EUROPEAN MEDICINES AGENCY
SCIENCE MEDICINES HEALTH

How are COVID-19 vaccines developed?

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Outline

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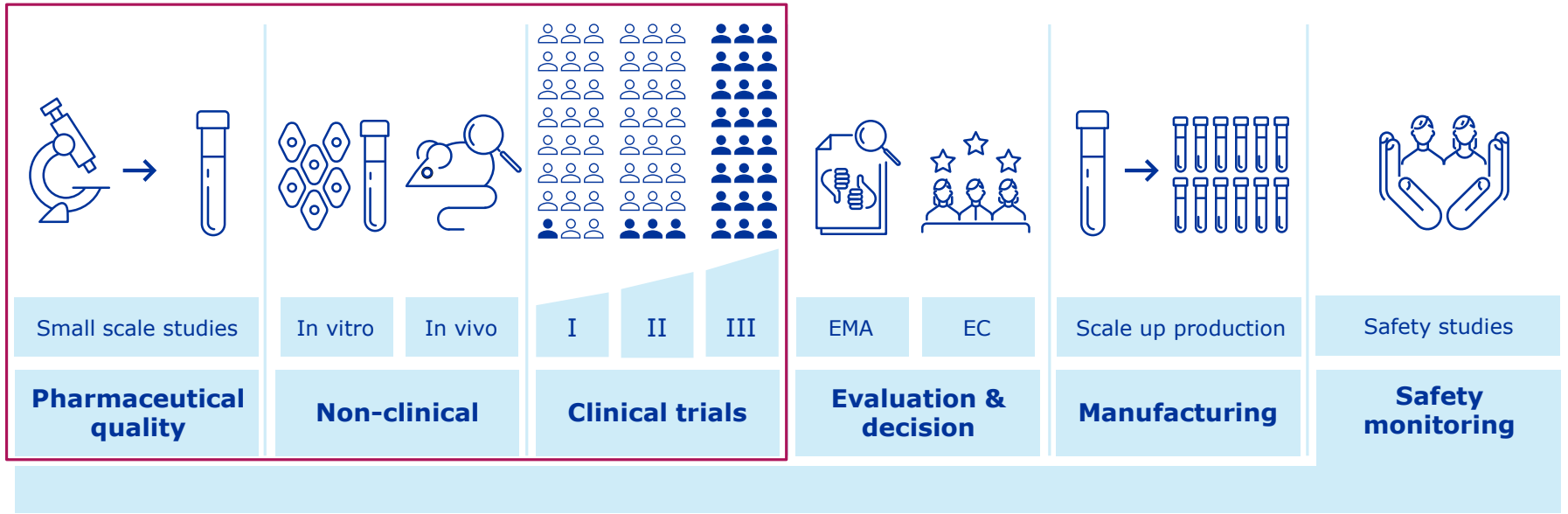
3. Laboratory studies
4. Clinical studies - efficacy and safety
5. COVID-19 vaccines compared with standard vaccines
6. COVID-19 vaccines under assessment for approval by EMA

Overview

COVID-19 VACCINE DEVELOPMENT, EVALUATION, APPROVAL AND MONITORING

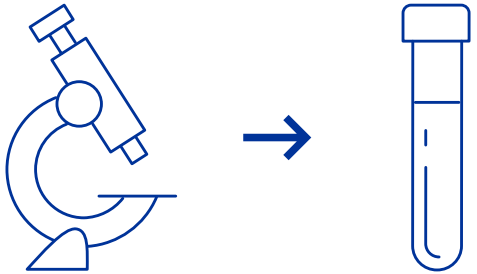


Pharmaceutical quality studies

Pharmaceutical quality | Non-clinical | Clinical trials | Evaluation & decision | Manufacturing | Safety monitoring

Studies to generate data on:

