

# Diagnositics and testing

CORONAVIRUS (COVID-19) UPDATE NO. 23  
23 April 2020



# Current global situation

- Nearly 2.5 million confirmed cases globally
- Nearly 170 000 deaths
- Four countries accounting for more than half of all new confirmed cases: USA, Russian Federation, Turkey and the United Kingdom

For the latest data, please access:

[WHO situation dashboard](#)

[WHO situation reports](#)

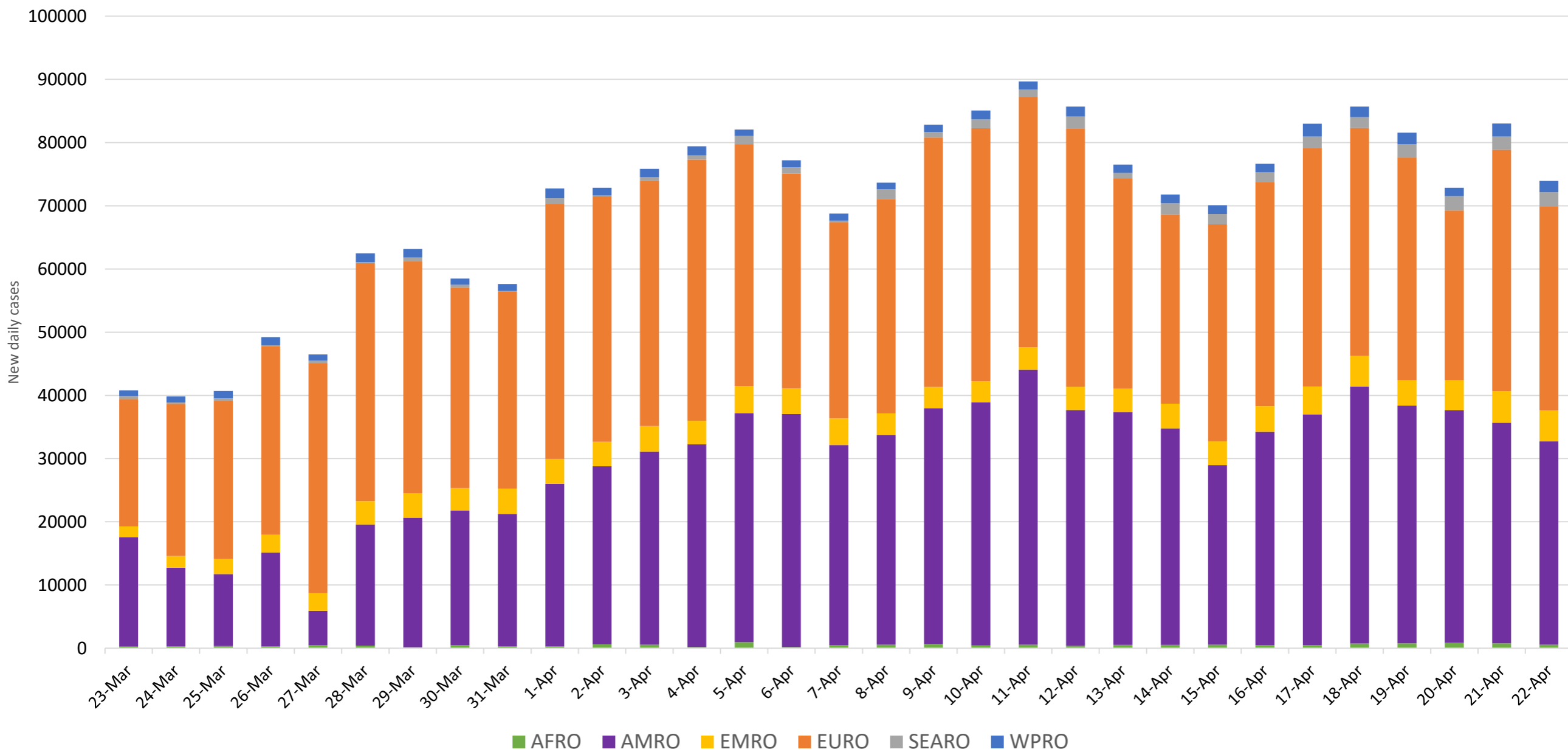
[UNWFP world travel restrictions](#)

