

# From zero to billions: The story of COVID-19 vaccines

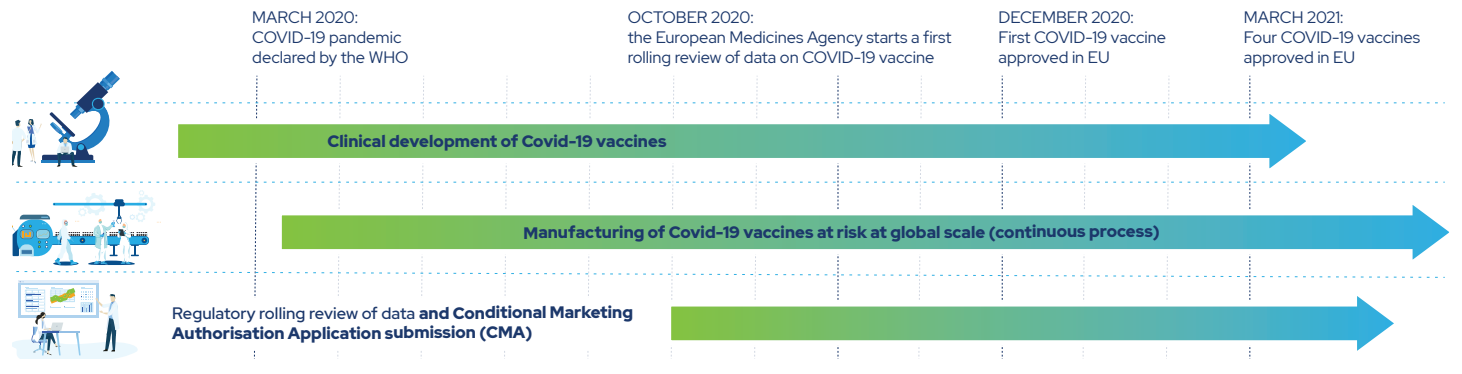
Development of innovative vaccines is complex and risky as it spans from clinical development to manufacturing and control processes. Typically, developing a new vaccine takes at least a decade.

When the SARS-CoV-2 coronavirus was first identified, most optimistic assumptions forecasted vaccine availability by summer of 2021.

The fact that the first COVID-19 vaccines were approved by different regulatory authorities worldwide and made ready for large-scale immunisation programs in December 2020 is an extraordinary achievement in the history of modern vaccination.

The next challenge ahead is to ensure that vaccines are available in sufficient quantities to cover the global population. According to WHO, at least 60 to 70% of the population needs to have immunity to break the chain of COVID-19 transmission<sup>(1)</sup>.

## Unprecedented 1-year achievements



## R&D of COVID-19 vaccines: Investment, knowledge and network

Vaccine development is typically taking 10 to 15 years from research and development to large-scale availability. Whilst companies have followed the highest regulatory standards to demonstrate the safety and efficacy of candidate vaccines, several key factors contributed to reducing drastically the development timelines of COVID-19 vaccines.



## Factors for successful manufacturing upscale

In contrast to the step-by-step approach typically taken for developing vaccines in order to reduce financial risks, massive efforts were undertaken to scale up COVID-19 vaccine manufacturing from the very early stage of clinical development, before any indication that a candidate vaccine could be promising. Some key factors contributed to scale up vaccine manufacturing:



## Thorough vaccines manufacturing processes

Vaccines manufacturing is a highly complex process that requires specific know-how and equipment. Typically, the manufacturing process is developed, optimized and finetuned over several years. Due to the high medical need for COVID-19 vaccines, manufacturers focused their efforts on ramping up the manufacturing capacity. This is why manufacturing processes of all COVID-19 vaccines are not fully optimized at the time of regulatory approval, compared to past commercially-approved vaccines.



To produce a new vaccine, all production steps require adaptation of equipment, recruitment and training of qualified personnel, transfer and validation of methods, quality control tests, and certification of compliance with Good Manufacturing Practices<sup>(2)</sup> by authorities.

<sup>(1)</sup> COVID-19: Science in 5: Episode #1 - Herd immunity (who.int)

<sup>(2)</sup> <https://www.ema.europa.eu/en/human-regulatory/research-development/compliance/good-manufacturing-practice>

Today, vaccine manufacturers are pursuing every avenue to accelerate production and continue to explore possibilities for further collaborations to scale up manufacturing.