Vaccine development: Where are we?

IABS WEBINAR

Dr Melanie Saville, Director Vaccine R&D, CEPI

27th May 2020
Our mission

CEPI accelerates development of vaccines against emerging infectious diseases and enables equitable access to these vaccines for affected populations during outbreaks
Our Strategic Objectives

**Preparedness**
Advance access to safe and effective vaccines against emerging infectious diseases

**Response**
Accelerate the research, development and use of vaccines during outbreaks

**Sustainability**
Create durable and equitable solutions for outbreak response capacity
A sustainable partnership

CEPI role as a facilitator

1. DISCOVERY
   - Academia
   - Governments
   - Wellcome Trust
   - NIH
   - IMI
   - GLOPID-R
   - Industry
   - Regulators
   - Biotech

2. DEVELOPMENT / LICENSURE
   - Industry
   - Governments
   - Regulators
   - Wellcome Trust
   - NIH
   - EC
   - IMI
   - BMGF
   - BARDA/DTRA etc.
   - WHO
   - Biotech
   - PDPs

3. MANUFACTURE
   - Industry
   - BARDA
   - CMOs
   - Regulators
   - Governments
   - WHO
   - GHIF

4. DELIVERY / STOCKPILING
   - GAVI
   - UNICEF
   - PAHO
   - Governments
   - WHO
   - Industry
   - Pandemic Emergency Facility (World Bank)
   - WHO Contingency Fund

5. LAST MILE
   - Countries
   - WHO
   - UNICEF
   - Responding Organisations (eg, MSF)
CEPI’s strategic portfolio targets

- Lassa
- MERS-CoV
- Nipah
- Rift Valley Fever
- Chikungunya
- Disease X

**Advance at least one vaccine for each pathogen through phase IIa and stockpile within five years of funding**

- Support activities enabling late stage development, prequalification and access

- Advance through phase I multiple rapid response platforms with potential to significantly improve speed of vaccine development against multiple pathogens
CEPI’s enabling sciences portfolio for advancement of vaccine candidates

<table>
<thead>
<tr>
<th>Preclinical</th>
<th>Phase I</th>
<th>Phase IIa Safety / Immuno Stockpile</th>
<th>Phase IIb / III Efficacy / outbreak</th>
<th>Registration / introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibody standard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standardisation of assays</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antigen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnostics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epidemiology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lines show timelines for projects; diamond show deliverable deadlines

Cross-cutting activities

Task Forces

Regulatory workshops
CEPI’s Rapid response platforms

CEPI will **accelerate** development by use of **vaccine technology platforms**

**Aspirational goals**
- 16 weeks from identification of pathogen to product for clinical trial
- 6 weeks from first dose to clinical benefit
- 8 weeks to manufacture 100,000 doses

**CEPI funding approach**
- Test platform versatility on three pathogens, two into phase I
- Characterize the safety and immunology profile
- Live fire exercise – for disease X

**Platforms**
- mRNA - Curevac
- SA RNA - Imperial
- Recombinant proteins – molecular clamp
CEPI’s response to COVID-19

speed, scalability and access

• Rapid response platforms
• More proven vaccine technology already at scale
• Adjuvants
• Enabling sciences
• Global manufacturing capacity
CEPI’s vaccine development so far

31st Dec 2019
WHO notified of pneumonia-like case cluster in Wuhan, China

10th Jan
First genetic sequences released

7th Jan
CEPI activated response

3rd Feb
CEPI launched Call for Proposals for COVID-19 vaccine development partnerships

3rd Feb
GSK/CEPI collaboration on adjuvant technology

31st Jan
CEPI announced 4th development partnership

29th Jan
Moderna enters first-in-human clinical trial

23rd Jan
CEPI announced 3 COVID-19 vaccine development programmes

14th Feb
WHO notified of pneumonia-like case cluster in Wuhan, China

10th-20th March
4 new (8 total) CEPI COVID-19 vaccine development partnerships

11th March
WHO declared SARS-CoV-2 a global pandemic

10th March
GPMB calls for scaled-up global response (US$8 billion)

11th March
SARS-CoV-2 included disease named COVID-19 by WHO

12th April
Wellcome Trust launch COVID-Zero resource mobilisation

24th April
Global launch of ACT Accelerator

15th April
IVI and KNIH for PhI/II trial in South Korea

23rd April
PhI clinical trial starts for CEPI partner Oxford University

27th April
CEPI announces 9th vaccine development partnership

16th April
CEPI partner w/IVI and KNIH for PhI/II trial in South Korea

4th May
European Commission pledges marathon to raise US$8.3 billion

4th May
CEPI announces second Call for Proposals to expand portfolio

17th March
CEPI partner Moderna enters first in human clinical trial

10th March
GPMB calls for scaled-up global response (US$8 billion)

