Outbreaks, CEPI and vaccines for COVID-19

Outbreaks, Epidemics and Pandemics

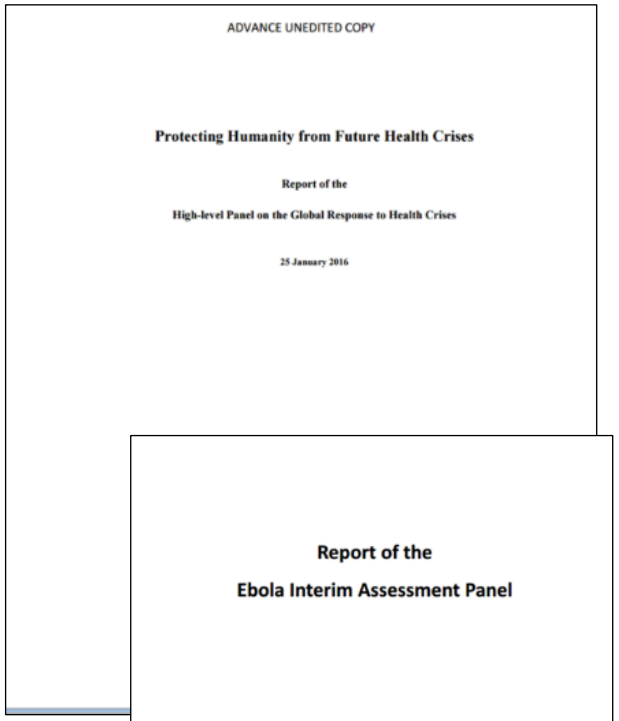
- The number and diversity of outbreaks has increased over the past 30 years
- SARS-CoV2 is one in a long line of infectious agents spreading around the world
- The alphabet from AIDS to Zika
- A-AIDS, B-Bacillus anthracis, C-Chikungunya, D-Dengue, E-Enteroviruses, F-Filoviruses, G-German measles, H-Hantaan virus, I-Influenza, J-Japanese encephalitis virus, K-Kyasanur Forest Disease virus, L-Lassa virus, M-MERS CoV, N-Nipah, O-Omsk hemorhagic fever virus, P-Polio, Q-Q fever, R-Ross River Virus, S-SARS-CoV, T-Tickborne Encephalitis virus, U-Usutu virus, V-Vibrio cholerae, W-West Nile virus, X-, Y-Yellow fever virus, Z-Zika virus
- With
  - increasing trade
  - travel
  - population density
  - human displacement
  - migration
  - Deforestation
  - climate change, a new era in the risk of epidemics has begun

Indirect costs

- Death of healthcare professionals
- Quarantine necessitates expensive, rigorous screening and closure of borders
- Reduces trade and travel
- Affects food supply (<30,000 cases but >1000,000 affected)

The World Bank estimates that Ebola cost 4 billion US dollars in direct costs, 54 billion in total costs

Calls for global action

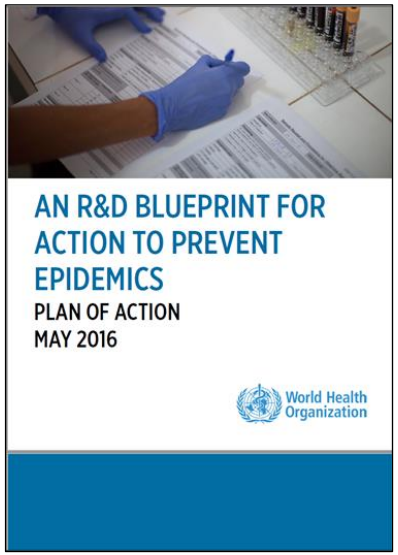

ADVANCE UNEDITED COPY

Protecting Humanity from Future Health Crises

Report of the

High-level Panel on the Global Response to Health Crises

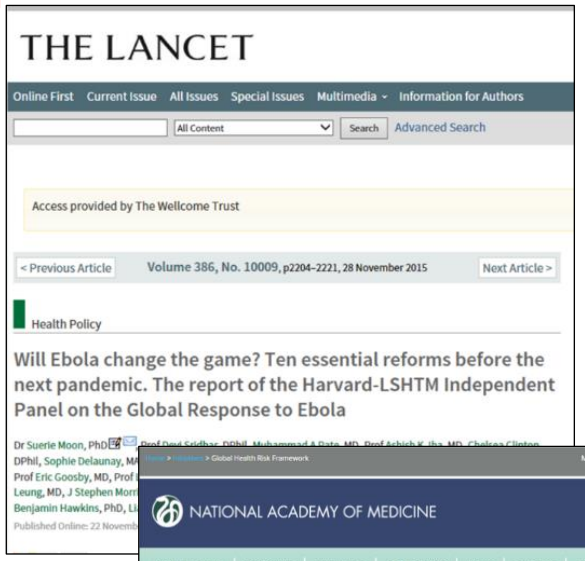
25 January 2016


AN R&D BLUEPRINT FOR ACTION TO PREVENT EPIDEMICS

PLAN OF ACTION

MAY 2016

World Health Organization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Health Policy

Will Ebola change the game? Ten essential reforms before the next pandemic. The report of the Harvard-LSHTM Independent Panel on the Global Response to Ebola


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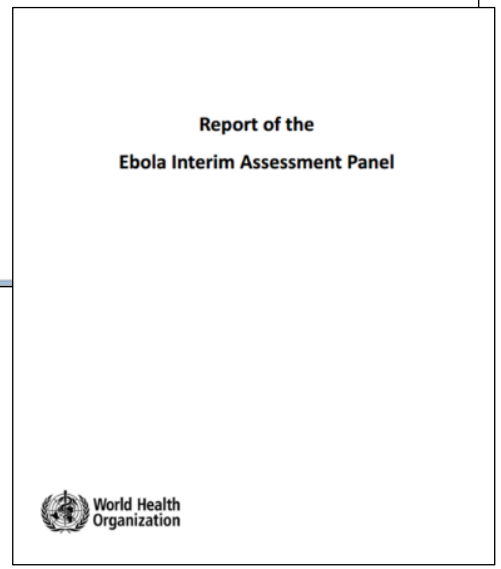
Global Health Risk Framework

