

What we know about **COVID-19 vaccine development**

THE LATEST ON THE COVID-19 GLOBAL SITUATION
& VACCINE DEVELOPMENT

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Current global situation

As of 04 October 2020; (10H CEST)

- **> 34 million cases**

- 5 countries with highest cumulative number of cases



United States of America



India



Brazil



Russian Federation



Colombia

- **> 1 million deaths**

(exceeded 30 September 2020)

- 5 countries with highest cumulative number of deaths



United States of America



Brazil



India



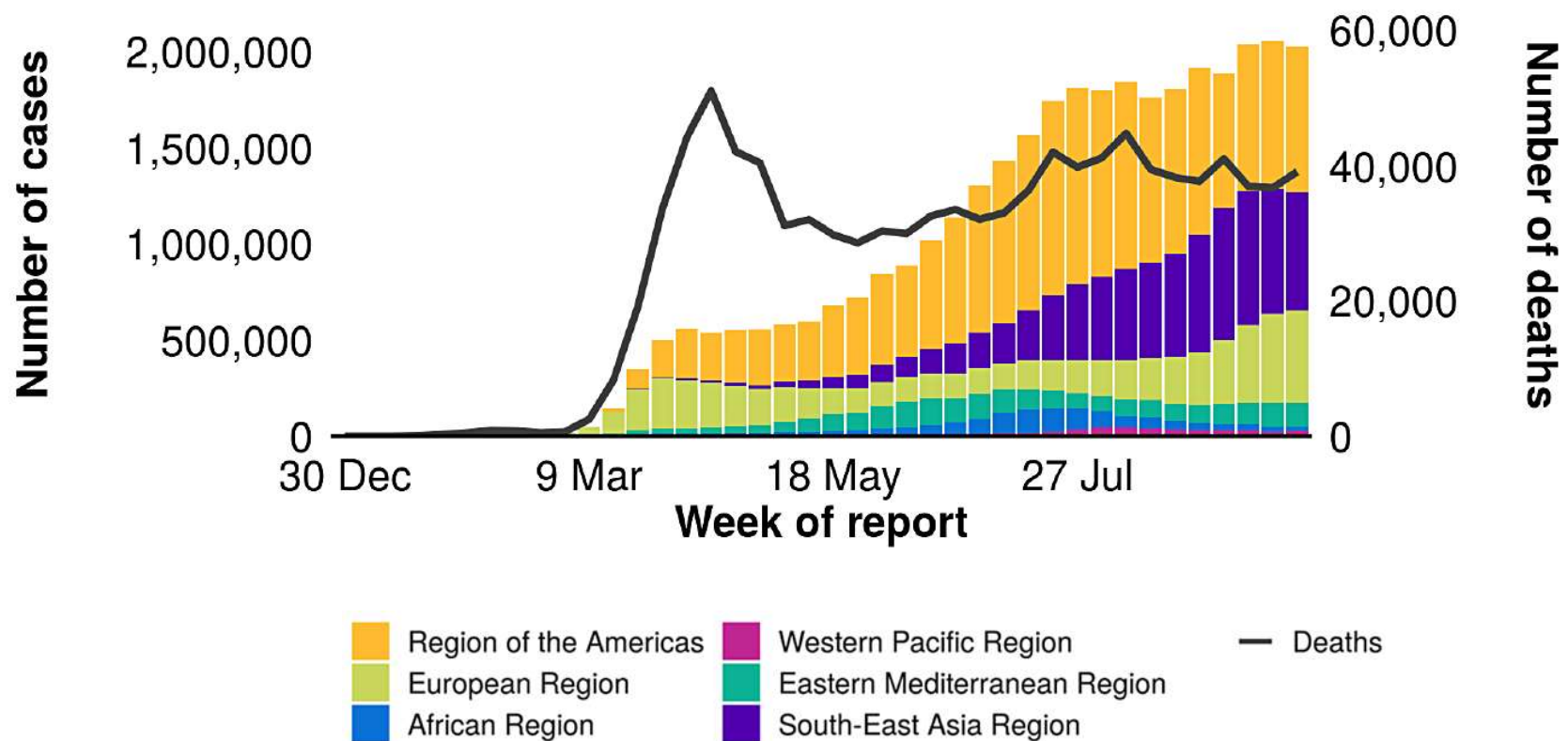
Mexico



The United Kingdom

Current global situation

(Cases reported to WHO as of 04 October 2020, 10:00 CEST)

