COVID and the URGENCY of SCIENCE

April 6, 2021

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Objectives

1. **Provide perspective:** ***where are we in this global COVID-19 pandemic, and what is necessary to get out of it?***

2. **COVID-19 vaccines:** ***what is available? Can we trust it? Should we take a COVID-19 shot? When will we have access? When will we get herd immunity? What about the variants?***

3. **Back to normal (?), discussion and Q&A**

IAVI is a global organization focused on the discovery and development of globally accessible vaccines and antibodies for infectious diseases

Four disease areas:

- **HIV/AIDS**
- **Tuberculosis**
- **Emerging Infectious Diseases**
- **Neglected Diseases**

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Translational Health Science and Technology Institute (IAVI/Government of India, Delhi)

$100M revenue

57 ongoing research and development programs

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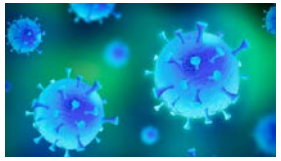
And many other generous individuals and partners around the world

As of September 2020

Where are we in the Global COVID-19 pandemic, and how can we get out of it?

COVID-19 has been the sixth major outbreak from a newly emerging infectious disease since 2000. So far, there has been *1 outbreak every 3 years*

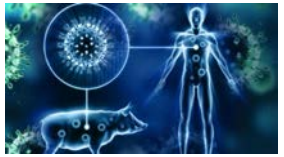


2002-03

SARS

Severe acute respiratory syndrome (SARS) is a viral respiratory illness recognized as a global threat in March 2003, after first appearing in Southern China in November 2002 and spreading in a limited fashion to Taiwan, Canada, Singapore, and many other countries.

8,098 cases
774 deaths

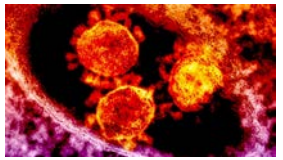


2009-10

Avian Flu

2009 Swine Flu was a new strain of H1N1, resulting from a previous combination of bird, swine, and human flu viruses that then combined with a pig flu virus. It was detected first in the U.S. and spread quickly across the world.

700 million-1.4 billion cases
284,000 deaths



2012-15

MERS

Middle East respiratory syndrome (MERS) is a respiratory illness caused by a novel coronavirus first identified in Saudi Arabia in 2012
MERS has been reported in 24 countries.

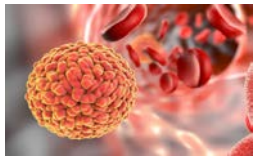
1,000+ cases
400 deaths

2013-16

Ebola

This Western African Ebola virus epidemic was the most widespread outbreak of Ebola virus disease in history—causing major loss of life and socioeconomic disruption in the region, mainly in Guinea, Liberia and Sierra Leone.

28,646 cases
11,323 deaths

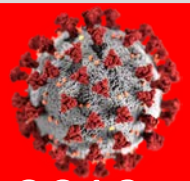


2015-16

Zika

In early 2015, an epidemic of Zika virus disease in Brazil spread widely in the Americas as well as islands in the Pacific, and Southeast Asia. For pregnant women, there is risk of pregnancy loss and congenital complications for the offspring.

700,000+ cases
20 deaths
≈4,000 cases congenital Zika syndrome



2019+

COVID-19

Coronavirus disease 2019 (COVID-19) is a contagious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first case was identified in Wuhan, China in December 2019. Spread across the world

133 million cases
2.9 million deaths

What is different this time and why global experts agree that SARS-CoV-2 will remain endemic for a long time?

It's NOT a "flu-like" infection: it's more contagious, more severe in a higher percentage of patients and with a mortality rate 10-30-fold higher

- **Twice as contagious as flu** - New variants are even more contagious
- **Incubation time is 3 times as long as flu** – higher chance of spreading without being detected
- **10-30 times higher fatality rate** than flu
- **Not seasonal**
- **Wide spectrum of clinical manifestations,** including post-viral syndrome

Fortunately, it's NOT a HIV/AIDS-like infection:

- **In most cases, the body knows how to respond:** difference versus HIV/AIDS
- There are no vaccines for HIV/AIDS and still 1.7M people are infected every year (700,000 people die of AIDS annually)
- AIDS has killed 32M people so far and infected 75M

"COVID-19 represents a perpetual challenge for which we have to be perpetually prepared."
Tony Fauci, NIAID

COVID19 is a unique infection with unique characteristics ...

… and there are still many unknowns.

COVID19 has [at least] five very different "faces" and we still don't know the determinants of each one of them…

With the information we have so far:

~ (70%) **ASYMPTOMATIC** patients

~ (20%) **LOW-to-MODERATE** patients

~ (10%) **SEVERE patients**, requiring hospitalization

~ (3-5%) enter the **EMERGENCY ROOM**

~ (1%) **DIE**

… **some (%?)** of which face **"Chronic COVID"**

We still don't know the determining factors for a person to be in one or another group

We still don't know the determining factors for a person to develop "Chronic COVID"

Spain has reported 1,623 deaths/Million people. Numbers might be underestimated by ~10% and are among highest worldwide

Country self-reported data (updated 6 APR 2021):

Country	Deaths /1 M	Total Deaths	Total Infection
Belgium	2,005 (*)	23,247	904,673
UK	1,872	127,126	4.38 M
Italy	1,848	111,747	3.69 M
US	1,681	556,528 (*)	30.85 M (*)
Spain	1,623	75,911	3.32 M
Brazil	1,585	336,947	13.1 M
South Africa	894	53,032	1.55 M
Germany	921	77,245	2.91 M
Israel	723	6,257	834,920
Russia	681	99,431	4.55 M
India	120	166,177	12.8 M
Japan	73	9,251	489,407
China	3.4	4,841	101,920

(*) World Highest. Own elaboration. Data from Our World in Data. https://ourworldindata.org/coronavirus

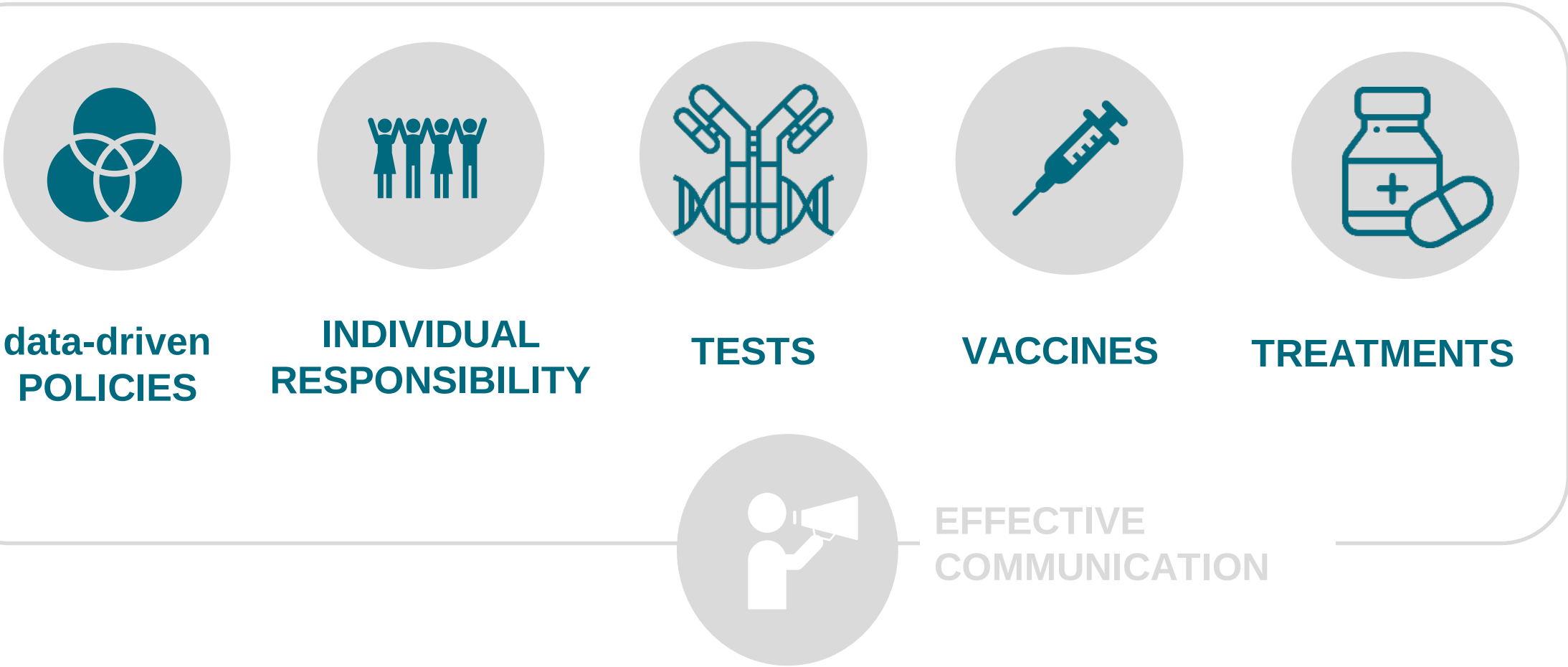
Historic trends and "excess deaths" (Updated 9 MAR 2021):