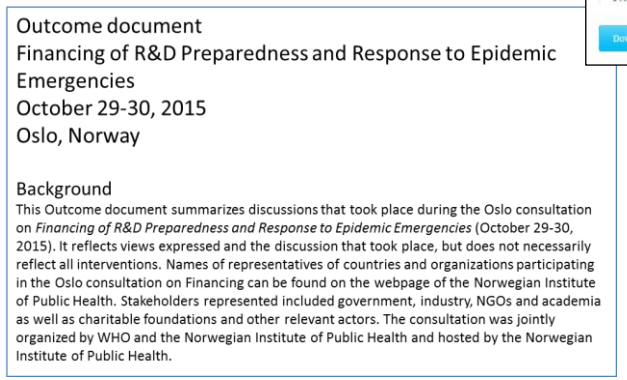
The Neglected Dimension of Global Security: A Framework to Counter Infectious Disease Crises

Download the Report


Report of the

Ebola Interim Assessment Panel

World Health Organization


Outcome document
Financing of R&D Preparedness and Response to Epidemic Emergencies
October 29-30, 2015
Oslo, Norway

Background

This Outcome document summarizes discussions that took place during the Oslo consultation on *Financing of R&D Preparedness and Response to Epidemic Emergencies* (October 29-30, 2015). It reflects views expressed and the discussion that took place, but does not necessarily reflect all interventions. Names of representatives of countries and organizations participating in the Oslo consultation on Financing can be found on the webpage of the Norwegian Institute of Public Health. Stakeholders represented included government, industry, NGOs and academia as well as charitable foundations and other relevant actors. The consultation was jointly organized by WHO and the Norwegian Institute of Public Health and hosted by the Norwegian Institute of Public Health.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Perspective

Establishing a Global Vaccine-Development Fund

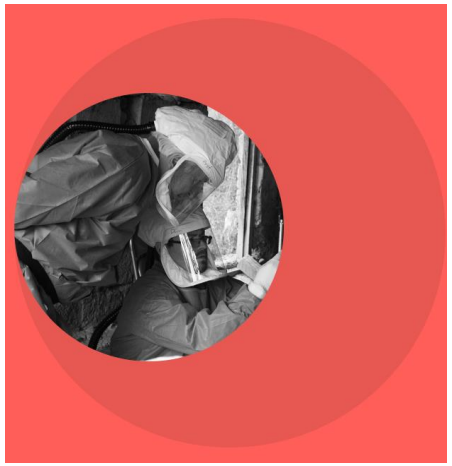
Comments open through July 29, 2015

Article References Citing Articles (8) Comments (2) Metrics

In response to Ebola-a new initiative

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

Coalition for Epidemic Preparedness Innovations

CEPI

The CEPI response

Rationalize & accelerate

Rationalize and **accelerate** research and development responses to new outbreaks

Coordinate

Coordinate resources of industry, academia, governments, philanthropies, and NGOs

Prioritize & facilitate

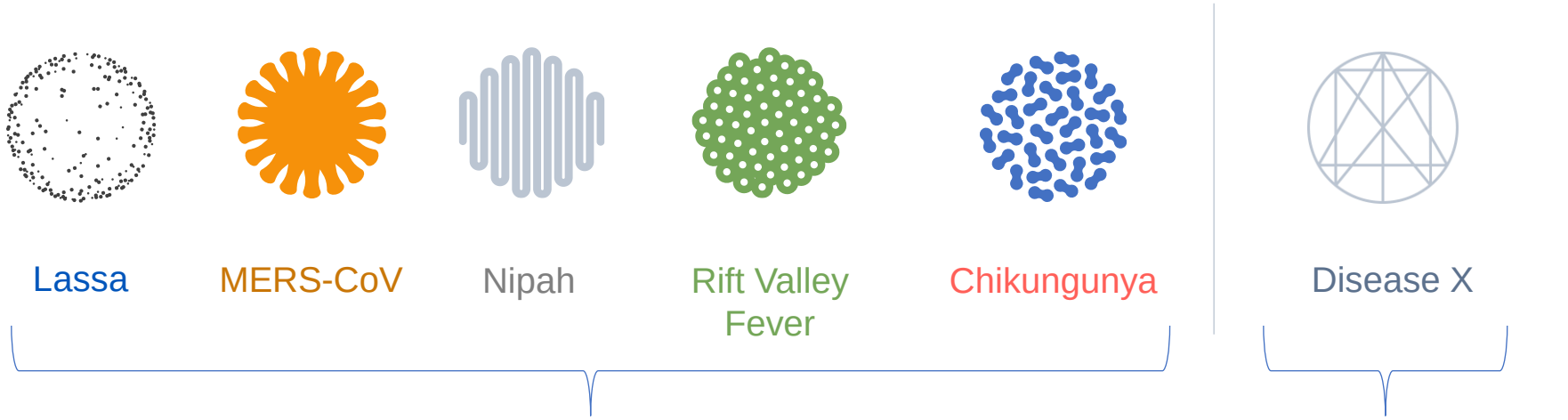
Prioritize platform technology and vaccine targets and **facilitate** the advanced development of vaccines for emerging infectious diseases

