TONY BLAIR INSTITUTE FOR GLOBAL CHANGE

# A Covid-19 Vaccination Plan for Africa

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# Contents



Published at https://institute.global/advisory/covid-19-vaccination-plan-africa on November 13 2020

# Foreword by Tony Blair

It seems likely that the worst-case scenarios regarding Covid-19 in Africa, which seemed all too plausible earlier this year, have not come to pass. African governments must continue to be vigilant and remain committed to testing, contact tracing and other measures aimed at suppressing the spread of the virus and keeping the economy running. Africa's leaders, experts and people should be congratulated on the systems they have put in place, the lives they have saved and the sacrifices they have made.

The next front in the battle against Covid-19 is vaccination. The stakes are high. A successful vaccination programme could reconnect Africa to the rest of the world, while enabling the reorganisation of the continent's health systems. Falling short could leave the continent in a kind of Covid-limbo, cut off from its markets and customers, with potentially devastating consequences for countries' economies and development.

Vaccination programmes need vaccines. Given Africa's limited capacity to develop and manufacture Covid-19 vaccines, it will have to import them. While international cooperation on Covid-19 has generally been very disappointing, the greater willingness on the part of the international community to cooperate on vaccine manufacture and distribution is more encouraging – notably the COVAX initiative, co-led by Gavi, the Coalition for Epidemic Preparedness Innovations (CEPI) and the WHO.

Africa CDC Director Dr John Nkengasong says the COVAX plan is unlikely to be enough and Africa will have to be proactive in securing vaccines; the news that the African Export Import Bank is ready to raise up to $5 billion to buy them is therefore welcome.

But as things stand, once vaccines are available in much of the world, Africa will not have them in the quantities required to support immunity. This will have serious consequences both economically and politically for African governments, and I urge the international community to do whatever it takes to make sure Africa is not left at the back of the queue. Pfizer's recent announcement, on 9 November, of a breakthrough with 90 per cent effectiveness for its vaccine underlines the wider challenges: There is limited production speed, it needs far lower than normal temperatures for its cold chain, there are questions over its effectiveness for different ethnic groups, and the WHO is already warning of a $4.5 billion funding gap for lower income countries.

An adequate supply of vaccines is vital to a vaccination programme, but much else is required. In this report, my Institute identifies three priorities for Africa's leaders and the global community which will help ensure the successful execution of a Covid-19 vaccination plan for Africa. These are: **engage public support and combat vaccine hesitancy, enable effective implementation, and leverage technology to**

**improve delivery and recording of the programme.** Nobody underestimates the scale of the task but there are several recent African vaccination programmes from which governments can learn.

**The first priority is to engage public support for vaccination and combat vaccine hesitancy.** As only two of the 43 vaccines are currently undergoing clinical trials in Africa – and these are in just two countries, Kenya and South Africa – there is a significant risk that these vaccines may not have the same clinical benefits on Africa's population, and may not be accepted by communities. Using trusted African medical experts in the development and testing of vaccines will help to counter any sense that the continent is being used as a "testing lab" for the leading vaccine candidates from the US, Europe or China.

Communities need to understand why the vaccine is important for them, that it's safe, and what the strategy for distribution is – and that their social and cultural norms will be respected throughout the process. A comprehensive and effective national awareness campaign will be needed to prepare and encourage people to be vaccinated. Burkina Faso's recent meningitis vaccination programme offers some lessons here.

**The second priority is to enable effective implementation**. The logistical challenge of delivery alone is daunting. Drawing on military logistical support, as Sierra Leone did in its 2014 Ebola outbreak, will in many cases be necessary. Establishing Points of Dispensing, which were also used by Sierra Leone during the Ebola outbreak, should be considered.

Establishing the right coordinating structures in government has been an important part of many African countries' Covid-19 response and that will also be the case with vaccination. Policymakers may consider setting up a coordinating body with a mandate to manage and monitor the national Covid-19 vaccine implementation strategy and provide a framework for decision-making.

Vaccines are likely to be in short supply. COVAX has within it a country-allocation criterion (per capita based). Beyond that, each country will need to establish its own vaccination prioritisation strategy based on epidemiological data and demographics, likely populations most at risk of acquiring and/or transmitting Covid-19 including health workers; groups with comorbidities or health states that put them at significantly higher risk; and social or employment groups at elevated risk of acquiring and/or transmitting Covid-19 because they are unable to effectively physically distance or require proof of immunity to stay in employment, which may include travellers.

Cold storage and transportation of the vaccines will be vital to their delivery. The results of an ongoing study of Rwanda's cold chain distribution should give us valuable insight into critical gaps in cold chain readiness and serve as a proxy for other African countries to consider ways in which they can improve their own channels.

