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Vaccine for Disease X: The ‘100 Day Mission’

Coalition for Epidemic Preparedness Innovations (CEPI)

Jakob Cramer
Director of Clinical Development
11th November 2022

WHO BP List of Priority Diseases

- List of diseases and pathogens are prioritized for R&D in public health emergency contexts
- Distinguishes which diseases pose the greatest public health risk due to their epidemic potential and/or whether there is no or insufficient countermeasures
- At present, the priority diseases are:
  - COVID-19
  - Crimean-Congo haemorrhagic fever
  - Ebola virus disease and Marburg virus disease
  - Lassa fever
  - Middle East respiratory syndrome coronavirus (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS)
  - Nipah and henipaviral diseases
  - Rift Valley fever
  - Zika
  - ‘Disease X’

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CEPI's vaccine portfolio

MERS	Lassa	Nipah	Chikungunya	Rift Valley fever	COVID-19/BPBC	Disease X
5 vaccine candidates	6 vaccine candidates	4 vaccine candidates	3 vaccine candidates	2 vaccine candidates	11 vaccine candidates 11 vaccine candidate	3 platform technologies

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* Includes broadly protective SARS-CoV-2 and broadly protective betacoronaviruses (BPBC)

Disease X: WHO Definition

Disease X represents the knowledge that a serious international epidemic could be caused by a pathogen currently unknown to cause human disease.

- Placeholder name for ‘knowable unknown’
- Added to WHO BP priority diseases list in February 2018
- Represent a hypothetical, unknown pathogen that could cause a future epidemic
- WHO projects to focus their research efforts on entire classes of viruses (e.g., flaviviruses), instead of just individual strains (e.g., zika virus), thus improving WHO capability to respond to unforeseen strains
- COVID-19 – caused by SARS-CoV-2 – first disease X

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What is our next Disease X ?

- Something we do not know yet?
- A zoonotic virus?
- A haemorrhagic fever (with high CFR)?
- Something like the non-polio enterovirus?
- What about synthetic viruses / bioweapons?
- A known bacterium with antimicrobial resistance?
- Something else?

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What is our next Disease X ?

- Something we do not know yet?
- A zoonotic virus?
- A haemorrhagic fever (with high CFR)?
- Something like the non-polio enterovirus?
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most likely, the future disease X will be a variant of something we already know (80% known, 20% unknown), like …

- … a future non-seasonal influenza virus (H7N9 in 2018, …)
- … a new SARS-CoV-2 variant? SARS-CoV-3? CoV-X
- … a Nipah outbreak with 130,000 cases in Bangladesh (with some clusters elsewhere)?

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2.0

Vision statement

A world in which epidemics and pandemics are no longer a threat to humanity

Mission statement

Accelerate the development of vaccines and other biologic countermeasures against epidemic and pandemic threats so they can be accessible to all people in need

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Prepare

for known epidemic and pandemic threats

Transform

the response to the next novel threat

Connect

to enhance and expand global collaboration

100 day aspiration

To develop a safe and effective vaccine in 100 days from the moment that a pathogen is sequenced and/or the need for a vaccine is recognised to initial availability for use.

CEPI's 100 Days Mission

Coupled with improved surveillance, and swift use of non-pharmaceutical interventions, a vaccine in 100 days could defuse the threat of a new pathogen with pandemic potential.

COVID-19:

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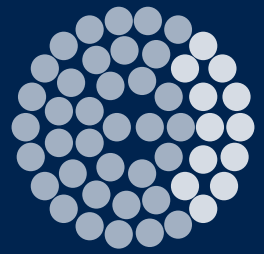
During COVID-19, it took 326 days for development to emergency use authorization by a stringent regulatory authority

Vaccine development then and now, months

Sample baseline scenario[1] (after multiple years of basic research)

~12-24	~12-24	~24	~36-48	~12	~12	
						**~10** years
Preclinical, incl. toxicity, technology development	Phase 1: Safety and immunology	Phase 2: Proof-of-concept study	Phase 3: Large-scale safety and efficacy trials	Filing	Registration	

Sample accelerated timeline[2] (enabled by previous SARS/MERS research)

Development was simultaneous vs. sequential. Clinical phases were continued after subsequent steps were initiated

~2	~2	~2	~4	~1	Authorization (EUA by stringent regulatory authority)
					

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1. Timelines can vary widely based on disease and trial designs
2. Patient safety was paramount despite the condensed timeline

Incrementalism will not to be sufficient to achieve the 100-day ambition

Illustrative vaccine development timelines

Point of outbreak

Year	0	1	2	3	4	5	
Traditional	Research	Phase I	Phase II	Phase III		Filing & Review	**10+** years
						Manufacturing	
COVID-19							**~350** days
Compressed timelines							**~250** days
Paradigm shift							**100** days