COUNTRY / CITY	TIME PERIOD	COVID-19 DEATHS	EXCESS DEATHS	EXCESS DEATHS PER 100K PEOPLE
Peru	Mar 31st-Feb 27th 2021	46,270	116,480	355
Russia	Mar 31st-Jan 30th 2021	72,010	425,290	291
North Macedonia	Mar 31st-Dec 30th 2020	2,490	5,690	274
Bulgaria	Apr 19th-Feb 13th 2021	9,580	18,930	272
Lithuania	May 24th-Feb 13th 2021	3,020	7,510	269
Mexico	Mar 28th-Jan 1st 2021	128,360	307,770	257
Serbia	Mar 31st-Jan 30th 2021	4,000	17,090	247
Ecuador	Feb 29th-Jan 30th 2021	14,860	41,130	239
Moldova	Mar 31st-Dec 30th 2020	2,980	5,870	222
South Africa	Apr 11th-Feb 19th 2021	48,920	128,560	219
Poland				207
Romania				206
Bolivia				203
Portugal	Mar 22nd-Feb 6th 2021	14,140	20,720	201
Czech Republic	Mar 29th-Jan 16th 2021	14,320	20,580	192
Britain	Mar 13th-Feb 18th 2021	140,160	124,170	187
Slovenia	Apr 5th-Jan 16th 2021	3,150	3,820	182
Belgium	Mar 15th-Feb 6th 2021	21,380	20,210	177
Spain	Mar 3rd-Feb 24th 2021	69,820	82,780	177
United States	Mar 7th-Feb 5th 2021	448,880	545,420	168

1,770 deaths / Million people (10% more than reported)

Own elaboration. Data from The Economist. https://www.economist.com/graphic-detail/coronavirus-excess-deaths-tracker

Five different types of interventions are [and will continue to be] necessary in the global COVID-19 toolkit



Current status of COVID-19 vaccines

What is a vaccine and what are the different types of vaccines?

A vaccine is a biological preparation that stimulates active acquired immunity to a particular infectious disease.

Platform		About	Licensed products
Inactivated		Inactivated vaccines consist of the whole virus, which has been killed with heat or chemicals so that it can't cause illness. In general, inactivated virus vaccines do not provide as strong of an immune response as live attenuated vaccines, so additional doses may be needed.	Polio
Live attenuated		Live attenuated vaccines are made up of whole viruses that have been weakened in a lab (usually through culturing). They tend to elicit a stronger immune response than inactivated vaccines.	MMR Varicella TB
Subunit		Subunit vaccines introduce a fragment or portion of the virus into the body. This fragment is enough to be recognized by the immune response and stimulate immunity.	Pertussis HPV Hep. B
Viral vector		Viral vector vaccines insert a gene for a viral protein into another, harmless virus (replicating or non-replicating). This harmless virus then delivers the viral protein to the vaccine recipient, which triggers an immune response.	Ebola Veterinary vaccines
mRNA		RNA vaccines work by introducing an mRNA sequence (the molecule that tells cells what to build) coded for a disease-specific antigen. Once this antigen is reproduced within the body, it is recognized and triggers an immune response.	None
DNA		DNA-based vaccines work by inserting synthetic DNA of viral gene(s) into small DNA molecules called plasmids. Cells take in the DNA plasmids and follow their instructions to build viral proteins, which are recognized by the immune system, and prepare it to respond to disease exposure.	None

COVID19 Vax

Novavax

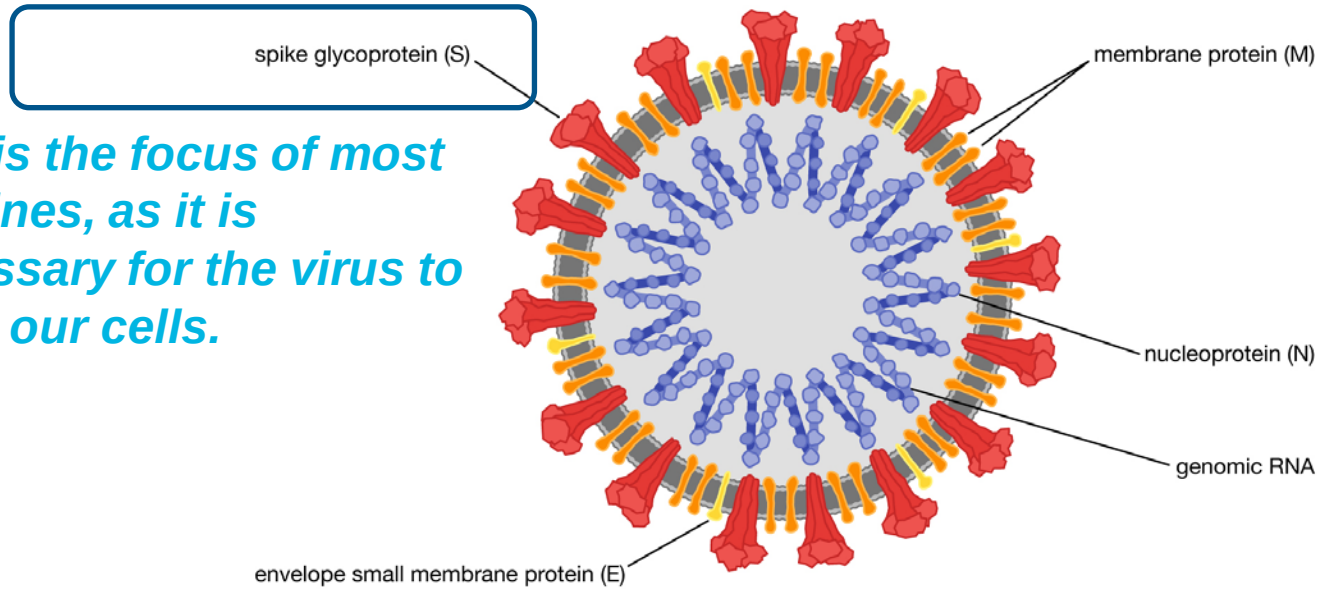
AZ/Oxford; J&J/Janssen; Sputnik

Pfizer/BioNTech; Moderna

Source: https://www.avac.org/resource/cheat-sheet-covid-19-vaccine-pipeline

(!) The mRNA of the mRNA-based vaccines doesn't integrate with human DNA and it can't alter our genetic code

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
Source: https://www.britannica.com/science/2019-nCov



This is the focus of most vaccines, as it is necessary for the virus to enter our cells.

