

## A SHOT OF HOPE

# World's 'best' vaccines could soon come to poor countries

**New mRNA shots keep well in ordinary refrigerators. Countries with patchy power supply and refrigeration can finally use them**

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In the 6 months since Covid vaccines became available, those based on mRNA technology have scored top marks. So far, there are only two – made by Pfizer and Moderna – and both show 95% efficacy.

Other types of vaccines are usually 80% or less efficacious. This difference affects not only the protection you get as an individual but also the protection available to the 'herd' or society. With a better vaccine a country can reach 'herd immunity' faster by vaccinating fewer people.

But mRNA vaccines are still confined to the rich world. This is partly because supply is limited and those countries placed their orders first. Another reason is these vaccines get spoilt if they are not stored at extremely cold temperatures. The Pfizer shot initially required storage at  $-80^{\circ}\text{C}$ . Poor countries couldn't afford to buy specialised freezers for it in bulk.

## A fragile molecule

Why do mRNA vaccines need ultra-cold storage? It's because their main ingredient, mRNA (messenger RNA), is extremely fragile. "(It is) really easily destroyed, and that's because there are many, many enzymes that will just break it apart," Selena Simmons-Duffin writes in NPR.

Ultra-cold temperatures prevent that. "The lower the temperatures, the slower the molecular movements — and the lower the chance of damaging reactions," says Maya Wei-Haas in the National Geographic.

The vaccine's key ingredient is called "messenger" because it carries instructions for your cells to start making a part of the Covid virus. Your immune system learns to recognise this part and take on the actual virus.

If the mRNA breaks, the message is lost. “Only one cut in your mRNA strand can be enough to lose function,” Wei-Haas quotes a scientist.

## **Second-generation mRNA**

Last year, mRNA vaccine makers were in a hurry to get vaccines out, even if it took ultra-freezers to keep them stable. “Our top priority was to quickly develop a safe and effective vaccine,” Ugur Sahin, CEO of Pfizer’s vaccine partner BioNTech, said. But now they are focusing on updated vaccines that are easier to store and distribute.

In the next few days, a third mRNA vaccine could arrive, Carl Zimmer writes in *The New York Times*. Made by German company Cure-Vac, it has caught the world’s attention because it remains stable at 5°C for 3 months, and can be left at room temperature for 24 hours.

The vaccine has been tested on 40,000 volunteers in Europe and Latin America, Zimmer says, and “CureVac is on the cusp of announcing the results.” If it’s successful, it could come to low- and middle-income countries.

Meanwhile, BioNTech announced on May 4 it is “working on getting approval” for their updated mRNA vaccine that can be safely stored at 2°C-8°C for up to 6 months.

Moderna began a trial of its next-generation vaccine, called mRNA-1283, on March

15. CEO Stéphane Bancel said they expect the new vaccine to be “refrigerator-stable” and it could “facilitate easier distribution and administration, including potentially for developing countries.”

## **First-generation surprise**

Pfizer and Moderna’s first mRNA vaccines have also turned out to be a lot hardier than initially thought. Pfizer’s -80°C requirement is old news now. Long-term studies showed the vaccine kept well between -25°C and -15°C for up to two weeks. The US Food and Drug Administration approved this new storage advice on February 25.

Moderna now claims its existing vaccine (mRNA-1273) can be kept at 2°C-8°C for up to three months. Initially, it was considered safe at this temperature for only one month.

