Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Africa is going to develop their own health capabilities for future challenges – Correspondence

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Several variants of concern (VOCs) have been identified and reported in various regions of the world since the beginning of the COVID-19 pandemic, including Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), Delta (B.1.617.2), and Omicron (B.1.1.529). These VOCs could have a substantial impact on virus transmission, vaccine effectiveness, therapeutic, and diagnostic procedures. Additionally, they have resulted in the global resurgence of subsequent waves of the devastating COVID-19 pandemic. The global endeavors taken for providing COVID-19 vaccines for most of the world countries could fall in the well of mistrust and the bad trials for improving some countries' image. Despite significant progress in the research and production of SARS-CoV-2 vaccines, vaccine access remains limited in many parts of the world.

The global vaccination drive, with the universal goal to mitigate the subsequent waves of COVID-19, combined with public health initiatives, such as using face masks, social distancing, hand hygiene, and environmental disinfection, is expected to remain an effective preventive strategy [1–3]. As a result, high-income countries (HICs) should step up to assist low and middle-income countries (LIMCs) through contributing COVID-19 vaccines, which would assist these nations in fast-reaching mass vaccination [4]. However, within the pandemic, a reliance on vaccines provided from rich countries and companies proved hazardous [5]. Vaccine hesitancy is also a barrier to high vaccination coverage in several parts of the world, including African countries.

There is a clear and urgent need for the continued development, testing, and use of additional vaccines [6] that's due to the reported waning effectiveness of SARS-CoV-2 vaccines and the continued emergence of variants capable of different degrees of immune evasion. Worryingly, two VOCs (Beta and Omicron) have been identified in Africa, while the other three VOCs have been identified in three different continents: Europe (Alpha), Asia (Delta), and South America (Gamma). The vaccine hesitancy and inequities in vaccine distribution among developing nations are a great challenge, resulting in the emergence of SARS-CoV-2 variants [7]. In Africa, only about 10% of people have been fully vaccinated against the COVID-19 [5]. Forty-seven African countries have joined the COVID-19 Vaccines Global Access (COVAX) facility, which aims to ensure equitable access to safe and effective COVID-19 vaccines globally through supplying COVID-19 vaccines to low- and middle-income countries [8].

One of the major factors contributing to the emergence of VOCs is low vaccination rates in many parts of the world, particularly in developing nations, such as Africa. Novel VOCs may evolve, in sooner time than we expect, if the SARS-COV-2 virus continues to circulate, particularly among the unvaccinated, immunocompromised people, and people with high contact with animals for different purposes like livelihood (hunting and eating), and the resultant viral evolution may eventually lead to vaccine-escape variants [7], which potentially worsening the situation SARS-CoV-2 [9].

Since the emergence of the Omicron variant, some governments have deployed vaccine boosters due to concerns about diminishing immunity and SARS-CoV-2 mutations [3]; additionally, these booster doses limit vaccine access in non-vaccinated nations, putting pressure on manufacturers to focus on HICs rather than LMICs. It is anticipated that a slow vaccination rate could lead to an increase in COVID-19 cases and deaths, as well as the risk of a lengthier epidemic. A high rate of vaccine uptake can be accomplished by expanding vaccine production as well as ensuring swift and effective transport, storage, and distribution monitoring. Consequently, many inquiries have been raised in our minds, such as; Could African countries depend on themselves via developing their own health capabilities to promote their people's immune system against coronaviruses? **"No one is safe until everyone is made safe by vaccination"**, there is a consensus that the best way to ensure equitable access to COVID-19 vaccines is to enable countries in the global south to make their own.

1. COVID-19; the stimulus for african countries

In North Africa, Egypt has strived early to be self-sufficient in drugs and vaccines against COVID- 19. The Egyptian Holding Company for Biological Products and Vaccines (VACSERA) signed agreements with the Chinese biopharmaceutical company Sinovac for local production of VACSERA-Sinovac vaccine. Egypt has received the first batch of the raw materials for production in 2021, and that may enable it to distribute this vaccine to the other African countries. On August 23, 2021, The Egyptian Drug Authority (EDA) granted VACSERA-Sinovac vaccine an

