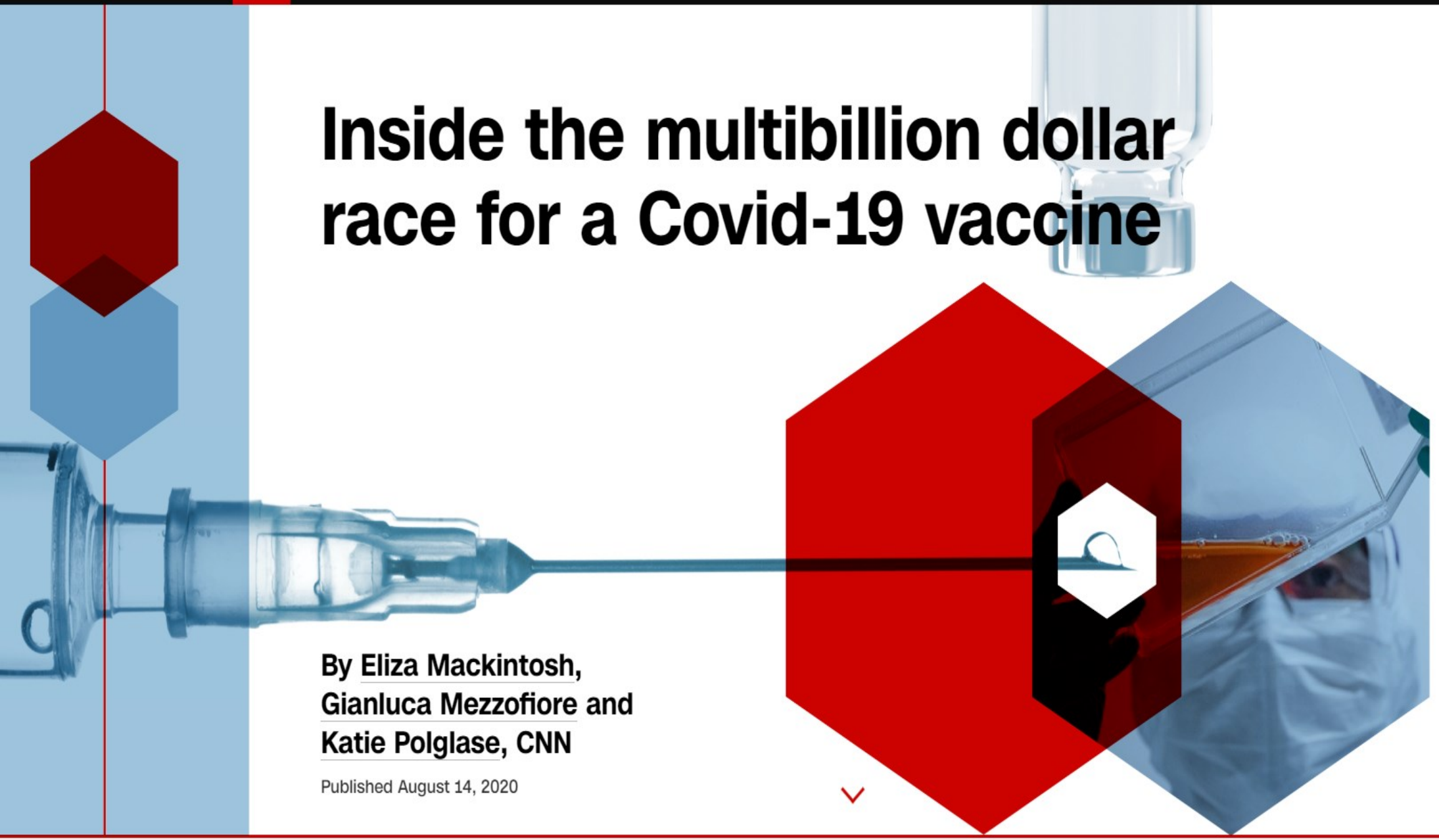
Inside the multibillion dollar race for a Covid-19 vaccine



By Eliza Mackintosh, Gianluca Mezzofiore and Katie Polglase, CNN

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Four years. That's the fastest a vaccine has ever been developed -- and most take 10 to 15.