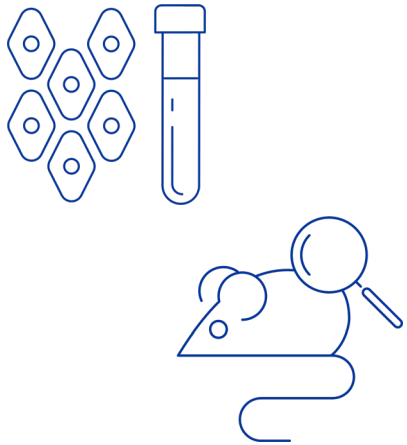
- Vaccine **components** and their **purity**
- Vaccine's biological activity
- Data on each step of **manufacturing**
- Data on the **controls** used to ensure that each batch of vaccine is consistently of good quality
- Conditions for **storing** the vaccine



Laboratory studies

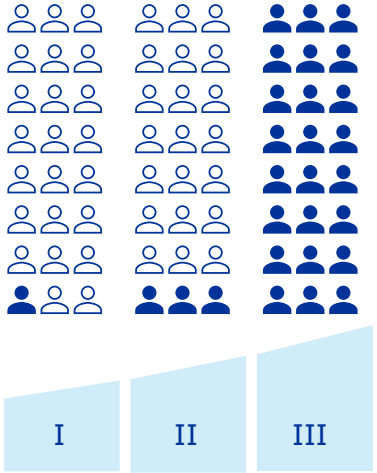
Pharmaceutical quality | **Non-clinical** | Clinical trials | Evaluation & decision | Manufacturing | Safety monitoring

- Studies in the **laboratory before** testing in **humans** for **all vaccines**
- **Types of immune responses** the vaccine causes.
- Can **identify potential safety problems**
- Make sure the vaccine does not cause **fertility problems** nor affect **babies' development** before birth
- **Challenge studies check** if animals given COVID-19 vaccine are protected from disease when exposed to the virus and not worsening the disease
- Sometimes studies on **how the vaccine reaches** body **organs**



Clinical studies – efficacy and safety

- Clinical trials are studies in humans which show:
  - **how safe the vaccine is** (safety)
  - **how well the vaccine works** (efficacy)
  - **immune responses** (immunogenicity)
- Three study phases:
  - Phase I: **early studies**
  - Phase II: **larger exploratory studies**
  - Phase III: **efficacy and safety studies**



Clinical trials follow strict scientific and ethical rules

Clinical studies – efficacy and safety

Pharmaceutical quality | Non-clinical | **Clinical trials** | Evaluation & decision | Manufacturing | Safety monitoring

Phase I trials

- **20 - 100** healthy volunteers
- Expected **immune response**?
- **Safe** to move into **larger studies**?
- Which **doses**?

Phase II trials

- **Several hundred** volunteers
- Best **doses** to use?
- Most common **side effects**?
- Immune response in more people?

Phase III trials

- **Thousands** of volunteers
- How the vaccine **protects against disease** compared with placebo (dummy) or with a non-COVID vaccine
- Less common **side effects**?

Clinical studies – efficacy and safety

MEASURING COVID-19 VACCINES' BENEFIT

- **Prevention of symptomatic disease as** main measure of benefit
  - **Less disease with symptoms** in people given vaccine *compared to placebo*
- Other benefits likely **uncertain at approval** and only clearer after the vaccine is used:
  - **Long term protection**
  - Prevention of infection (**asymptomatic** cases)
  - Prevention of virus **transmission in the community** - needs specific studies post-approval

