses)** | **Reserved Courses1** | **Remaining Manufacturing Capacity (in courses)2** |
| AstraZeneca/Oxford\* | 1,500,000,0003 | 1,610,600,000 | -66,900,000 |
| Novavax | 1,000,000,0007 | 813,000,000 | 187,000,000 |
| Pfizer/BioNTech | 650,000,0005 | 261,200,000 | 388,800,000 |
| Sanofi/GSK | 500,000,0008 | 266,000,000 | 234,000,000 |
| Johnson & Johnson/Janssen | 500,000,0006 | 184,000,000 | 316,000,000 |
| Moderna | 500,000,0004 | 147,750,000 | 352,250,000 |
| SinoVac and CanSino+ \*\* | 805,000,00010 | 95,000,000 | 710,500,000 |
| Gamaleya Research Institute | 250,000,0009 | 174,500,000 | 75,500,000 |
| CureVac\* | 150,000,00012 | 112,500,000 | 37,500,000 |
| Medicago | 50,000,00011 | 38,000,000 | 12,000,000 |
| University of Queensland/CSL | 50,000,00013 | 25,500,000 | 24,500,000 |

**Note**: All data are updated as of November 15, 2020. Projected manufacturing capacity by the end of 2021 are based on publicly available, company-based estimates assuming successful regulatory approval, scale-up and demand for the company’s vaccine candidate. Reserved courses refer to publicly known, pre-market purchase commitments as of November 15, 2020. Total projected manufacturing capacity is 5.96B courses, and total remaining manufacturing capacity is 2.36B courses.

\* For AstraZeneca/Oxford, the number of reserved vaccine courses exceeds the projected manufacturing capacity by the end of 2021. Limited transparency of these arrangements and uncertainties over the speed of introduction and scale-up of these COVID-19 vaccine candidates do not make it possible to know whether these reserved courses have been promised to be delivered by the end of 2021 or whether the projected manufacturing capacity announced by each company is just a ballpark figure.

\*\* Multiple firms based in China are bringing forward COVID-19 vaccine candidates. Only two—SinoVac and CanSino—have pre-market purchase commitments of publicly known volumes. However, China’s National Health Commission has announced plans of producing 610 million doses by the end of 2020 and at least a billion doses annually by the end of 2021. This combined figure for 2020 and 2021 COVID-19 vaccine production was used in this study’s calculations.

**References:**

[1] The number of reserved vaccine doses represents the total from pre-market purchase commitments from the vaccine manufacturers, by country, identified in **Table S1.** COVID-19 Vaccines: Key Characteristics of Pre-Market Purchase Commitments.

[2] Displayed in courses and calculated given by the given formula:

[3] FiercePharma. AstraZeneca shells out up to $60M to reserve more coronavirus shot capacity with Oxford Biomedica, September 1, 2020. Available at: <https://www.fiercepharma.com/manufacturing/astrazeneca-shells-out-up-to-60m-to-reserve-covid-19-vaccine-capacity-oxford>

[4] BioPharma-Reporter. Lonza and Moderna shoot for billion COVID-19 vaccine doses, May 5, 2020. Available at: <https://www.biopharma-reporter.com/Article/2020/05/05/Lonza-and-Moderna-partner-for-COVID-19-vaccine>

[5] Pfizer. Pfizer and BioNTech conclude Phase 3 study of COVID-19 vaccine candidate, meeting all primary efficacy endpoints, November 18, 2020. Available at: <https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-conclude-phase-3-study-covid-19-vaccine>

[6] BioPharma-Reporter. Catalent takes on manufacture of J&J’s coronavirus vaccine, April 30, 2020. Available at: <https://www.biopharma-reporter.com/Article/2020/04/30/Catalent-to-manufacture-Janssen-coronavirus-vaccine>

[7] Novavax. Novavax Announces COVID-19 Vaccine Manufacturing Agreement with Serum Institute of India, Increasing Novavax’ Global Production Capacity to Over 2 Billion Doses Annually, September 15, 2020. Available at: <https://ir.novavax.com/news-releases/news-release-details/novavax-announces-covid-19-vaccine-manufacturing-agreement-serum>

[8] Sanofi. Sanofi and GSK selected for Operation Warp Speed to supply United States government with 100 million doses of COVID-19 vaccine, July 31, 2020. Available at: <https://www.sanofi.com/en/media-room/press-releases/2020/2020-07-31-13-00-00>

[9] Sputnik V. RDIF and GL Rapha (Hankook Korus) agree to produce over 150 million doses of the Sputnik V vaccine in South Korea. Press release, November 13, 2020. Available at: <https://sputnikvaccine.com/newsroom/pressreleases/rdif-and-gl-rapha-agree-to-produce-over-150-million-doses-of-the-sputnik-v-vaccine-in-south-korea/>.

[10] McNeil, Sam. China aims to make 1 billion COVID-19 vaccine doses a year. Associated Press, September 25, 2020. Available at: <https://apnews.com/article/virus-outbreak-beijing-china-archive-a9fc0c458fda6a950da5f2cc0f4a354b>

[11] Medicago. Medicago begins phase 1 clinical trials for its COVID-19 vaccine candidate, July 14, 2020. Available at: <https://www.medicago.com/en/newsroom/medicago-begins-phase-i-clinical-trials-for-its-covid-19-vaccine-candidate/>

[12] CureVac. CureVac establishes European-based network to ramp up manufacturing of its COVID-19 vaccine candidate, CVnCoV. Press release, November 17, 2020. Available at: <https://www.curevac.com/en/2020/11/17/curevac-establishes-european-based-network-to-ramp-up-manufacturing-of-its-covid-19-vaccine-candidate-cvncov/>

[13] CSL. CSL to manufacture and supply University of Queensland and Oxford University vaccine candidates for Australia, September 6, 2020. Available at: <https://www.csl.com/news/2020/20200907-csl-to-manufacture-and-supply-uq-and-ou-vaccine-candidates-for-australia>