14th Feb
First cases reported in Africa

14th Feb
GSK/CEPI collaboration on adjuvant technology

17th March
WHO declares SARS-CoV-2 a global pandemic

17th March
UNESCO calls for global response (US$8 billion)

12th April
CEPI announces 9th vaccine development partnership

17th March
WHO declares SARS-CoV-2 a global pandemic

4th April
WHO announces SARS-CoV-2 a global pandemic

7th March
WHO declares SARS-CoV-2 a global pandemic

20th March
WHO declares SARS-CoV-2 a global pandemic

16th March
WHO declares SARS-CoV-2 a global pandemic

12th March
WHO declares SARS-CoV-2 a global pandemic

3rd March
WHO declares SARS-CoV-2 a global pandemic

29th February
WHO declares SARS-CoV-2 a global pandemic

24th February
WHO declares SARS-CoV-2 a global pandemic

19th February
WHO declares SARS-CoV-2 a global pandemic

13th February
WHO declares SARS-CoV-2 a global pandemic

7th February
WHO declares SARS-CoV-2 a global pandemic

1st February
WHO declares SARS-CoV-2 a global pandemic

31st January
WHO declares SARS-CoV-2 a global pandemic

27th January
WHO declares SARS-CoV-2 a global pandemic

20th January
WHO declares SARS-CoV-2 a global pandemic

14th January
WHO declares SARS-CoV-2 a global pandemic

7th January
WHO declares SARS-CoV-2 a global pandemic

30th December
WHO declares SARS-CoV-2 a global pandemic
## COVID-19 vaccine candidates

<table>
<thead>
<tr>
<th>Partner</th>
<th>Technology platform</th>
<th>Antigen</th>
<th>Partner type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inovio</td>
<td>DNA</td>
<td>Spike</td>
<td>Biotech</td>
<td>US</td>
</tr>
<tr>
<td>Moderna</td>
<td>mRNA</td>
<td>Spike</td>
<td>Biotech</td>
<td>US</td>
</tr>
<tr>
<td>CureVac</td>
<td>RNA</td>
<td>Spike</td>
<td>Biotech</td>
<td>EU</td>
</tr>
<tr>
<td>Queensland</td>
<td>Subunit</td>
<td>Spike</td>
<td>Academic</td>
<td>Australia</td>
</tr>
<tr>
<td>Novavax</td>
<td>Nanoparticle</td>
<td>Spike</td>
<td>Biotech</td>
<td>USA</td>
</tr>
<tr>
<td>University of Oxford</td>
<td>ChadOX</td>
<td>Spike</td>
<td>Academic</td>
<td>UK</td>
</tr>
<tr>
<td>University of Hong Kong</td>
<td>Viral vector</td>
<td>Spike RBD</td>
<td>Academic</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>IP Themis</td>
<td>Viral vector</td>
<td>Spike</td>
<td>Academic/Industry</td>
<td>France/Germany</td>
</tr>
<tr>
<td>Clover</td>
<td>Subunit</td>
<td>Spike</td>
<td>Biotech</td>
<td>China</td>
</tr>
</tbody>
</table>

**CEPI** Second call for proposal for vaccine candidates open for applications
Only a fundamental paradigm shift provides potential of rapid vaccine development with appropriate safety standards

**Major shifts**

- **Speed:** Accelerate and advance development stages in parallel with continuous risk-benefit monitoring; quickly raise and deploy funds
- **Scale:** Adaptive versus rigid development process and earlier launch of scale-up
- **Access:** Geographic spread of manufacturing and development sites and pursuit of emergency authorization before licensure

### Traditional paradigm

- **6 - 11.5 years**
  - **Target ID, development partner selection, and pre-clinical** 6 - 24 months
  - **Phase I** 12 months
  - **Phase IIa** 12-18 months
  - **Phase IIb** 18-36 months
  - **Licensure** 12-36 months

### Outbreak paradigm

- **12 - 18 months**
  - **Target ID, development partner selection, and pre-clinical** 4 - 8 months
  - **Clinical development**
    - **Early stage** 3 - 4 months
    - **Late stage** 6 - 8 months
  - **First in human**
  - **Go/no-go decision to invest in candidates**
  - **Scale from n=10s to n=100s**
  - **Emergency authorization**
  - **Emergency authorization**