Rationalize and accelerate

- WHO R and D Blueprint
- Updated for top ten threats every year

- And disease X

CEPI's strategic portfolio targets



CEPI has 12 vaccine candidates funded since Jan 2020

CEPI and Gavi Alliance lead the vaccine pillar of the ACT Accelerator

CEPI

The first two months of Disease X

Coronavirus disease 2019 (COVID-19)
Situation Report – 37

World Health Organization

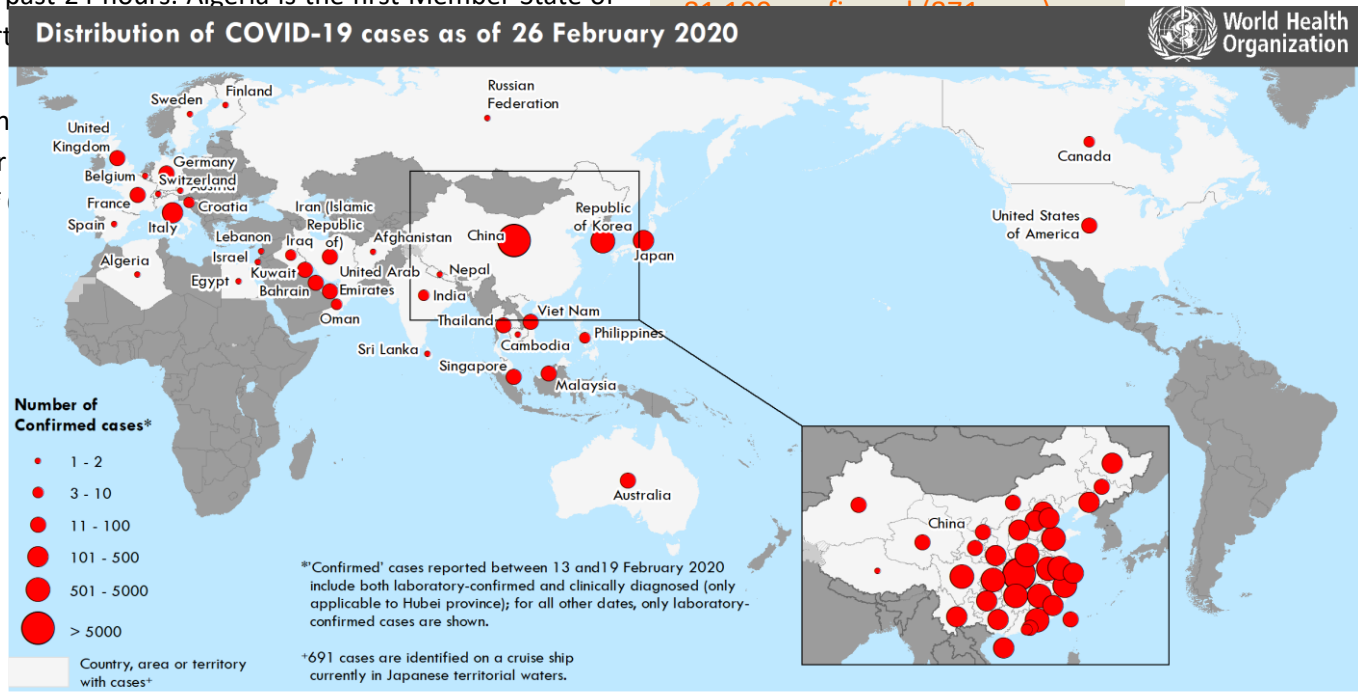
Data as reported by 10AM CET 25 February 2020*

HIGHLIGHTS

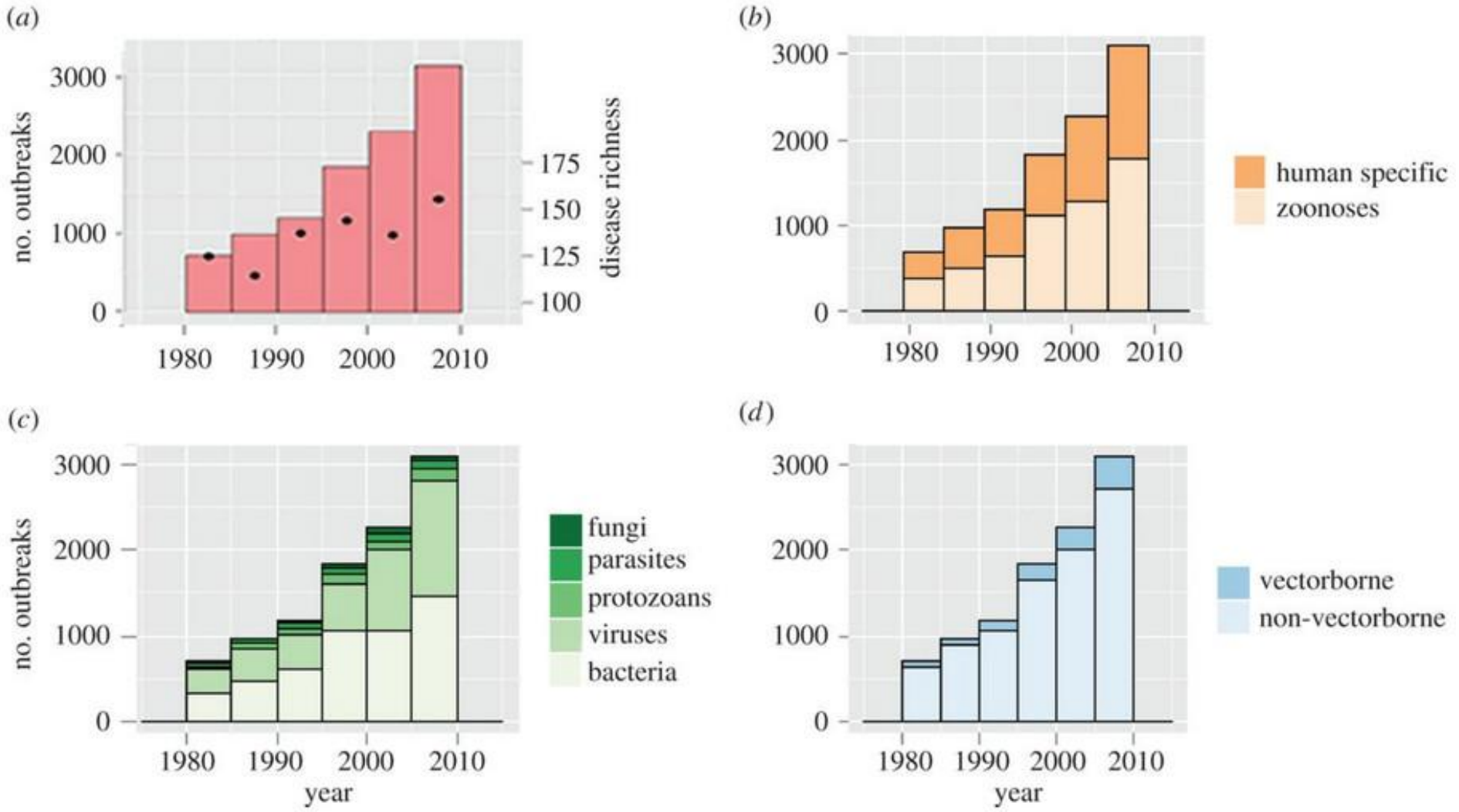
- Four new Member States (Algeria, Austria, Croatia, and Switzerland) reported cases of COVID-19 in the past 24 hours. Algeria is the first Member State of the AFRO Region to report
- For the first time, since th
COVID-19 on 8 December
from countries outside of