A significant factor for effective implementation is health-care worker capacity. This is already lower per capita in Africa than it should be. Additional health-care staff will also be needed to ensure non-Covid routine vaccinations and health-care services are not compromised.

**The third priority is for leaders to grasp the opportunity which technology presents**. As well as enabling effective vaccine distribution, technology can enable countries to track and demonstrate the progress of their vaccination programmes and ultimately provide a foundation for reorganising the health system.

Electronic or digital vaccine registries are a particularly promising tool. They can ensure equitable access by identifying sections of communities with limited access to the vaccines, and crucially, they can also help to reconnect Africa to the world economy by providing "immunity passes" to enable free travel, much like the vaccine for yellow fever does now. Despite having much lower Covid-19 cases and following equally if not more stringent public-health safety protocols than countries whose citizens face no quarantine restrictions, the majority of African countries are shut out of international air travel which is so vital to their economies. Vaccine registries can provide the certification to re-establish that international connectivity. There are already a number of African-created and international apps and registries under development.

Beyond interconnectivity, Covid-19 vaccines present African governments with a catalyst to reorganise health systems and a starting point from which to modernise or further modernise government and essential public services. By definition, vaccination is designed to reach as many people as possible, and a vaccine registry will capture and store this data. A Covid-19 vaccine registry also paves the way to a registry for all non-Covid vaccination programmes. Once set up, the platform provides the backbone for the digitisation of health-care delivery, from diagnosis to treatment to more efficient referrals. With another leap, governments will have the foundations to enable the digital nation, enabling other public services: from proof of health status to authorising social welfare payments.

Beyond these three priority recommendations, we must recognise that the pandemic has accentuated the unfairness and imbalance in the global system of vaccine manufacture and distribution. Left unaddressed, these may pose a risk to global health resilience in the future. We can only expect more viral pandemics and mobile pathogens in the 21st century. Countries must again work together to detect and eliminate them. Collaboration is much needed. Since Western countries have jumped the queue and pre-ordered stocks, poorer countries in sub-Saharan Africa will have no choice but to accept the Covid-19 vaccines they are given, regardless of whether they want them or they have been tested for efficacy among their populations. This is not only unfair, it risks increased vaccine hesitancy among those countries' populations.

In the medium- to long-term, with the real risk of other potential future viral and pathogen outbreaks, Africa needs its own domestic and regional manufacturing capacity rather than relying on reserved doses

from foreign producers. That will take time, but the pandemic should provide the spur for progress to be made.

Covid-19 was not the first global pandemic, and history tells us it will not be the last. As we grapple with the current crisis, we should not miss the opportunity to prepare for the next one.

*Tony Blair*

*Executive Chairman*

# Introduction

When vaccines for Covid-19 eventually arrive, policymakers around the world will have to design and implement the largest vaccination programme in history. It will differ from all previous programmes not only in terms of scale but also in terms of target populations – children are unlikely to be the first recipients as they generally are now. The vaccination effort will challenge countries' ability to plan and deliver what will become a basic requirement of global public health and global economic participation, and involve reconfiguring health resources, while at the same time maintaining current ongoing health initiatives. It will start with convincing people to take the vaccine, then countries will need to deliver it through a massive logistical operation – from community engagement to testing to development to, in some cases, manufacture.

African governments know that, irrespective of how Covid-19 plays out in their countries, until they fully reconnect to the regional and global economy, the economic and social damage of this pandemic will continue to rise. Today, seven months after global air travel shut down, there is virtually no safe travel corridor between Africa and Europe (the top source of visitors to Africa and number one destination for passenger and e-commerce cargo). Only Rwanda is on the EU's safe travel list, and Mauritius and Seychelles on the UK's. Meanwhile, medical-related travel restrictions – and in particular 14-day quarantines, which are a major bottleneck to travel – are increasing.

This is devastating Africa's aviation, travel and tourism sectors, which alone stand to lose $120 billion in revenues in 2020 [1], equivalent to 5 per cent of African GDP, and that is before we even consider the wider economic impact. This risks significantly undermining the continent's ability to recover the developmental progress lost in 2020. And with the prospect of travel restrictions continuing well into 2021, this doesn't bode well for the coming year.

To reconnect to the global economy Africa will need to embark on a massive vaccination programme. Proof of vaccination will become a passport to travel with minimum or no restrictions, reducing the costs in time and money incurred under current PCR testing and quarantine regimes. This will free up business travel and the movement of cargo and freight and will enable international tourism once again.

A robust vaccination plan will allow African governments to reconnect to the world economy and reorganise health systems. This paper seeks to identify and discuss the main considerations for Africa.