Preparedness | Reaction | Roll-out and review

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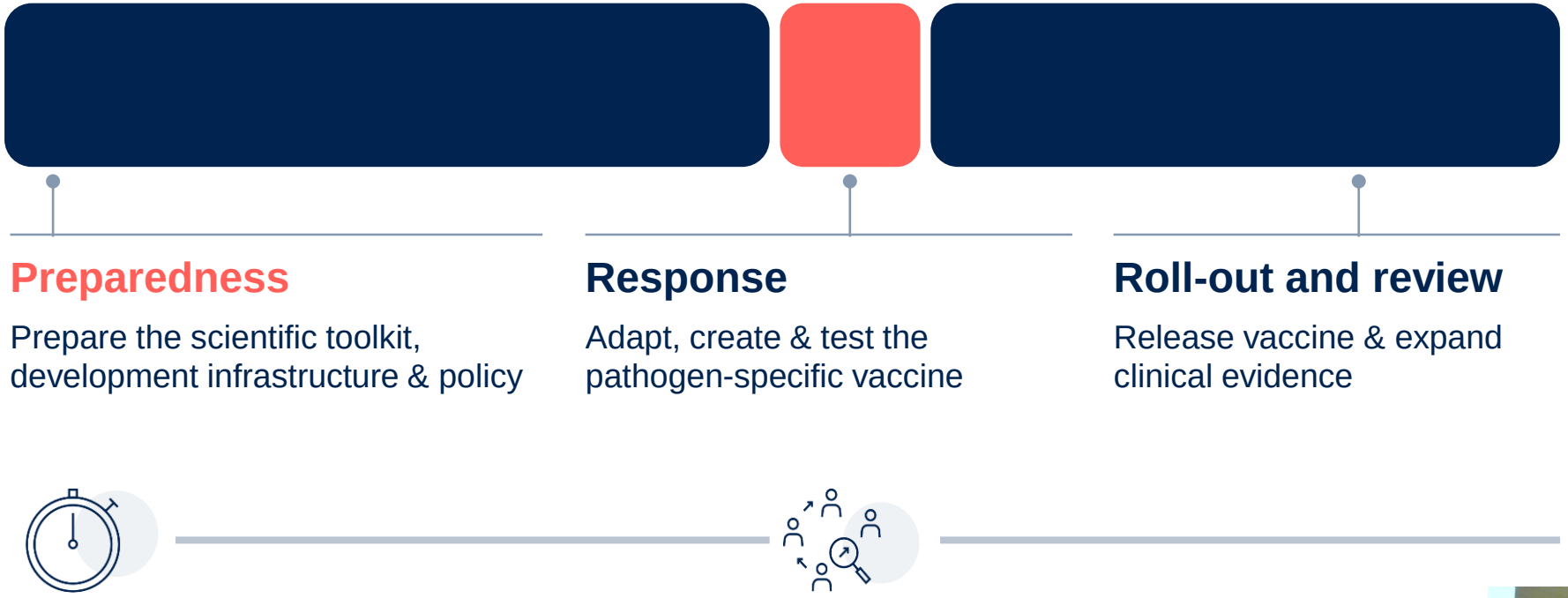
Achieving maximal response acceleration will require a paradigm shift



Preparedness

Prepare the scientific toolkit, development infrastructure & policy

Response

Adapt, create & test the pathogen-specific vaccine

Roll-out and review

Release vaccine & expand clinical evidence

Significant front-loading of preparedness: → Vaccine Li

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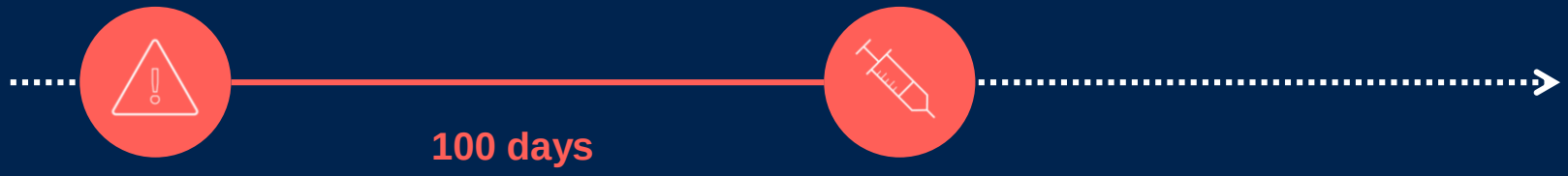
CEPI's aspiration is to develop a vaccine in as short as 100 days from alert trigger to a vaccine available for use



Alert trigger

Example metrics:

- Human-to-human transmission confirmed, with failure of typical control measures
- Unusual high # severe disease cases or deaths (e.g., at hospitals within country / area)
- New infectious diseases pathogen identified as causative agent