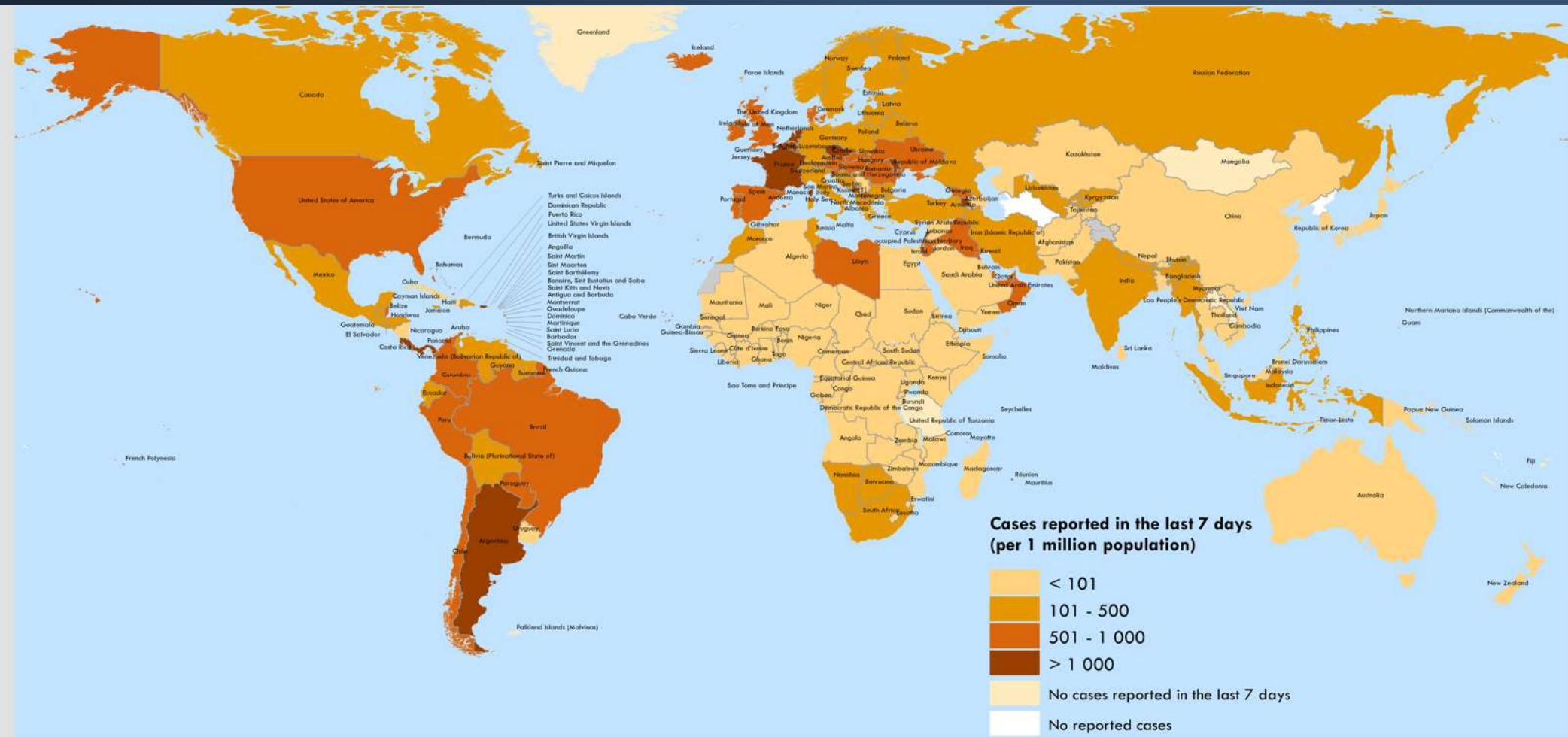


* Cases depicted by bars; deaths depicted by line

COVID-19 cases reported in the last 7 days

Per million population

(FROM 28 SEPTEMBER 2020, 10:00AM CEST to 04 OCTOBER 2020, 10:00 AM CEST)



Data Source: World Health Organization,
United Nations Population Division (population prospect 2020)
Map Production: WHO Health Emergencies Programme



Not applicable

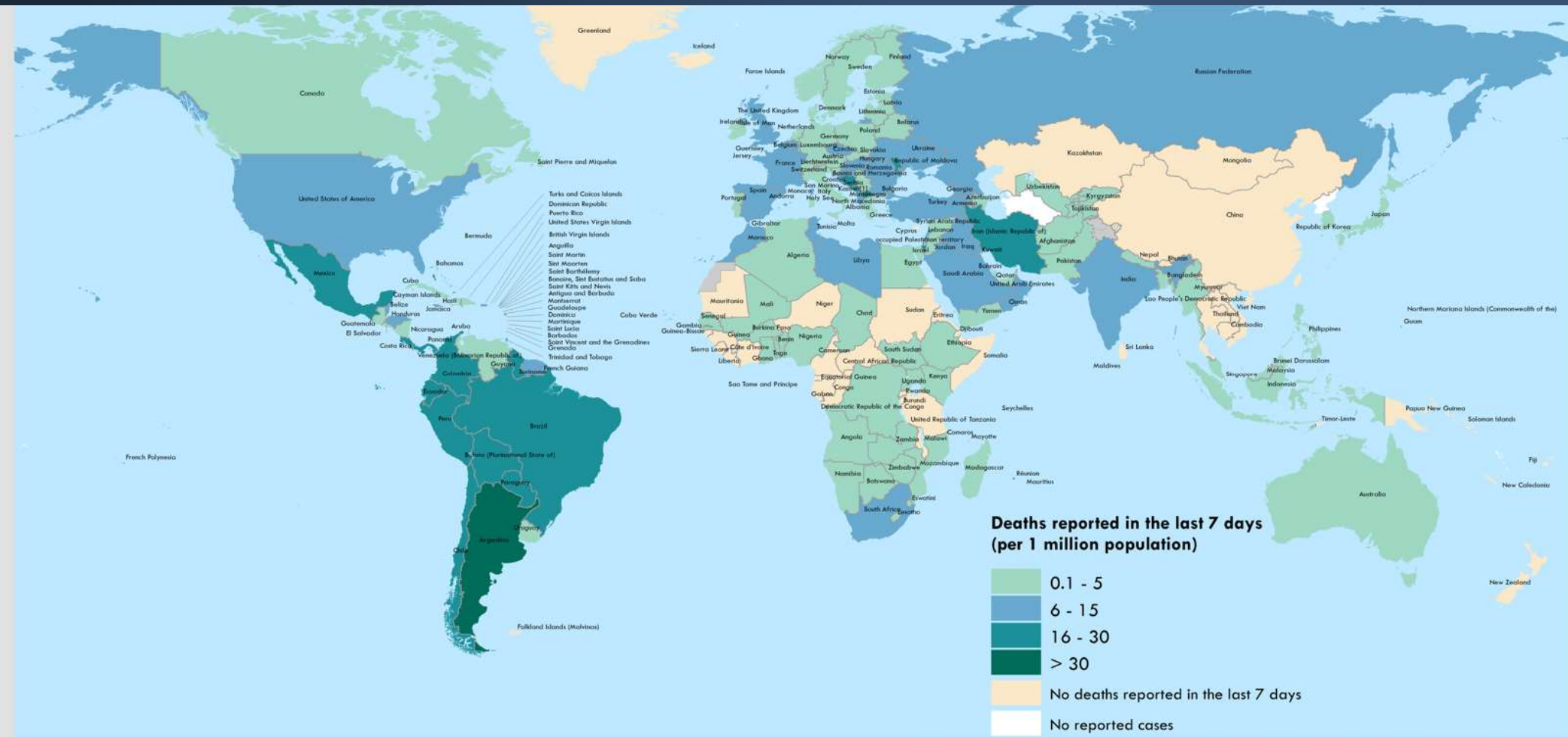
0 2,500 5,000 km
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COVID-19 deaths reported in the last 7 days

Per million population

(FROM 28 SEPTEMBER 2020, 10:00AM CEST to 04 OCTOBER 2020, 10:00 AM CEST)



Data Source: World Health Organization,
United Nations Population Division (population prospect 2020)
Map Production: WHO Health Emergencies Programme

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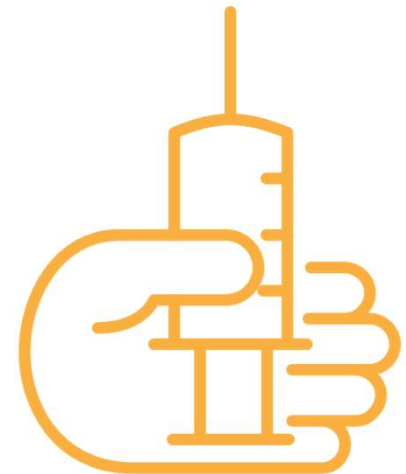
Why we use vaccines

- **Vaccines can prevent infectious diseases.** Examples of vaccine-preventable diseases are: measles, polio, hepatitis B, influenza and many others.
- When most people in a community are vaccinated against a disease, the ability of the pathogen to spread is limited. This is called 'herd' or 'indirect' or 'population' immunity.
- When many people have immunity, this also indirectly protects people who cannot be vaccinated, such as very young babies and those who have compromised immune systems.