DNA

Can be synthesized in the lab

↓

RNA

Can be synthesized in the lab

↓

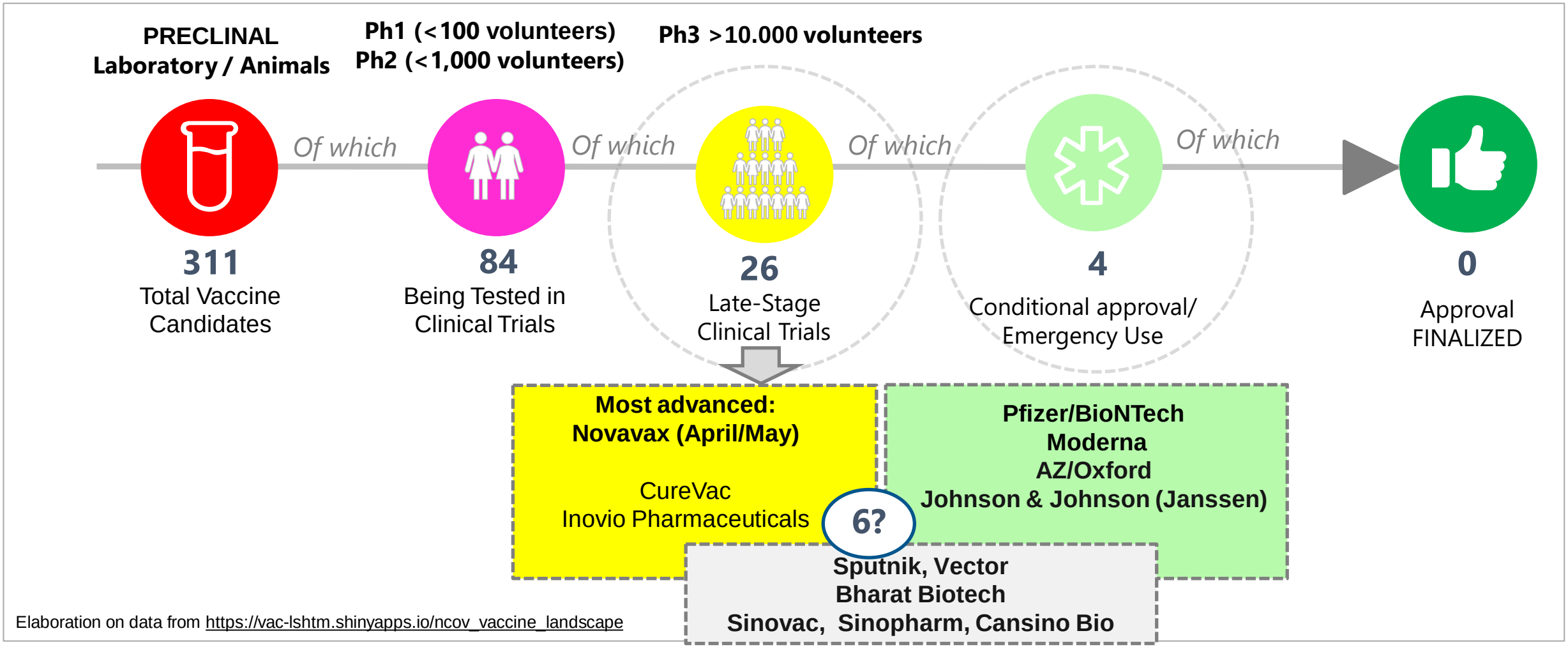
PROTEIN

Requires a "living cell" to be produced

mRNA is not the same as DNA, and it cannot combine with our DNA to change our genetic code. It is also relatively fragile and will only stay inside a cell for about 72 hours, before being degraded.

https://www.gavi.org/vaccineswork/will-mrna-vaccine-alter-my-dna

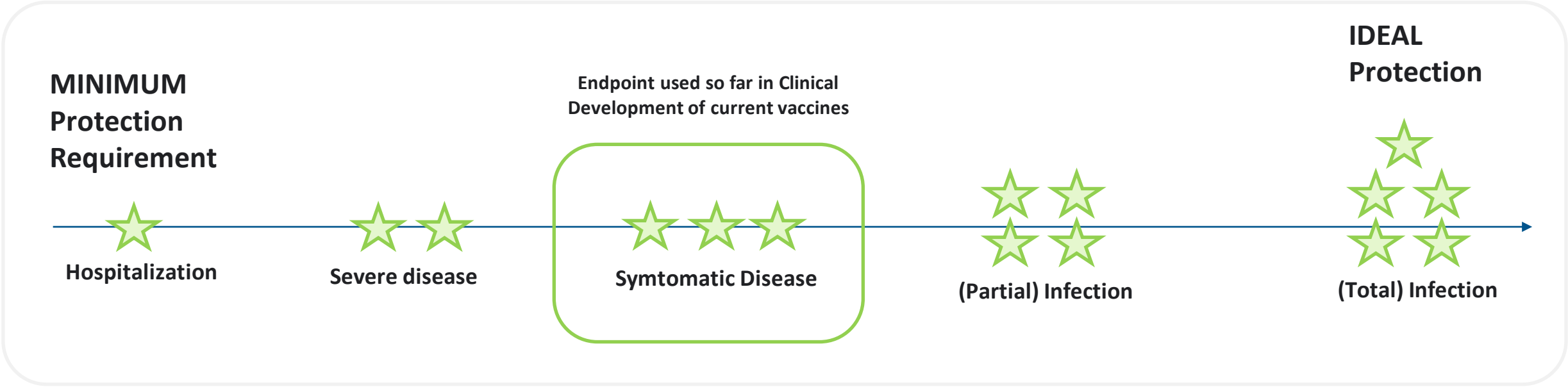
An unprecedented investment has led to 311 programs, 84 in the clinic and 4 (+6) conditionally approved (and/or used outside of clinical trials)



Elaboration on data from https://vac-lshtm.shinyapps.io/ncov_vaccine_landscape

What does the % efficacy of a vaccine mean?

Clinical trials are designed with a specific objective ("endpoint") and allow us to measure only that endpoint. Over time, the information is expanded to measure additional elements (adding, time, subpopulations, analysis results ...)



How long does it protect? What age ranges are in each sub-groups? What about variants

Four vaccines have already received EUA/Conditional Approval in western countries. Approvals were led by *mRNA-based vaccines.*

Vaccine	Doses	Efficacy	Safety	Age groups	Viral Mutations	Access and Pricing
Pfizer BIONTECH **BNT162b2** synthetic mRNA	2 doses 3 weeks apart	Ph3 with 44,000 volunteers: ▪ 95% Prevention of Symptomatic Disease (PD) Real World Data ▪ Israel: 97% PD effective and 94% PI efficacy (#pep, when) ▪ USA (Medical workers): 80% PD after first dose and 90% of PD after second dose	3.8 cases anaphylac. shock / Million doses	>16 years ▪ 40% of volunteers in study > 56y ▪ Study infants 6 months> ▪ Study on pregnant women ongoing. And preliminary data indicates (n=131) safety.	Neutralizing Ab against some variants significantly reduced ▪ UK (n=99): 5 of 10 variants were "highly resistant to neutralization" Strategies: third dose AND/OR update vaccine	▪ EUA UK Dec 2, Canada Dec 9, US Dec 10, EU Dec 21 ▪ Initial production 1,300 M doses. **Extended to** 2,000 Million ▪ $20/dose: $40 immunization ▪ 2°C to 8°C (35°F to 46°F) for 5 days
moderna messenger therapeutics **mRNA-1273** synthetic mRNA	2 doses 4 weeks apart	Ph3 with 30,000 volunteers: ▪ 94,4% Real World Data • USA (Medical workers): 80% PD after first dose and 90% effective of PD after second dose	2.5 cases anaphylac. shock / Million doses Delayed large local reaction ("Moderna Arm")	>18 years ▪ 25% of volunteers in study >65y ▪ New 12< trial started ▪ Preliminary studies (n=131) indicate it's safe	Neutralizing Ab against some variants significantly reduced ▪ US: Antibodies against SA variant reduced to 1/6 ▪ UK (n=99): 5 of 10 variants were "highly resistant to neutralization Working on booster shot	▪ EUA US Dec 18, Canada Dec 23, EU Jan 6, UK Jan 8 ▪ Initial production 500K-1,000 M doses extended to 600K doses ▪ $32-37/dose: $64-$74 immunization ▪ 6m at -4 °F

PD: Prevention of Symptomatic Disease | PI: Prevention of Asymptomatic Infection | n= number of patients

Four vaccines have already received EUA/Conditional Approval in western countries. *AZ* not yet approved in the US.