But scientists are now racing to do it in under one.

Dozens of research teams around the world are working to develop a vaccine for SARS-CoV-2, the virus that causes Covid-19, using a mix of established techniques and new technologies.

Funding for a vaccine has never been greater, with billions of dollars pouring in from around the world to make a product that could help to control the pandemic -- but the US, China and Europe have invested the most.

Before even the most vulnerable groups can get a shot in the arm from their family doctor, however, a lot of work needs to be done -- and a lot of deals need to be made.

As the coronavirus continues to accelerate unabated, here's what it will take to bring a vaccine to the masses and how each of the three biggest players are faring in their quest to make it happen as quickly as possible.

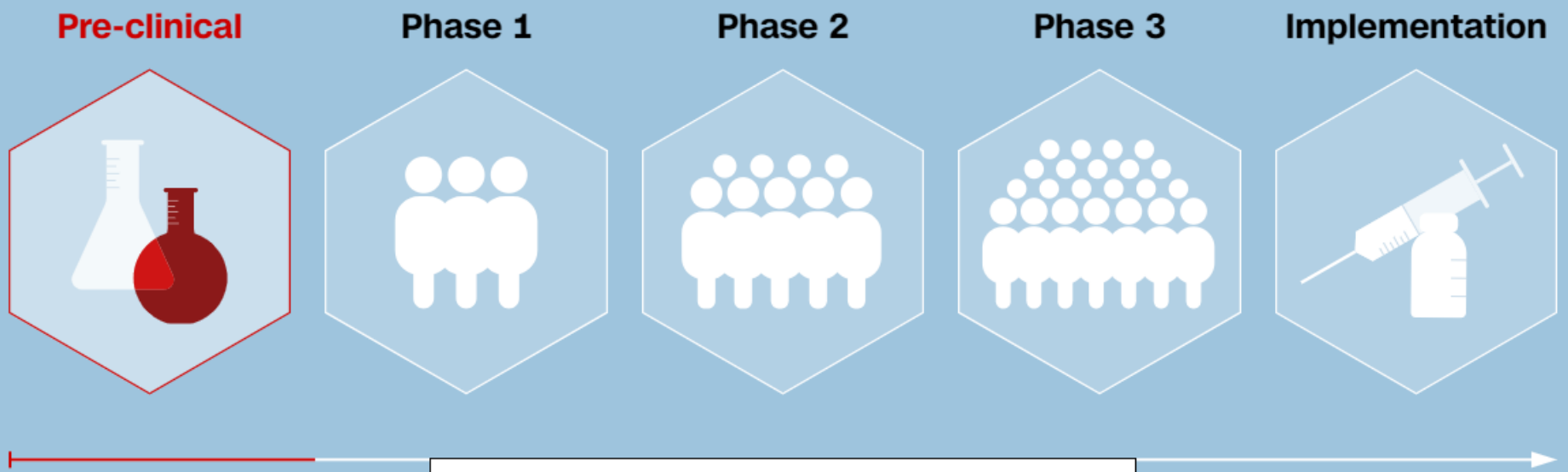
The path to a Covid-19 vaccine

Scientists are hoping to deliver a vaccine that protects against Covid-19, and its transmission, by early 2021. In order to do that, the development process has been rapidly accelerated.

A vaccine must go through multiple stages before being green lit for use. An initial research and development stage is followed by a series of pre-clinical and clinical trials (consisting of three phases), and typically each step can take two years or more to complete.

But in the race to stop the coronavirus, some of those steps are being combined, or skipped altogether, to speed up the process.

