Trends and lessons learned in early COVID-19 vaccine efforts

April 2021

pwc

COVID-19 – Unprecedented global impact

Human

- 130.4m confirmed cases of COVID-19, including 2.8m deaths.
- Disruption of critical mental health services in 93% of countries worldwide with demand increasing significantly.
- The emotional, economic and long lasting health costs of the pandemic are much higher for the poor and vulnerable communities and countries.

Broad Economic

- World merchandise trade volume is forecast were estimated to have fallen by 9.2% in 2020.
- Global GDP will fall by 4.8% in 2020 before rising by 6% in 2021.

Industry Specific

- The top 5 industries most impacted by COVID are: Airlines, Leisure, Oil & Gas Drilling, Auto Parts & Equipment and Restaurants.

Government

- National and local governments are experiencing a significant reduction in tax revenue linked to decreased economic activity.
- While at the same time the demand for basic and emergency services related to the pandemic have increased significantly.

Healthcare

- National Healthcare systems are strained in responding to the second wave of the outbreak.
- While at the same time, mass vaccination programs are being undertaken.

We are still at the early stages on the road to achieving herd immunity, estimated to be 65-70% of the total global population

14.9

Billion doses reserved

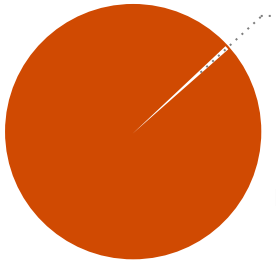
* Source: Duke University https://launchandscalefaster.org/covid-19/vaccineprocurement

Confirmed purchases cover 8.6 billion doses, with another 6.3 billion doses currently under negotiation or reserved as optional expansions of existing deals.