Efficacy levels

Studies designed to show efficacy of 50% or more

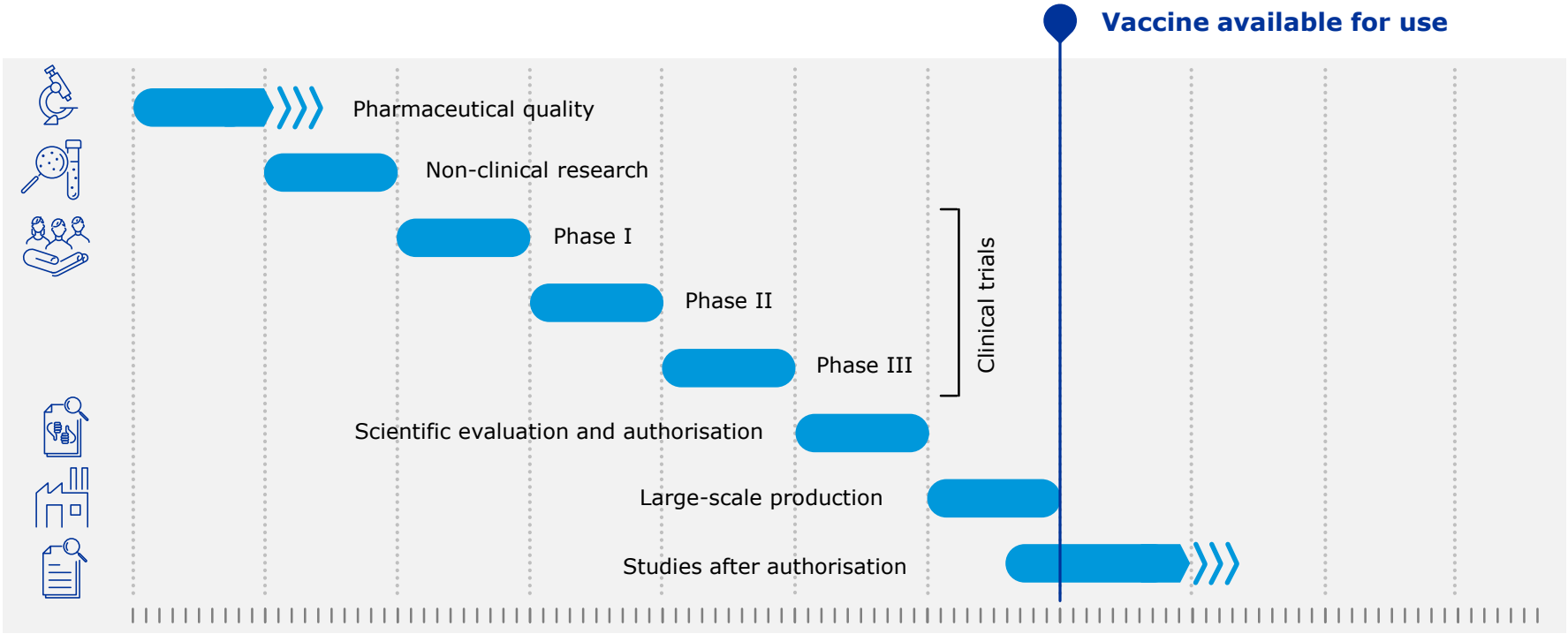
50% efficacy means the vaccine prevents half of the cases of symptomatic COVID-19 compared with placebo

90% efficacy means the vaccine prevents nine out of 10 cases of symptomatic COVID-19 compared with placebo