Vaccine available for use

Vaccine made available for use by respective authorities

e.g., vaccine deployment for public health intervention to control an outbreak in agreement with regulatory authorities

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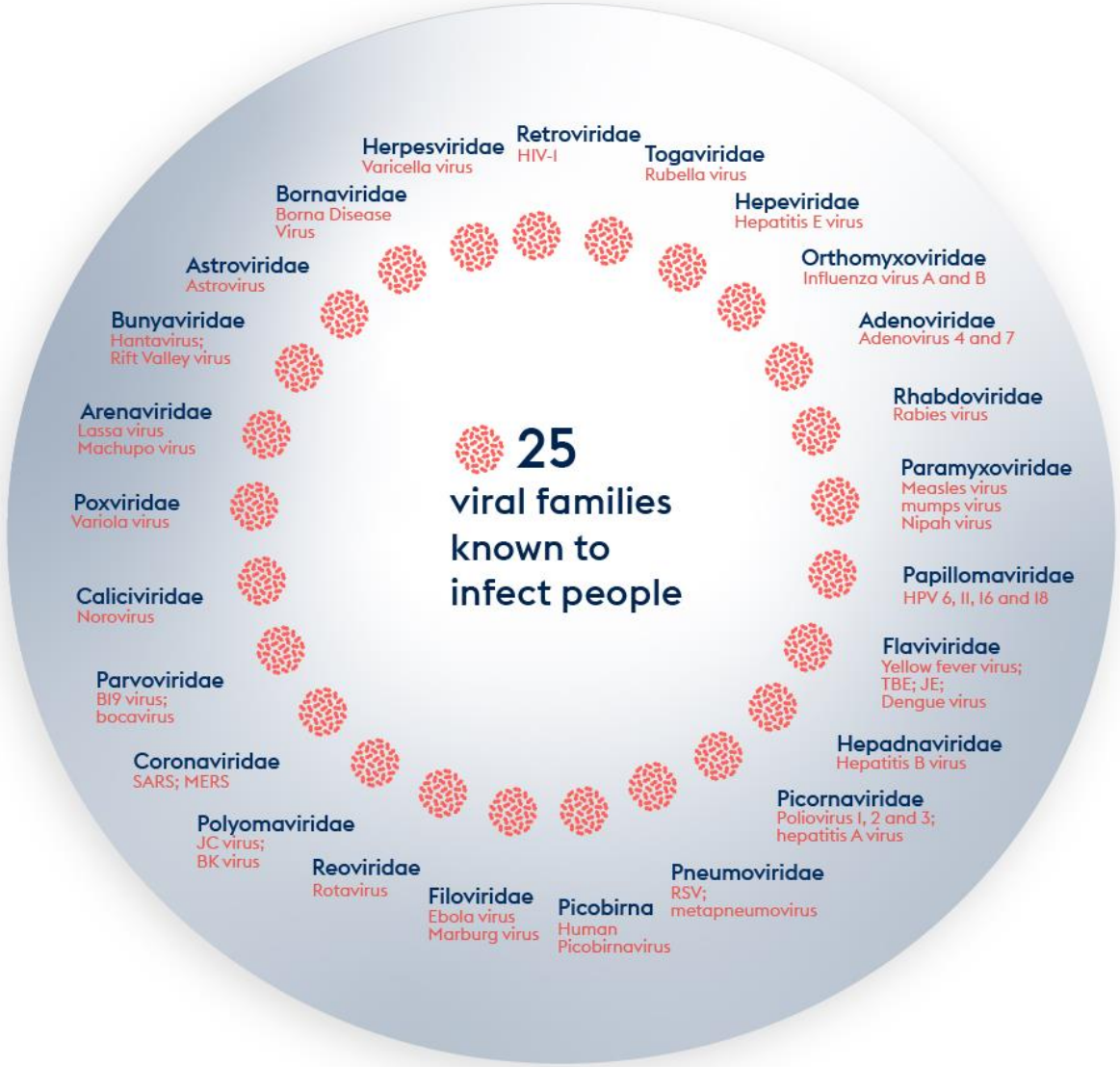
Developing a library of vaccines