Data as of 23.04.2020



# Global situation – the past month

Number of new cases of COVID-19 per day, by WHO Region

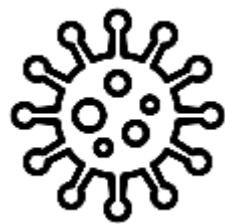




# DIAGNOSTICS & TESTING

There are different types of diagnostic tests available. Some diagnostic tests detect infection and others detect an immune response. Testing plays an important role in a public health response to COVID-19 [MORE](#)

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The immune response to COVID-19 infection



Diagnostic tests for COVID-19



Breaking the chains of transmission



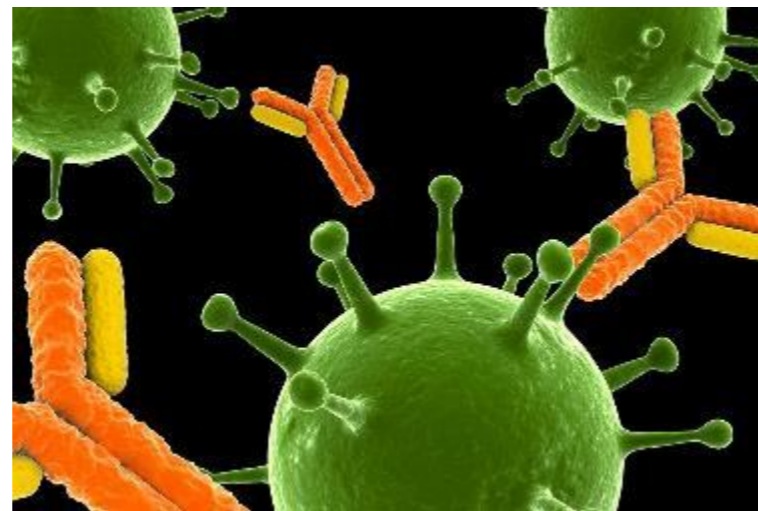
# The immune response to COVID-19 infection

Coronaviruses have 4 structural proteins: the spike (S), nucleocapsid (N), envelope (E) and membrane (M).

During an infection the body's immune system makes antibodies (immunoglobulins) that bind themselves to the structural proteins and neutralize the virus.

The spike (S) and the nucleocapsid (N) are the main proteins (antigens) which trigger an antibody response in humans.

The most important antibodies in the response are IgG and IgM. IgM antibodies are produced first during a response.