Clinical studies – efficacy and safety

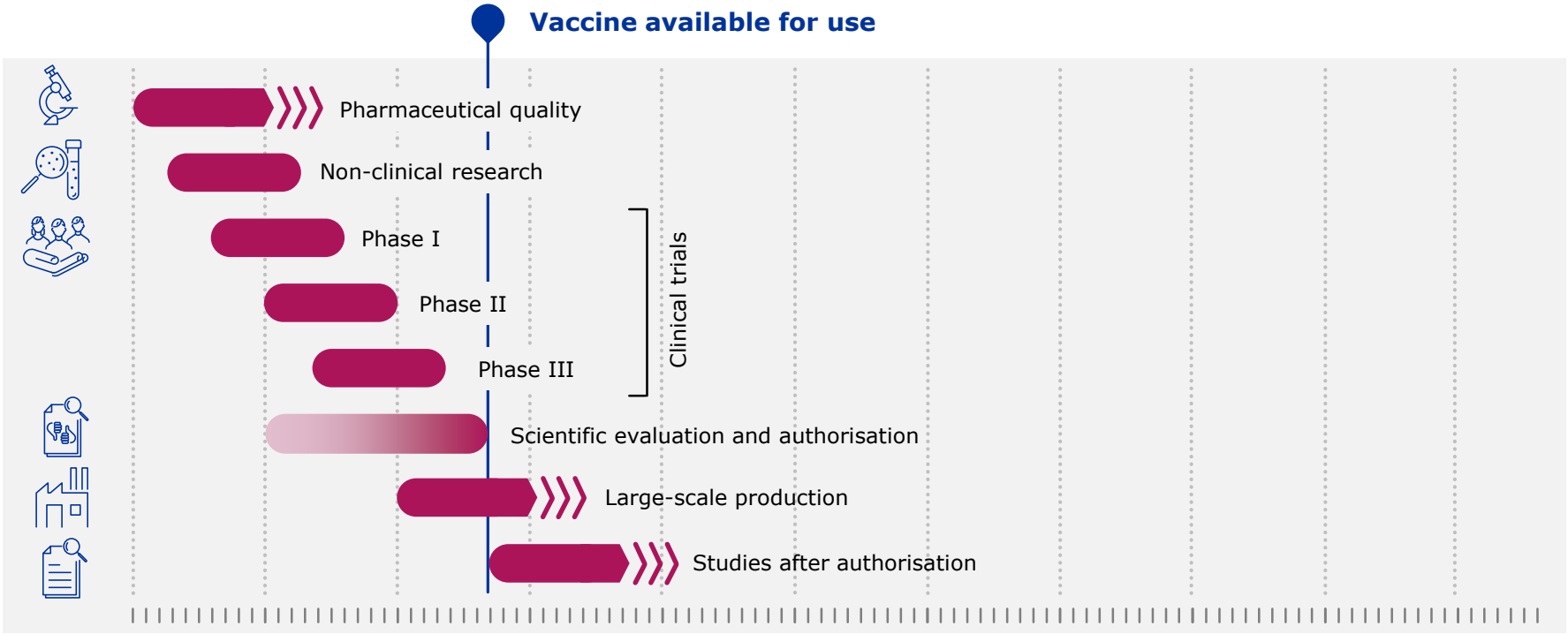
- **Large number** of **adults** expected (above 30,000)
- Ideally **one quarter** of all participants **above 65 years** of age
- **Some people** with **underlying diseases** at risk of severe COVID-19
- Some studies include **adolescents above 16** years of age
  - Younger children to be studied after analysing data in adults and adolescents
- Some **minorities** represented
- Follow-up data for **at least** the **6 weeks** after last dose of vaccine
  - Most side effects occur within 4-6 weeks of having a dose
- Trials to last **for at least 1 year:** longer-term protection & side effects

Indicative timeline



STANDARD VACCINES COMPARED WITH COVID-19 VACCINES

Indicative timeline



Regulatory standards

COVID-19 vaccines must be approved according to the **same standards** that apply to all medicines in the EU