Stage of vaccine development



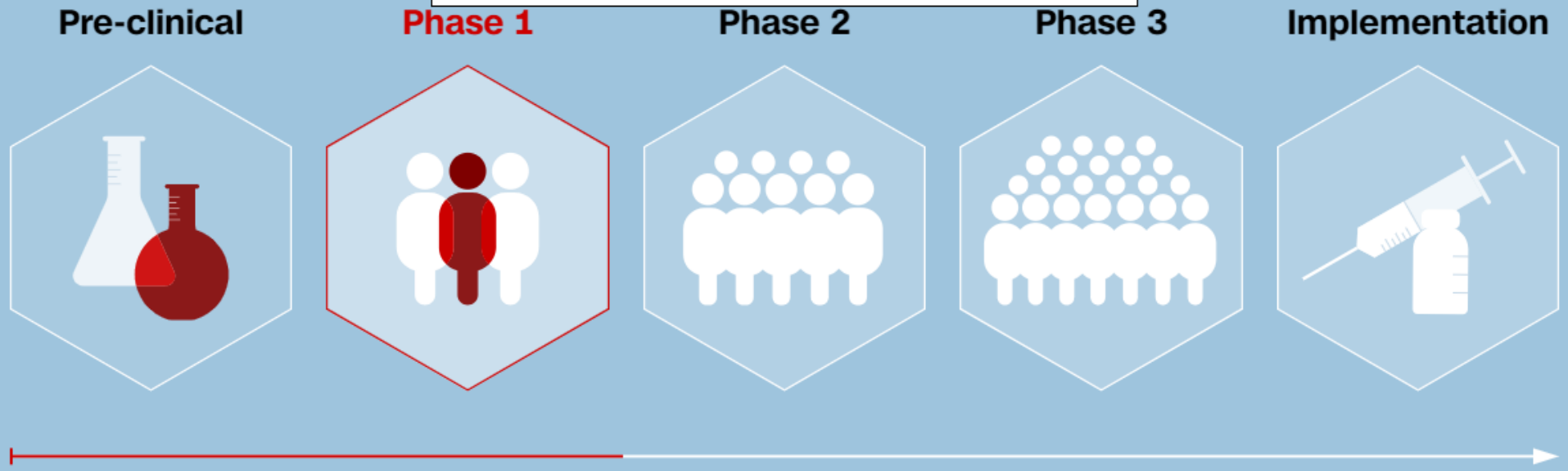
Pre-clinical: Before testing on humans, researchers usually give the vaccine to animals to assess safety and see if it triggers an immune response. But for some coronavirus vaccines, researchers have been able to speed

Notes: This vaccine tracker was last updated c

Source: World Health Organization

Stage of vaccine development

Phase 1: In the first stage of clinical trials, the vaccine is given to a small group of people (usually between 10-50) to check it's safe.



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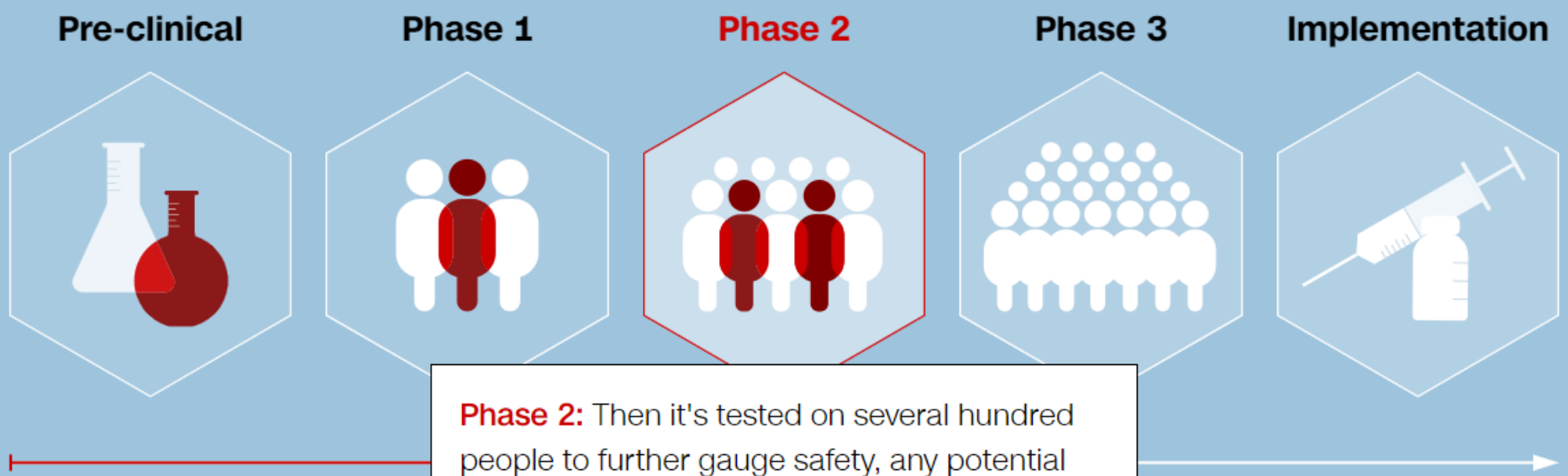
Stage of vaccine development