693.37

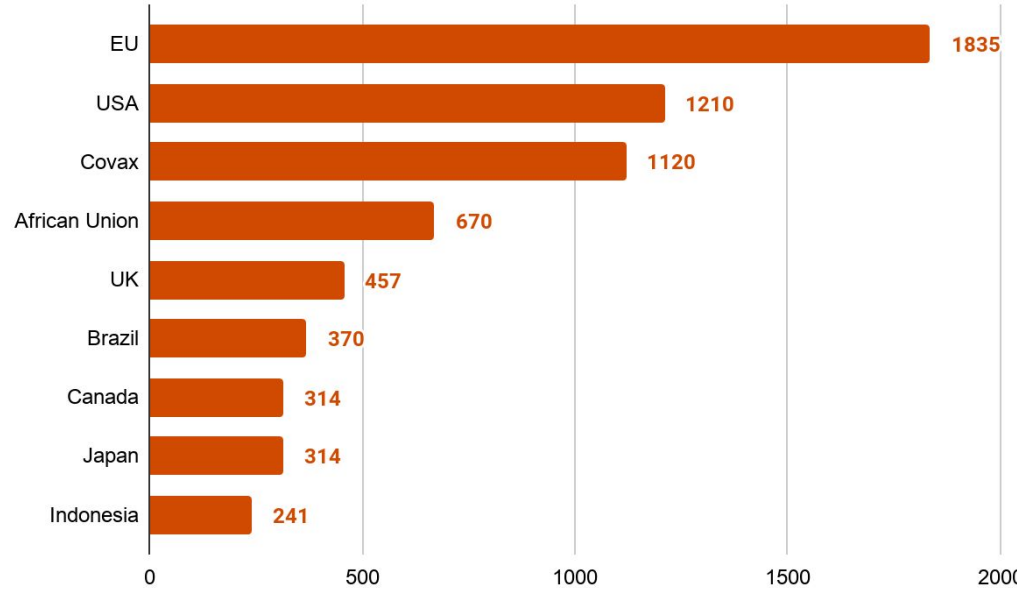
Million doses administered globally

* Source: https://ourworldindata.org/covid-vaccinations

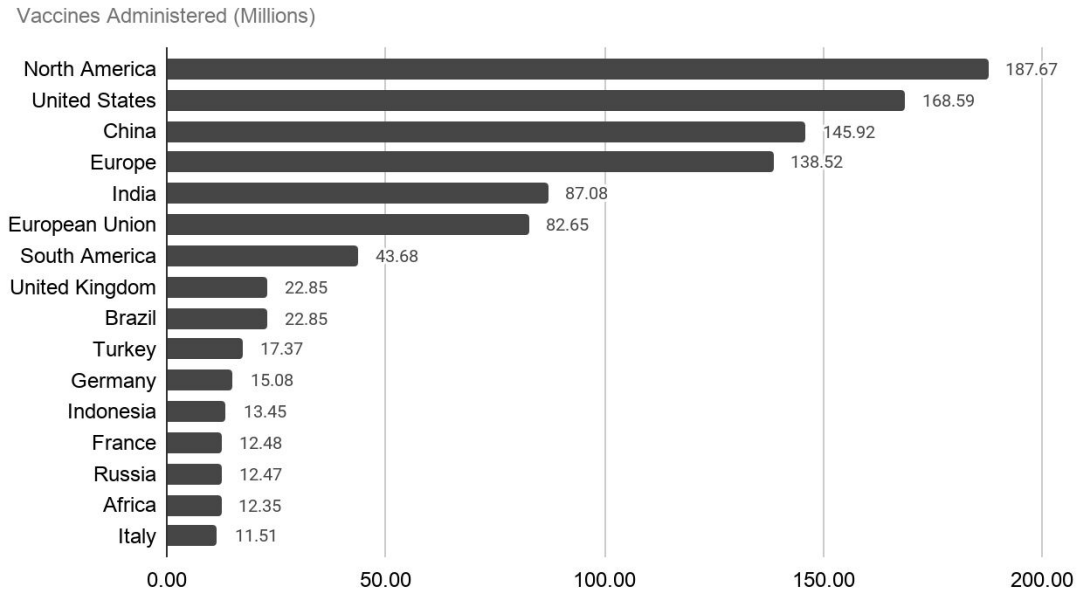


7.41% Percentage current coverage required for herd immunity

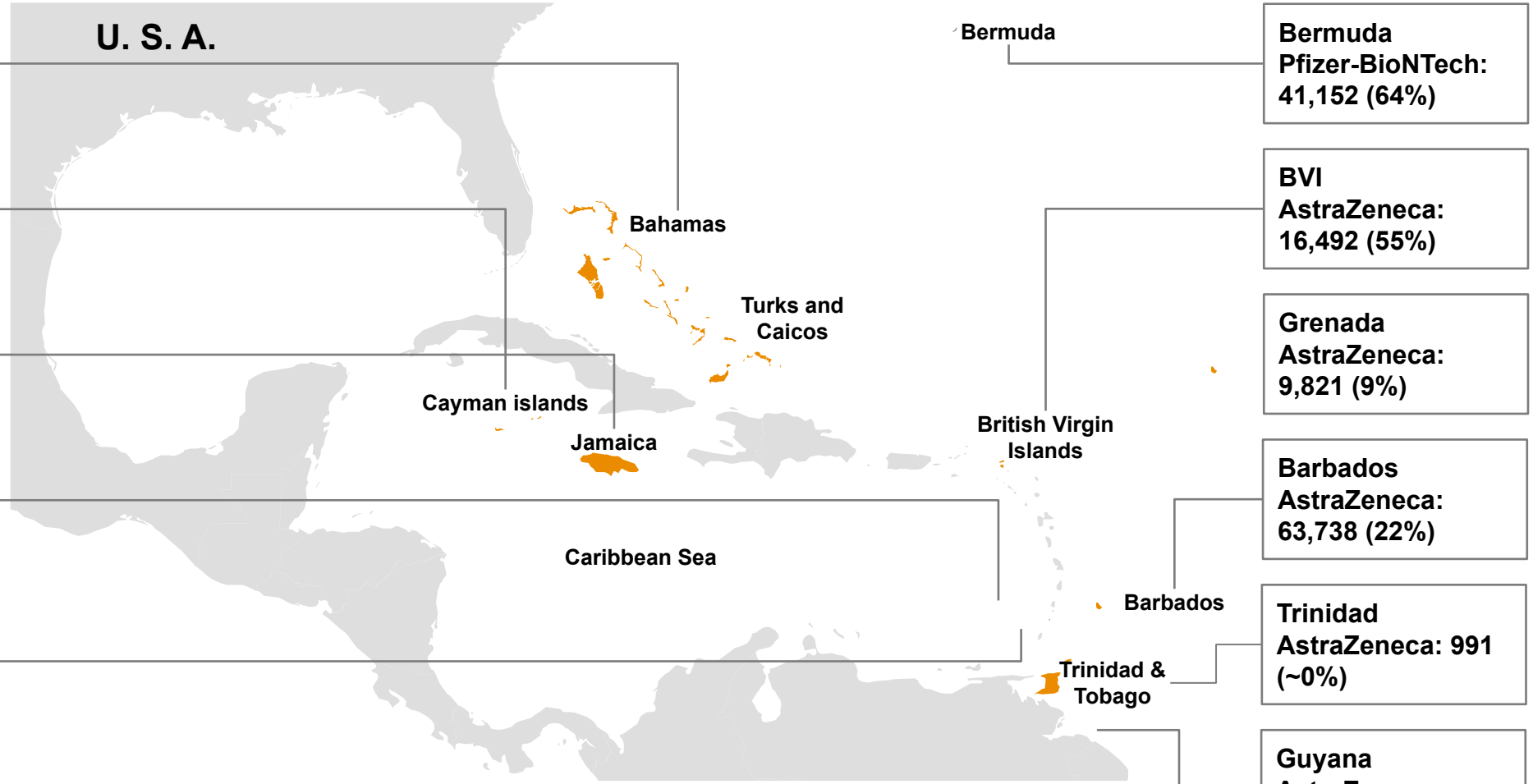
Doses secured by governments/institutions as of 16-03-2021 (in millions)