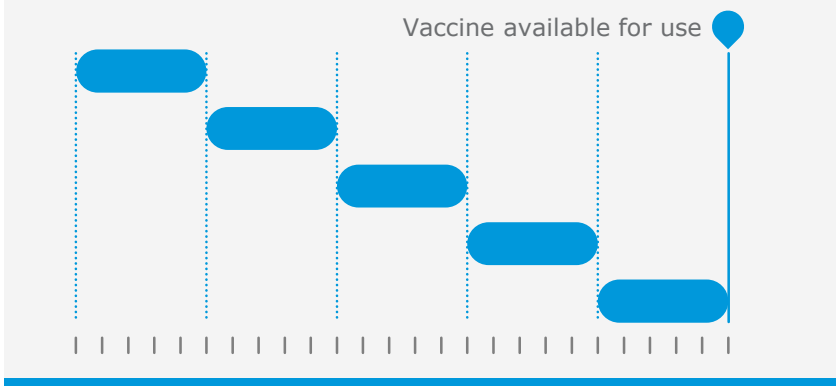
STANDARD

COVID-19

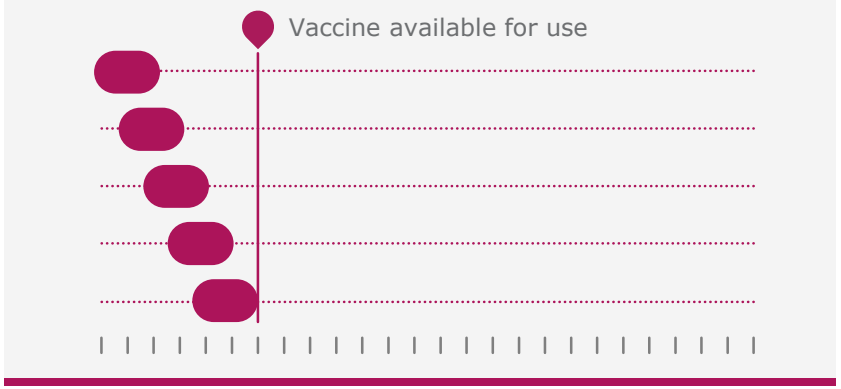
Timelines

COVID-19 vaccine development is **compressed in time**, applying the extensive **current knowledge** on vaccine development

STANDARD



COVID-19

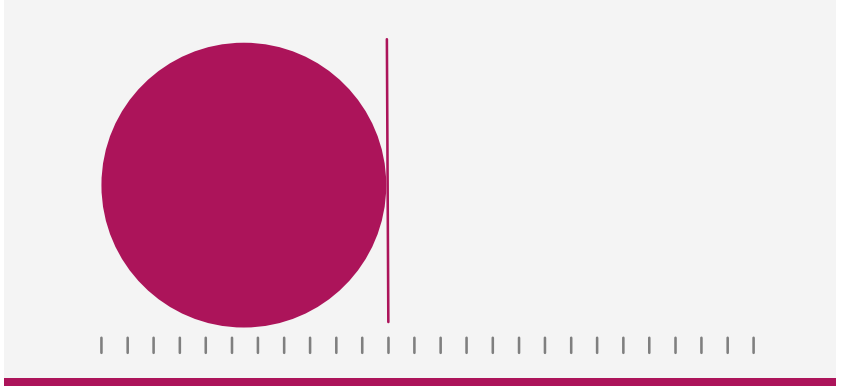


Resources

COVID-19 vaccine development **mobilises more resources simultaneously**

STANDARD

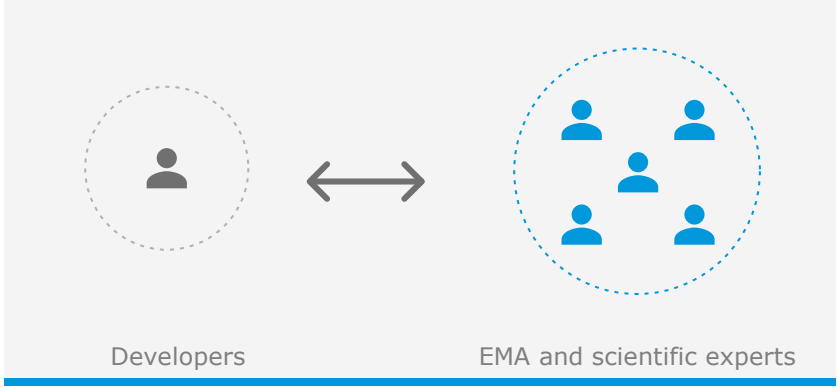
COVID-19



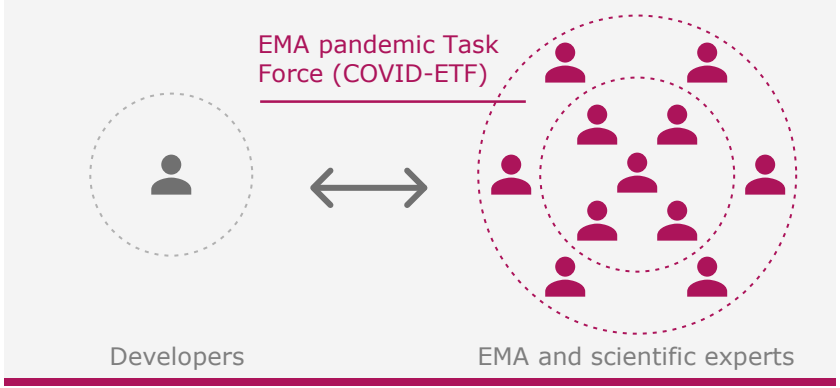
Expert Task Force & continuous dialogue

COVID-19 vaccine development is supported by early, continuous dialogue between developers and a dedicated group of regulatory experts **EMA COVID-19 Task Force**