Source: Jstor daily

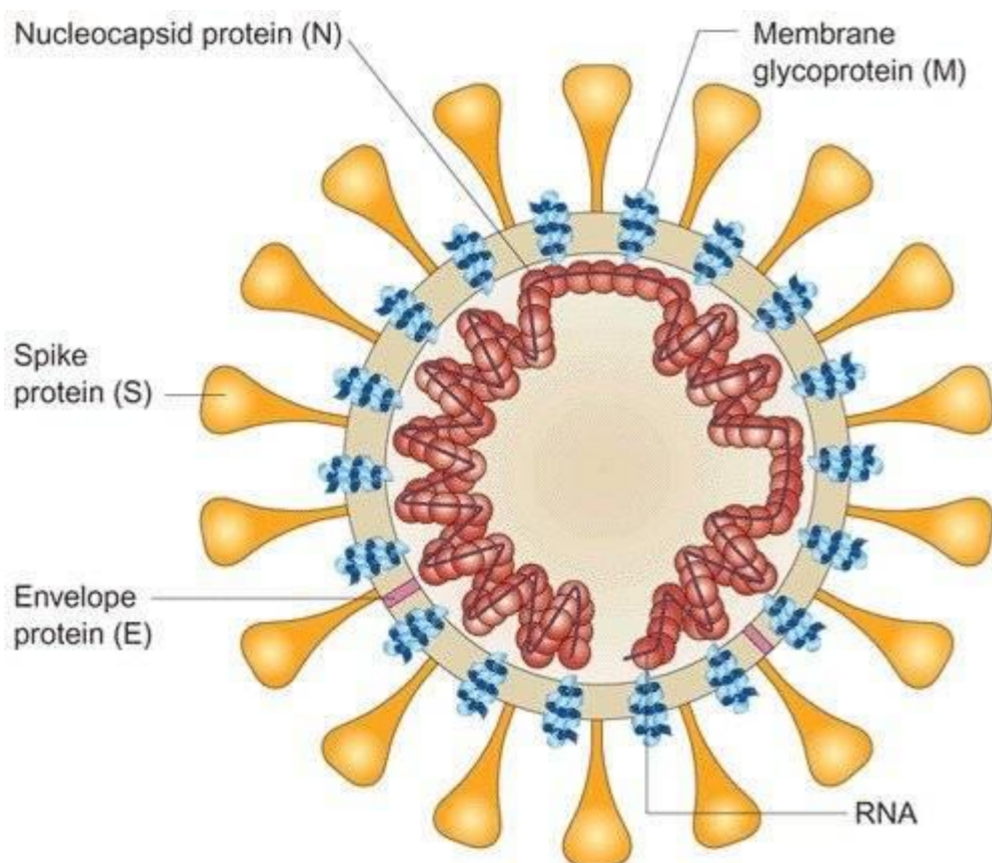


# What do the diagnostic tests for COVID-19 detect?

Diagnostic tests for COVID-19 detect either the virus or the immune response.

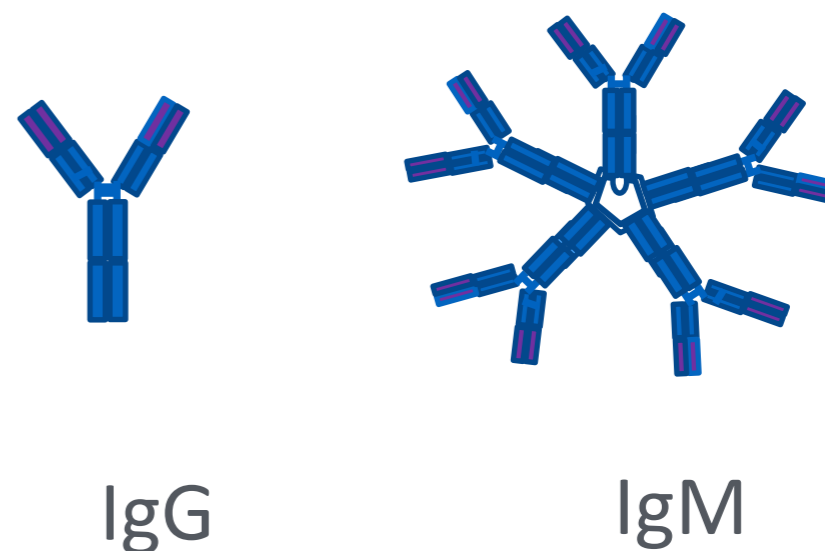
## The virus:

- Viral RNA detected by NAAT/RT-PCR (molecular testing)
- COVID-19 viral antigen



## The immune response:

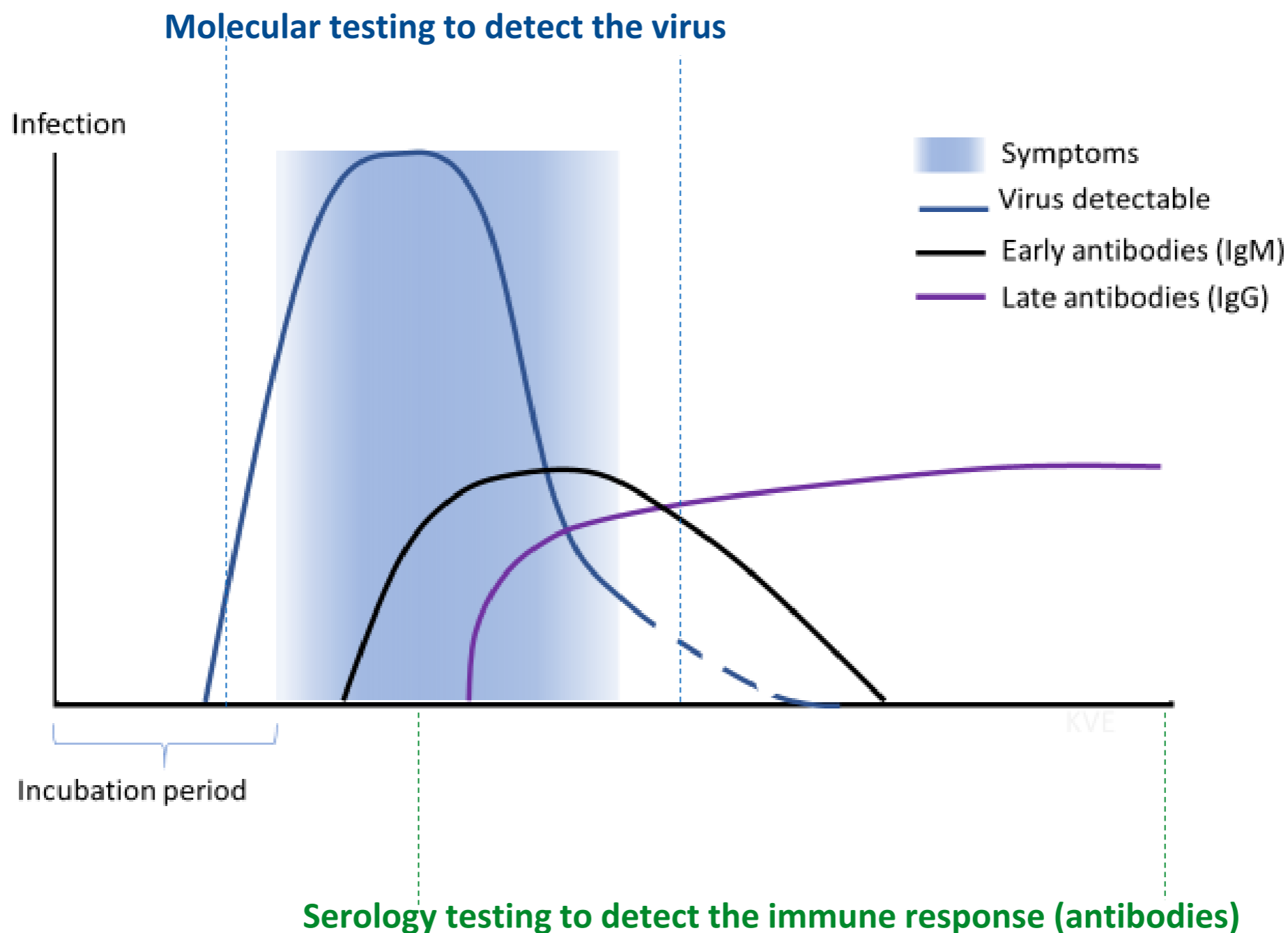
- Antibodies against COVID-19 antigen (IgM, IgG, IgA) (serology testing)





# Testing COVID-19 infection

The timing of testing is important







# Diagnostic tests for COVID-19

## To diagnose an acute covid-19 infection

- a molecular test is used to detect genetic material of the virus present in respiratory samples. These tests use secretions coming from the nose or throat and are collected via nasopharyngeal swaps.
- antigen tests may be used in the future to detect antigens which are a part of the virus (spikes, envelopes, membranes, etc). However, current available tests will need to be validated before use because they may miss people with active infection \*

## For serosurveillance of covid-19 infection

- a serological blood test is used to detect antibodies in response to the infection. These antibodies last in the body for some time after the infection has passed. Therefore, these tests can inform who has been infected in the past.

\*Antigen test for other diseases (influenza and RSV) pooled sensitivity between 34-80% this would be insufficient for clinical use.