Vaccine	Doses	Efficacy	Safety	Age groups	Viral Mutations	Access and Pricing
AZD1222 Chimpanzee Adeno vector	2 doses 4-8 weeks apart in EU 4 months in Canada	Ph3 with 32,449 volunteers: ▪ 79% (76%?) of PD and 100% against severe disease and hospitalization Real World Data ▪ 67% effective reduction of asymptomatic transmission	1.25 rare trombo. Events/Million doses	18 – 65 or 18> depending on the country ▪ 13.0% of trial volunteers in > 65y	Efficacy impacted by Variants ▪ Minimal protection against mild disease caused by SA variant. (SA rollout on-hold Feb 7)	• EUA UK Dec 30, India Jan 6, EU 29 Jan • 3,000 M doses in 2021 (?) • $3-4/dose: $6-$8 immunization • Regular fridge temperature
JNJ-78436735 Ad26 vector viral vector (Same as J&J Ebola Vax)	1 (trial assessing a second dose)	Ph3 with 43,783 volunteers ▪ 66% of PD 28 days after Vaccination; 85% in preventing Severe Disease 100% against COVID19-related hospitalization and death		18y> ▪ 34% of trial participants >60y	Efficacy impacted by Variants ▪ 72% in USA ▪ 66% in Latin America ▪ 57% in South Africa (nearly 95% of cases of COVID-19 due to SA variant)	• EUA US Feb 27, EU Mar 12 • Stable 2y at -20°C (-4°F), at least 3m at 2-8°C (36°F–46°F). • 20 million doses by the end of March and 100 M June (?) • $10 a dose • Merck & Co to help with manufacturing

PD: Prevention of Symptomatic Disease | PI: Prevention of Asymptomatic Infection | n= number of patients

Other COVID-19 vaccines have already published Ph3 data. *Novavax* is expected for April/May and Sputnik has requested approval to EU

Vaccine	Doses	Efficacy	Safety	Age groups	Viral Mutations	Access and Pricing
NOVAVAX **NVX-COV2373** glycoprotein nanopartical	2 3 weeks apart	Ph3 (in UK) final results with 15,000 volunteers: • 96% Efficacy of PD against original COVID-19 strain Ph2b in South Africa with 4,400 participants: • 55.4% Efficacy of PD (nearly 90% of cases due to new variant)		15,000 participants between 18-84 years of age, including 27% over the age of 65	UK: 96.4% against original and 86.3% against UK variant strain SA: 48.6% against SA variant. The company said it is working to develop a booster vaccine to better protect against all the emerging virus variants.	• Started a rolling review of its vaccine with regulators in the U.S., U.K., European Union, and Canada. Approval in the U.S. could arrive in April. • GSK will be supporting manufacturing of up to 60M doses • Storage temperature at 2-8 C
Gamaleya Nat. Cent. Epidem. & Microbio. Sputnik Viral vector (2 different strains of adenovirus	2 3 weeks apart	Preliminary Ph3 results show a 92% Efficacy with 22,000 participants	94% reported side effects were very mild No strong allergies have been reported	18y>		• Storage temperature at -18 C • Sputnik V will cost less than $10 USD per dose for international buyers • As of March 3rd, EMA started a rolling review for Sputnik V • 59 countries outside of Russia have approved the vaccine for emergency use. Hungry is the only EU country to authorize at this time

PD: Prevention of Symptomatic Disease | PI: Prevention of Asymptomatic Infection | n= number of patients

The data on the Chinese, Russian and Indian programs aren't yet fully transparent

Candidate	Doses	Efficacy	Age groups	Viral Mutations	Approval timelines, doses and pricing
CansinoBIO Ad5-nCoV Viral vector	1	Preliminary Ph3 results of 40,000 volunteers: • 65.3% PD efficacy (not yet published)	18y>	?	• Storage temperature 2-8 C • June 25 – first company announcing use of the vaccine outside of clinical trials (military) • Feb 25th China announced the approval of the CanSino vaccine for general use • March 22nd CanSino was approved to begin a clinical trial on an inhaled vaccine
Vector Institute EpiVac Corona Protein subunit	2	Ph3 began in November of 2020 with 1,438 volunteers	?	?	Emergency used granted by Russia October 14
Bharat Biotech COVAXIN inactivated vaccine	2 4 weeks apart	Preliminary Ph 3 results with 25,800 volunteers • 80.6% efficacy of PD	18y>	?	Emergency Use in India, Iran, Mauritius, Nepal and Zimbabwe 31 DEC'20

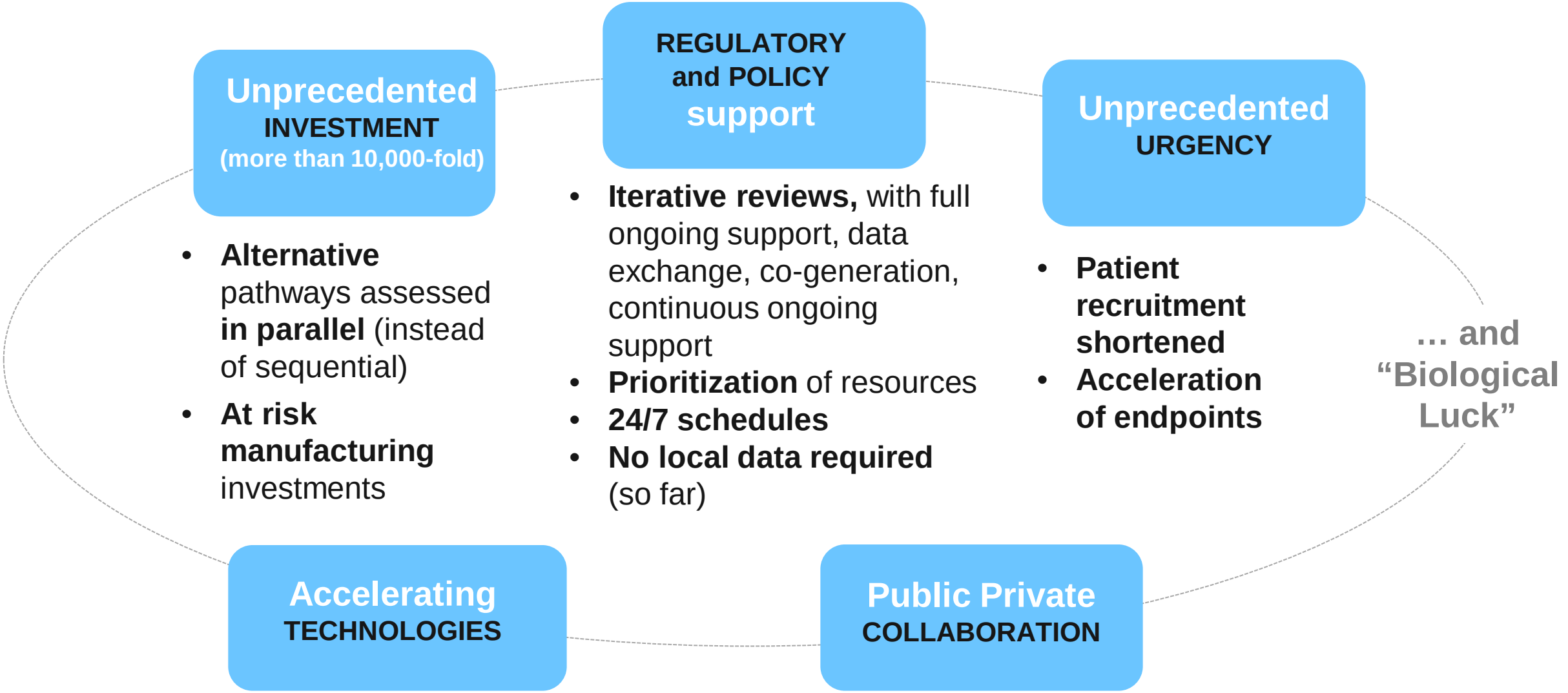
PD: Prevention of Symptomatic Disease | PI: Prevention of Asymptomatic Infection | n= number of patients

The data on the Chinese, Russian and Indian programs aren't yet fully transparent (Cont.)