# Priority 1: Engage Public Support and Combat Vaccine Hesitancy

In 2019, the WHO listed vaccine hesitancy as one of the one of the top 10 threats to global health. [2] Hesitancy is defined by the WHO as delay in acceptance or refusal of vaccines despite availability of vaccination services. The issue of vaccine hesitancy raises a key question in any forthcoming Covid-19 mass-vaccination effort: Will Africans be willing to take the vaccine? This is particularly true because the vaccine question goes beyond public health into economic recovery and reconnecting with the world post Covid-19. Put simply, African countries currently face disproportionate restrictions on air travel despite a relatively lower number of cases. Making the case to lift these types of restrictive policies will depend upon Africa's ability to prove its citizens do not pose a global public-health risk. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. Some data exists, globally, around vaccine willingness [3] and there are some lessons that can be drawn from the perception of and behaviours relating to vaccines that have been rolled out in sub-Saharan African countries and elsewhere before the Covid-19 pandemic.

This data could point to Africans being more willing than people in high-income countries to take a Covid-19 vaccine. But some will argue that because Africa has been less severely affected by Covid-19, African people and policymakers could be less inclined to worry about the importance of vaccination. There are key differences between vaccinations against other diseases and Covid-19, such as its rapid spread as well as the variance in demography at risk. While vaccine hesitancy has mostly focused on parents' reluctance to vaccinate their children, in the case of Covid-19, children are not likely to be the number one priority. Indeed, the rollout of the Covid-19 vaccine is likely to be unique by prioritising adults over children. This means a lot of work needs to be done on public attitudes to ensure adult acceptance.

Traditional attitudes cannot be assumed to hold, and policymakers must be mindful of this as they design and roll out their programmes. A global survey of Covid-19 published in October 2020 showed 72 per cent of participants would likely take a vaccine, 14 per cent would refuse and 14 per cent would hesitate. [4] The London School of Hygiene and Tropical Medicine (LSHTM) has a Vaccine Confidence Project that been looking at public attitudes towards Covid-19 containment and treatment interventions. In a June 2020 study covering nine countries (China, India, Indonesia, Italy, Japan, South Africa, Sweden, the United Kingdom and the United States), the VCP found reluctance to the Covid-19 vaccine in South Africa to be one of the highest. [5] While this cannot be considered to hold for the rest of the continent, it underlines the importance of moving early to combat hesitancy.

Misinformation is particularly pervasive in times of great anxiety and diminished trust in authorities. Concerns have been exacerbated by the media, including comments made on French TV channel LCI about a vaccine trial in Africa, leading former footballer Didier Drogba to comment: "Do not take African people as human guinea pigs! It's absolutely disgusting." The #SayNoToWitsVaccine messaging on Twitter and other social-media platforms is also driving vaccine hesitancy.

A few other developments might have ripple effects on hesitancy. One was the public and parliamentary backlash against the proposed Control of Infectious Diseases Bill 2020 in Nigeria as an alleged route to mandatory vaccination. Another was confirmation of a vaccine-derived outbreak of polio in Sudan, Chad and Cameroon in September. There is existing evidence of resistance to vaccine uptake in Africa. Recent work published in the *Lancet* suggests that vaccine confidence has dropped between 2015 and 2019, including in Nigeria, [6] Africa's most populous nation. Another study of populations in north-central Nigeria showed that only 29 per cent of people surveyed would accept Covid-19 vaccines when available. Governments should therefore closely monitor attitudes towards vaccines as they plan to roll out any Covid-19 vaccination programmes.

The Perception for Evidence-Based Response to Covid-19 (PERC) surveys conducted in African Union member states give us an additional insight into the perception that African countries may have on the severity of the Covid-19 pandemic. PERC data on Africa shows that although a majority of the respondents believe Covid-19 poses a significant national challenge, their perception of their own risk of catching it is much lower, with more than half of the survey population stating that they are not at risk of catching Covid-19. While this is not an exact indicator of the perception of vaccines, it will have an impact on the willingness of people to take the vaccine.

Finally, there is the vital element of the trust that people have in government and international partners to provide an effective and safe vaccine. PERC data show most respondents said they trusted government information, but those aged 18 to 25 were less likely to believe government (61 per cent) than those over 46 (74 per cent). [7] The data also show that while a majority in each country express satisfaction with the response of their government, there are wide variations, ranging from a small majority in Nigeria to strong satisfaction in Ghana.

PERC data show some people believe foreigners are using Africans essentially as guinea pigs and that local solutions are being disregarded and undermined. For example, in June, the recruitment of study participants for a Covid-19 vaccine clinical trial was suspended after Kenyans protested that they were being used as a "testing lab". Subsequently, in August, a clinical trial for a Covid-19 vaccine was announced in Nairobi, with study participants already enrolled. This underlines the importance of including trusted African medical experts in the development and testing of vaccines. We discuss this later in the paper.

# Priority 2: Enable Effective Implementation

As the world races to develop effective Covid-19 vaccines, forward planning on rollout should start now.