Phase 2: Then it's tested on several hundred people to further gauge safety, any potential side effects, the immune response and dosage. But a number of coronavirus vaccines are in simultaneous Phase 1/2 trials, which means they're being tested for the first time on hundreds of people.

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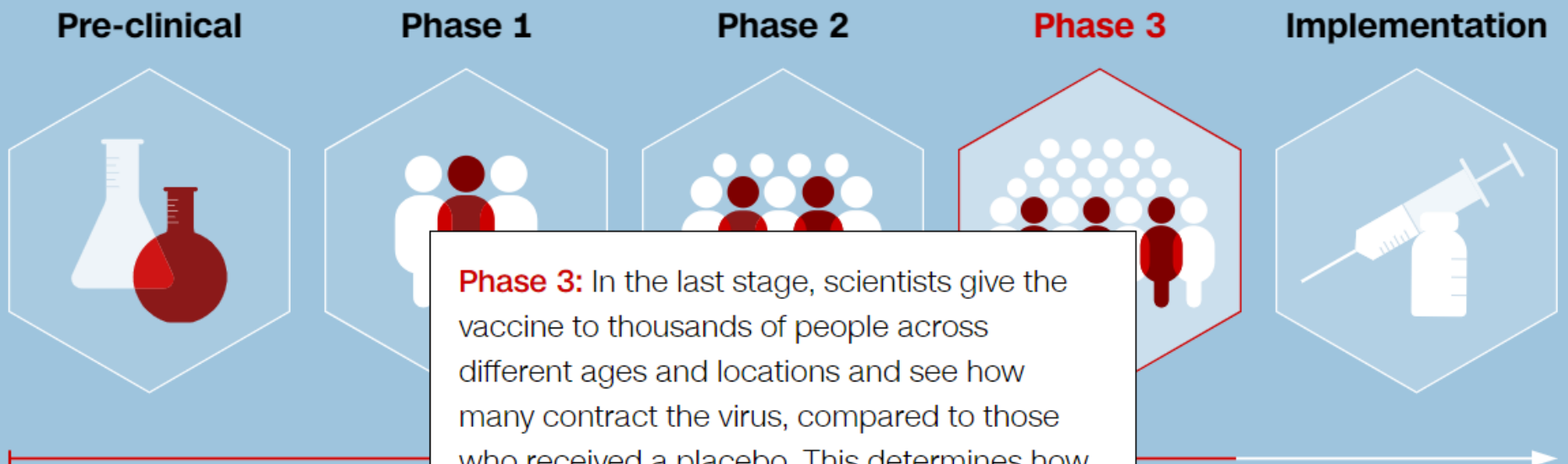
Source: World Health Organization

Stage of vaccine development



Phase 3: In the last stage, scientists give the vaccine to thousands of people across different ages and locations and see how many contract the virus, compared to those who received a placebo. This determines how good it is at reducing new infections -- its efficacy.