Doses administered globally - as of 16-06-2021



Progress on vaccine distribution varies across the Caribbean region*



Bahamas
AstraZeneca:
7,000 (1.8%)

Cayman
Pfizer-BioNTech:
50,763 (78%)

Jamaica
AstraZeneca:
41,901 (1.4%)

St Lucia
AstraZeneca:
22,554 (12%)

St. Vincent and the Grenadines
AstraZeneca:
10,519 (9.5%)

Bermuda
Pfizer-BioNTech:
41,152 (64%)

BVI
AstraZeneca:
16,492 (55%)

Grenada
AstraZeneca:
9,821 (9%)

Barbados
AstraZeneca:
63,738 (22%)

Trinidad
AstraZeneca: 991
(~0%)

Guyana
AstraZeneca:
40,468 (5.2%)

Vaccine type indicates primary vaccine currently in use for each country.
Figures indicate vaccines administered to date. % indicates % of population.

The market landscape for COVID-19 vaccines is crowded, with several late entrants entering the market in 2021

Not exhaustive and rapidly evolving

	Product profile	Age indication	Stability	Packaging	Regulatory approval*	Global supply agreements
	Has EUA And/Or Expected BLA in 2021					
Pfizer	95% efficacy, two-dose regimen	Currently 16+, with ongoing pediatric studies for 12+	14 days at -20°C (to be submitted in Feb)	Min order size of 195 vials, 5-6 doses/vial	EUA received Dec 11 20 BLA ~ Q3 2021	1,537.2 MDS secured
moderna	94% efficacy, two-dose regimen	Currently 18+; ongoing pediatric study for ages 12-17	30 days at 2°C to 8°C	Min. order size of 10 vials; 10 doses/vial (expected to increase to 15 doses)	EUA received Dec 18 20 BLA ~ Q3 2021	917.5 MDS secured
Johnson & Johnson	66% overall efficacy, single-dose regimen	Currently 18+; pediatric study expected to start in Q2-Q3 2021	3 months at 2º to 8ºC	Min. order size not disclosed; 5 doses/vial	EUA received Feb 27 21 BLA ~ Q4 2021	1,047 MDS secured
NOVAVAX	89% overall efficacy, two-dose regimen	Anticipated to be 18+	6 months at 2º to 8ºC	Min. order size not disclosed	EUA ~ March BLA ~ Q4 2021	439.7 MDS secured
AstraZeneca	82% efficacy, two-dose regimen	Currently 18+ (limited to under-55 or 65 in certain countries); pediatric study expected to start in Q2 2021	6 months at 2º to 8ºC	Min. order size not disclosed; 8-10 doses/vial	EUA ~ Q2 2021	1,446 MDS secured
SANOFI gsk	Efficacy to be announced, two-dose regimen **Delayed anticipated launch due to Phase I/II data, starting Phase IIB in Q1 2021**	Anticipated to be 18+	6 months at 2º to 8ºC	N/A	EUA ~ Q4 2021	732 MDS secured
SANOFI Translate Bio	Efficacy to be announced, two-dose regimen. **Starting Phase I/II trials in Q1 2021**		Expected at -20ºC	N/A	TBA - 2022	N/A
gsk CUREVAC	**Pact to develop next-generation multi-valent mRNA vaccine**		TBA	N/A	TBA - 2022	N/A
	91·6%, two-dose regimen	Adults 18+	6 months at-18ºC		EMA began a rolling view of Sputnik V on March 4	538.1 MDS secured
CanSinoBIO	65%, single-dose regimen	Adults 18+	2º to 8ºC		Approved in China, EUA in Mexico & Pakistan	38.5 MDS

Manufacturers are also pursuing clinical trials to test effectiveness against new variants and develop new boosters