Governments need to do the following things:

- Engage their public early to counter any potential vaccine hesitancy
- Appoint or activate a vaccine coordinating group
- Decide on their prioritisation plan for who gets vaccinated and when
- Identify the personnel and logistical requirements for the rollout
- Start now to implement the tech solutions that will help them with their rollout and recording of the programme

Community engagement and social mobilisation are fundamental to counter vaccine resistance. Early community engagement and social mobilisation will play a key role in proactively curbing any existing mistrust of state actors and health-care providers. This requires coordination with local leaders, formal and informal structures and networks, partners and government agencies.

Important lessons can be taken from Sierra Leone's social-mobilisation efforts during the Ebola crisis.

**Table 1 – Six lessons from the Sierra Leone Ebola response**

| | |
|---|---|
| 1. **Promote Community Ownership and Agency** | • Engage community leaders early and work through existing structures – e.g. youth groups, faith organisations and so on.<br>• **Channel resources to communities** so they can self-organise, self-help and innovate. |
| 2. **Ensure Leaders Are Active From the Outset** | • **Engage the nation's leader to act as 'social mobiliser in chief'**, actively providing guidance, mobilising resources and building trust.<br>• Encourage trusted local leaders to be active and visible in their communities to boost local ownership. |

| | |
|---|---|
| 3. **Focus on Building and Maintaining Trust** | • **Train all community response personnel in building trust** and in empathetic communication.<br>• If any response personnel are seen to be unempathetic, blaming or overly directive it can erode trust in the whole response. |
| **4. Identify Trusted Messengers** | • People in official leadership roles (e.g. politicians) may not be trusted by communities. **Take time to identify people that have influence and legitimacy.**<br>• Community members, rather than outsiders, are often more effective at mobilising their communities. |
| **5. Reach Out to Those at High Risk of Spreading the Disease** | • Certain community members may pose a high risk of contracting and passing on the disease (e.g. traditional healers [8]).<br>• **Likely high-risk groups must be identified and engaged early.** |
| **6. Ensure Two-Way Communication With Communities** | • **Community mobilisers should listen to how people feel and understand the barriers to them taking the right action.**<br>• Put in place the structures for long-term engagement and follow up, not just one-off interactions. |

*Source: June 2016, Sierra Leone Ministry of Health and Sanitation, Lessons from the Response to the EVD Outbreak in Sierra Leone, Summary Report*

Africa has good experience from its established vaccination campaigns, including using vaccines to counter outbreaks – such as with Ebola in the Democratic Republic of the Congo in 2018 and meningitis in 2010 to 2015. However, those efforts have mostly targeted children and young adults or localised outbreak areas. Certain features of any successful vaccines that may impact rollout strategy are still unknown – such as the number of doses that will be required or the temperature at which it will need to be stored – but governments should establish their distribution frameworks and start addressing gaps in preparedness.

**Given the enormous global demand and limited supply, how do you determine who gets vaccinated first?**

COVAX – the vaccines pillar of the Access to Covid-19 Tools (ACT) Accelerator, a scheme designed to push closer global cooperation on diagnostics, treatment and vaccines – has a phased plan for rollout of vaccine supply. [9] According to this plan, in Phase 1, all countries will receive a vaccine supply to cover 3 per cent of their population. As more vaccine supply becomes available, coverage will be increased to 20 per cent of the population. After reaching that mark, in Phase 2, vaccines will be further allocated, likely based on a country's vulnerability to Covid-19. [10]

Given the limited global distribution of an effective vaccine, a gradual allocation plan for each country will need to be rolled out with target groups identified among the population and sorted into tiers based on risk level. Different target groups may have similar risk levels and thus belong in the same tier. Governments will need to determine the risk profiles of each tier.

Typical tiered prioritisation based on risk level may look like this:

**Tier 1:** To immediately protect health systems and reduce mortality, countries should consider prioritising the initial 3 per cent allocation to frontline health and community care workers. [11]

**Tier 2:** As additional supply becomes available to cover up to 20 per cent of the population, people over 65 years of age and people under 65 who have underlying high-risk comorbidities should be next to receive the vaccine. [12]

**Tier 3:** Further priority groups as defined by the country. This may include essential workers (such as bus drivers), frontline business operators (such as restaurant servers) and international travellers (such as those crossing land or air borders).

