Covid-19 and mRNA technology are helping Africa fix its vaccine problems

After the disastrous effect of vaccine nationalism on access in Africa, boosting local production is key to preventing a repeat in future pandemics. WHO’s new mRNA vaccine hub is at the forefront, report Emma Bryce and Sandy Ong

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In June 2021, the World Health Organization selected South African biotech company Afrigen to be part of the “hub” where mRNA technology—which underpins the most effective covid-19 vaccines—would be developed and shared with other lower and middle income countries. More than 15 manufacturers (“spokes”) have been named so far, almost half located in Africa.

For the world’s second largest continent, by size and population, this initiative has come not a moment too soon. Africa uses one quarter of global vaccines but produces just 1%—a shortage that left it wrong footed as covid-19 swept the globe and rich nations hoarded vaccine supplies.

To avoid a repetition in future pandemics, many experts agree there is just one solution: local vaccine manufacturing. Patrick Tippoo, head of science and innovation at the Biovac Institute in Cape Town, another part of the WHO hub, says this is the only way “to break the cycle of dependence and provide an equitable base.”

If the hub succeeds, African nations will be equipped with the know-how to make their own mRNA vaccines, a versatile technology that could serve the continent far beyond covid-19, forming the basis for a suite of novel vaccines against malaria, tuberculosis, HIV, and other diseases that currently affect the region.

But how revolutionary the hub becomes will depend on the challenging infrastructure and regulatory backdrop it is rooted in, which for decades has hobbled manufacturing efforts in Africa.

Decentralise and disperse

The hub was devised as an incubator for the development of Africa’s first covid-19 vaccine, a process that is driven by the three institutions at its core: the South African Medical Research Council, which provides the key research to fuel the initiative; Afrigen, which is developing the mRNA technology and the formulation underpinning the vaccine; and Biovac, which is tackling scale-up and commercialisation of the new product.

A crucial part of the development process is crafting a unique version of Moderna’s covid-19 vaccine. In February, Afrigen announced it had successfully created a proof-of-principle replica. The next challenge is to make changes to its formulation, in the hope that these innovations will distinguish it enough from Moderna’s vaccine to overcome the broad restrictions imposed by the company’s patents.

That step is critical to pave the path for adoption by lower and middle income countries. What’s needed is a “second generation product” that is cheaper to produce and with intellectual property freedom, explains Martin Friede, coordinator of the Initiative for Vaccine research at WHO. Another improvement Afrigen is currently working on, together with partners in collaborations that are soon to be announced, is boosting the vaccine’s thermostability—which will be a boon for warmer countries and regions where cooling infrastructure is scarce.

In the meantime, Afrigen has already started sharing its newfound mRNA know-how with other countries. In March, researchers from Sinergium Biotech (Argentina), the Oswaldo Cruz Foundation (Brazil), and BioFarma (Indonesia) arrived in Cape Town for the first round of training, with Incepta Vaccine (Bangladesh) expected to follow. “This introductory training is just to get the participants up to speed on bench level processes”—for example, learning how to convert plasmids to RNA, purifying that product, and packaging it into lipid nanoparticles, says Friede.

The idea is for spokes to take this adaptable technology and plug it into their unique local set-ups. “What works for one spoke will not be applicable in the next one,” says Rabera Kenyanya, acting chief executive officer of Kenya Biovax Institute, which is one of the spokes.

The WHO hub’s 15 spokes were chosen for their existing level of biomanufacturing capacity. Many more have expressed interest, and there are over 100 manufacturers across Asia, Africa, and Latin America that have the potential to produce mRNA vaccines, says Kate Stegeman, advocacy coordinator for Médecins Sans Frontières’ access campaign in the African region.

The hub hopes more countries will join its ranks in the future. “We want to ensure that as many interested parties who are well positioned to receive, absorb, and build on this capability have access to the technology,” says Biovac’s Tippoo.