Candidate	Doses	Efficacy	Age groups	Viral Mutations	Approval timelines, doses and pricing
Sinovac Corona Vac Inactivated vaccine	2 Two weeks apart	Preliminary Ph3 result: • 50.3% PD efficacy in Brazil trial with 12,688 participants • 83.5% of PD efficacy in Turkey trail with 7,371 participants	Brazil: 18y> Turkey: 18-59y	?	Limited use in China and Indonesia *AP: Sinovac Says Its Vaccine Is Safe For Children As Young As 3*
Sinopharm inactivated vaccine (2 vaccines)	2	Company announced 79% PD efficacy / UAE 86% (no publications)	?	Immune response was modestly weaker against UK variant (not yet published)	Storage temperature 2-8 C July onwards – China • In March 2021, small number of recipients in UAE have been invited to take a 3rd booster shot of the vaccine

PD: Prevention of Symptomatic Disease | PI: Prevention of Asymptomatic Infection | n= number of patients

No “scientific shortcuts” taken in this 10-fold reduction of Vaccine development timelines: priority, urgency, technologies, public-private partnerships



More time is needed to answer some critical *EFFICACY* questions which remain unknown

- Will vaccines also protect from infection or “only” from disease?

  The endpoint studied was “prevention of disease”. This is one of the reasons why vaccinated people still need to use masks.

- Will vaccines protect against current and future variants (UK, SA, Brazil….)?

  We still don’t know this: it’s unlikely that protection disappears completely. However, it’s becoming more and more apparent that future updates might be necessary.

- How long will the protection last?

  We don’t know yet. With natural infection 6m, the risk of reinfection is higher in >65y

- Can pregnant women be vaccinated?

  There is an increasing body of evidence to support however, it’s still not widely recommended (Janssen and WHO approval)

- Can children be vaccinated?

  Not yet, studies are ongoing

More time is needed to answer some critical *SAFETY* questions

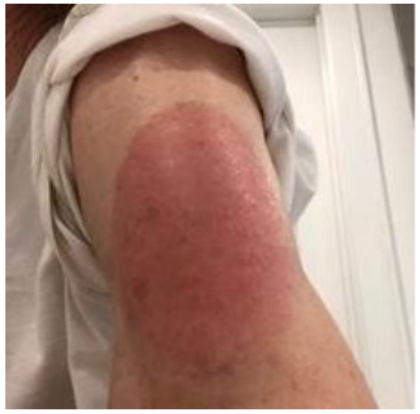
Cases of anaphylactic shock: 3.8 cases per million doses of Pfizer; 2.5 cases per million doses of Moderna

Large, local, delayed skin reactions noted after Moderna COVID vaccine

A small number of Moderna COVID-19 vaccine recipients experienced delayed, large, localized skin irritations at the point of injection, according to a letter published yesterday in the *New England Journal of Medicine*. While the symptoms cleared up in a median of 8 days, the researchers want to make sure clinicians are aware of this side effect and can navigate appropriate treatment and vaccine guidance.

The letter details these delayed skin reactions in 12 people, 4 of whom didn't have any allergy history.

Injection-site characteristics included hypersensitivity, redness, and itchiness, and the affected area could be up to 10 centimeters (4 inches) in diameter (see photo at right, used with permission of Massachusetts General Hospital). Some concurrent systemic conditions also occurred, such as high blood pressure, fatigue, additional rashes, and fever. Median onset was day 8 post-vaccination (range, 4 to 11) and the reactions cleared in a median of 6 days.



Most patients were treated with ice and antihistamines, although some required corticosteroids. Upon the second vaccine dose, 6 of the patients didn't have any delayed injection-site reactions, 3 had the same level, and 3 had lower levels.

"Whether you've experienced a rash at the injection site right away or this delayed skin reaction, neither condition should prevent you from getting the second dose of the vaccine," says lead author Kimberly Blumenthal, MD, MSc, in a Massachusetts General Hospital press release. "Our immediate goal is to make physicians and other care providers aware of this possible delayed reaction, so they are not alarmed, but instead well-informed and equipped to advise their patients accordingly."

January 15 Norwegian officials urged caution in vaccination of people more than 80 years of age with serious underlying diseases. Out of 33,000 doses given so far in Norway, the country recorded 23 deaths with suspected ties to the COVID-19 vaccine. Investigation of 13 of these deaths suggest that common side effects contributed to a more severe course of underlying disease.

COVID-19 Vaccine AstraZeneca: benefits still outweigh the risks despite possible link to rare blood clots with low blood platelets

Share

News 18/03/2021

EMA's safety committee, PRAC, concluded its preliminary review of a signal of blood clots in people vaccinated with COVID-19 Vaccine AstraZeneca at its extraordinary meeting of 18 March 2021. The Committee confirmed that:

- the benefits of the vaccine in combating the still widespread threat of COVID-19 (which itself results in clotting problems and may be fatal) continue to outweigh the risk of side effects;
- the vaccine is not associated with an increase in the overall risk of blood clots (thromboembolic events) in those who receive it;
- there is no evidence of a problem related to specific batches of the vaccine or to particular manufacturing sites;
- however, the vaccine may be associated with very rare cases of blood clots associated with thrombocytopenia, i.e. low levels of blood platelets (elements in the blood that help it to clot) with or without bleeding, including rare cases of clots in the vessels draining blood from the brain (CVST).

These are rare cases – around 20 million people in the UK and EEA had received the vaccine as of March 16 and EMA had reviewed only 7 cases of blood clots in multiple blood vessels (disseminated intravascular coagulation, DIC) and 18 cases of CVST. A causal link with the vaccine is not proven, but is possible and deserves further analysis.

The approved vaccines are quite reactogenic (=numerous very common adverse reactions). This also indicates that "they are working"

Pfizer/BioNTech: "Comirnarty"

Table 1: Adverse reactions from Comirnaty clinical trials

System Organ Class	Very common (≥ 1/10)	Common (≥ 1/100 to < 1/10)	Uncommon (≥ 1/1,000 to < 1/100)	Rare (≥ 1/10,000 to < 1/1,000)	Not known (cannot be estimated from the available data)
Blood and lymphatic system disorders			Lymphadenopathy		
Immune system disorders					Anaphylaxis; hypersensitivity
Psychiatric disorders			Insomnia		
Nervous system disorders	Headache			Acute peripheral facial paralysis†	
Gastrointestinal disorders		Nausea			
Musculoskeletal and connective tissue disorders	Arthralgia; myalgia		Pain in extremity		
General disorders and administration site conditions	Injection site pain; fatigue; chills; pyrexia*; injection site swelling	Injection site redness	Malaise; injection site pruritus		

*A higher frequency of pyrexia was observed after the 2nd dose.
†Throughout the safety follow-up period to date, acute peripheral facial paralysis (or palsy) was reported by four participants in the COVID-19 mRNA Vaccine group. Onset was Day 37 after Dose 1 (participant did not receive Dose 2) and Days 3, 9, and 48 after Dose 2. No cases of acute peripheral facial paralysis (or palsy) were reported in the placebo group.

Moderna: "COVID-19 Vacuna Moderna"

Within each frequency grouping, adverse reactions are presented in order of decreasing seriousness.