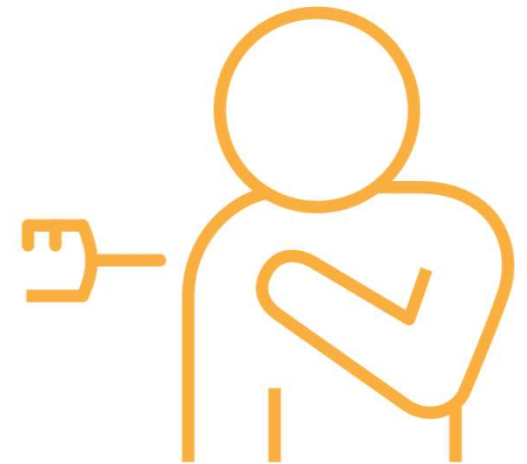
How vaccines work

- Vaccines greatly reduce the risk of infection by training the immune system to recognize and fight pathogens such as viruses or bacteria
- Vaccines safely deliver an **immunogen** which is a *specific type of antigen that elicits an immune response*, to train the immune system to recognize the pathogen when it is encountered naturally.



How vaccines are delivered

- A vaccine can be administered through different routes, for example injection in the muscle or under the skin or via the oral route.
- Vaccines sometimes require **more than one dose** to:
 - build complete immunity
 - give a 'booster' dose when immunity wears off
 - immunize people against viruses causing disease that may be different from season to season, for example, the yearly flu vaccine



Immunogens used to develop viral vaccines

- Vaccines are being developed with different technologies — some well-known and others completely new for human vaccines, such as peptide and nucleic acid technologies

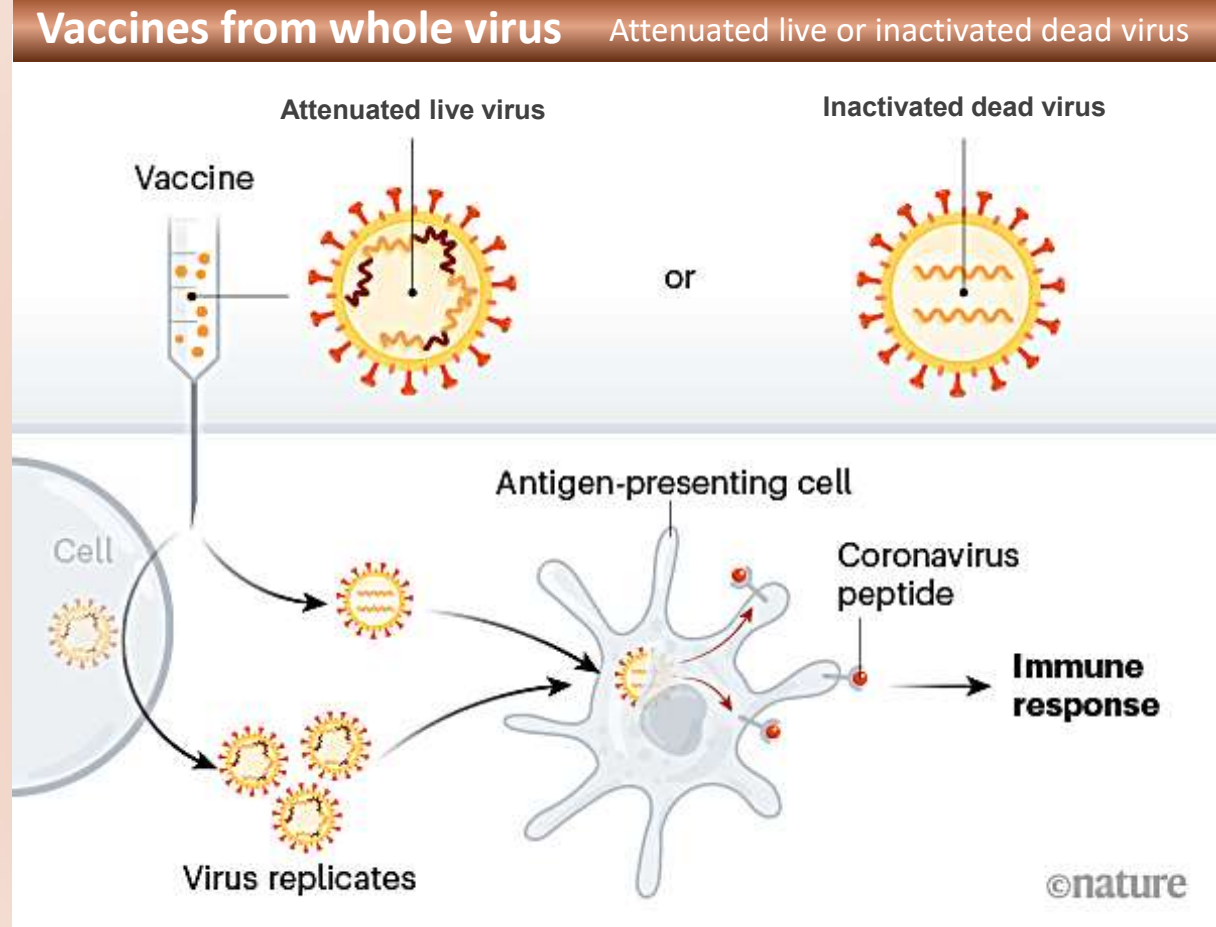
IMMUNOGEN	HOW IT WORKS	ADVANTAGE	DISADVANTAGE	EXAMPLE of vaccines
Attenuated live virus	Live virus but doesn't cause disease	Induces same response as natural infection	Not recommended for pregnant women and immunocompromised persons	Measles, rubella, mumps, yellow fever, smallpox (vaccinia)
Whole inactivated virus	Inactivated dead virus	Induces strong antibody response	Requires large quantities of virus	Influenza, rabies hepatitis A
Protein subunit	A protein derived from a pathogen	May have fewer side effects than whole virus (redness, swelling at injection site)	May be poorly immunogenic; complex process	Influenza
Recombinant	Host cell is used to express an antigen	No need to produce the whole virus	May be poorly immunogenic; High cost	Hepatitis B
Peptides	Synthetic produced fragment of an antigen	Rapid development	Poorly immunogenic; High cost	<i>COVID-19 vaccines in development</i>
Replicating or non-replicating viral vector	Viral pathogen expressed on a safe virus that doesn't cause disease	Rapid development	Prior exposure to vector virus (eg. adenovirus) may reduce immunogenicity	Ebola
Nucleic acid	DNA or RNA coding for a viral protein	Strong cellular immunity; rapid development	Relatively low antibody response	<i>COVID-19 vaccines in development</i>

Virus vaccines

- **Virus is selected, modified (weakened) or completely inactivated** so that it will not cause disease

Note:

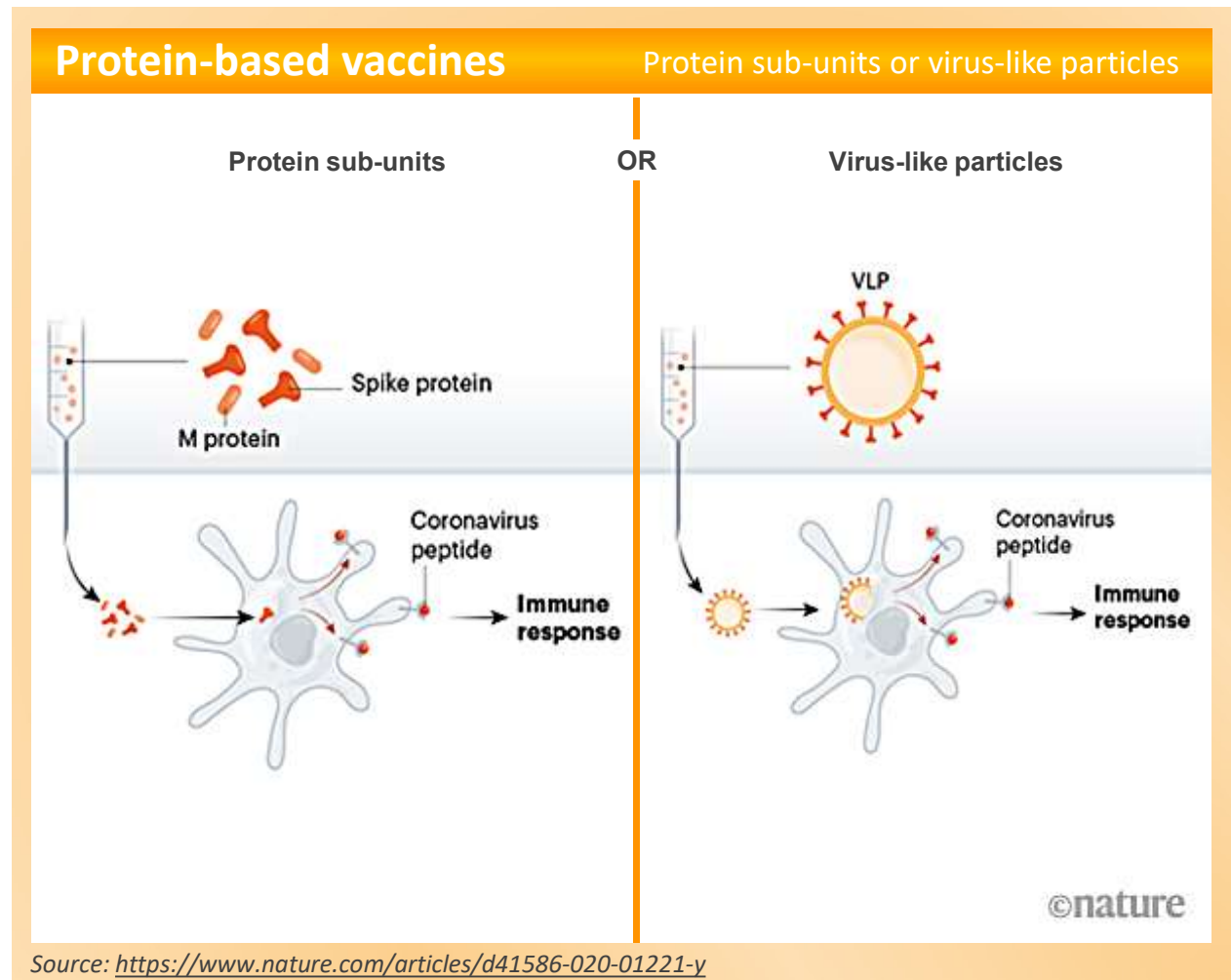
This illustration shows injectable vaccines. Some vaccines in this category are administered orally



Source: <https://www.nature.com/articles/d41586-020-01221-y>

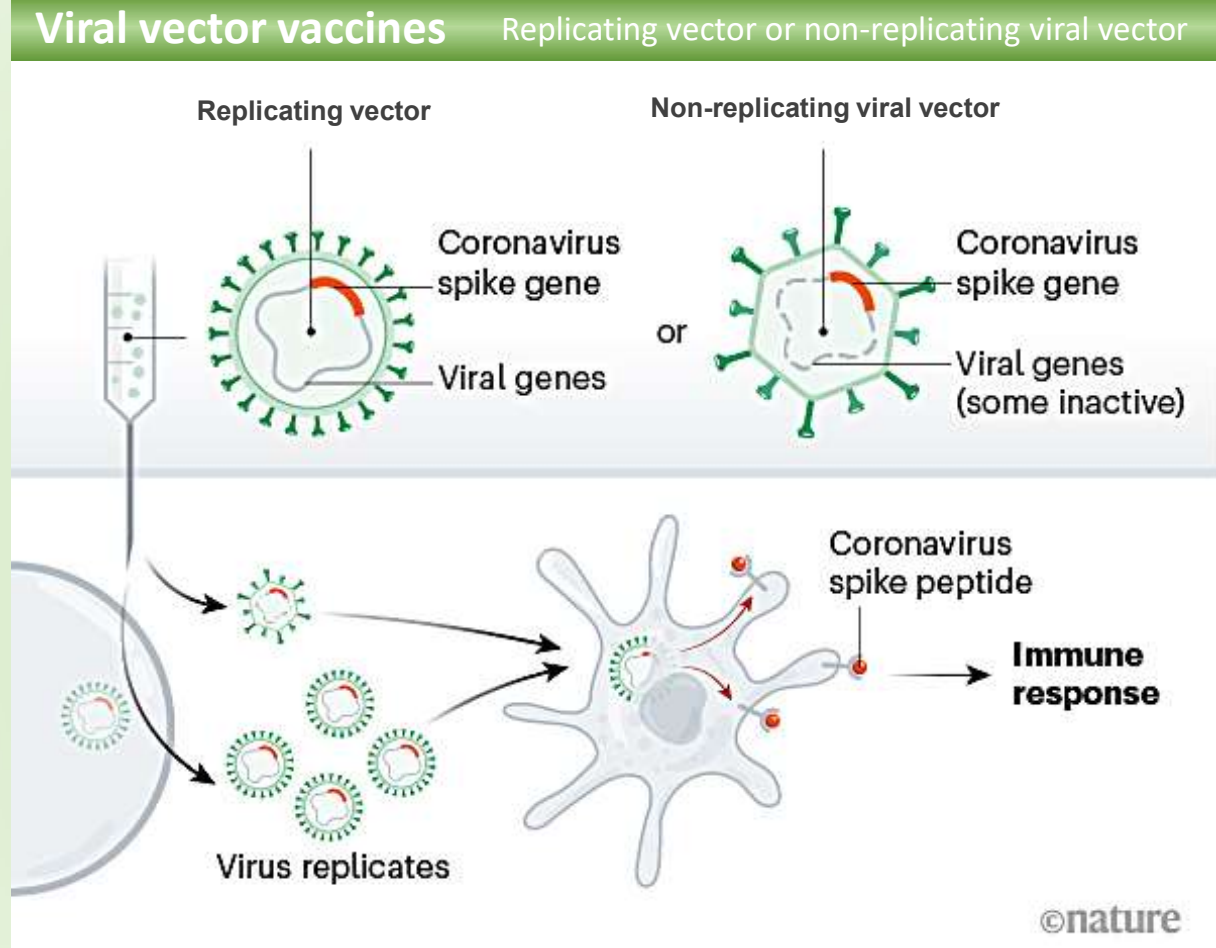
Protein-based vaccines

- A protein is extracted from the virus (alive or inactivated), purified, and injected as a vaccine
- For coronavirus, this is most commonly the spike protein
- Virus-like particles work in the same way



