



Iran hopes to defeat COVID with home-grown crop of vaccines

Iran is one of few Middle Eastern nations with the capacity to develop vaccines. It has been doing so in earnest: more than ten are in development, but little is known about them outside Iran. *Nature* speaks to Kayhan Azadmanesh, head of the virology division at the Pasteur Institute of Iran in Tehran, about the nation's vaccine landscape. Azadmanesh also advises the Iranian government and is developing vaccines through his spin-off company Humimmune Biotech.

How badly has the pandemic affected Iran?

Since January 2020, we've had five waves. We're currently experiencing the highest number of new cases reported so far, with around 40,000 a day, and the most common variant we detect is Delta.

Which COVID-19 vaccines are available?

As of 17 August, 18 million or so doses have been administered. Some 12 million were China's Sinopharm vaccine; 4 million were the Oxford–AstraZeneca vaccine; and one million were COVIran Barekat, developed by Shifa Pharmed Industrial Group in Tehran. The remainder include doses of Russia's Sputnik V and India's Covaxin. More than half a million doses are being administered every day, and some 17% of Iran's population of 85 million have received at least one dose.

Could you tell us about COVIran Barekat?

It is an inactivated vaccine undergoing phase III trials, but it received emergency-use authorization in June. It was approved on the basis of the levels of antibodies it induces, including those that can 'neutralize' SARS-CoV-2, or block it from entering cells. In early trials, the researchers found that more than 93% of vaccinated people produced neutralizing antibodies. We don't know how long this protection will last, but I assume that it will be similar to other inactivated vaccines — such as CoronaVac, produced by the Chinese firm Sinovac Life Sciences — for which antibody levels have been shown to drop after six months, suggesting that boosters are required (M. Li *et al.* Preprint at medRxiv <https://doi.org/grsh; 2021>).

What other vaccines is Iran developing?

Pasteurovac is a recombinant-protein vaccine developed by a collaboration



Iranians wait to be inoculated at a mass vaccination centre in Tehran.

between Cuba's Finlay Institute of Vaccines in Havana and the Pasteur Institute of Iran. The vaccine is known as Soberana O2 in Cuba. It received emergency-use approval in Iran in June, despite still being in phase III trials. There are several other vaccines based on inactivated viruses and recombinant proteins in clinical trials. There is also at least one vaccine that uses mRNA, two that use adenovirus vectors and one that has a measles-virus vector in earlier stages of development.

Can you tell me about your own vaccines?

Humimmune Biotech has been working on two candidates. One uses the measles virus as a backbone to introduce a gene that encodes either the SARS-CoV-2 spike protein, which the virus uses to enter cells, or the nucleocapsid protein that it requires to replicate. That vaccine is being produced by BioSun Pharmed in Tehran.

The other vaccine has an adenovirus 5 backbone, similar to that used in the second dose of Sputnik V. We hope to start clinical trials early next year.

Why are Iranian scientists making so many?

We can't rely on help from the international community with the pandemic. We are living under sanctions imposed by the United States; in our opinion, these are unjustified. The United States says that sanctions don't affect humanitarian activities, but when your ability

to transfer money is restricted, it is difficult to buy drugs and medicines. And we have the technology to produce vaccines, so why not use it? To ensure the safety of Iranians, it makes sense to develop a variety of vaccines using different research and development strategies, as China has done.

Why are Iranian researchers reluctant to publicize their work internationally?

This could be another effect of the sanctions. Researchers in Iran might not want to draw too much attention to their work in case they put potential partnerships in jeopardy or they run the risk of losing access to raw materials.

Researchers are also extremely busy during the pandemic. But some have started to share results. In June, the researchers developing COVIran Barekat published a preprint of their preclinical results (A. Abdoli *et al.* Preprint at bioRxiv <https://doi.org/grsj; 2021>), and they will share clinical results very soon. We also plan to share the results of our adenovirus-vector vaccine soon.

What have been the biggest challenges in developing COVID-19 vaccines?

The sanctions have caused a lot of difficulty, because they make it hard for us to buy materials and equipment. For example, chromatography resins to purify vaccines are produced mostly by multinational companies that are major suppliers to the United States, so they might be afraid of selling to us. We modify our methods, find other providers, or look for local solutions.

What does the future hold?

The initial target for COVIran Barekat production was to make up to 30 million doses a month by September, which would have been enough to vaccinate the adult population. But it has not been possible to achieve that, so Iran has had to import millions of doses of other vaccines. As many people have said, this will not be the last coronavirus pandemic that we face. I expect the vaccine production capacity will be used for years to come to develop new vaccines and drugs, for both coronaviruses and other pathogens.

Interview by Smriti Mallapaty

This interview has been edited for length and clarity.