SITUATION IN NUMBERS
total and new cases in last 24 hours

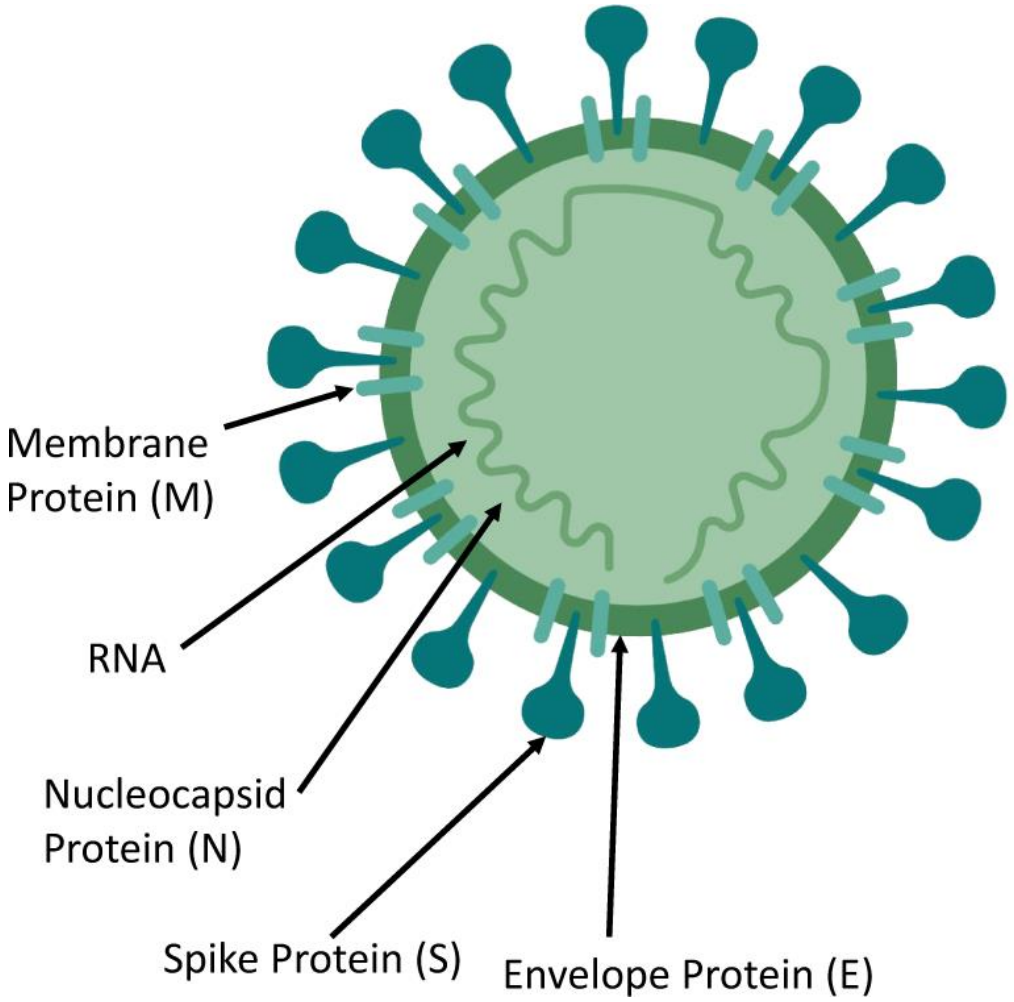
Globally



Not unexpected, zoonotic diseases from AIDS to Zika

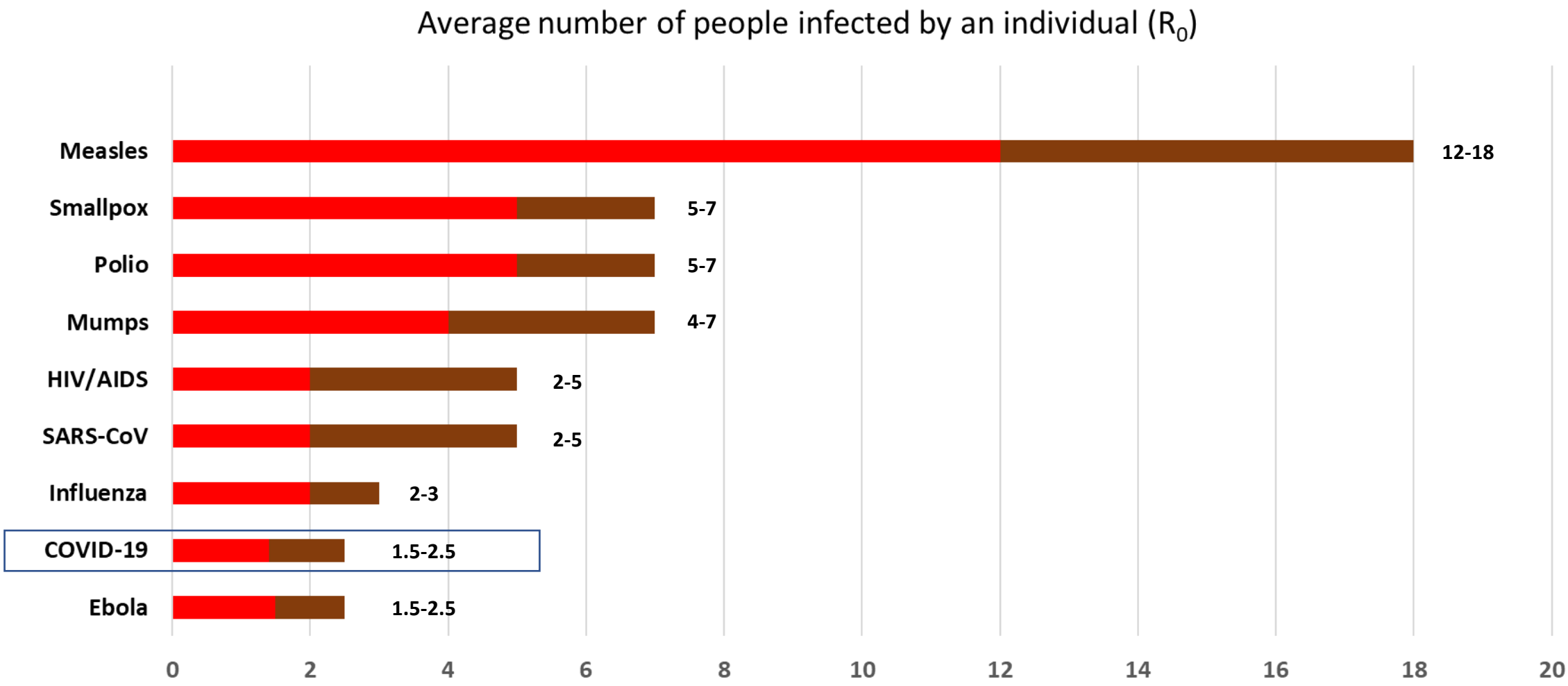


Coronavirus

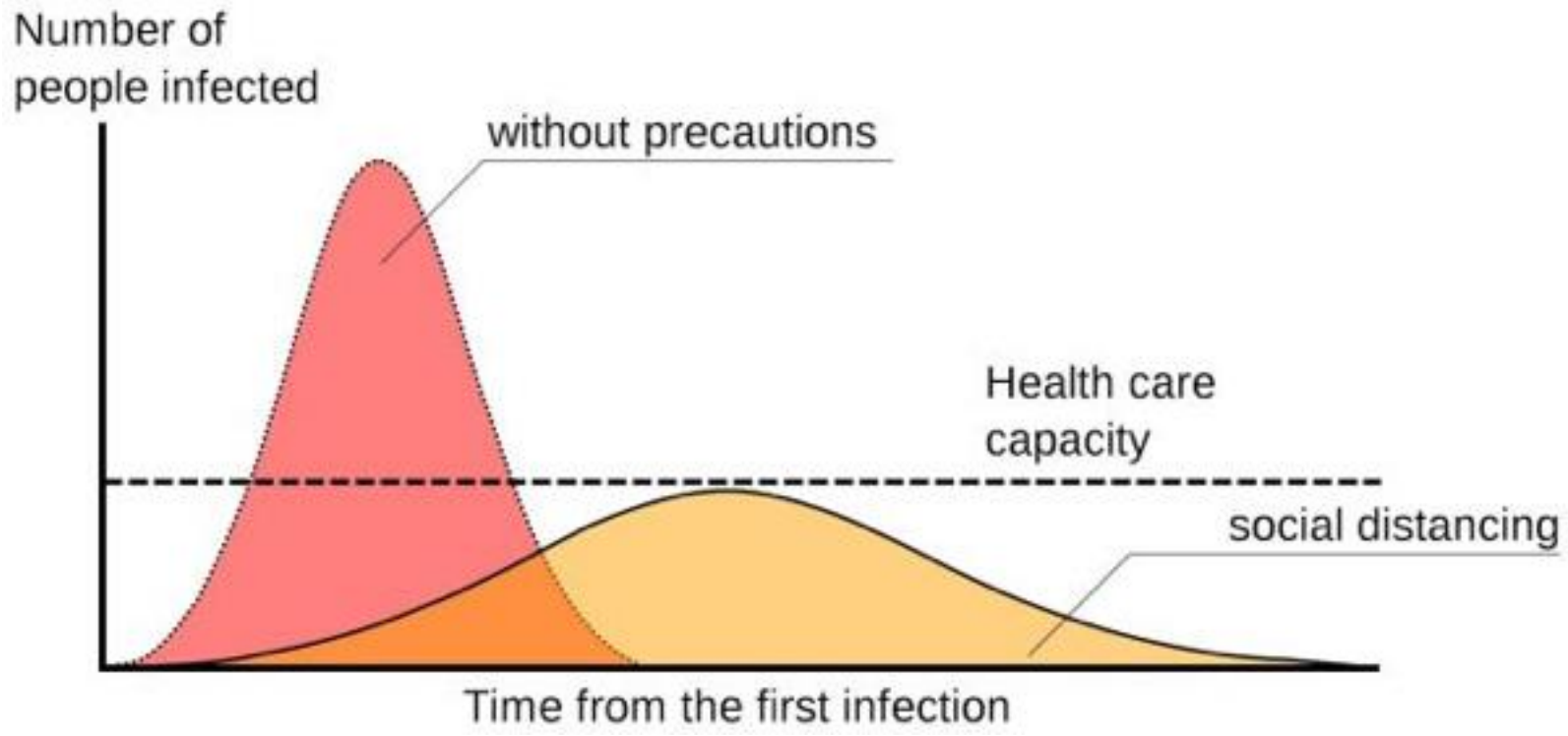


Structural Protein	Functional Protein
Nucleocapsid Protein (N)	• Bound to RNA genome to make up nucleocapsid
Spike Protein (S)	• Critical for binding of host cell receptors to facilitate entry of host cell
Envelop Protein (E)	• Interacts with M to form viral envelop
Membrane Protein (M)	• Central organizer of CoV assembly • Determines shape of viral envelop
NOTE: Some CoVs do not need to have the full ensemble of structural proteins to make virions, highlighting that certain proteins may be dispensable or compensated by the function of non-structural proteins.	