**Tier 4:** Further priority groups as defined by the country. The risk profiles will need to be re-evaluated periodically as more epidemiological data about the virus becomes known and assessed against any changes to country context. [13]

**Table 2 – The two phases of vaccine allocation from the COVAX plan, including indicative target groups**

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|---|---|---|---|
| **Goal** | **Protect public health and minimise societal and economic impact by reducing Covid-19 mortality** | | |
| **Indicative Target Groups** | **Frontline workers in health- and social-care settings** | **High-risk adults** | **Further priority groups** |
| | **All countries receive doses to cover 3% of their population.** | **All countries receive additional doses to cover a total of 20% of their population (in tranches).** | **Countries receive doses to cover more than 20% of their population.** |
| | This would be enough to cover all workers involved in health- and social-care work in most countries. | This could include the elderly, adults with comorbidities or others depending on locally relevant risk factors. | This would cover additional priority populations. |
| **Timing** | **Phase 1:** Countries receive doses proportionally to their total population. | | **Phase 2:** Timing may be based on consideration of country need, vulnerability and Covid-19 threat. |

*Source: Gavi (the Vaccine Alliance)* [14]

The size of the target groups across countries will vary and should be considered within a country's allocation strategy. For example, in sub-Saharan Africa, just 3 per cent of the population is above 65,

compared to 20 per cent in the EU, 11 per cent in East Asia and the Pacific, and 9 per cent in Latin America and the Caribbean. [15] Health-worker density in Africa also differs considerably relative to the rest of the world and across the continent. [16] There is still a dearth of data on comorbidities considered high-risk to severe Covid-19 infection, [17] such as HIV. As more evidence becomes known, countries will need to assess the prevalence of these characteristics within their populations. These considerations mean the percentage of the population composing Tiers 1 and 2 will vary from country to country.

Analysis of the severity of the disease against its economic impact may also drive a different prioritisation of target groups – for example, putting international travellers and frontline business workers earlier in the queue. Therefore, the above prescribed risk-based prioritisation may not be the best fit for all countries in Africa. Policymakers should establish a strategy based on their own context and priorities.

**Policymakers may consider a coordinating body with a mandate to manage and monitor the national Covid-19 vaccine implementation strategy and provide a framework for decision-making.** This body may be inaugural or, if there is existing capacity, work within the national immunisation structure. It can ensure alignment with partner organisations such as the WHO, Africa CDC, and Gavi at the global and regional levels. This body should sit above "subgroups" responsible for distinct tasks. In the case of the 2013–2016 global polio elimination campaign, an Immunizations Management Group was established with five subgroups: implementation, communications, regulatory, finance and routine immunisations. These subgroups engaged directly with partner organisations to leverage technical and operational expertise for planning. [18] It is vital to ensure that the Covid-19 implementation programme does not divert from ongoing routine immunisation for other diseases.

**To implement a tiered vaccination programme, countries should consider establishing Points of Dispensing (PODs).** PODs are locations within the community at which dispensation and administration of the vaccine takes place. There are two types of POD: open and closed. Open PODs are public locations such as stadiums, community centres or schools, operated by local health agencies. [19] Closed PODs are sites operated by public or private organisations that dispense and administer a vaccine to their own populations. Health-care organisations that provide the vaccine to their staff, as could be the case in Tier 1, is a closed POD. Closed PODs help to offset the number of people going to open PODs. [20] PODs can serve as the local immunisation points for each Tier target group. During the Ebola outbreak in Sierra Leone in 2014, the Sierra Leonean and British militaries played an important role in supporting the civilian-led response and building critical infrastructure. [21] Utilisation of military logistical capability for Covid-19 vaccine distribution could prove effective, depending on the country context.

During the Ebola outbreak in the Democratic Republic of the Congo (DRC) in 2018, a vaccination approach known as ring immunisation was implemented. [22] Ring vaccination works by:

- Identifying a positive case.

- Contact tracing everyone who was in close contact with the positive case (during a set period of time) and vaccinating them.
- Contact tracing everyone who was in close contact with the original contacts (during a set period of time) and vaccinating them (this group benefits the most from vaccination).
- Simultaneously, health-care workers at health facilities visited by the original positive case and health facilities at highest risk of an outbreak are vaccinated.

In the context of a Covid-19 immunisation programme, a ring vaccination approach may be considered alongside the tiered POD vaccination strategy. This may be especially useful for circumstances in which a country is experiencing outbreaks and has a surplus of vaccines per allocation phase.

**To roll out an immunisation programme at this scale, additional staff and resources will be needed.** Supplementing the existing workforce is a critical step for successful implementation for two key reasons: (1) to ensure the target populations are reached as and when planned, and (2) to ensure that routine vaccination and health-care services are not compromised during this time. In DRC disruption to services as a result of Ebola resulted in an increase in measles and mortality, as they were fighting Ebola, in some cases in conflict areas. In an epidemic many more people die of other things as they and health-care workers avoid hospitals or staff are diverted to meet the emergency or lockdowns. To avoid trade-offs between treating one infectious disease or another, as soon as possible, countries should begin recruiting and training additional health-care staff and consultants who can support the range of required tasks. During the Ebola crisis, the military in Sierra Leone provided essential support to the response, and some countries may consider deploying their military in a similar way.