*Anticipated timing assuming 9 months from EUA approval to BLA approval, subject to clinical trial outcomes and regulatory approval

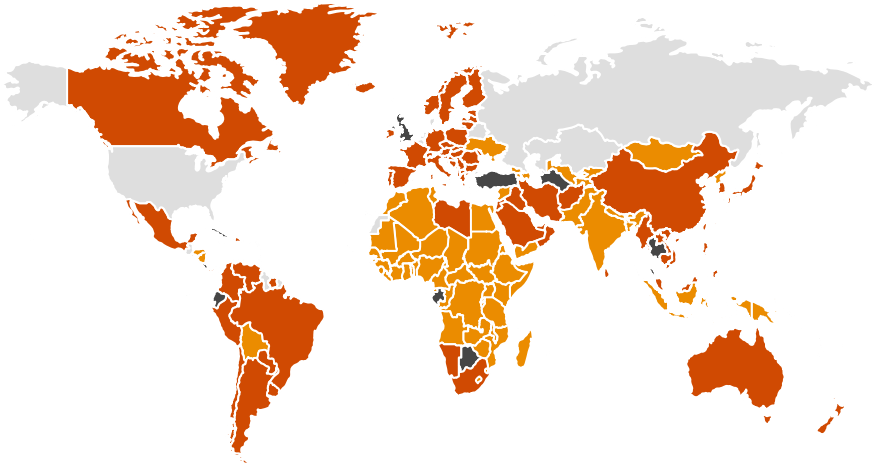
Greater understanding of COVID-19 and its implications will dictate how the post-pandemic landscape evolves over time

	Potential Scenarios	
SARS-CoV-2 Virology	SARS-CoV-2 mutates minimally and existing vaccines can confer protection to new variants	Prevalent mutations of the SARS-CoV-2 give rise to variants with different transmissibility and virulence profiles, resulting in ability of evolving strains to evade existing vaccines
Immunological Protection	Vaccination with the primary series is itself sufficient to produce durable and sustained protection	Immunological protection wanes over time and will require re-vaccination on a routine basis to boost immune system
Transmission and Epidemiology	Given initial herd immunity is achieved, the chances of severe outbreaks are unlikely, assuming fundamental prevention techniques are maintained and therapeutics are widely available	Herd immunity is not attained and/or rapid transmission of variants continue to give rise to outbreaks
Economic Impact	Herd immunity and minimal transmission renders large outbreaks unlikely, and thus limited disruption to a normal functioning economy	Local and regional outbreaks may result in disruptions and shut downs of key sectors and industries, resulting in localized impact to an already recovering economy
Psychological Toll	Pervasive public confidence that, upon vaccination with the primary series, there is a return to “normalcy” and sporadic cases, while present, will not cause a state of panic	Public is skeptical that an imminent return to normalcy is likely, and any reports of case spikes will induce a strong response and potential overreaction
	Vaccination with primary series is sufficient	**Recurring vaccination with seasonal doses will be required**

The COVAX initiative is a playing an increasingly critical role in driving equitable global distribution of COVID-19 vaccines

COVAX

COVAX initiative co-lead by CEPI, Gavi and WHO & partnered with UNICEF for delivery



'COVAX's aim is to accelerate the development and manufacture of COVID-19 vaccines, and to guarantee fair and equitable access for every country in the world'

Strategy for Equitable Global Access

- **Invest in the development of 9+ vaccine candidates**
- **Procure 4B doses with a target distribution of 2B doses[1]**
- **Vaccinate 20% of every country by YE'21**
- **Pool resources to secure lower-cost bulk access**

Recent Developments

March 2021

- Milestone of >15M doses reached across ~35 countries
- Ivory Coast first country to vaccinate with COVAX doses (frontline workers and public officials)
- Ghana receives first shipment from COVAX marking beginning of roll-out
- Announcement of 237M doses of AstraZeneca vaccine, anticipated for delivery by May 2021 to 142 countries

February 2021

- Announcement of 1.2M doses of Pfizer-BioNTech vaccine, anticipated for delivery in Q1 2021
- President Biden announced $4B contribution to COVAX

Source: Axios, COVAX website, US News, Time Magazine, NPR, Forbes

1) 1.3B doses allocated to lower income countries

Early distribution efforts have yielded several lessons…

Vaccine policy, landscape analysis and selection

Any policies must be adapted as circumstances change, and subject to rigorous scenario planning.

- Ensure national policies are clear, but with sufficient flexibility to allow local regions to adapt policies to fit local needs, including those of vulnerable and hard to reach population groups, and to minimize wastage.
- Closely align vaccination policies to those relating to testing, contact tracing and social distancing measures. The impact of a change to any of these policies should considered in light of the others.
- Plan and rehearse scenarios including outbreaks, new strains and the impact of border openings.
- Track ongoing research and be ready to be agile as it changes.