Viral vector vaccines

- The gene for a pathogen protein is inserted into a **different virus** that can infect someone without causing disease
- The safe virus serves as a 'platform' or 'vector' to deliver the protein that triggers an immune response
- The safe virus is then injected as a vaccine
- Some replicate (reproduce) in the body and some do not

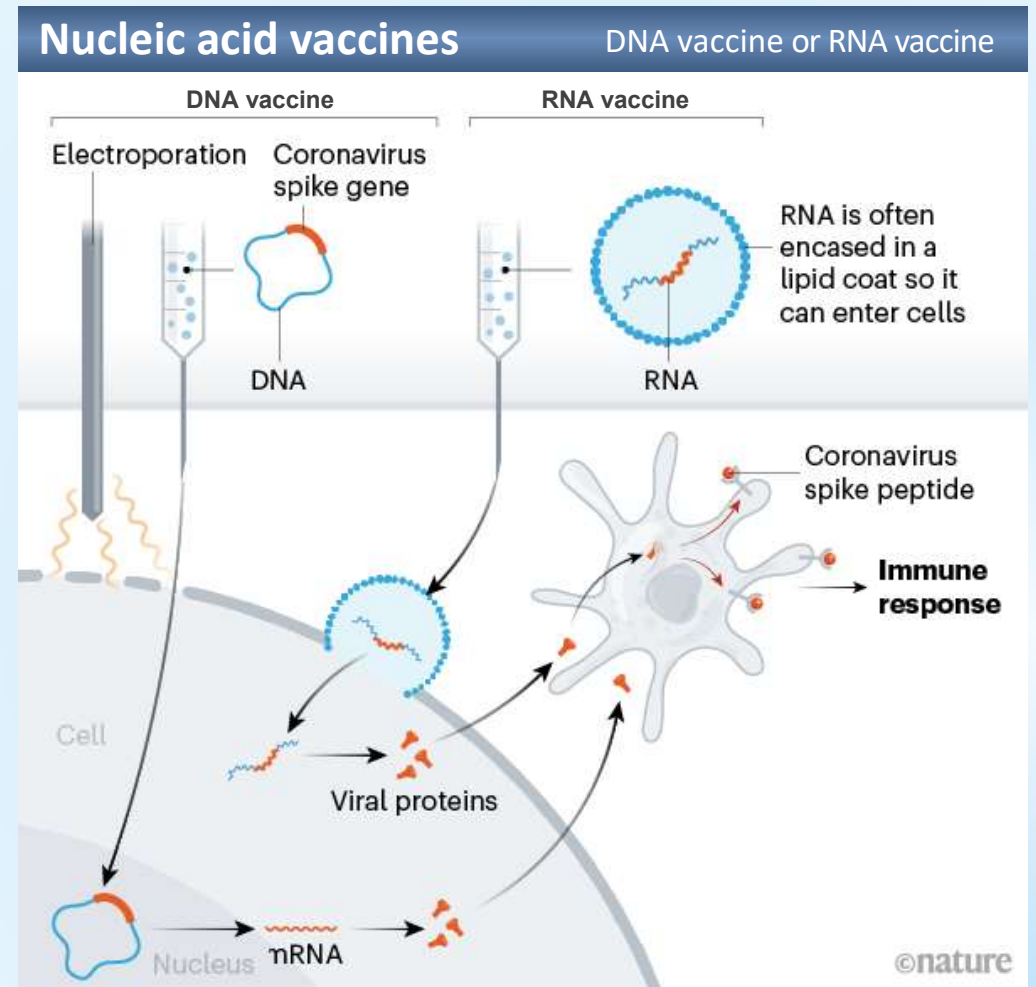


Source: <https://www.nature.com/articles/d41586-020-01221-y>

Nucleic acid vaccines

- Instead of a virus, a protein antigen, or a virus expressing the protein, **nucleic acid coding for the antigen is injected**
- DNA plasmid: enters nucleus, translated to mRNA for expression of protein
- Or mRNA can be injected. More direct (no translation required) but less stable than DNA
- This is new technology – no other vaccines for human use have used this

Source: <https://www.nature.com/articles/d41586-020-01221-y>



Steps in vaccine development

Actions taken to ensure a new vaccine is safe and works well

- **Pre-clinical studies**

Vaccine is tested in animal studies for efficacy and safety, including challenge studies

- **Phase I clinical trial**

Small groups of healthy adult volunteers receive the vaccine to test for safety

- **Phase II clinical trial**

Vaccine is given to people who have characteristics (such as age and physical health) similar to those for whom the new vaccine is intended

- **Phase III clinical trial**

Vaccine is given to thousands of people and tested for efficacy and safety

- **Phase IV post marketing surveillance**

Ongoing studies after the vaccine is approved and licensed, to monitor adverse events and to study long-term effects of the vaccine in the population