Bruning AHL, Leeflang MMG, Vos JMBW, Spijker R, de Jong MD, Wolthers KC, et al. Rapid Tests for Influenza, Respiratory Syncytial Virus, and Other Respiratory Viruses: A Systematic Review and Meta-analysis. Clin Infect Dis [Internet]. 2017 Sep 15 [cited 2020 Apr 1];65(6):1026–32. Available from: <http://academic.oup.com/cid/article/65/6/1026/3829590/Rapid-Tests-for-Influenza-Respiratory-Syncytial>





# What is cross-reactivity?

Cross-reactivity occurs when antibodies produced against proteins of one type of CoV can occasionally bind weakly to proteins of another type of CoV (cross-reaction).

Tests that detect antibodies for COVID-19 virus may cross-react with other coronaviruses and give false-positive results.

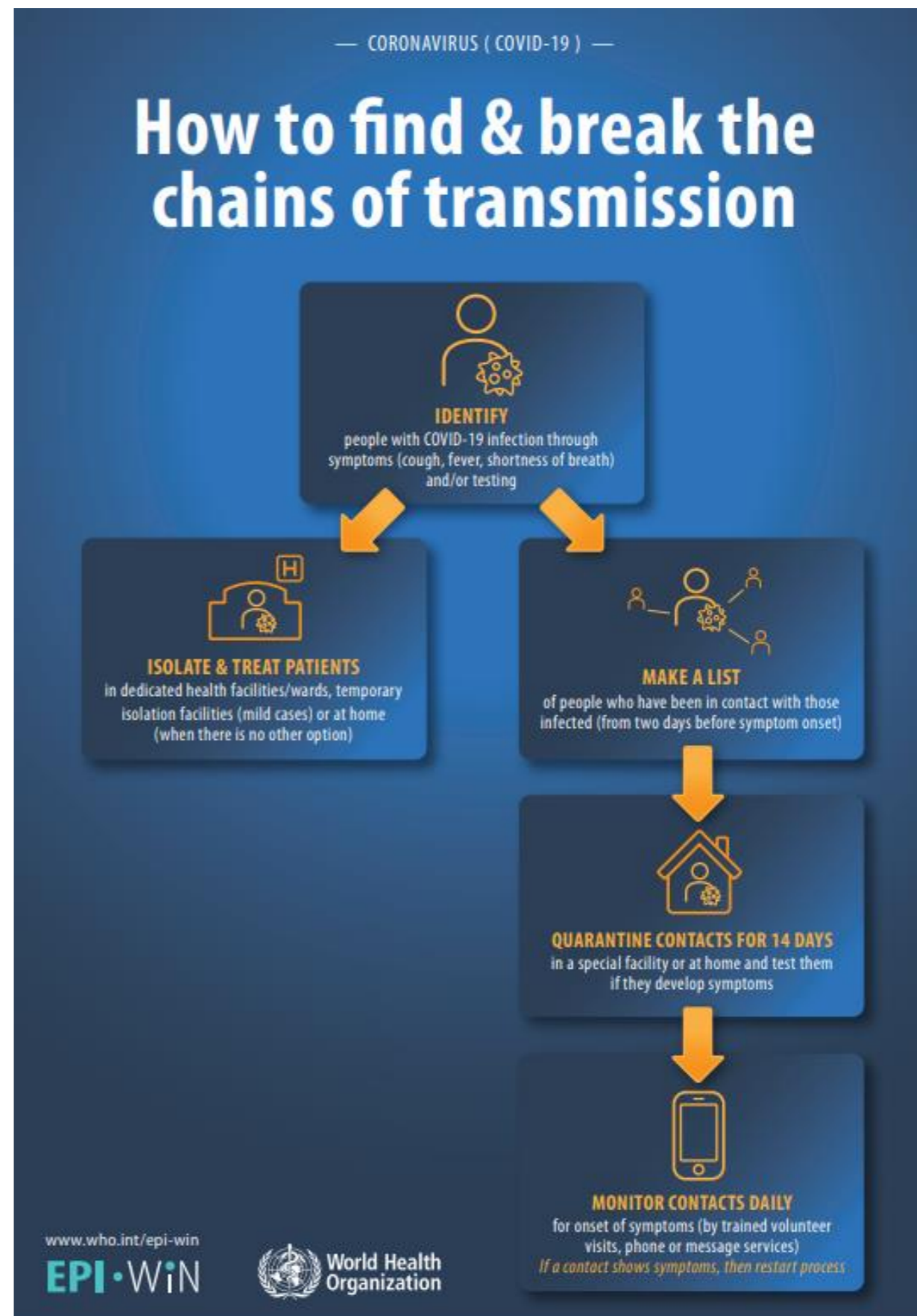
Coronaviruses	Disease
SARS-CoV-2	COVID-19
SARS-CoV	Severe Acute Respiratory Syndrome (SARS)
MERS-CoV	Middle East Respiratory Syndrome (MERS)
HCoV – 229E	Usually mild respiratory disease (10-15% of common colds caused by HCoVs) but can cause severe disease in vulnerable groups
HCoV – OC43	
HCoV – NL63	
HCoV - HKU1	