**The cornerstone of a successful vaccine rollout is its communications strategy and level of community engagement.** To address the problems about acceptance we highlighted above, policymakers should consider educating and sensitising the public as a worthwhile investment of time and resources. As soon as possible, a nationwide awareness-raising campaign should be launched to begin informing the population of the upcoming vaccination process. To reduce the risk of vaccination hesitancy, communities need to understand why the vaccine is important for them, that it's safe, what the strategy for distribution is and why (i.e., why tiered prioritisation is being implemented), and that their social and cultural norms will be respected throughout the process.

Burkina Faso's highly successful rollout of the meningitis vaccine in 2010 is largely attributed to the scope and effectiveness of its communication plan, which was:

- Early: it involved years of preparation
- Comprehensive: it targeted health professionals, community leaders/communicators (such as traditional and religious figures), and the public at-large
- Layered: national, regional, village

- Broadcast: radio, television, national press conferences
- Multilingual: national languages

In the 10-day vaccination campaign, officially launched in a national ceremony led by the president, more than 11.4 million Burkinabes were vaccinated, representing 100 per cent of the target population. [23]

Burkina Faso started communicating and doing briefings about the vaccine as early as 2007. These included formal and informal press briefings focused on the start of clinical studies and international meetings held in countries in the meningitis belt. This early communication work was aimed at informing health professionals, communicators and the public that a new and more effective vaccine was being worked on.

**When a Covid-19 vaccine gets produced, supply will be limited.** While the coordinating group should produce a supply-and-demand forecast on which to base its strategy, countries should prepare for fluctuating supply-chain constraints to be an ongoing feature of the rollout. Thus, the management group will need to be flexible and adaptable as circumstances evolve. Risk groups may not be static. This also requires that the community continue to be proactively engaged throughout the rollout, not just prior to implementation. The final section of this paper explores the argument and potential for manufacturing vaccines in Africa, a key enabler for more control on the supply side.

**Adequate cold chain distribution channels are among the most fundamental elements of a successful vaccination programme.**

Cold chain distribution is the series of facilities, trucks and refrigerators needed to transport vaccines to and maintain them at PODs. Gavi has estimated that just 10 per cent of health facilities in the poorest countries in the world have reliable electricity, with fewer than 5 per cent of facilities having vaccine-ready refrigeration in some of those countries. [24] Weak infrastructure across the continent, particularly in rural areas, poses a significant challenge to vaccine delivery. For example, cold chains cannot function without reliable power sources. Further complicating cooling capacity may be the temperature at which the vaccines must be stored. AstraZeneca has indicated that their vaccine may require refrigeration between 2° and 8°C. [25] However, if the vaccine requires ultra-low refrigeration (the Ebola vaccine requires -60°C), special freezers will need to be procured, installed and certified well in advance of rollout. [26] Continuous temperature monitoring of the refrigeration systems indicates a staff member may be needed on call 24 hours per day. [27] Countries can deploy remote monitoring technology (there are several on the market), but this would still likely require human response in the event of an alert. The stability of the Covid-19 vaccine (the ability of the vaccine to retain its compositional properties during its shelf life) may not be known when it initially reaches global markets. An assessment of current cold chain channels per district must be conducted to gauge preparedness.

An evaluation of Rwanda's cold chain distribution was initiated in June. [28] The results of the study will shed light on critical gaps in cold chain readiness and serve as a proxy for other African countries to consider ways in which they can improve their own channels. Given the importance of the cold chain in successful vaccination rollout, the management group may consider establishing a discrete subgroup for this area.

**Countries will need to be flexible and adapt to evolving global and national situations.**

From infrastructure problems to syringe shortages to conflict-zone flare-ups, governments and their management groups should plan for the unexpected. Some circumstances are in a country's control: quality of roads, electricity supply. Others are not: inclement weather, geography, insurgencies. A key consideration is the impact of the rainy season on essential infrastructure, which may significantly impede distribution if the rollout corresponds with the season. Therefore, alternative scenarios should be considered as part of the overall rollout preparation strategy – to include weather, conflict areas, etc.

**A ceremonial launch of the rollout by the head of government is recommended.** As was seen in Burkina Faso in 2010, a national ceremonial kick-off signals a well-organised effort as well as robust political backing, adding to public confidence. [29]

**As soon as the first person has been vaccinated, passive surveillance will need to be employed.** [30] Vaccines need to be monitored for both efficacy (is the person truly immune from Covid-19 infection?) and adverse side effects (is there a secondary, negative immune response?). Clinical data (such as age, gender, comorbidity status) and immunisation data (such as date of vaccination) will also need to be collected. [31] It is vital also to ensure that ongoing testing is continued and not disrupted by the vaccination programme. There are centralised surveillance systems available to track and analyse individual-level data, such as the WHO or DHIS2 platforms. New staff will need to be trained on how to use the system. Furthermore, a digital registry carefully tracking who has received the vaccine is essential for rejoining the global economy as it enables freedom of movement.