This model of knowledge creation and dispersal contrasts with the support that some big pharmaceutical companies are currently offering countries, which focuses less on building local capacity and more on extending their manufacturing facilities to Africa. BioNTech, for instance, announced...
plans in February to build vaccine plants in Rwanda and Senegal later this year. BioNTech is planning to send “shipping container laboratories” to produce their covid-19 vaccine in Africa later in 2022—though without sharing the patent knowledge.

The WHO hub is taking a different tack from those companies, says Petro Terblanche, chief executive officer of Afrigen. “Their model is large economies of scale . . . we can produce at the same costs but we will have 10 smaller, highly agile, high quality facilities distributing on a continental basis, because we’re building a sector not a company.”

“This is the type of collaboration that we’ve been yearning for,” says Faisal Shuaib, director of Biovaccines Nigeria, which joined the hub in February. Amadou Sall, director of Institut Pasteur de Dakar (IPD), the Senegalese spoke, says “any initiative that shows that Africa has capacity in research, manufacturing, and development of vaccines is a good one.”

Road ahead

However, the formula for an mRNA vaccine is just the start. “What we’ve currently got is a small company that has proved they’ve got a candidate [vaccine], but that candidate now has to grow and become a product,” says Friede.

The hub’s next challenges will be to scale up production of their novel vaccine, test it in clinical trials, then commercialise the final product. In this regard, South Africa is comparably advanced, with a solid system of supporting institutions that are ready to step in and scale up—part of the reason it was selected to host the hub. But many of the countries that the mRNA technology will be returning to via the spokes may lack this critical baseline, endangering the eventual success of technology transfer. “It’s going to be a while before we see the benefits translated into public health,” says Friede.

The hub is just one part in tackling a much larger infrastructure challenge. Building the infrastructure needed is one of the biggest hurdles. Some African firms—including Biocav, which produces a hexavalent hepatitis B vaccine, and IPD in Senegal, which makes the yellow fever vaccine—have decades of experience making products from start to finish, but they are among the few. Added to that, pandemic related disruptions in global supply chains have deepened shortages of critical reagents and equipment—for instance, polymerase chain reaction machines.

Training up a workforce with the necessary skills is another hurdle. In February, WHO established a new biomanufacturing training facility in South Korea, with a focus on developing a broader skill set around biological medicine production, expanding beyond mRNA and vaccines to monoclonal antibodies, cancer treatments, and insulin. From next year, this new hub should be able to train several thousand people, including scientists from the spokes, with a focus on increasing manufacturing capacity in their home nations.

In addition, supportive regulatory environments will be crucial to smooth the path for vaccine development, but in many countries this will take time to establish. So far, Senegal, South Africa, and Egypt are among the nations that are on track to reach the standard required, while others “don’t even have any actors on the ground yet,” says Friede.

“Let’s recognise that it isn’t going to be months to do the product development, the tech transfer, it’s going to take another two years. And in that time, hopefully, recipient countries will have the regulatory agency capacity,” Friede adds.

The challenges don’t only revolve around production but also ensuring a sustainable level of demand once the product is there. Already there are signs that this could be a challenge. Last November, South African drugmaker Aspen Pharmacare struck a deal with Johnson & Johnson to produce covid-19 vaccines for the African market, but it has yet to receive a single order and has said it will be forced to discontinue that production line in June if orders don’t pick up.

The move could foreshadow other demand-side issues, underscoring the need for sustainable markets for future vaccines on the continent. “Without demand it is extremely difficult, as the Aspen situation demonstrates,” says Tipppo, who is also head of the African Vaccine Manufacturing Initiative. “Sustainability is the key issue which needs to be addressed and solved.”

All told, national government buy-in and support will be essential to any vaccine manufacturing venture, says Dicky Akamnori, WHO’s regional adviser for vaccine research and regulation in Africa. You need political commitment to “make available funding to ensure that the conditions are right for companies to establish facilities, to make sure that their regulatory authorities are well funded and have the capacity to review these products for their efficacy, safety, and quality of manufacture.”

African governments may have dragged their feet on lending support to vaccine makers in the past, but Akamnori believes the pandemic has shifted priorities in their favour. “Political will is at its highest at present,” he says.

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