Source: <https://www.medrxiv.org/content/10.1101/2020.03.18.20038059v1.full.pdf>

<https://www.who.int/news-room/commentaries/detail/advice-on-the-use-of-point-of-care-immunodiagnostic-tests-for-covid-19>



**The public health importance of testing:**  
Testing is important to identify those who are infected so that patients can be isolated and onward transmission prevented and their contacts followed up.





# Guidance on testing and diagnostics

WHO laboratory testing strategies recommendation for COVID-19, see [https://apps.who.int/iris/bitstream/handle/10665/331509/WHO-COVID-19-lab\\_testing-2020.1-eng.pdf](https://apps.who.int/iris/bitstream/handle/10665/331509/WHO-COVID-19-lab_testing-2020.1-eng.pdf)

WHO's advice on the use of point of care immunodiagnostic tests for COVID-19, see [https://www.who.int/docs/default-source/coronaviruse/sb-2020-1-poc-immunodiagnosics-2020-04-08.pdf?sfvrsn=5b6820\\_2](https://www.who.int/docs/default-source/coronaviruse/sb-2020-1-poc-immunodiagnosics-2020-04-08.pdf?sfvrsn=5b6820_2)

These resources can be found along with other technical guidance for national laboratories on the WHO website:

<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/laboratory-guidance>



# When will a COVID-19 vaccine be ready?

Vaccine development is a lengthy and expensive process which normally takes more than years

Developing a vaccine more rapidly as a response to the COVID-19 outbreak requires a different approach and has been estimated to take around 12 to 18 months. This includes:

- A rapid start of development by using novel platforms like mRNA and DNA, that use synthetic processes that are faster than traditional platforms that recreate the virus
- Vaccine development steps that are executed in parallel, e.g. initial trials in humans (phase 1 clinical trials) may proceed in parallel with animal studies