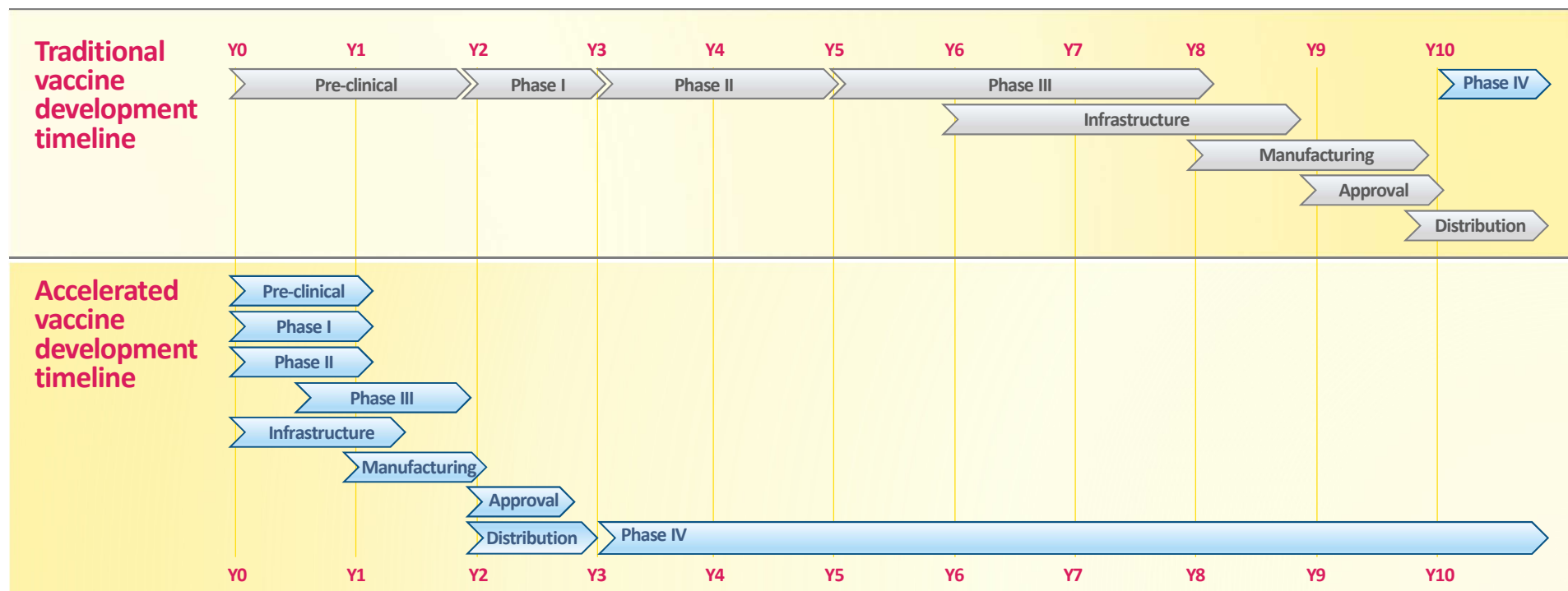
- **Human challenge studies**

Studies in which a vaccine is given followed by the pathogen against which the vaccine is designed to protect. Such trials are uncommon in people as they present considerable ethical challenges

Why there are so many COVID-19 vaccines in development

- There are many different COVID-19 vaccines in development because it is not yet known which ones will be effective and safe
- Based on experience, **roughly 7% of vaccines in preclinical studies** succeed. Candidates that reach **clinical trials have about a 20% chance of succeeding.**
- Different vaccine types may be needed for different population groups
- For example, some vaccines may work in older persons and some may not, as the immune system weakens with older age

COVID-19 vaccine accelerated development



- Normal vaccine development performs each step in sequence
- To accelerate COVID-19 vaccine development, **steps are done in parallel**
- All usual safety and efficacy monitoring mechanisms remain in place; such as adverse event surveillance, safety data monitoring & long-term follow-up
- **Phase IV post-marketing surveillance** for side effects is critical and essential

COVID-19 vaccine candidates in Phase III trials

- As of 02 October 2020 there are **42 COVID-19 candidate vaccines** in clinical evaluation of which **10 in Phase III trials**
- There are another **151 candidate vaccines in preclinical** evaluation
- Phase III trials usually require **30,000 or more participants**
- All top candidate vaccines are for **intra-muscular** injection
- Most are designed for a **two-dose** schedule (exceptions with a * in table are single dose)

10 CANDIDATE VACCINES IN PHASE III CLINICAL EVALUATION	VACCINE PLATFORM	LOCATION OF PHASE III STUDIES
Sinovac	Inactivated virus	Brazil
Wuhan Institute of Biological Products / Sinopharm	Inactivated virus	United Arab Emirates
Beijing Institute of Biological Products / Sinopharm	Inactivated virus	China
University of Oxford / AstraZeneca	Viral vector *	United States of America
CanSino Biological Inc. / Beijing Institute of Biotechnology	Viral vector *	Pakistan
Gamaleya Research Institute	Viral vector	Russia
Janssen Pharmaceutical Companies	Viral vector	USA, Brazil, Colombia, Peru, Mexico, Philippines, South Africa
Novavax	Protein subunit	The United Kingdom
Moderna / NIAID	RNA	USA
BioNTech / Fosun Pharma / Pfizer	RNA	USA, Argentina, Brazil

<https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines>

* Single dose schedule

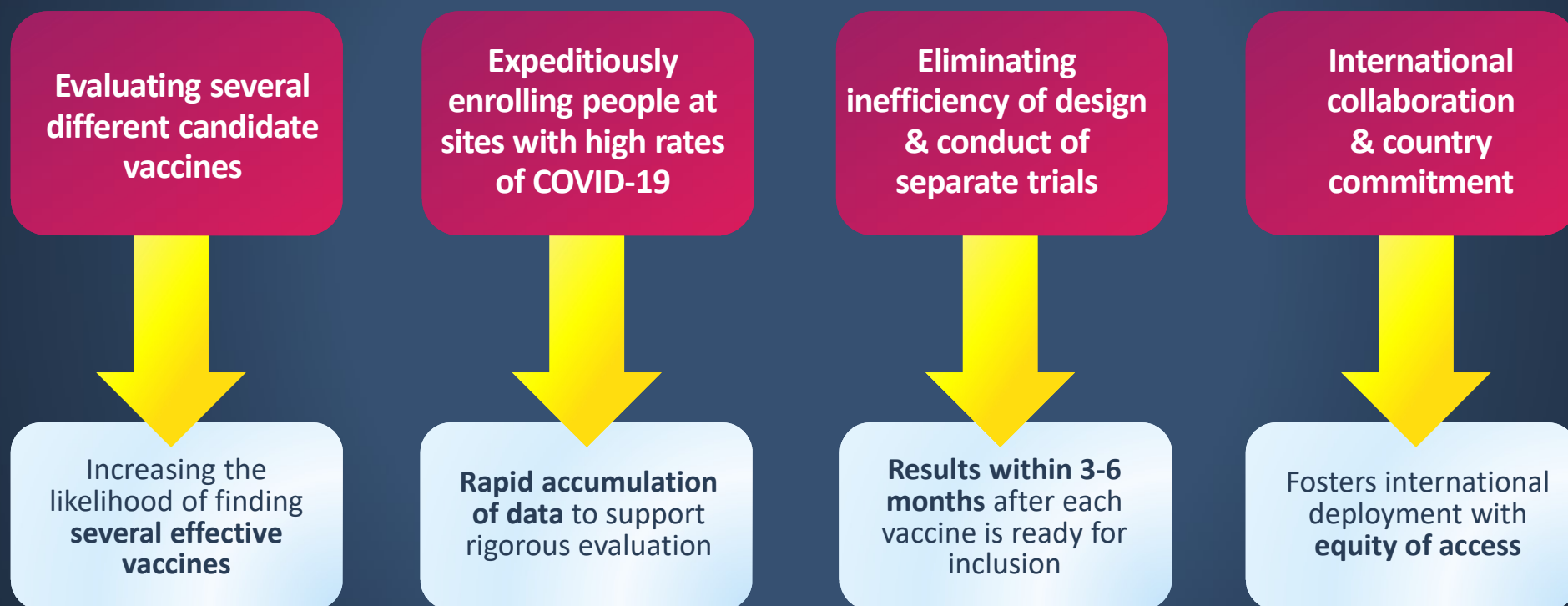
WHO COVID-19 Solidarity vaccine trial

- On 28 May 2020, WHO announced the launch of a coordinated international, concurrent randomized controlled Phase III trial of different vaccine candidates.
- A trial in several sites at once will help **speed evaluation** and **ensure that vaccines will have been tested in different populations**.
- **The trial aims to enroll more than 280,000 participants** from at least **470 different sites in 34 countries**.
- Local involvement will help to identify trial sites with high COVID-19 transmission and ensure community engagement.