**Community engagement must be sustained throughout the rollout.** It is an ongoing and evolving job that involves input from the head of state to the local community campaign worker. It is recommended that the head of state regularly provides updates to citizens on the status of implementation. Transparency garners trust and contributes significantly to the success of the programme.

**Governments should not forget to plan for proper waste disposal.** Given the scale of the vaccination programme, there will be a substantial increase in hazardous waste material in need of safe disposal. Risks associated with improper disposal of hazardous materials, such as through open burning and incineration, include infection from harmful microorganisms, spread of drug-resistant microorganisms, sharps-inflicted injuries, toxic exposure, and air pollution. These risks can be mitigated by implementing a waste management system, training staff, providing adequate financial support, and raising awareness of the

dangers of exposure. [32] The waste associated with a global Covid-19 vaccination campaign may have serious adverse consequences on human health and the environment if not properly managed.

# Priority 3: Harness the Power of Technology in Vaccination Efforts

The only sustainable solution to the Covid-19 crisis will be a vaccine delivered at global scale, shared fairly between different countries. It will be essential for countries to be able to show they have the right systems in place to deliver and track their vaccination programme, and technology has a central role to play in making this possible.

Digital registers for vaccination can help on two fronts.

First, they provide the basic data infrastructure for managing and monitoring domestic vaccination programmes. By recording individuals' vaccination status, along with details about their health and other information, they give governments and donors a reliable way to know that the doses a country received have been used (and that everyone who needs a second dose has received it). The aggregate view they provide can also help identify sections of communities with limited access, in order to bridge inequalities that arise between regions, genders, generations and other groups.

Second, they provide the infrastructure to reconnect African countries to the global community. Despite having relatively low numbers of Covid-19, there are currently many African countries on the EU's no-fly list, while citizens from other countries with higher case numbers can travel without quarantine restrictions. Testing for Covid-19 is already a requirement for travel to many countries; as people start being vaccinated, Africa can start work early on systems to record individuals' test results and vaccination status.

The sorts of digital vaccination registers required to manage Covid-19 present African leaders with a wider opportunity to accelerate the digitisation of public administration and service delivery. At a minimum, any country establishing a register for Covid-19 should consider extending this to all their vaccination programmes to cover all ages. This is because, currently, most digital vaccination records in Africa and worldwide do not cover adolescent and adult vaccinations such as Yellow Fever and HPV.

As ever, the application of new technologies requires policymakers to understand and navigate new sorts of challenges and trade-offs. In the case of technologies for managing public-health data, systems need to be designed with care and built to the highest standards for security and access control.

From the user perspective, the best approaches will ensure that individual health data, including test results and other personal information, is owned and controlled by the citizens themselves. Digital systems can ensure that citizens have direct access to their records (via a smartphone, tablet or computer) and can grant access to others – e.g. their family doctor – as required. Digital systems also enable people to make credible assertions in privacy-protecting ways – for example showing a QR code

which can be scanned to verify that the holder has been vaccinated. This sort of digital proof can be used without sharing any personal data with a third party – a far cry from traditional methods like carrying and showing paper medical records and identity documents. With the right standards for interoperability, people will be able to use these digital proofs around the world, without any need for countries to share the underlying data.

From the health authority perspective, digital systems enable data and insights to be aggregated and reported in ways that provide actionable insights without compromising individual privacy. People working at different levels in the system can be limited to different sorts of access, for example a doctor would work with identified records for the patients in their care, but managers would only see deidentified, aggregated data. Access controls can prevent people from accessing personal data without authorisation and provide an indelible record that can be used to deter abuse.

Finally, digital systems that are properly designed and configured should provide significant improvements in terms of data security. Everything in the digital world is exposed to cyber-security risks; the best defence is to ensure that software is updated regularly and that networks and infrastructure are secured to the highest standards. The physical location of data infrastructure is secondary to the digital security applied to a system; data secured with strong encryption (both in transit and at rest) and held on sites with best-in-class network protections will be far more secure than local premises running older software. Countries can and should require encryption keys to be held by their government and not shared with any commercial partners or system providers; this will ensure that none of the data belonging to individual citizens can be accessed by third parties.