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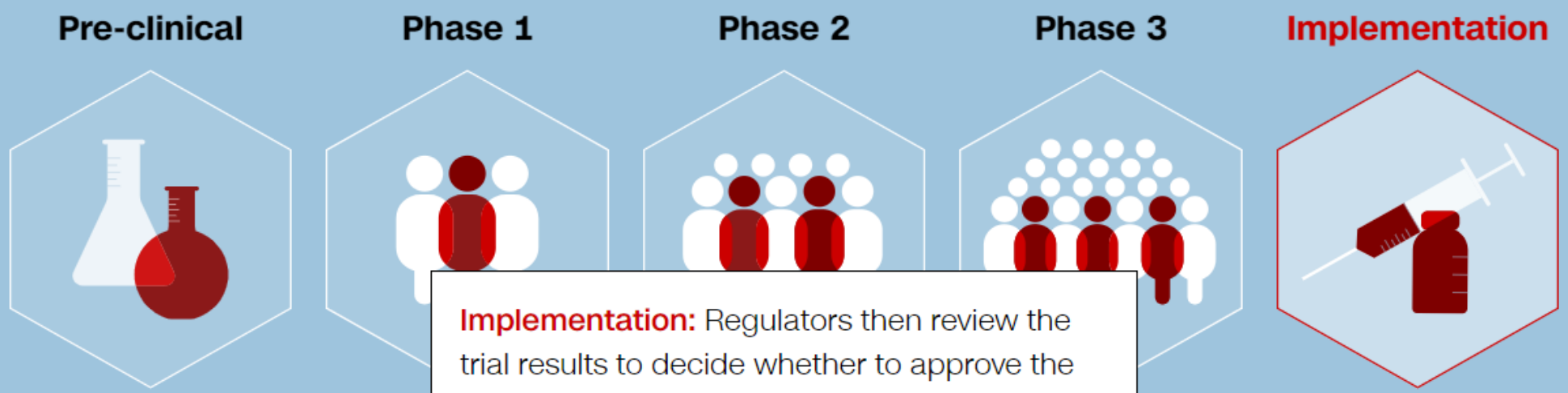
Source: World Health Organization

Stage of vaccine development



Implementation: Regulators then review the trial results to decide whether to approve the vaccine for use, licensing and large-scale manufacturing. Many vaccines also undergo Phase 4 studies after they are approved and licensed.

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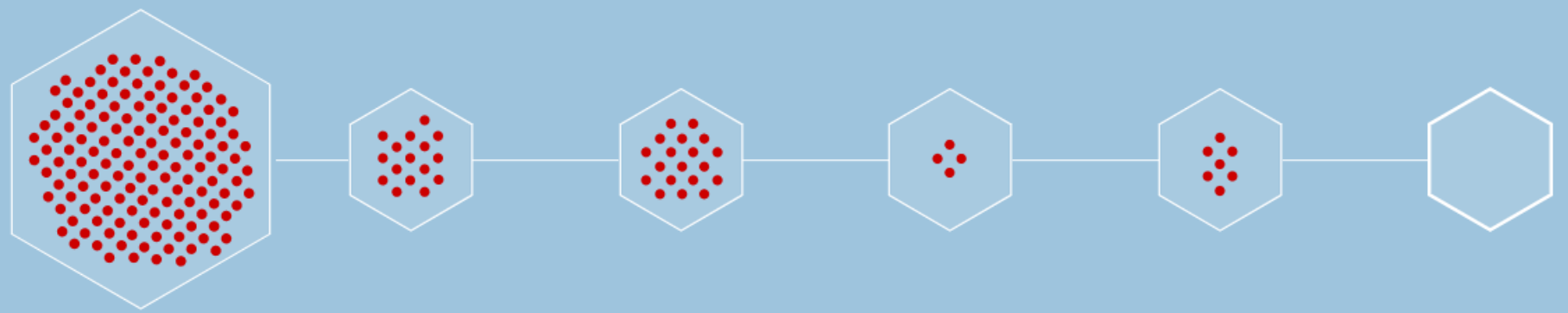
Stage of vaccine development



There are currently 29 vaccines being tested in multiple human trials, running simultaneously around the world. Among these, six vaccines are being tested in seven Phase 3 trials.

Notes: This vaccine tracker was last updated on August 13

Source: World Health Organization

Record speed to human trials

Progress on a vaccine for Covid-19 has been rapid compared to other viruses, with human trials starting just 67 days after the outbreak began.

In the case of SARS and Zika, the epidemics ended before development was complete, and the vaccines are not yet approved for use.

Note: This graphic includes outbreaks declared Public Health Emergencies of International Concern (PHEIC) by the World Health Organization. Speed to trials was calculated using the date of each outbreak's first reported case. SARS -- which was identified in 2003, before the WHO established the PHEIC designation -- is included here because it was a major reason for the creation of the designation.