STANDARD



COVID-19

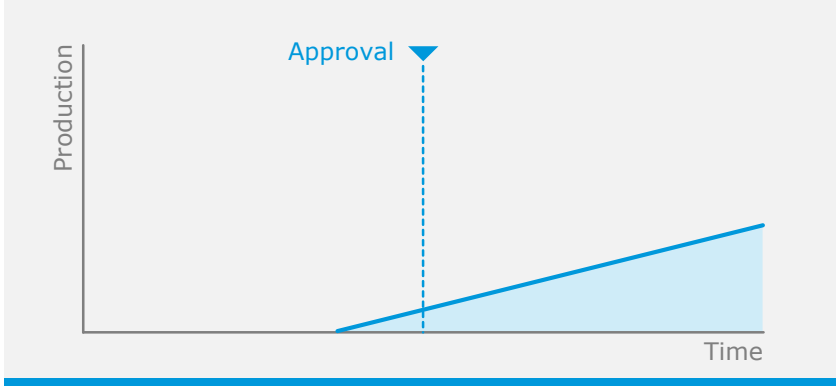


STANDARD VACCINES COMPARED WITH COVID-19 VACCINES

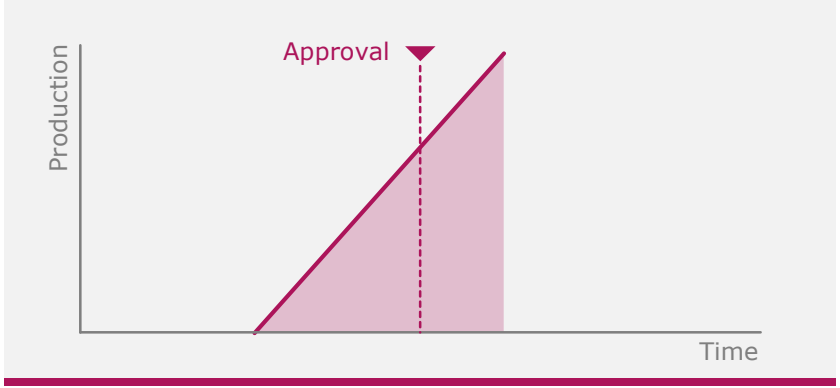
Manufacturing

Companies are **expanding** manufacturing and production **capacity** to ensure efficient vaccine deployment

STANDARD



COVID-19



COVID-19 vaccines under assessment for approval by EMA

mRNA vaccines contain genetic instructions (mRNA) for making an immune response against coronavirus

- Pfizer-BioNTech (BNT162b2)
- Moderna (mRNA-1273)

Viral vectors use modified harmless adenovirus to carry genetic instructions for making an immune response against coronavirus

- Astra Zeneca/Oxford (ChAdOx1-SARS-CoV-2)
- Janssen (Ad26.COV2.S)

New systems

- Faster development and manufacture of key ingredients
- Based on experience and knowledge with other vaccines and medicines

More vaccines

- With other viral vectors or specific proteins are under development

Conclusions

- **Same types of studies** as for other medicines
- Timelines **shortened** - **Pooling** expertise
- Studies in **large numbers of people**
- Expected benefits at time of initial approval:
  - Demonstrated **reduction in** COVID-19 **disease**
  - Some **uncertainties: long term protection** and **community transmission**
  - Use of facemask, hand hygiene, physical distance **remain important**
- **High** regulatory **standards** for Quality, Safety and Efficacy