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\$25 Billion to Vaccinate the World

The U.S. Government Must Ramp up Vaccine Production and End the Global Pandemic

- **The United States can help the world produce billions of vaccine doses for just over \$3 per dose. A \$25 billion investment in vaccine production by the U.S. government would produce enough vaccine for low- and middle-income countries.**
- Scaling-up production in the United States and in regional manufacturing centers around the world could shave years from the global pandemic.
- With \$25 billion in designated funding, BARDA (the Biomedical Advanced Research and Development Authority) has the experience to quickly implement a worldwide vaccine manufacturing program. It can build on its prior pandemic flu vaccine program.
- This proposal aims to leverage the investment the United States already has made in COVID-19 vaccines, including the ownership rights the U.S. government has in the National Institutes of Health-Moderna vaccine. It would also ensure fair compensation to vaccine corporations.
- The proposal would assign authority to BARDA to determine exactly which vaccines should be mass-produced. It would also charge BARDA with determining where to best locate production facilities, which may include retrofitting and adding production lines to existing manufacturing facilities, with a starting presumption that – in addition to what vaccine makers can produce on their own – the agency would combine contract manufacturing in the United States on behalf of the U.S. government with licensing, technology transfer and investment in regional manufacturing centers around the world.
- In shortening the pandemic by years, this proposal would pay for itself many times over. It would save hundreds of thousands of lives in poorer countries. It would shorten the period of pandemic mitigation measures which are costing trillions in lost economic output. It would reduce the risk of new, vaccine-resistant variants emerging and traveling to the United States. And it would provide enhanced vaccine manufacturing capacity for the United States, making it possible to produce booster shots for coronavirus vaccines, if needed, on a much faster timetable than currently possible.
- The proposal would also reestablish U.S. scientific, technology, humanitarian and foreign policy leadership.

Maximizing Vaccine Production

The U.S. government can maximize vaccine production by sharing vaccine manufacturing technology and building or retrofitting manufacturing facilities both in the U.S. and in regional centers across the world. While this cannot be done overnight, it can help start production in as few as six months and shorten the pandemic, particularly for low- and middle-income countries which otherwise may wait several years for enough doses to successfully vaccinate their populations.

The FDA has authorized use of two mRNA vaccines: NIH-Moderna and Pfizer-BioNTech. Because mRNA vaccines are developed using synthetic processes instead of living cells, they require smaller production facilities than other kinds of vaccines and are cheaper and faster to scale-up.¹ mRNA facilities can also be

quickly repurposed to tackle new variants and even new viruses. However, the cost of materials to produce mRNA doses is currently higher than for other kinds of vaccines.ⁱⁱ

\$3 Per Dose

Repurposing and Building Manufacturing Facilities

Imperial College engineers have estimated the cost of mass mRNA vaccine production, using tools employed by industry.ⁱⁱⁱ For the NIH-Moderna vaccine, they estimate 25 production lines are needed to produce 8 billion doses.^{iv} The total capital investment would be \$1.9 billion.

Producing Doses

Imperial College engineers estimate that producing 8 billion doses of NIH-Moderna vaccine “drug substance” would cost \$17 billion. (Raw material costs are a major component and could be reduced by allowing multiple suppliers.^v) Fill-finish to make the final “drug product” would cost \$1.8 billion if existing capacity were redeployed.^{vi} A 5 percent profit margin would add \$1 billion.

Technology Transfer

The government can negotiate with Moderna to share the mRNA vaccine technology with other manufacturers. The National Institutes of Health (NIH) and Moderna jointly invented the vaccine. The federal government helped run the clinical trials and paid Moderna to figure out how to scale-up production. Indeed, the public funded the vaccine’s entire development, and the government maintains some intellectual property rights.^{vii}

An upfront \$3 billion payment to Moderna can help facilitate rapid technology transfer. In line with international practice on technology sharing^{viii}, Moderna can also be paid a 4 percent royalty rate on post-pandemic sales. An additional \$500 million would be needed to cover costs for a federal rapid-response program to provide technical assistance to manufacturers and the World Health Organization’s technology hub, the COVID-19 Technology Access Pool.^{ix}

Table 1: Producing 8 Billion Doses of Coronavirus Vaccine (NIH-Moderna)

Type	Activities	USG Investment
Building Capacity (Capital Expenditures)	- 25 production lines to produce ~10,000 batches	\$1.9 billion
Producing Doses (Operating Expenditures)	- Raw materials, single-use equipment, vials, labor, reasonable profit	\$17 billion (drug substance) \$1.8 billion (drug product) \$1 billion (reasonable profit)
Technology Transfer	- Technical assistance - Compensation to originator corporation for sharing intellectual property and know-how	\$3.5 billion
Total		\$25.2 billion

ⁱ Zoltan Kis et al., Rapid development and deployment of high-volume vaccines for pandemic response, 29 Journal of Advanced Manufacturing and Processing 2020.

ⁱⁱ For domestic mRNA public production, see James Krellenstein et al., The World is Desperate for Covid Vaccines, NY Times, (Jan 12 2021), tinyurl.com/2yj8c3sb. Viral vector technology used by J&J, which has been heavily subsidized by the U.S. government, may be another option.

ⁱⁱⁱ Zoltan Kis et al., Resources, Production Scales and Time Required for Producing RNA Vaccines for the Global Pandemic Demand, 9 Vaccines 2021, <https://www.mdpi.com/2076-393X/9/1/3>. See SuperPro Designer, www.intelligen.com (clients include Pfizer, J&J, Lonza).

^{iv} One 30L bioreactor in each production line. Multiple production lines could be setup in each facility to lower costs. LMIC population is 5 billion. We assume 80 percent vaccination is required for herd immunity.

^v An industry expert noted privately that removing IP barriers could lead to a 40 percent reduction in the price of some raw materials.

^{vi} \$0.22 per dose. Cost of goods sold and total cost of delivery for oral and parenteral vaccine packaging formats, Vaccine (2018). Employing new technologies could offset concerns about fill-finish bottlenecks. See MEDInstill, Intact Modular Filler (IMF), <http://tinyurl.com/5ga2avo3> (noting one filler can fill 2 bn doses per year).

^{vii} Axios, The NIH claims joint ownership of Moderna’s coronavirus vaccine (June 25, 2020), Moderna skirts disclosures of coronavirus vaccine costs (August 5, 2020), Moderna reveals it may not hold patent rights for coronavirus vaccine (August 11, 202).

^{viii} WHO, Remuneration guidelines for non-voluntary use of a patent on medical technologies, <https://apps.who.int/iris/handle/10665/69199>

^{ix} WHO, COVID-19 technology access pool, <http://tinyurl.com/yejmlgnc>.