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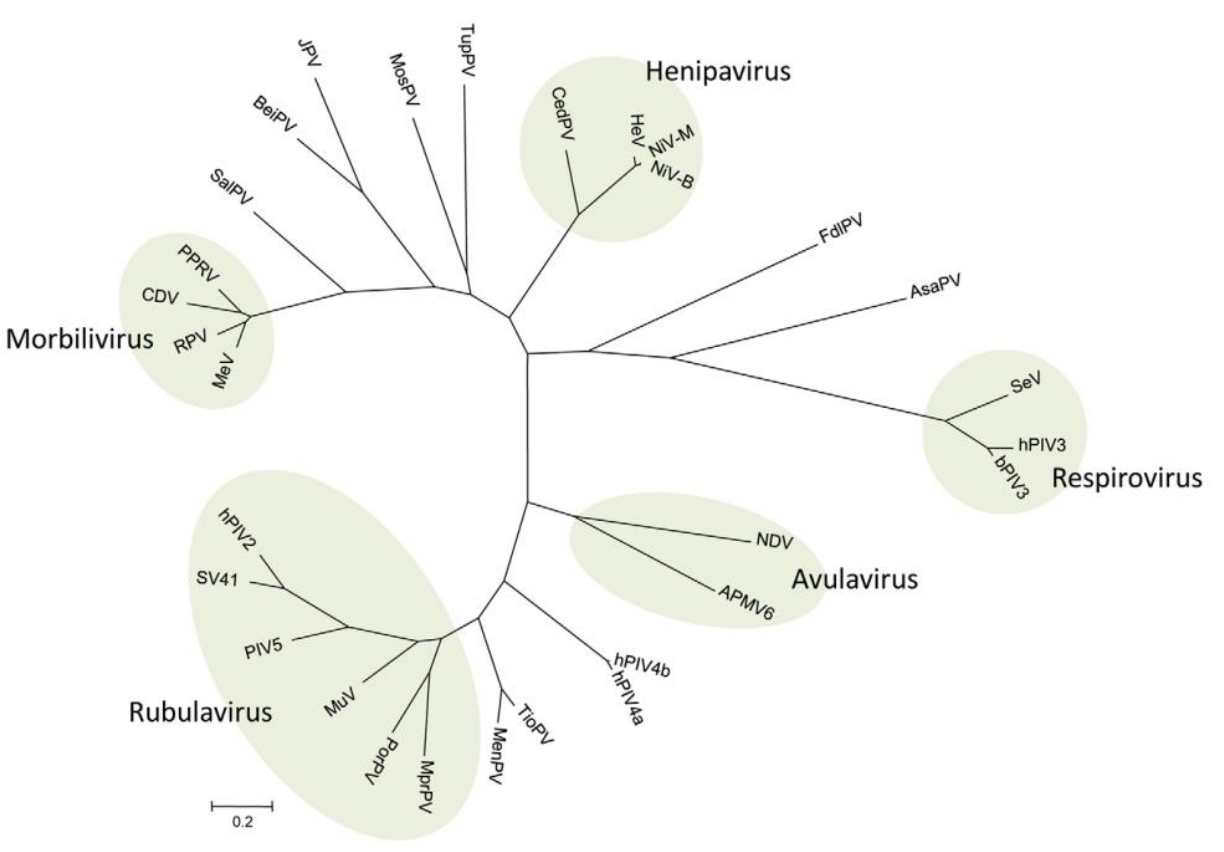
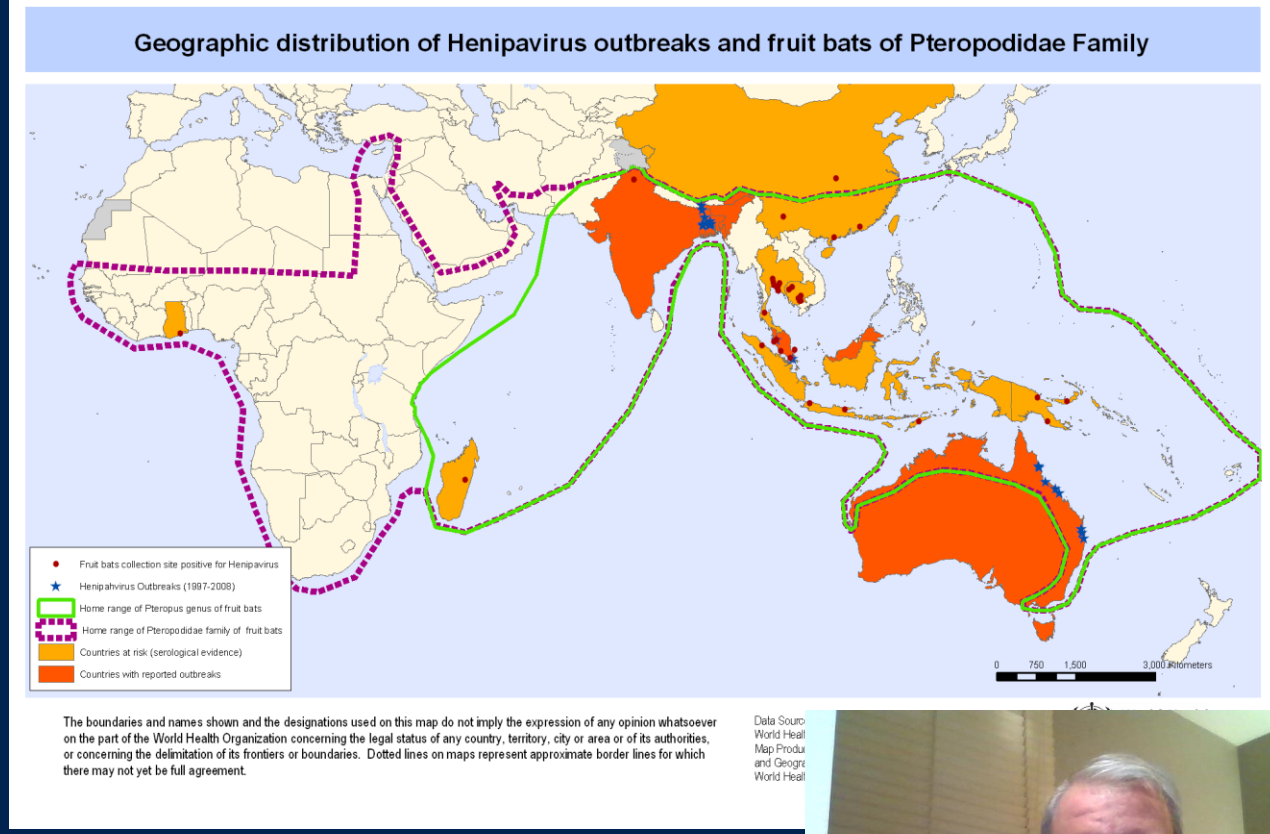
Prototype pathogen approach - *Paramyxoviridae*