Source: World Health Organization, National Institutes of Health

Stages of vaccine manufacturing

Note: This is a distilled version of the vaccine manufacturing process.
Source: International Federation of Pharmaceutical Manufacturers and Associations, World Health Organization

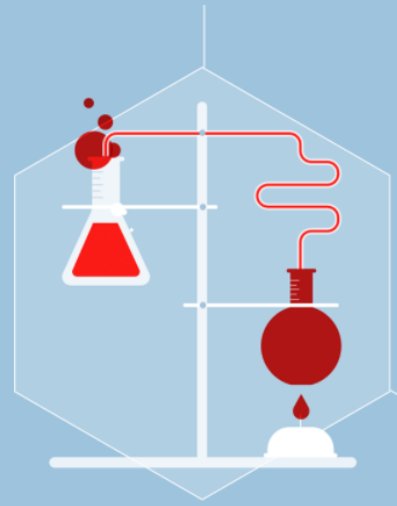
Manufacturing a vaccine is a complex journey that can be broken down into six main steps

1

Raw material check:
Manufacturers test raw materials that make up the vaccine to ensure quality standards.

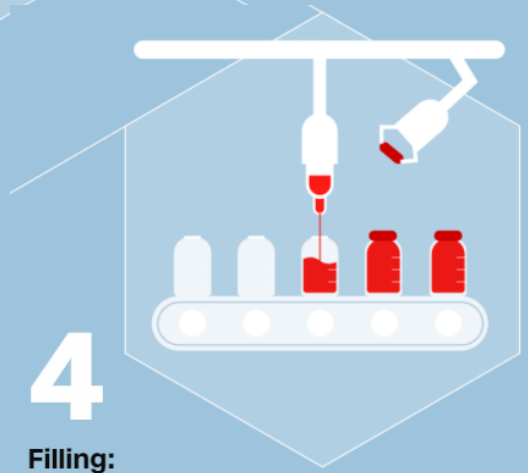
2

Vaccine bulk manufacturing:
The antigen — the active ingredient of the vaccine, which stimulates an immune response — is grown, harvested and purified at scale.



3

Formulation and quality control:
The antigen is mixed with other ingredients to enhance immune response and ensure the vaccine's stability. Each batch is then tested and the antigen verified for sterility.



4

Filling:
The batch of vaccine is put into glass vials or prefilled plastic syringes.