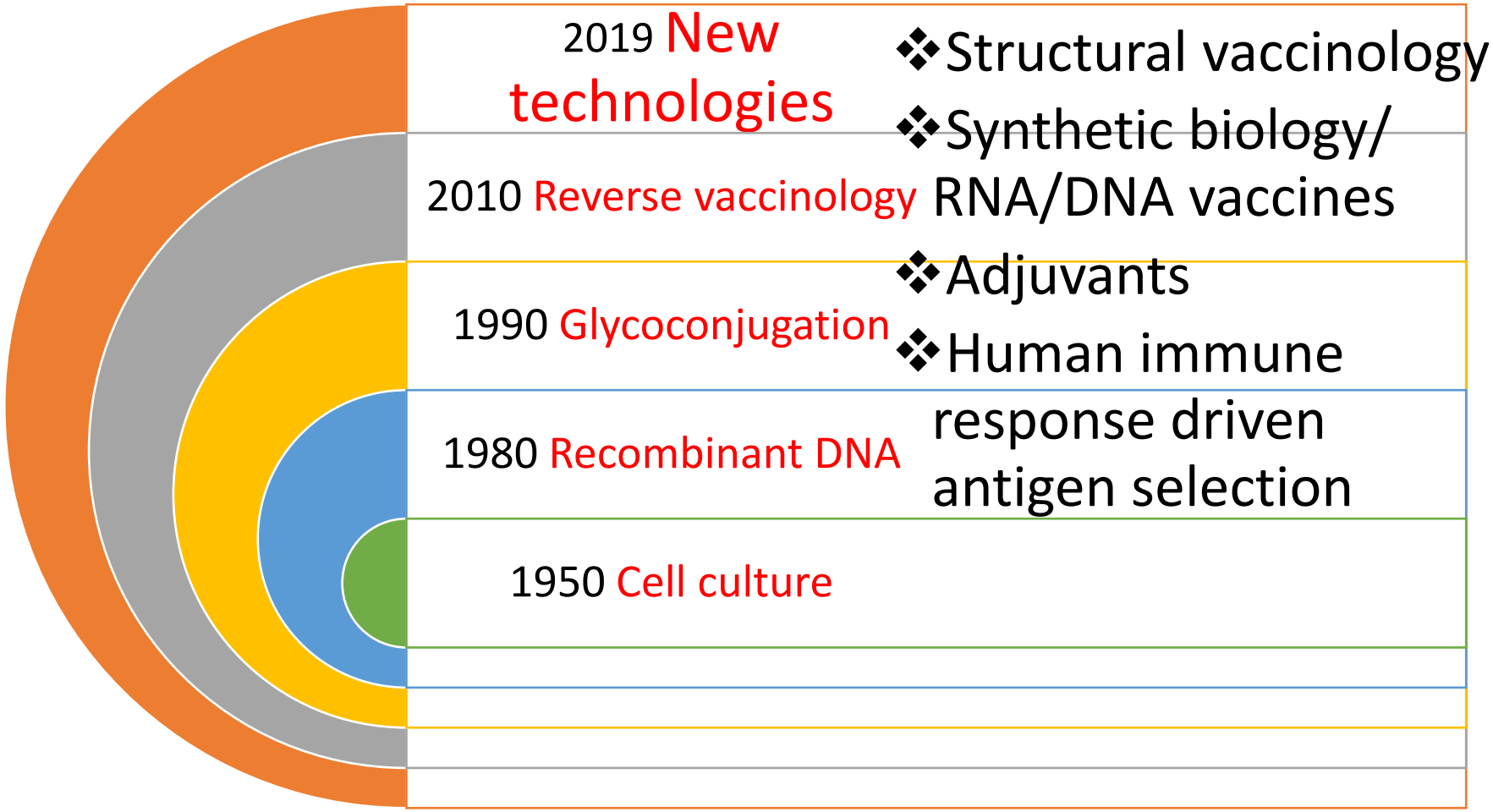
How Contagious is COVID-19?

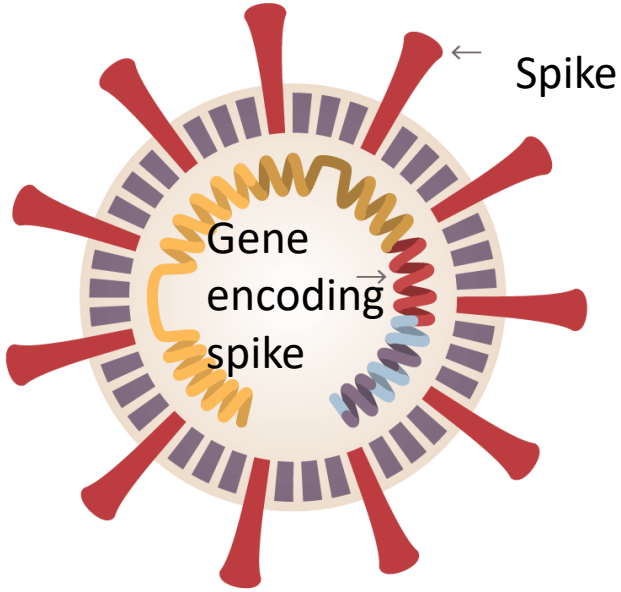


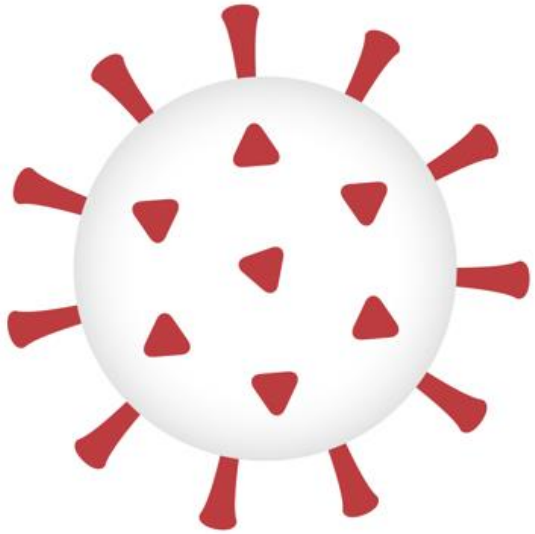
Flatten the curve/ Buy us time



During the past 20 years, new technologies have exploded vaccine design→230+ candidates for COVID 19 prevention