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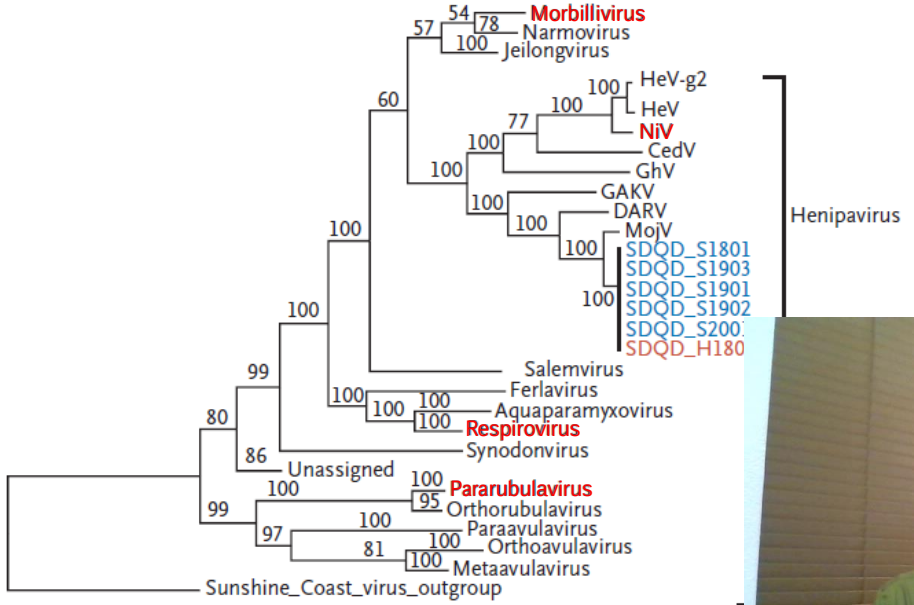
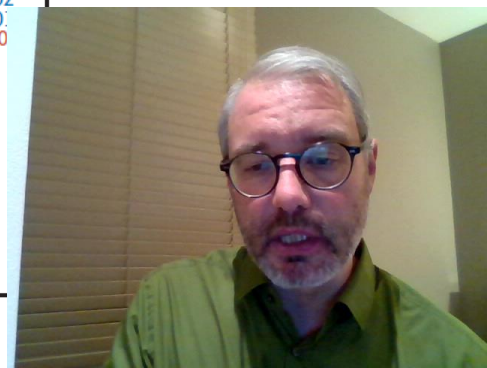
NEWS | 11 August 2022

New 'Langya' virus identified in China: what scientists know so far

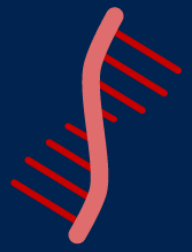
The henipavirus can cause respiratory symptoms and is related to Nipah and Hendra viruses, but cannot spread easily in people.

Scientists think some species of shrew are carriers of Langya virus. Credit: Hyun-tae Kim (CC BY 4.0)

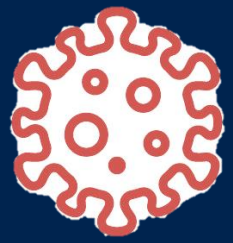




Rapid response platforms



mRNA



Viral Vectors

Proteins

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Eight critical preparedness initiatives will be required for reaching the 100-day ambition

Scientific advancement

1. Virus family vaccine libraries
2. Rapid-response vaccine platforms
3. Full deployment of advanced analytics and AI to derisk and accelerate development

Development excellence

4. Continuous global surveillance and novel approaches to rapidly investigate disease characteristics
5. Availability of standardized and rapidly scaling manufacturing capacity
6. Global clinical trial infrastructure and readiness

Policy innovation

7. Regulatory framework to enable accelerated development, including prototype safety data and accelerated efficacy
8. Fast “At risk” financing mechanisms

Equitable access

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What is Meant by 'Vaccine Efficacy' ?