---

6

12

12 - 36 months
COVID-19 Regulatory Activities

- CEPI vaccine candidate portfolio regulatory support and guidance
- Outreach to NRAs
  - Evaluation of regulatory aspects for rapid access to licensed/marketed vaccine
  - Framing of product agnostic questions for official review and comment
- Routine interactions with:
  - WHO Regulatory Working Group
  - CEPI Regulatory Steering Committee
- Internal coordination with clinical and CMC aspects of COVID-19 response
Clinical Considerations for COVID-19

- **Early stage clinical development:**
  - FIH: healthy adults (excluding older adults) for dose selection and safety / reactogenicity
  - Phase Ib/IIa: expand trial populations to risk populations

- **Vaccine efficacy:**
  - Endpoints included from early on (phase I) - to support integrated analyses across early stage trials
  - Adaptive design - number-of-events approach subject to COVID-19 incidence

- **Safety**
  - Safety data based prior to MAA: 1,500-2,000 subjects exposed to vaccine
  - Vaccine-Mediated Enhanced Disease: Data from animal models, immune response characterisation as well as monitoring throughout clinical development (and post-licensure)
  - SPEAC / CEPI developing case definitions (AESIs) and mDSMB

CEPI
Manufacturing will be scaled-up and scaled-out at risk to maximize doses available in 2020/2021

- Processes scaled-up at risk (before clinical trial results)
- Begin stockpiling DS
- Begin form/finish when dose is known
- Emergency Use or Licensed Use of vaccine

The most productive platforms will be scale-out to multiple countries/regions (Expression of Interest for expanding capacity*)

Drug Product capacity and vial/stoppers procured in advance of knowing which products will advance

- The same scenario is running for all programs in our portfolio. Standard DP approaches are considered to fit any product that succeeds through development (2-3 of 10)
- Scale-out and Drug Product will seek to distribute manufacturing across multiple countries/regions.
- Manufacturers with capacity should send a note to sustainable.manufacturing@cepi.net for invitations to participate.
Cross cutting activities and projects to support vaccine development projects and prepare for vaccine use in clinical trials and in outbreak response settings.

1. Biological standards and assays
   - Access to laboratory analyses of preclinical samples via BMGF (Global Health – Vaccine Accelerator Platforms)
   - Antibody standard development in partnership with NIBSC
   - CEPI Centralized Laboratory and Assay Development
   - Support for evaluation of diagnostic assays

2. Animal models
   - Development of animal models (Ferrets, Hamster, NHP)
   - Access to laboratories for vaccine testing
Enabling Science strategy for COVID-19

3. Epidemiology

- **Modelling**
  - Collaboration with IDM on modelling the public health impact of a COVID-19 vaccine on disease burden and transmission (herd immunity).
  - Parameters assessed:
    - Target populations, duration of protection, onset of immune response, dosing schedules, dosing regimen, adherence, coverage, VE, and others.

- **Support clinical vaccine development**
  - Testing of case definitions in large hospital and household databases
  - Assessment of safety and vaccine efficacy from phase I onwards
    - Ideas for data pooling / parallel observational studies under discussion
  - Ongoing review of seroprevalence and incidence of Covid-19 globally and in defined geographical areas
  - Assessment of key epi parameters
    - Clinical spectrum, risk factors, transmission parameters
CEPI as part of ACT Accelerator

ACT Accelerator is a Global Collaboration created to Accelerate the Development, Production and Equitable Access to New COVID-19 diagnostics, therapeutics and vaccines

- Rolling pledging campaign started on May 4th 2020
- CEPI has been appointed as one of the leaders of the Vaccines pillar

SOURCE: (ACT) ACCELERATOR Commitment and Call to Action 24th April 2020
CEPI’s new Epidemic Preparedness Innovations (EPI) web space

• New clinical knowledge hub for anybody working on or interested in the field of epidemic preparedness innovations

• To bring together knowledge, tools and methods to support vaccine researchers, developers, funders and anybody working on or interested in the field of epidemic preparedness innovations

• Access via https://epi.tghn.org/
Under the vaccine pillar of the ACT accelerator partnership

- A diverse portfolio of vaccine candidates will be funded under the ACT accelerator
- Additional candidates will be evaluated through the call for proposal
- Enabling sciences projects are being developed to accelerate vaccine development
- A global footprint of vaccine manufacturers will be developed
- Vaccine will be committed to fair allocation mechanism