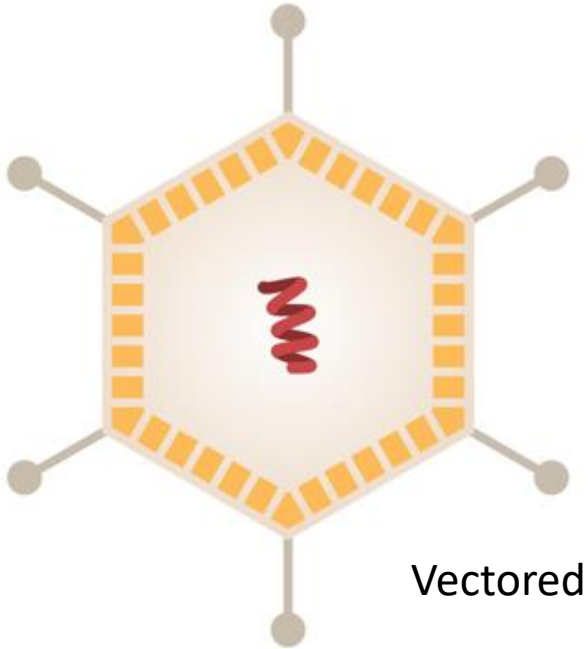




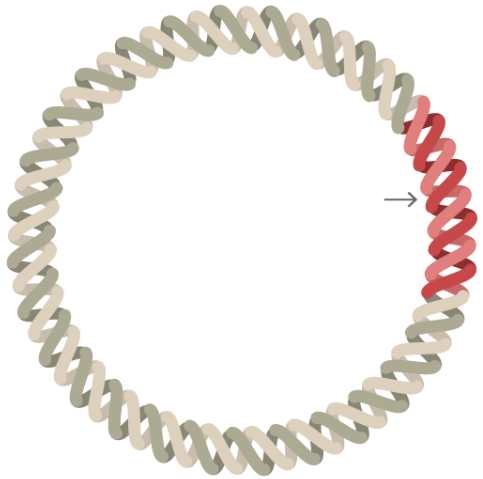


Virus like particles

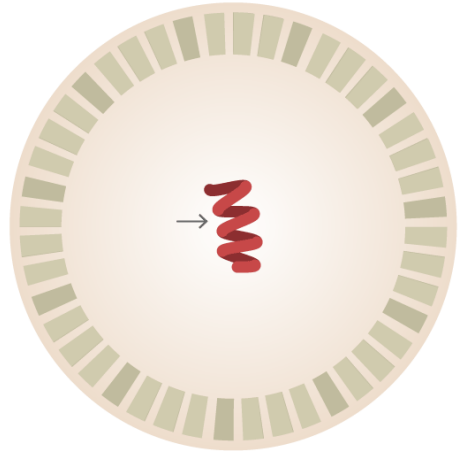
Recombinant DNA



Vectored vaccines



DNA vaccines

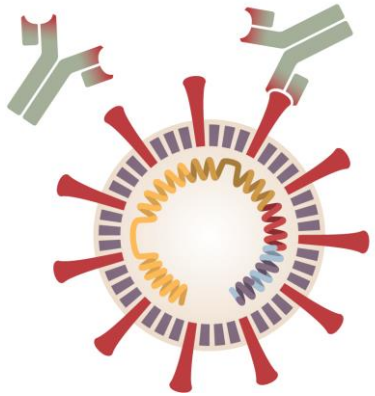


RNA vaccines

Illustrations from the New York Times, May 2020

Not yet in human trials → Safety and dosage → Expanded safety/ immunogenig enicity → Efficacy → Approved for use

Pre-clinical 125+ → Phase 1 7 → Phase 2 6 → Phase 3 2 → Licensed 0



Major and Indian players

- J & J, Sanofi Pasteur (with adjuvants from GSK), Merck (Oxford), Pfizer (BioNTech), Takeda
- Overall, 230+ projects
  - DNA-Zydus Cadila
  - Inactivated-Bharat Biotech, Indian Imunologicals
  - RNA-Gennova
  - deoptimized live attenuated-Codagenix-SII, Indian Immunologicals
  - Replicating viral vector (including VSV, horsepox)-Aurobindo Pharma
  - Coroflu, self-limiting influenza, Bharat Biotech
  - Non-replicating viral vector (MVA, Ad)-SII/Oxford Astra Zeneca, Rabies vector-Bharat Biotech
  - Replicating measles vector-Zydus Cadila
  - Subunit protein/VLP-Biological E, Mynvax
  - Multiple other approaches including plant based vaccines