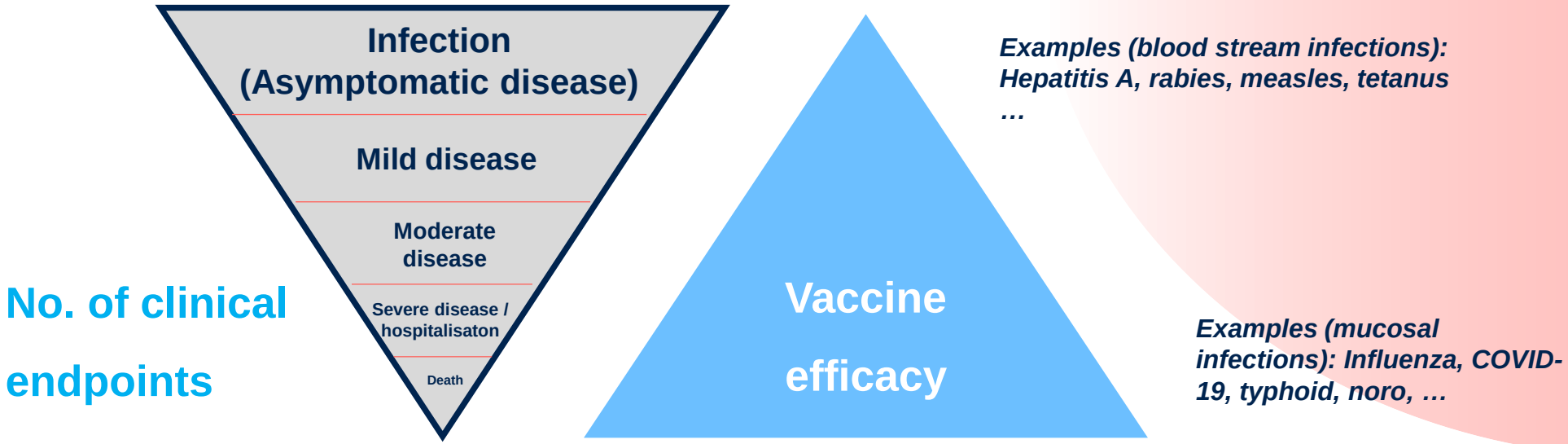
Vaccine characteristic	Preferred	Critical or Minimal
Measures of Efficacy	At least 70% efficacy (on population basis, with consistent results in the elderly)[4]. Endpoint may be assessed vs. disease, severe disease, and/or shedding/transmission. Outbreak: Rapid onset of protection (less than 2 weeks). LT: rapid onset of protection is less important	Clear demonstration of efficacy (on population basis) ideally with ~50% point estimate[4]. Endpoint[5] may be assessed vs. disease, severe disease, and/or shedding/transmission[6].

[WHO TPP, Version 3, 29 April 2020; www.who.int]

What is Meant by 'Vaccine Efficacy' ?

Respiratory tract infection like COVID-19 / sarbecovirus vaccines → vaccine efficacy against …

A) … disease → to reduce BoD:



Examples (blood stream infections): Hepatitis A, rabies, measles, tetanus …

Examples (mucosal infections): Influenza, COVID-19, typhoid, noro, …

B) … transmission (≠ infection!) → required to stop further spreading / end an outbreak

→ **Role for CHIM?**

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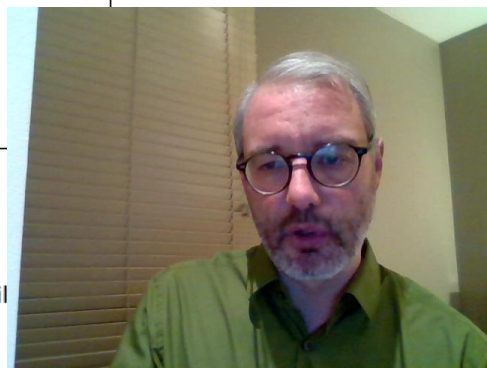
What is Meant by 'Vaccine Efficacy' ?