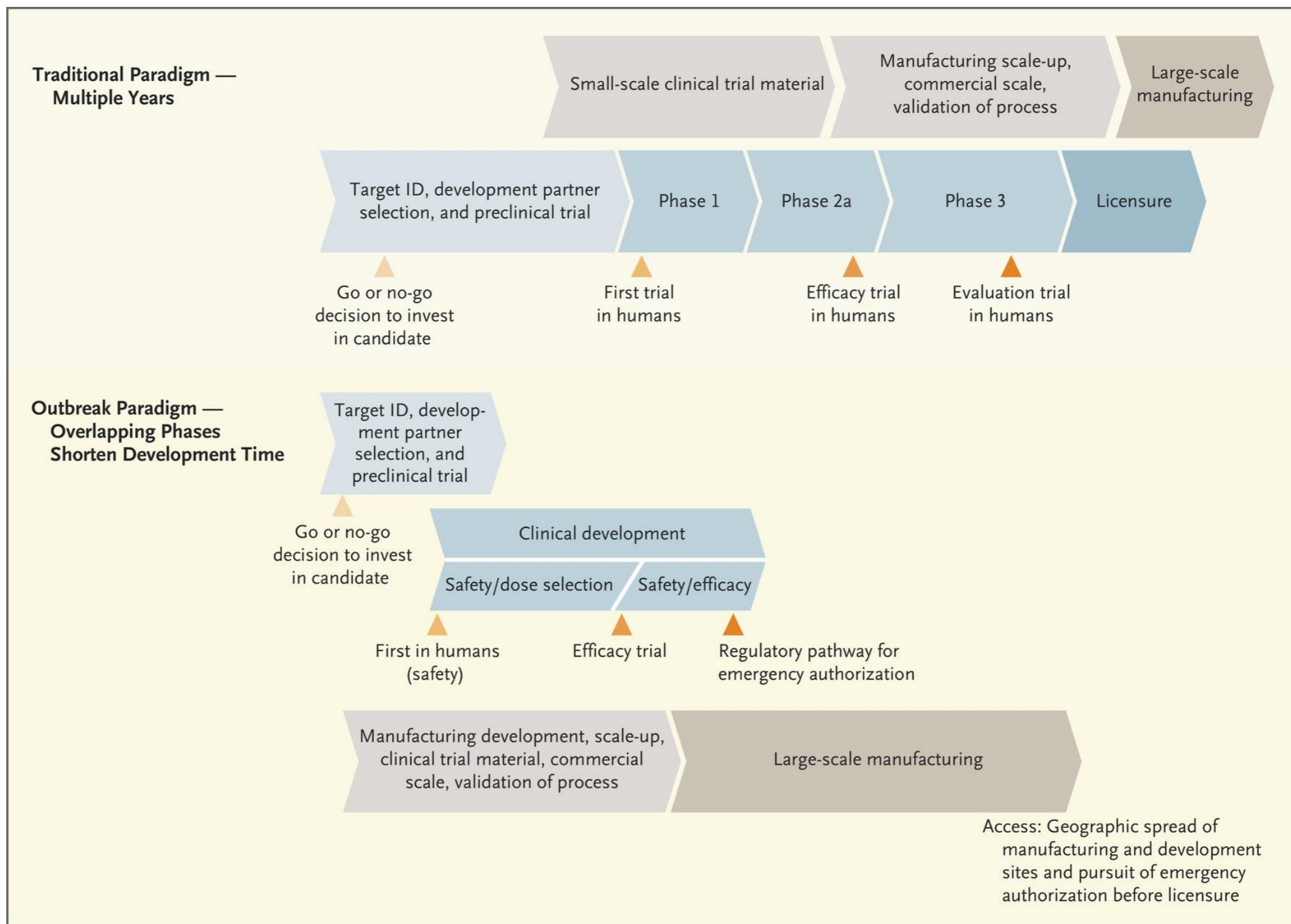
To proceed rapidly beyond efficacy trials in humans (phase 2 trials), large scale manufacturing of vaccines starts earlier in the vaccine development process than in the traditional process







# Comparing the traditional vaccine development approach with one designed for outbreaks



Developing Covid-19 Vaccines at Pandemic Speed; new England journal of medicine [https://www.nejm.org/doi/full/10.1056/NEJMp2005630#figures\\_media](https://www.nejm.org/doi/full/10.1056/NEJMp2005630#figures_media)



# Challenges of rapid COVID-19 vaccine development and ways to address these challenge

## Challenges

- Limited experience with novel mRNA and DNA platforms with some uncertainty these platforms will work
- Financial risks for vaccine developers and vaccine manufacturers
- Where and when to start clinical trials during the COVID-19 outbreak may be hard to predict
- Ensure not to overburden countries when several candidate vaccines are ready for human efficacy trials
- Placebo-controlled trials might be perceived to be unacceptable during the COVID-19 outbreak

## Addressing these challenges

- Vaccine development through traditional platforms must continue to make sure that more tried and tested platforms are included even though the initial development phase of these traditional platforms takes longer
- Coalition for epidemic preparedness innovation (CEPI) supports:
  - vaccine development and raises funds for vaccine candidates from phase 2 trials on
  - development of new platform technologies
  - the creation of a global network to ensure equitable vaccine distribution