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emergency use authorization as the first locally made Coronavirus vaccine against COVID-19. On November 14, 2021, the EDA announced the start of clinical trials (Phase I) for the first Egyptian-made coronavirus vaccine Covi Vax, NRC-VACC-101, Egyptian Inactivated SARS-CoV-2 Vaccine, NRC Inactivated SARS-CoV-2 Vaccine (https://covid19.trackvaccines.org/vaccines/160/). This vaccine had achieved promising results when it was tried in experimental animals. With this step, Egypt will be the first country in the Middle East to manufacture a coronavirus vaccine using solely Egyptian resources. Additionally, Algeria, Morocco (North), Rwanda (East), and Senegal (West) have either signed or commenced production agreements or memorandums of understanding for the COVID-19 vaccine. Rwanda and Senegal signed an agreement with BioNTech in October 2021 to build full-scale mRNA vaccine manufacturing facilities, and construction will start in mid-2022.

In South Africa, which set to become vaccine hub. Pfizer and South Africa's Biovac Institute signed a letter of intent in July 2021 to partially produce Pfizer's COVID-19 vaccine for distribution throughout the African Union. Biovac Institute, which produces conventional vaccinations, will begin manufacturing Pfizer-BioNTech COVID-19 vaccine in 2022 after obtaining the drug substance from Europe "fill and finish".

Patrick Soon-Shiong, a South African-American businessman, unveiled a new vaccine plant in Cape Town on January 2022, with the goal of assisting his local NantSA company in producing COVID-19 doses in the future and addressing the continent's catastrophic shortage of production capacity. ImmunityBio, another Soon Shiong's company in South Africa, is currently evaluating a novel coronavirus vaccine candidate that aims to prime the body's T cells to destroy the virus [10].

Recently, Afrigen Biologics and Vaccines company, based in Cape Town, has produced only microlitres of Moderna's COVID-19 mRNA vaccine, which is based on the same data that Moderna utilized to make its shot. Researchers claim to have largely completed the process of manufacturing Moderna's COVID-19 mRNA vaccine without the help of Moderna. However, the success is a watershed moment for a major WHO technology-transfer hub effort aimed at increasing vaccine manufacturing capacity in low- and middle-income nations [5]. It is considered the first step in a project to enhance vaccine production capacity in low- and middle-income countries to have been completed by researchers at the WHO technology-transfer hub [5]. The mRNA vaccines are extremely efficient at preventing symptomatic and severe COVID-19 infection caused by Delta (B.1.617.2) [11], and also at preventing asymptomatic SARS-CoV-2 infection and therefore transmission. During the COVID-19 pandemic, 70% of the doses of mRNA vaccines, produced by Moderna, Pfizer, and BioNTech, have been sent from their developers to wealthy nations. It is not expected for Afrigen's mRNA vaccine candidate to be distributed to people in Africa and beyond in the sooner future. But it is like throwing a stone to move the stagnant water for a more globally distributed mRNA-vaccine industry in Africa. The WHO invited Moderna, Pfizer, and BioNTech to help teach researchers in low- and middle-income countries how to create COVID-19 vaccines when it inaugurated its mRNA tech-transfer hub in South Africa last June 2021. In late September 2021, South African academics began working on the project with funding from France, Germany, and Belgium. On January 5, 2022, Afrigen's researchers accomplished another tricky part of the process: they encapsulated the mRNA in a fatty nanoparticle made of a mixture of lipids, but not Moderna's specific lipid mixture. By the end of November 2022, the WHO anticipates a Moderna mimic to be ready for human phase I trials.

2. Conclusion

The promising outcomes from this step are not restricted to COVID-19 or other coronaviruses-caused pandemics, but extend to protect African people from their endemic diseases like HIV. Because of their long-lasting responses, ease of production, ability to encode complicated protein designs, and safety as immunogens, mRNA vaccines are an excellent platform for HIV vaccine development in the presence of the obvious hurdles for broadly neutralizing antibodies (bnAb) development by vaccines. Notwithstanding, the road to vaccine self-sufficiency in Africa is not paved with roses. There are some hurdles, like electricity and water shortages, that must be overcome in order for vaccine production to be available on the continent. The appropriate efforts must be done urgently and focused to enable Africa to be armed with the best available preventive strategies, particularly with mRNA vaccine technology, which requires little time to manufacture and requires no prior familiarity with biological pharmaceutical agents.

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Author contribution

AAS: Conceptualization, Data Curation, Visualization, Writing - Original Draft, Writing - review & editing. AAS has critically reviewed and approved the final version of the manuscript.

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijsu.2022.106585.

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