Program management

Robust but agile program management is essential for any vaccine program.

- Define very clear workstreams for delivery, supported by detailed roles & responsibilities and governance structures.
- Establish a decision making framework and maintain an audit-trail to support decisions taken.
- Apply agile ways of working and encourage the team to think and act flexibly. Where possible, the opportunity to reflect and improve systems and processes should be built into the workstreams.
- Allow for resourcing and time to provide more detail than usual to senior leaders and government officials.
- Ensure there is a clear structure for stakeholder engagement with regular (multiple times daily) meetings to manage the project complexity, program management layers and technical delivery.

Vaccine operations, logistics and supply

Vaccination efficiencies will be found as the vaccine program matures.

- Understand what related vaccine programs exist already. What can you use what exists already?
- Plan for future efficiencies - the number of participants that can be vaccinated by a clinician within an hour will continue to improve and the supervised wait time following vaccine administration has significantly decreased in some territories.
- Conduct detailed planning to minimise waste for multi-dose vials. This is essential for an efficient program whilst demand is greater than supply.
- Consider the auxiliary products used, e.g. selecting a different syringe can result in more vaccinations out of a vial.

Case study: UK COVID-19 Vaccination Program

PwC UK are supporting the English COVID-19 vaccination program with PMO resource and program delivery. The program is being delivered through mass vaccination sites, roving units & primary care. The program has rapidly expanded, with 20 million doses delivered by the end of February 2021.

Early lesson include:

- Program management input is critical to design and deliver an effective program.
- Moving at this scale and pace has a particular impact on availability of and communication to workforce.
- There is a need for robust, local decision making processes to ensure there is clear direction for the program.
- A lack of targeted national and local communications presents risk to uptake due to mistrust of vaccine.
- Demand modelling should inform the scale and type of delivery model.

...Across all components of vaccine distribution

Delivery model and requirements

Any COVID-19 vaccine program must be able to adapt to the rapidly changing environment.

- Identify and plan for multiple scenarios to mitigate risk. This should include new strains, supply chain failures and changes to social distancing measures and public attitudes. Rehearse scenarios regularly to ensure preparedness. Scenarios will change and should be revisited often.
- Use agile and sprint ways of working so if timeframes flex, you can adapt. Use a 'build as you go' approach, and start with a small, but scalable approach.
- Plan for when supply exceeds demand to enable the vaccine program to adapt.
- Build a distribution and delivery model that can allow for changes to population monitoring and cohorts as the vaccine supply changes.

Digital enablement, analytics and reporting

Properly designed and implemented, digital solutions can hugely improve program efficiency.

- Ensure digital solutions are straightforward for consumers to use, for example, when booking appointments. Participant experience is essential for uptake.
- Improve vaccine compliance by employing multi-dose digital bookings.
- Co-design the right digital solutions for recording vaccines and other data which need to be straightforward for clinicians or administrators to use and with the right level of interoperability with other systems.
- Ensure offline capability is built into systems, especially in rural areas and for mobile vaccine units.
- Drive on demand decision making through comprehensive dashboards with real time data.
- Ensure considerations of privacy and cyber-security are addressed.

Communications, engagement and activation

Communications must be clear, focused, targeted and preferably co-designed.

- Establish processes to monitor and act on evolving community sentiment and relationships, including focus groups, surveys and digital sentiment analysis.
- Include representation for the communities you are prioritising, in governance, operational and decision making roles in the program. Understand how to regularly connect with these communities
- Deliver consistent and regular communications managed centrally. Communicate the good and bad news stories to be transparent and foster trust.
- Adapt the communication strategy to different phases of the vaccine program. For example, consider how you will promote vaccine uptake amongst young people when the vaccine program is mature and case rates and their perceived risks are low.

Case study:

Central and Eastern Europe COVID-19 Vaccine Distribution System

PwC has designed, developed and maintained the COVID-19 Vaccine Distribution System for a CEE government. The system integrates key stakeholders including pharmaceutical distributors and up to 10,000 vaccination points across the country to provide the capability of ordering, managing and reporting vaccine doses.

Early lessons include:

- Developing the system at pace is essential. PwC developed this system over a three week development cycle, leveraging Microsoft Power Platform.
- Flexible customisations according to local requirements increases user uptake.
- Integration with the key IT systems of all stakeholders is essential.
- A focus on cyber security from the outset of the program has reduced the risk of data loss.

Thank you

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