MedDRA System Organ Class	Frequency	Adverse reactions
Blood and lymphatic system disorders	Very common	Lymphadenopathy*
Immune system disorders	Not known	Anaphylaxis Hypersensitivity
Nervous system disorders	Very common	Headache
	Rare	Acute peripheral facial paralysis**
Gastrointestinal disorders	Very common	Nausea/vomiting
Skin and subcutaneous tissue disorders	Common	Rash
Musculoskeletal and connective tissue disorders	Very common	Myalgia Arthralgia
General disorders and administration site conditions	Very common	Injection site pain Fatigue Chills Pyrexia Injection site swelling
	Common	Injection site erythema, Injection site urticaria, Injection site rash
	Uncommon	Injection site pruritus
	Rare	Facial swelling***

*Lymphadenopathy was captured as axillary lymphadenopathy on the same side as the injection site.
**Throughout the safety follow-up period, acute peripheral facial paralysis (or palsy) was reported by three participants in the COVID-19 Vaccine Moderna group and one participant in the placebo group. Onset in the vaccine group participants was 22 days, 28 days, and 32 days after Dose 2.
***There were two serious adverse events of facial swelling in vaccine recipients with a history of injection of dermatological fillers. The onset of swelling was reported 1 and 2 days, respectively, after vaccination

The approved vaccines are quite reactogenic (=numerous very common adverse reactions). This also indicates that “they are working” (Cont.)

AstraZeneca

Table 1 Adverse drug reactions

MedDRA SOC	Frequency	Adverse Reactions
Blood and lymphatic system disorders	Uncommon	Lymphadenopathy
Metabolism and nutrition disorders	Uncommon	Decreased appetite
Nervous system disorders	Very common	Headache
	Uncommon	Dizziness Somnolence
Gastrointestinal disorders	Very common	Nausea
	Common	Vomiting Diarrhoea
Skin and subcutaneous tissue disorders	Uncommon	Hyperhidrosis Pruritus Rash
Musculoskeletal and connective tissue disorders	Very common	Myalgia Arthralgia
General disorders and administration site conditions	Very common	Injection site tenderness Injection site pain Injection site warmth Injection site pruritus Injection site bruising[a] Fatigue Malaise Feverishness Chills
	Common	Injection site swelling Injection site erythema Fever[b]

[a] Injection site bruising includes injection site haematoma (uncommon)
[b] Measured fever ≥38°C

J&J /Janssen

Table 1: Adverse reactions reported following vaccination with COVID-19 Vaccine Janssen

System Organ Class	Very common (≥1/10)	Common (≥1/100 to <1/10)	Uncommon (≥1/1 000 to <1/100)	Rare (≥1/10 000 to <1/1 000)	Not known (cannot be estimated from the available data)
Immune system disorders				Hypersensitivity[a]; urticaria	Anaphylaxis[b]
Nervous system disorders	Headache		Tremor		
Respiratory, thoracic and mediastinal disorders		Cough	Sneezing; oropharyngeal pain		
Gastrointestinal disorders	Nausea				
Skin and subcutaneous tissue disorders			Rash; hyperhidrosis		
Musculoskeletal and connective tissue disorders	Myalgia	Arthralgia	Muscular weakness; pain in extremity; back pain		
General disorders and administration site conditions	Fatigue; injection site pain	Pyrexia; injection site erythema; injection site swelling; chills	Asthenia; malaise		

[a] Hypersensitivity refers to allergic reactions of the skin and subcutaneous tissue.
[b] Cases received from an ongoing open-label study in South Africa.

Some countries are promoting to “mix and match” vaccines or to delay the second dose in order to reach a larger population with first dose

New UK trial will 'mix and match' different Covid vaccines

A new trial testing whether giving people two different Covid vaccines for their first and second doses is as effective as the current approach of using the same vaccine for both has been launched.

City AM (Febrero 4th, 2021)

Britain trial to test combining Pfizer and AstraZeneca vaccines in two-shot regimen

By Reuters Staff 3 MIN READ

LONDON (Reuters) - Britain on Thursday launched a trial to assess the immune responses generated if doses of the COVID-19 vaccines from Pfizer Inc and AstraZeneca Plc are combined in a two-shot schedule.

Reuters (February 3rd, 2021)

Canada vaccine panel recommends 4 months between coronavirus doses

Brad Wouters 🇨🇦
@bradwouters

This is way outside of NACI jurisdiction. There are no data. Nobody in the world has been 4 months between doses. These are RNA vaccines never used before. We should use evidence to make decisions. Canada conducting a population level experiment.

Anthony Dale @AnthonyDaleOHA
This is a huge decision & I am sure NACI gave it thorough, rigorous consideration. But to engender trust & confidence within the health care system & general public we need more than an online posting and tweets from @GovCanHealth. canada.ca/en/public-heal... #onhealth #onpoli

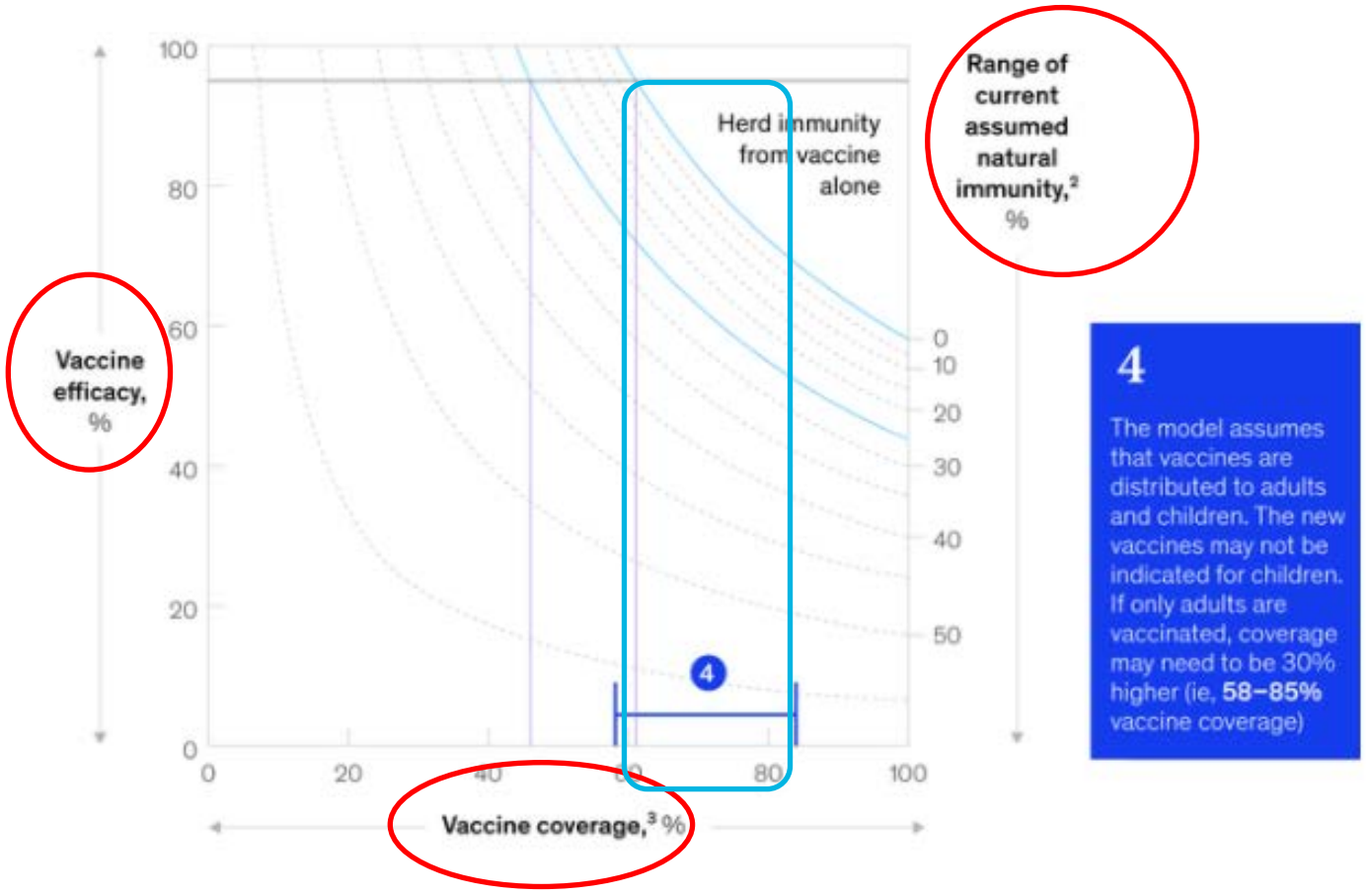
7:21 PM · Mar 3, 2021 from Toronto, Ontario

247 142 Copy link to Tweet

AXIOS (March 4th, 2021)

Assuming 95% efficacy and 10% of existing immunity, we need ~ 70% of the vaccinated population:

COVID-19 immunity scenarios *(Source: McKinsey)*



Higher efficacy provides greater benefits to any vaccinated individual and may help encourage uptake among some segments of the population.