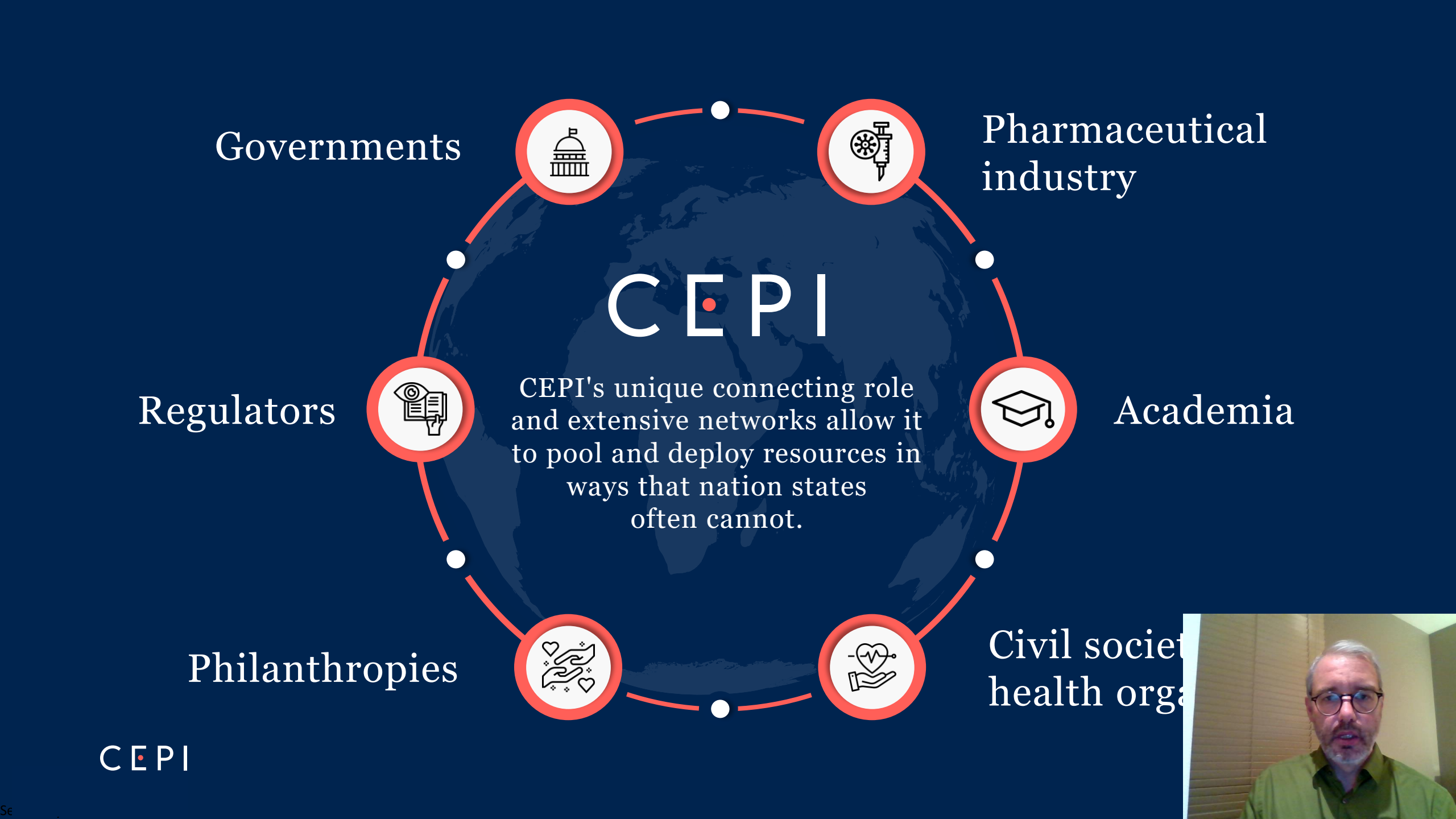
Vaccine characteristic	Preferred	Critical or Minimal[4]
Measures of Efficacy	For initial vaccination series: Efficacy[8] against symptomatic disease with ~70% point estimate and lower 95% confidence interval ≥50% OR Efficacy against severe disease[9,10] with 90% point estimate and 70% lower bound. For booster doses (doses after primary series): Additional or booster doses (whether of the same or different vaccines) should be considered when vaccines no longer meet or appear to meet the severe disease criterion, and additional/booster doses must reach the severe disease criterion Vaccines with efficacy against transmission are preferred. For previously infected: Evidence of >70% effectiveness against severe disease.	For initial vaccination series: Efficacy against symptomatic disease with ~50% point estimate and lower 95% confidence interval ≥30% OR Efficacy against severe disease with 70%-80% point estimate and 30% lower bound[11]. For booster doses (doses after primary schedule): Additional or booster doses (whether of the same or different vaccines) should be considered when vaccines no longer meet or appear to meet the severe disease criterion, and additional/booster doses must reach the severe disease criterion

TPP: → separate items for vaccine efficacy against **disease** and **transmission**