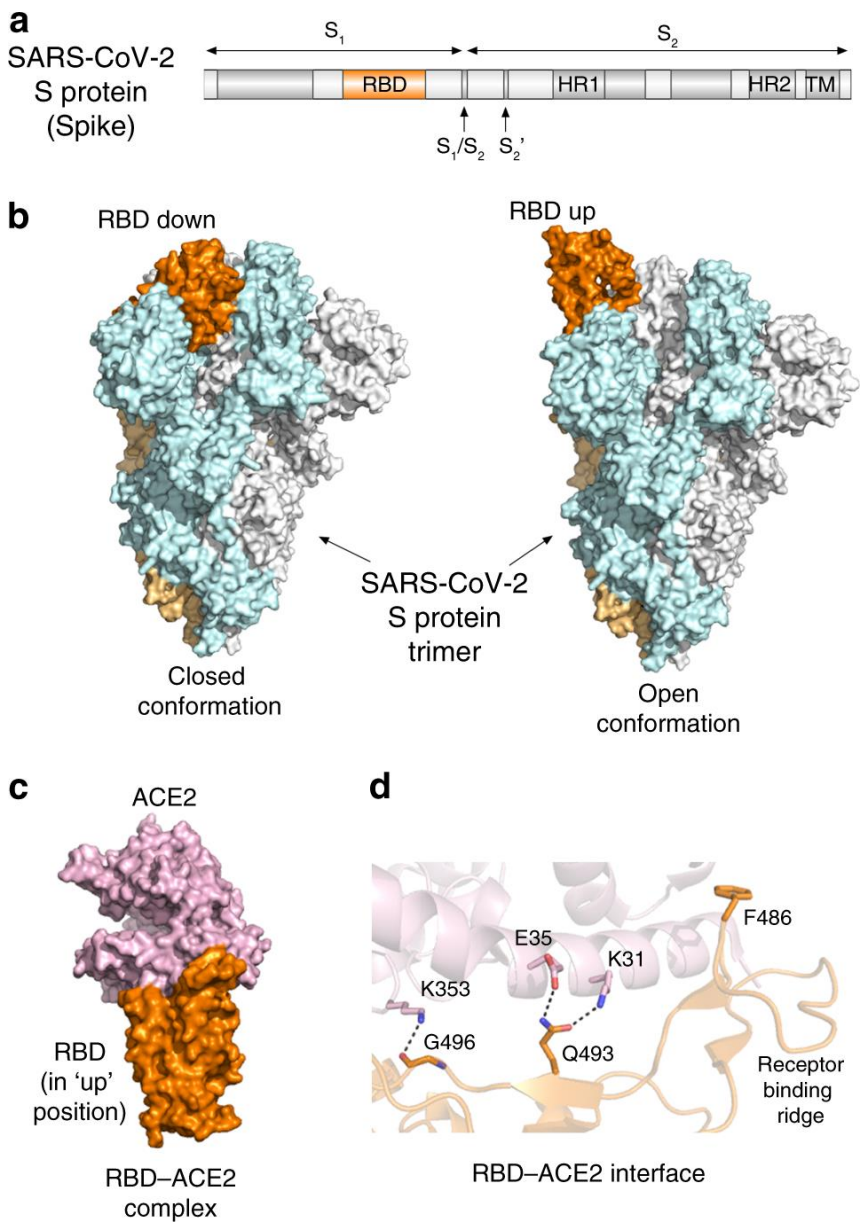
Projects in clinical phases

- University of Oxford/Astra Zeneca/other partners-ChAdOx1, phase 2/3
- Moderna (US) -lipid encapsulated mRNA, 1st readout May 2020-safe and immunogenic, moving to phase 3
- CanSino (China)- Ad5 nCoV, 1st readout available, now phase 2
- Sinovac (China)- inactivated+alum, animal studies show no antibody dependent enhancement, phase 1/2
- Sinopharm (China)- Inactivated, phase 1/2
- Inovio (US)-DNA, in phase 1

- Shenzhen Geno-Immune Medical Institute (China) 2 programs in phase 1, Pathogen-specific aAPC, Lentiviral minigene vaccine
- BioNTech-RNA-LNP, in phase 1/2

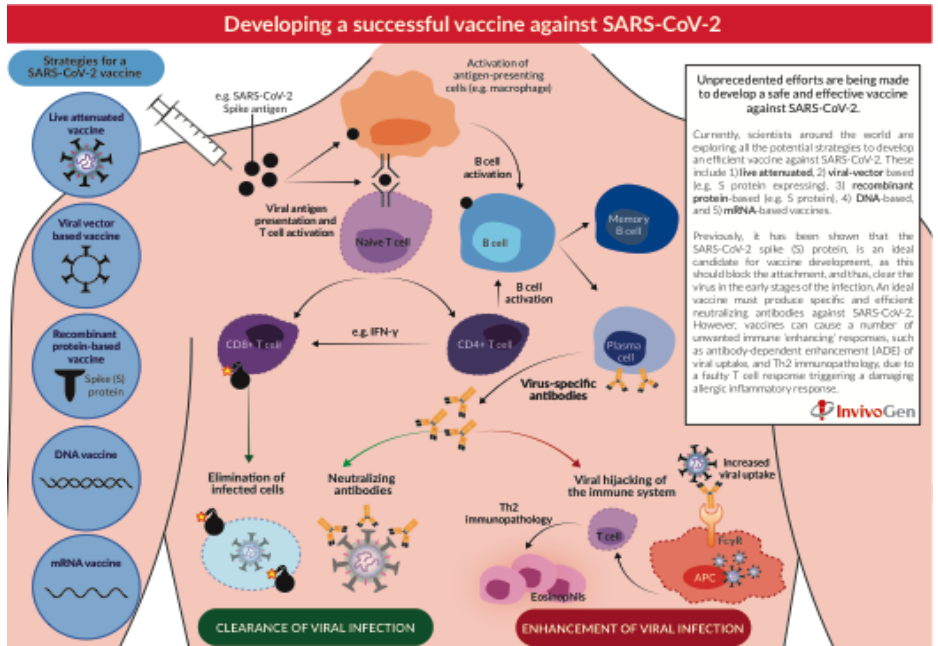
What are the vaccines targeting?

- **a** Domain architecture of the SARS-CoV-2 spike protein. Receptor-binding domain (RBD), heptad repeats (HR1 and HR2), transmembrane domain (TP), and protease cleavage sites S_1/S_2 and S_2' are labeled. **b** Side views of the spike protein trimer in a closed conformation (left, PDB 6vxx) and open conformation (right, PDB 6vyb). Three protomers are colored light cyan, gray, and light orange. Buried in the closed state RBD (orange) from one of the protomers (light orange) swings up and is ready to bind ACE2 in the open state. **c** Side view of the RBD-ACE2 complex (PDB 6m0j). The RBD position is aligned to that of in (**b**). **d** Zoom in view of the interface of the RBD-ACE2 complex (PDB 6vw1). Dashed lines indicate salt bridges observed in the SARS-CoV-2 complex that are absent in the corresponding SARS-CoV complex.
-



We need vaccines, and fast

- But no compromise on safety
- Issues of scale/manufacture
- Vaccine nationalism
- Glass vials/syringes/adjuvants



- Our vaccine industry leads the world in number of doses
- But we make vaccines very slowly and on limited platforms

- DBT is leading efforts in India

Coordination for public protection