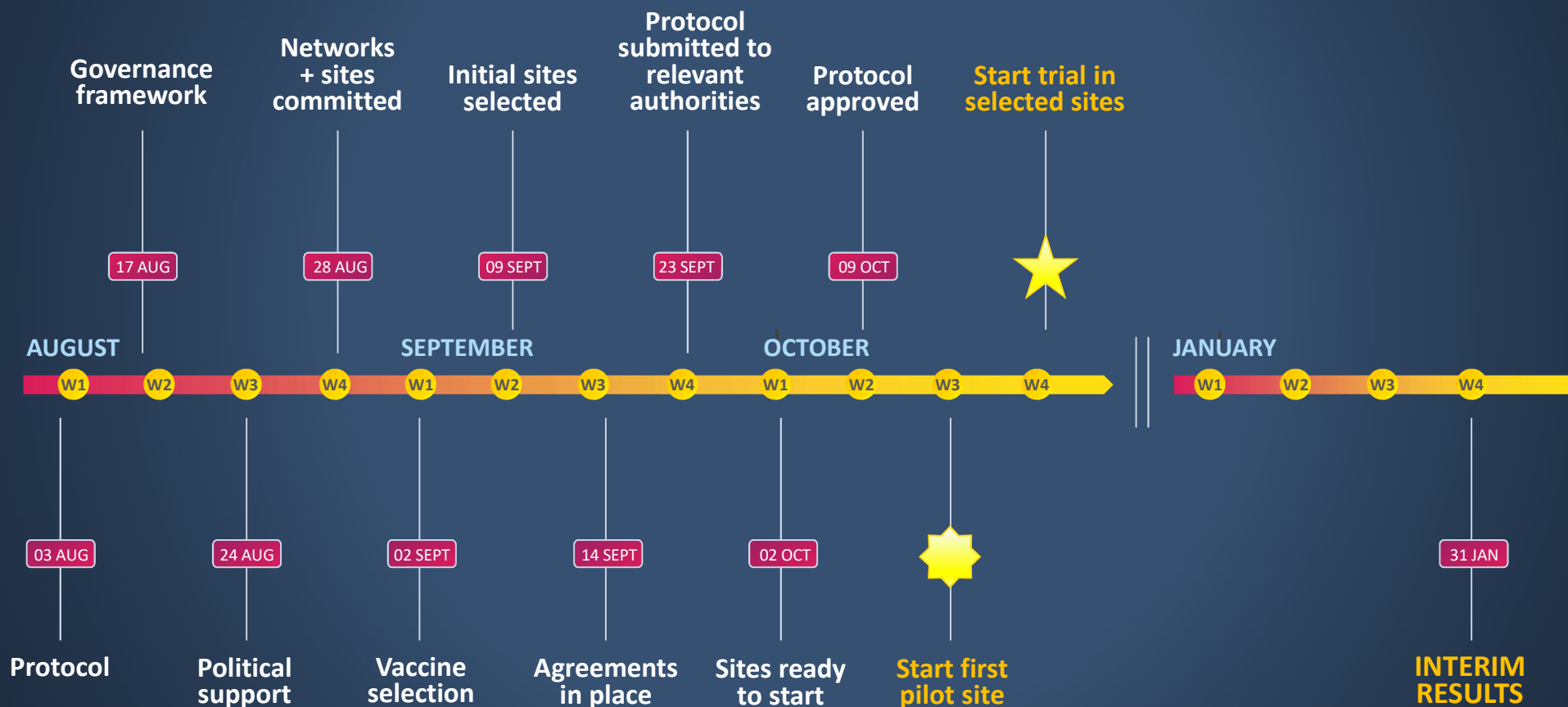
<https://www.who.int/publications/i/item/an-international-randomised-trial-of-candidate-vaccines-against-covid-19>

WHO Solidarity vaccine trial

Achieving rapid progress towards global objectives



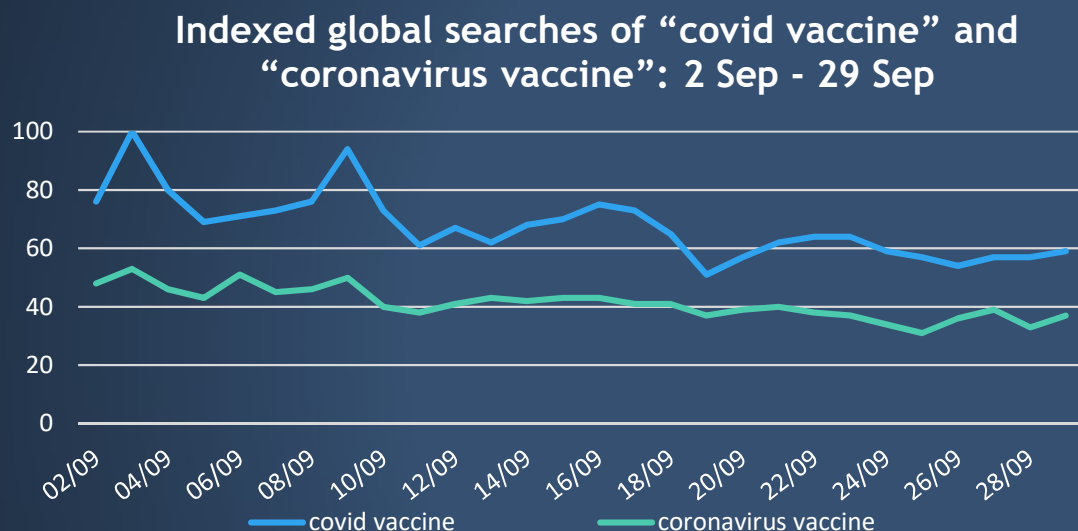
WHO Solidarity vaccine trial milestones



Monitoring social media on vaccine development

Most discussed topics surrounding COVID-19 vaccines development on social media

(24 SEPTEMBER to 30 SEPTEMBER 2020)



News: the Johnson & Johnson COVID-19 vaccine trial showed it was well tolerated and that a “strong immune response” was produced in almost all 800 participants.

Response: Concern that vaccine development in the US has been politicised and may lead to a vaccine being rushed was seen across many top posts.