[8] Efficacy or Effectiveness, which should be assessed against currently circulating variants of concern.
[9] Severe disease endpoints may include long COVID, but are not required to.
[10] Immunobridging, based on standardized and validated assays, and with appropriate regulatory concurrence, can be used to predict that vaccines wil

[Revised WHO TPP April 2022; www.who.int]




Governments
Pharmaceutical industry
Regulators
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CEPI's unique connecting role and extensive networks allow it to pool and deploy resources in ways that nation states often cannot.
Academia
Philanthropies
Civil societ
health orga
CEPI

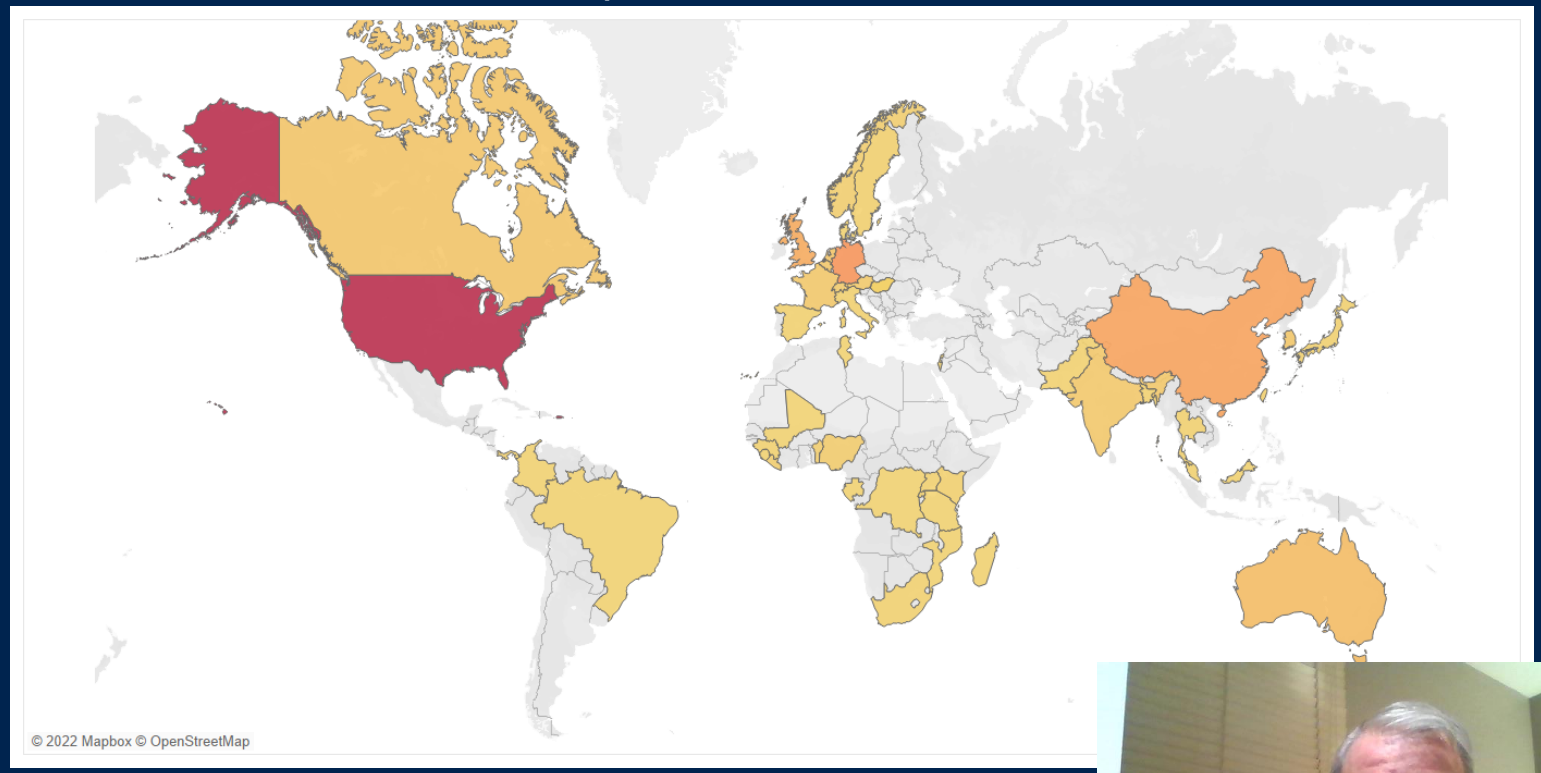
CEPI is funding vaccines, enabling science and other cross-cutting projects at a global scale…

CEPI's portfolio comprises of a global base of

- over 70 partnerships with more than
- 250 awardees and sub-awardees / contractors
- 50 countries, across vaccine development, enabling science and cross-cutting activities

Equitable access is at the core of all CEPI agreements

CEPI funded awardees / sub-awardees



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