## WHO R&D blueprint

- The WHO R&D Blueprint is a global strategy and preparedness plan that allows the rapid activation of R&D activities during epidemics
- International randomized trial of candidate vaccines against COVID-19 is being planned (Solidarity Vaccine Trial) which seeks to coordinate evaluation of the many preventive candidate vaccines under development, to evaluate promptly, efficiently and reliably their safety and efficacy including only one placebo group, enabling assessment



# Covid-19 candidate vaccines as of 11 April 2020

- 3 candidate vaccines in clinical evaluation
- 67 other vaccine in pre-clinical development phase (see the draft landscape of Covid-19 candidate vaccines)

	Platform	Developer	Current stage of clinical evaluation/regulatory status
1	Non-replicating viral vector	CanSino Biological Inc./Beijing Institute of Biotechnology	Phase 2 Phase 1
2	DNA	Inovio Pharmaceuticals	Phase 1 Started 3 April
3	mRNA is used to activate the immune system against virus, doesn't need recreation of virus itself	Moderna/NIAID	Phase 1 Started 16 March

Draft landscape of COVID-19 candidate vaccines – 11 April 2020; [https://www.who.int/blueprint/priority-diseases/key-action/Novel\\_Coronavirus\\_Landscape\\_nCoV\\_11April2020.PDF?ua=1](https://www.who.int/blueprint/priority-diseases/key-action/Novel_Coronavirus_Landscape_nCoV_11April2020.PDF?ua=1)





## Summary: when will a COVID-19 vaccine be ready?

- Many potential vaccine candidates, 3 in clinical evaluation and 67 in the pre-clinical phase as of 11 April 2020
- Vaccine development process being fast-tracked
- A commercially-available vaccine is not likely to be available for at least 12-18 months
- However, subject to authorization by the appropriate regulatory agencies, vaccines might be ready for emergency use in priority populations, like health workers, by the end of the year



Source: Time Magazine



# Does BCG vaccine protect against COVID-19?

WHO does not recommend Bacille Calmette-Guérin vaccine (BCG) for the prevention of COVID-19.

An updated search on the use of BCG vaccine and COVID-19 was conducted on April 11. Based on that search:

There is no evidence that BCG vaccine protects people against infection with COVID-19 virus.

Two clinical trials addressing this question are underway

WHO will evaluate this evidence when it is available

WHO continues to recommend neonatal BCG vaccination in countries or settings with a high incidence of tuberculosis.

<sup>1</sup> [https://www.who.int/news-room/commentaries/detail/bacille-calmette-gu%C3%A9rin-\(bcg\)-vaccination-and-covid-19](https://www.who.int/news-room/commentaries/detail/bacille-calmette-gu%C3%A9rin-(bcg)-vaccination-and-covid-19)



# Information resources



## WHO WhatsApp messaging service

Receive the latest news and information on COVID-19. To subscribe:  
text 'hi' to +41 79 893 1892



## EPI-WIN website

Access to timely, accurate, and easy-to-understand advice and information from trusted sources

[www.who.int/epi-win](http://www.who.int/epi-win)

Links to EPI-WIN webinar recordings from this week

COVID-19 and hospitals 22.04.20:

[https://who.zoom.us/rec/share/JZSErLhz25IU5X8uH\\_keoN7JI3Aeaa8hidP\\_PdcyRxxFjBGm0-7P-fMjaUDydRK](https://who.zoom.us/rec/share/JZSErLhz25IU5X8uH_keoN7JI3Aeaa8hidP_PdcyRxxFjBGm0-7P-fMjaUDydRK)

COVID-19 and the maritime sector 22.04.20:

[https://who.zoom.us/rec/share/xNBPCO\\_d6UdLEqPMwWXbVZMOFcO9X6a81CcW-PMJnxlY4spPMVq5RNq7IpPK1nNW](https://who.zoom.us/rec/share/xNBPCO_d6UdLEqPMwWXbVZMOFcO9X6a81CcW-PMJnxlY4spPMVq5RNq7IpPK1nNW)

COVID-19 testing and diagnostics 23.04.20:

<https://who.zoom.us/rec/share/tfZNBK7prVpOaJGW12L-avZwEovgT6a8gyQZ8vYLn9AvoosxduF0s645O-h2idg>