5

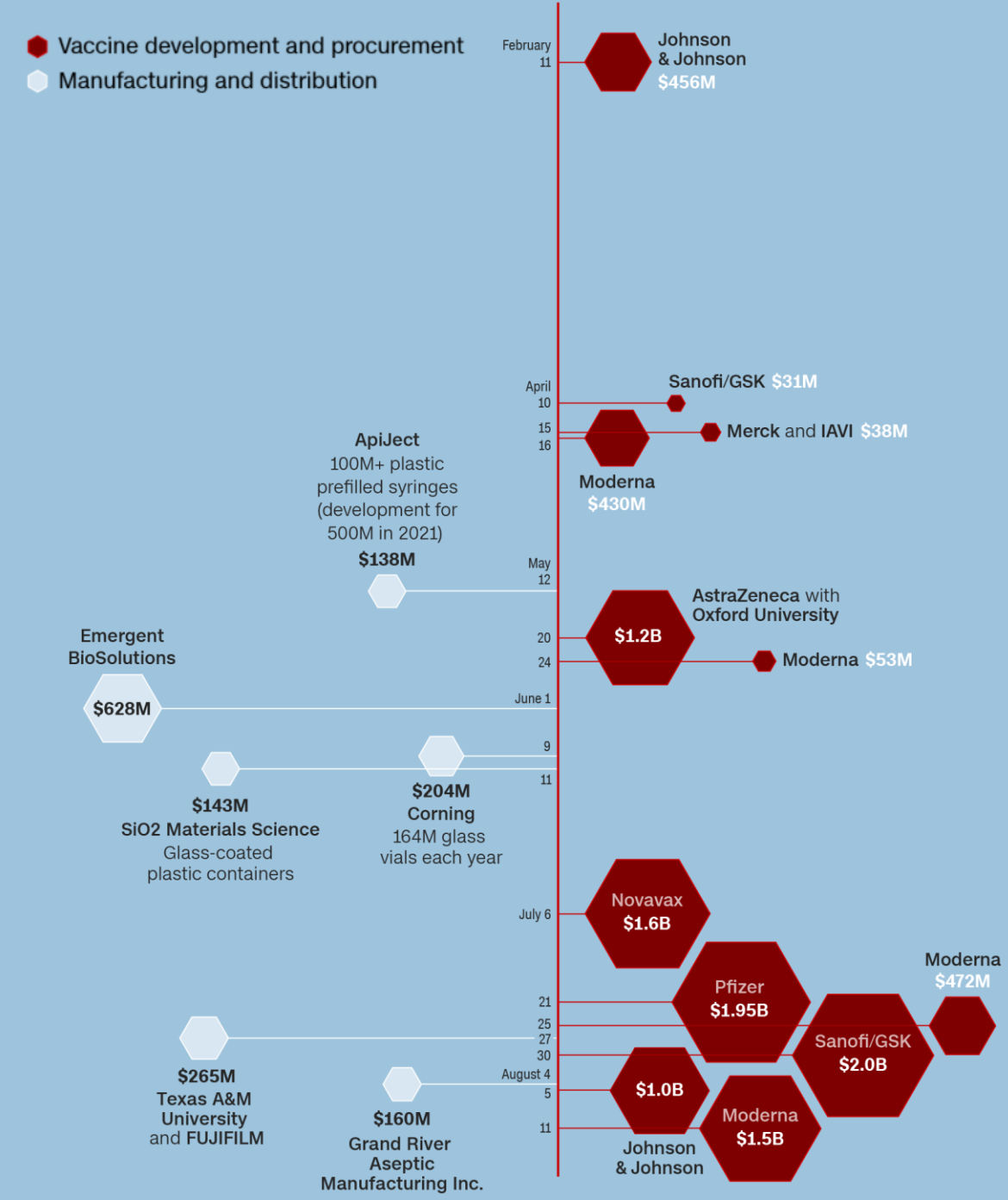
Packaging:
Now in a container, the vaccine is labeled per regulatory requirements and packed for shipping.

6

Release:
After testing has been completed for quality assurance, the national regulatory authority gives final authorization to release the vaccine for shipping and distribution.

Timeline of US investment

Operation Warp Speed remains shrouded in secrecy. Here's what we know about the contracts inked by the US government to secure vaccine doses and shore up the manufacturing supply chain.



Note: Operation Warp Speed investment as of August 11
Source: US Department of Health and Human Services, Biomedical Advanced Research and Development Authority, Department of Defense

principles.

What happens next

But the question remains: Will leaders -- the world over -- be able to respond and buy the vaccine for their own populations if one of the big three efforts succeeds? And will poorer nations once again be left behind?

It is this concern that prompted Dr. Seth Berkley, CEO of Gavi, the Vaccine Alliance, to call for an international accord to ensure poorer countries get access to the vaccine.

The best-case chance of getting a vaccine, according to Berkley, is adopting the collaborative approach that was used in the race for an Ebola vaccine -- a process which began in the Canadian Public Health laboratory, was transferred to an American biotech firm, then an American multinational company, and finally to a German company for manufacturing.

Restricting the effort to a national lab or set of scientists or certain company won't deliver the best vaccine -- and it certainly won't allow it to be distributed to all -- he added.

There are some promising signs of international cooperation. Aside from WHO's ACT Accelerator initiative, the Coalition for Epidemic Preparedness Innovations (CEPI) -- a nonprofit co-founded by the Bill & Melinda Gates Foundation to fund the development of vaccines against emerging diseases -- has injected capital into multiple vaccine efforts with the explicit goal of meeting "global demand for a vaccine as quickly as possible."

Those efforts, combined with those from organizations such as Gavi and the International AIDS Vaccine Initiative, aim to deliver safe and effective vaccines to everyone who wants one.

And even if countries who cross the finish line first do start by protecting their own populations, Robinson believes the world is cooperating the best it can in the face of an unprecedented health emergency.

"I think at this point everyone is saying the right things," he said.

"When we actually have vaccine candidates that are approved by the regulatory authorities to go forward, then that may be a different thing."