Higher efficacy also reduces the fraction of the population required to reach herd immunity.

*Assuming **95% efficacy** for the adult population (not indicated in children), vaccine coverage of around **58-85%** would be required if existing natural immunity is **25% - 0%,** respectively*

There are not (yet) enough doses globally: *66 million doses* would be needed in Spain for 33 million people (70% of population)

Farmacéutica	Contrato UE	Total dosis	Dosis para España	Calendario de aprobación previsto
Oxford/ Astra-Zeneca	Contrato firmado en agosto 2020	300 M (+100 M opcionales)	31.555.469 dosis	Rolling review iniciado en octubre 2020
Sanofi/GSK	Contrato firmado en septiembre de 2020 (derecho de adquisición)	300 M	Se decide cuando finalice la fase I/II	2021
BioN-Tech/ Pfizer	Contrato firmado en noviembre 2020	200 M (+100 M opcionales)	20.873.941 dosis	Rolling review iniciado en octubre 2020
J&J/Janssen	Contrato firmado en octubre 2020	200 M (+200 M opcionales)	Pendiente*	2021
Curevac	Acuerdo cerrado, pendiente de firma	225 M (+180 M dosis opcionales)	Pendiente*	2021
Moderna	Negociación muy avanzada	80 M (+80 M opcionales)	Pendiente*	Rolling review iniciado en noviembre 2020
Novavax	Negociación en curso	-	-	2021

* España representa el 10,57% de la población de la UE sin los países del Espacio Económico Europeo (EEE) y el 10,44% incluyendo los países del EEE (Noruega, Islandia y Lietchtenstein).

Approved **JAN 29, 2021**

Approved **DEC 21, 2020**

Approved **MAR 12, 2021**

Approved **JAN 12, 2021**

Spain is accelerating vaccine roll-out from 35,700 doses/day (first 5w) to **204,053 doses/day**.

Even if 10% of the Spanish population were vaccinated with Janssen (one dose) it would still take **17 months** to vaccinate 33 million people (63 M doses) at this speed.

An unprecedented SUCCESS (4 vaccines in <1y) and an unprecedented CHALLENGE: all-ages, all-countries vaccination campaign (7,500 million people)

Global Vaccination Campaign

(Bloomberg, updated 29 MAR 2021)

1.3 years to vaccinate 70% of the world?

Assumptions:

- *16.3 Million doses/day*
- *9,975 Million doses needed (70% of 7,500 Million people eligible; 10% one-dose vaccines and 90% two-dose)*

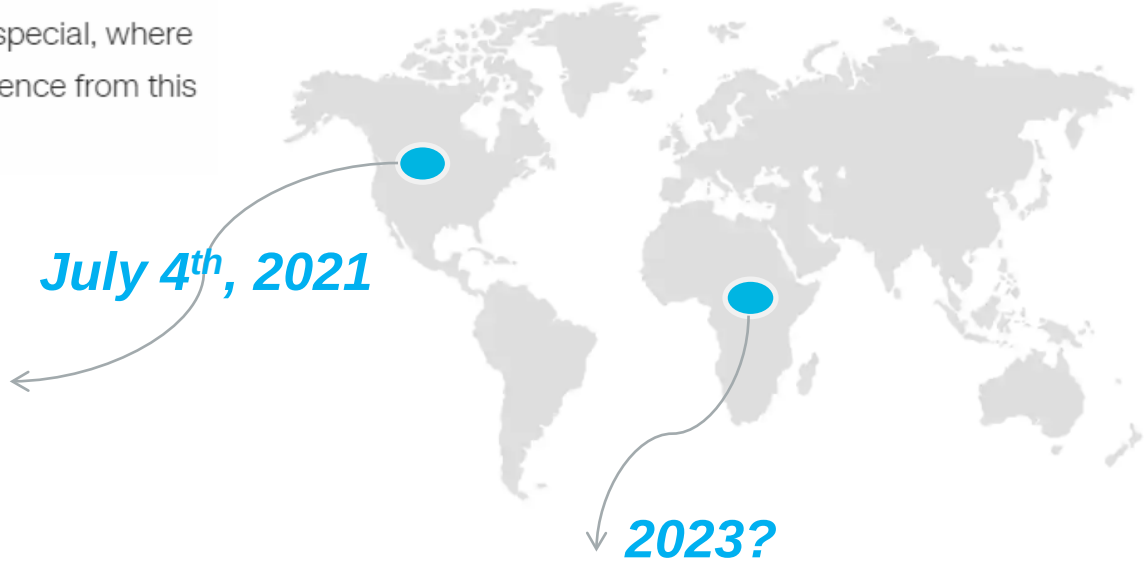
Global Vaccination Campaign

Country	Doses administered ▾	Enough for % of people	% of population: given 1+ dose	% of population: fully vaccinated	Daily rate of doses administered
Global Total	*689,646,491*	–	–	–	*16,276,596*
U.S.	168,592,075	26.0	32.6	19.0	2,998,533
China	142,802,000	5.1	–	–	4,548,571
India	84,065,357	3.1	5.3	0.8	3,093,861
EU	82,279,211	9.3	12.7	5.3	1,657,616
U.K. +	37,119,083	27.8	47.3	8.2	371,446
Brazil	26,366,794	6.3	9.8	2.8	646,865
Turkey	17,663,830	10.6	12.4	8.8	283,537
Germany	15,082,044	9.1	12.7	5.5	272,056
Indonesia	13,452,610	2.5	3.4	1.7	293,056
France	12,769,252	9.8	14.7	5.0	312,194
Russia	11,650,000	4.0	4.7	3.2	75,000
Italy	11,450,649	9.5	13.1	5.9	231,459
Chile	11,156,647	29.2	36.9	21.5	164,646
Israel	10,153,942	56.1	58.4	53.8	22,680
Mexico	9,287,405	3.6	6.4	0.9	324,137
Spain	9,021,001	9.7	13.2	6.2	183,484
UAE	8,659,503	40.3	–	–	62,674
Morocco	8,375,241	11.8	12.3	11.2	70,420
Poland	6,665,384	8.8	12.1	5.5	100,207

Half-full or half-empty? It depends on where you live

"After this long hard year, that will make this Independence Day something truly special, where we not only mark our independence as a nation but begin to mark our independence from this virus," he said.

March 11, 2021



Here's the good news. Covid-19 vaccination is here. Here's the bad news. Based on current procurement estimates, only 30 percent of Kenyans will have been vaccinated by 2023. In perspective, the two-shot Oxford/Astra-Zeneca we are acquiring expires in six months (as, mostly, do the others), which is why logistics matter. But here's the global perspective.

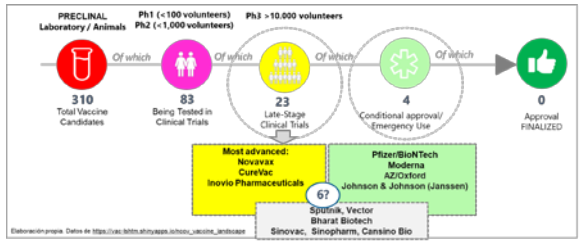
What needs to happen to go faster?