• INTERNET SEARCHES

In the past week, searches for “johnson and johnson covid vaccine” rose by 250%

“Covid vaccine” was most likely to be searched in Brunei, Ireland and Ethiopia. Meanwhile, “coronavirus vaccine” saw the highest volume of searches in Ireland, Trinidad & Tobago and Nepal.

Working together to deliver vaccine to all countries

- The **Access to COVID-19 Tools (ACT) Accelerator** was launched in April 2020 to speed up development and delivery to countries of diagnostics, treatments and vaccines. It includes a health systems connector to support delivery of these resources to countries. Watch the video [here](#)!
- *WHO developed a **framework** for equitable and affordable access to safe and effective vaccines.*
- The **COVAX Facility is an umbrella mechanism** through which demand and resources are pooled to support procurement of, and equitable access to, COVID-19 vaccines.
- The ACT Accelerator aims to **deliver two billion vaccine doses** for global needs by the end of 2021.
- Vaccine allocation will be driven by public health needs for priority groups, which may represent about 20% of the population, in the first year.
- Countries will be asked to **develop vaccination plans** following advice from **SAGE**.
- WHO recommends **front-line personnel** (such as health workers) **and seniors** be the first priority to receive vaccine.
- *Coordinated by GAVI, the Coalition for Epidemic Preparedness Innovations (CEPI) and WHO.*

Resources on COVID-19 vaccine development

- [WHO Target Product Profile for COVID-19 vaccine](#)

This Target Product Profile (TPP) describes the preferred and minimally acceptable profiles for human vaccines for long term protection of persons at high ongoing risk of COVID-19, such as health workers, and for reactive use in outbreak settings with rapid onset of immunity.

- [Vaccine landscape](#)

Landscape documents prepared by the WHO for information purposes concerning the 2019-2020 global development of new COVID-19 vaccines.

- [Solidarity Vaccine Trial](#)

This large, international, randomized controlled clinical trial is designed to enable an expeditious, agile and concurrent evaluation of the benefits and risks of multiple candidate preventive vaccines against COVID-19 at international sites with sufficient COVID-19 attack rates.

- [Access to COVID Tools \(ACT\) Accelerator](#)

The vaccines pillar of the ACT Accelerator, convened is speeding up the search for an effective vaccine for all countries.

- [Covax facility \(WHO\)](#) [Covax explained](#) (GAVI) [COVAX](#) (CEPI)

- CEPI, Gavi and WHO launched COVAX to ensure equitable access to COVID-19 vaccines and end the acute phase of the pandemic by the end of 2021.
-

- [WHO Guidance on ethics of vaccine allocation](#)

This policy brief answers a number of questions about the ethics of setting priorities for the allocation of resources during times of scarcity. Such decisions may include access to hospitals, ventilators, vaccines and medicines.

How to protect ourselves & others

9 important COVID-19 prevention measures



- 01** **Stay home and self-isolate** if you feel unwell, even with mild symptoms



- 02** **Clean hands frequently** with soap & water for 40 seconds or with alcohol-based hand rub



- 03** **Cover your nose and mouth** with a disposable tissue or flexed elbow when you cough or sneeze



- 04** **Avoid touching** your eyes, nose and mouth



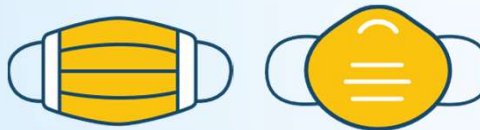
- 05** Maintain a minimum physical **distance of at least 1 metre** from others



- 06** **Stay away from crowds** and avoid poorly ventilated indoor spaces



- 07** **Use a fabric mask** where physical distancing of at least 1 metre is not possible



- 08** **Use a medical / surgical mask** if you may be at higher risk (age, medical conditions)



- 09** **Regularly clean & disinfect** frequently touched surfaces

WHO guidance on COVID-19

VIDEO RESOURCES

Masks



[Medical and fabric masks: who wears what when?](#)



[How to wear a fabric mask safely](#)



[How to wear a fabric mask](#)



[How to wear a medical mask](#)

Transmission



[How to break the chains of transmission](#)

Protecting ourselves



[How to protect yourself against COVID-19](#)



[Seven steps to prevent the spread of the virus](#)

Call for applicants: 1st WHO training in infodemic management

Online training over 4 weeks
3 – 27 November 2020

DEADLINE FOR SUBMISSION:
18 October 2020, 18:00 CET

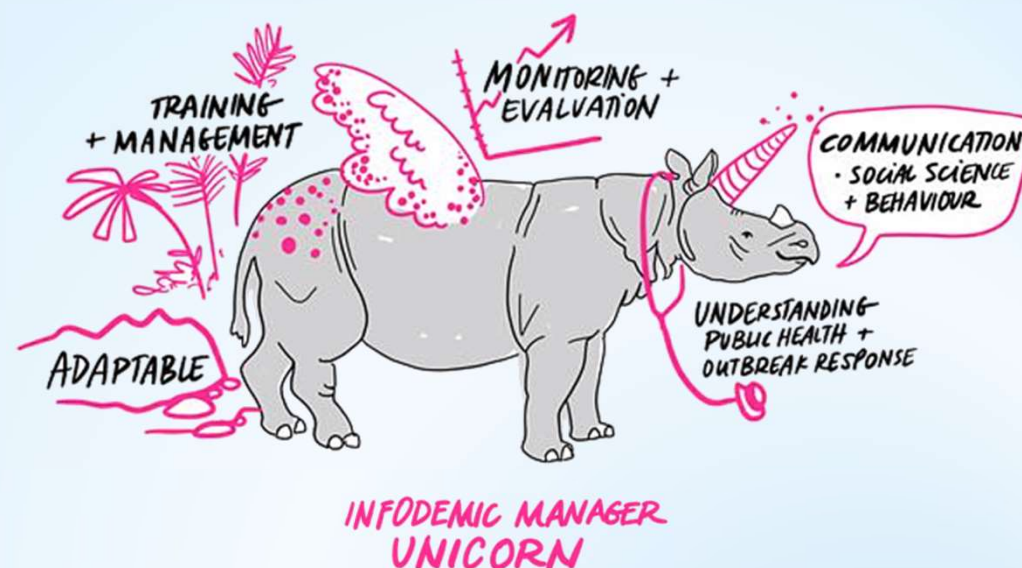
WHO is developing activities to support country preparedness and to mitigate the current COVID-19 pandemic. There is an urgent need to address the infodemic along with the COVID-19 pandemic, as most countries are battling both.

Applications are open to **freelance consultants, national health authority staff** and **United Nations staff** who meet the selection criteria to constitute a cohort of trained infodemic managers to support response in countries.

The primary objective of the training is to build the skills of health authority personnel in infodemic management.

Find out more about the training and specific [eligibility criteria](#).

NEW TRAINING



[FIND OUT MORE](#)



EPI•WiN

infodemic
MANAGEMENT

www.who.int/epi-win