More APPROVED vaccines

More AVAILABLE doses

Massive VACCINATION

More VACCINE trust



MERCK

Media > News releases > News release

Merck to Help Produce Johnson & Johnson's COVID-19 Vaccine; BARDA to Provide Merck With Funding to Expand Merck's Manufacturing Capacity for COVID-19 Vaccines and Medicines

NOVARTIS

Our Company | Our Focus | Our Impact | Our

Novartis signs initial agreement with CureVac to manufacture COVID-19 vaccine candidate

← Back to News Archive

Mar 04, 2021

- *Novartis to support global supply of another COVID-19 vaccine, leveraging manufacturing capacity and capabilities to help address pandemic.*
- *Novartis plans to manufacture the mRNA and bulk drug product of the CVnCoV vaccine candidate for up to 50 million doses by the end of 2021 and up to a further 200 million doses in 2022. Delivery from manufacturing site in Kundl, Austria expected to start in summer 2021.*

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PRESS RELEASES · February 22 2021

Sanofi to provide manufacturing support to Johnson & Johnson for their COVID-19 vaccine to help address global supply demands

More COORDINATION

Will we have a vaccination passport?

EDITORIAL

COVID-19 vaccination passports

Christopher Dye[1†], Melinda C. Mills[2†]
+ See all authors and affiliations

Science 19 Mar 2021:
Vol. 371, Issue 6535, pp. 1184
DOI: 10.1126/science.abi5245

Article | Info & Metrics | eLetters | PDF

As countries grow eager to reignite their economies and people increasingly yearn for mobility and normalcy in life, pressure is mounting for some form of COVID-19 health status certificate that would support these desires. There has already been an explosion of COVID-19 passport initiatives for domestic use and international travel. But scientific, legal, and ethical concerns abound with such documentation. Given the high stakes, what is the path forward?

From doctors' examinations to ship inspections, clean bills of health have secured passage through centuries of human plagues. Today's best-known health passport is the International Certificate of Vaccination or Prophylaxis, created by the World Health Organization (WHO). WHO's Yellow Card has certified vaccinations for cholera, plague, and typhoid, among other infections. There is certainly precedent for a COVID-19 vaccination passport certifying that the holder can

REUTERS

HEALTHCARE & PHARMACEUTICALS MARCH 1, 2021 / 7:43 AM / UPDATED 21 DAYS AGO

EU to propose vaccine certificates in time for summer holidays

By Sabine Siebold, Philip Blenkinsop 2 MIN READ

Considerations:

- *Vaccines don't protect from infection*
- *Lack of access for some populations*
- Data protection
- International validity
- Equity

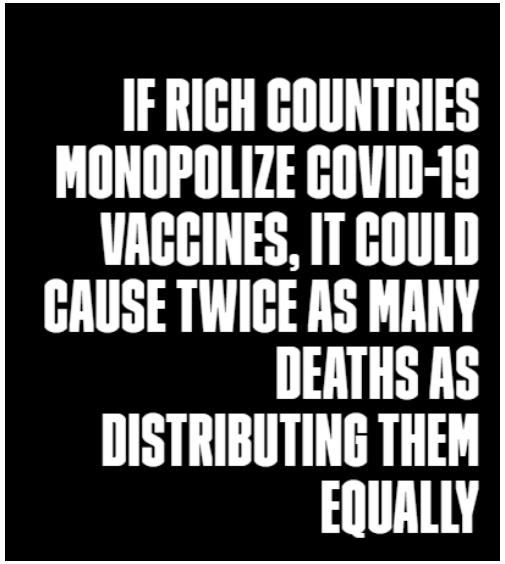
Global vaccination requires generosity… but it's also the smart thing to do as it can generate returns as high as 166x the investment

High and upper-middle income countries have purchased 71% of the 8,600 million doses purchased

- 4,600 M High Income Countries
- 1,500 M Middle High Countries
- 1,381 Low Income Countries
- 1,120 COVAX

14,900 M doses reserved: 8.6 billion confirmed purchased doses, with another 6.3 billion doses potential expansion

Source: Duke Global Health Innovation Center (30 MAR 2021)



Source: Northeastern (14 SEP 2020)

61% of deaths could be averted if the vaccine was distributed to all countries proportional to population, while only **33% of deaths** would be averted if high-income countries got the vaccines first.

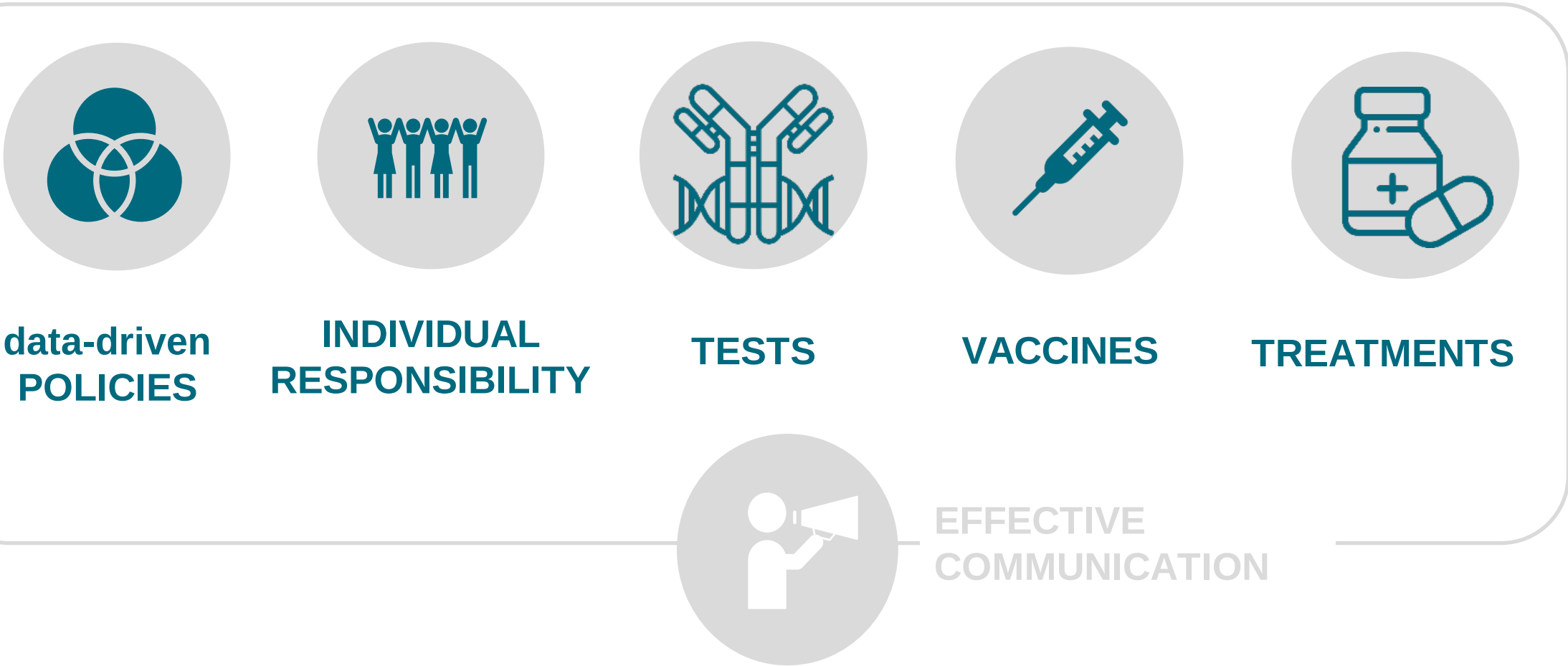
https://launchandscalefaster.org/covid-19/vaccineprocurement

Source: International Chamber of Commerce (25 JAN 2021)

US $27.2 billion investment on the part of advanced economies – the current funding shortfall to fully capitalize the ACT Accelerator and its vaccine pillar COVAX – is capable of generating returns as high as **166x the investment.**

The economic costs borne by wealthy countries in the absence of multilateral coordination guaranteeing vaccine access and distribution range between **US $203 billion** and **$5 trillion, depending on the strength of trade and international production network relations.** **The ACT Accelerator is fully costed at US$ 38 billion.**

Five different types of interventions are [and will continue to be] necessary in the global COVID-19 toolkit




Do we really want to go “back to normal”?
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