Ultimately many countries that implement digital health registers will have begun to build or augment the infrastructure required for a more functional digital ID. As they go down this road, the four key requirements identified by the ID2020 alliance provide a helpful guide: Digital ID should be private (citizens control their data), portable (accessible anywhere), persistent (stays with you for life) and personal (unique to you and you only). [33]

## The Case to Strengthen Technology and Manufacture in Africa

While the initial response to the Covid-19 outbreak suffered from a lack of global coordination, many countries have shown much greater willingness to cooperate on vaccine manufacture and distribution. For example, there is COVAX, the vaccines pillar of the Access to Covid-19 Tools (ACT) Accelerator discussed earlier in this paper. [34] COVAX is co-led by Gavi, the Coalition for Epidemic Preparedness Innovations (CEPI) and the WHO. It has brought countries of different income levels together to invest in manufacturing in developing countries and foster cooperation to secure fair access based on need, not

financial ability. By 19 October 2020, 184 countries had joined the scheme, [35] representing more than 60 per cent of the global population.

One result is an agreement for the provision of 200 million, low-cost doses of Covid-19 vaccines produced by the Serum Institute of India to low- and middle-income countries. [36] The chief executive of Gavi has celebrated this as "vaccine manufacturing for the Global South, by the Global South". While this is excellent progress for the Global South, the Global North still holds all the cards – from testing and development to vaccine nationalism.

Testing and development is undeniably focused away from Africa. Of the 43 vaccines now undergoing clinical trials, only three are being tested in Africa (the AstraZeneca, Novavax and Johnson & Johnson candidates) and only two countries are hosting trials (South Africa and Kenya, though the Imperial candidate is scheduled to be trialled in Uganda from November 2020).

Without development and testing work being done in Africa, what is the risk of these vaccines not having the same clinical benefits on Africa's population and being accepted by communities? We would argue it is significant.

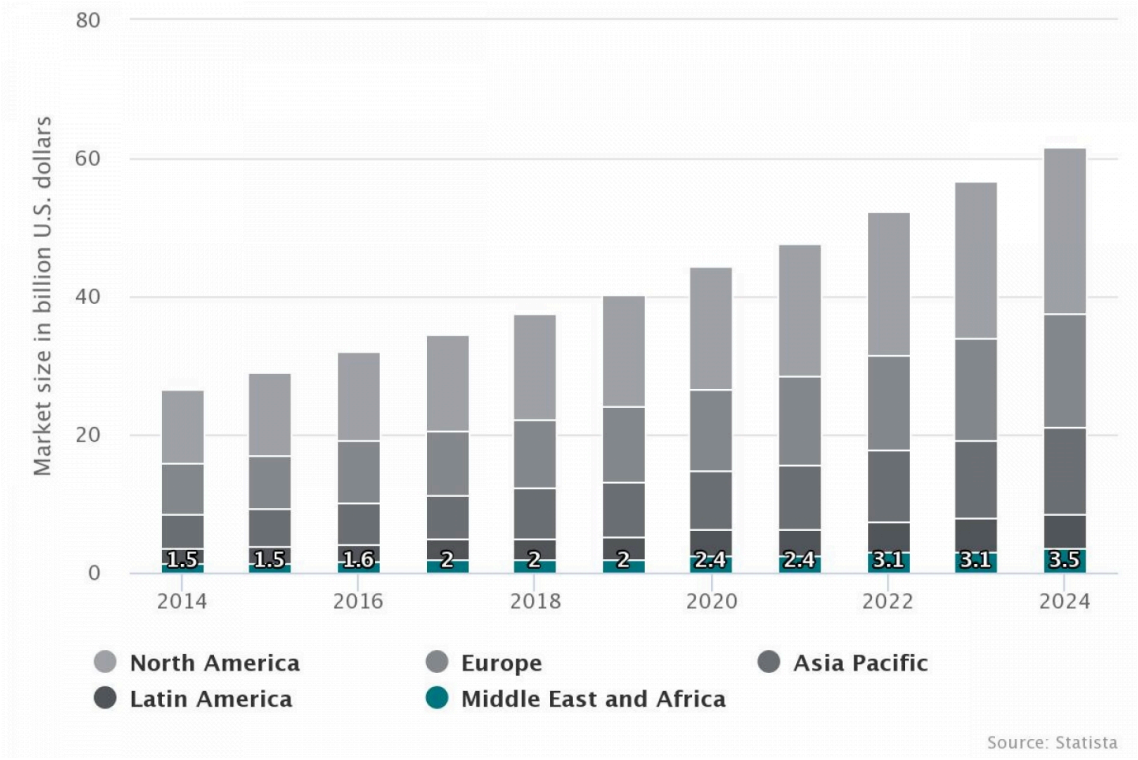
Furthermore, vaccine nationalism means Western countries have already pre-ordered the bulk of potential vaccines even though they do not have the bulk of the world's population (though it is worth noting that population size is generally a poor metric for prioritisation). The UK, for example, has signed deals for more than 350 million doses of six vaccine candidates based on four mechanisms of action, including the Sanofi-GlaxoSmithKline candidate, which is still in pre-clinical stages of development.

Low-income countries in sub-Saharan Africa do not have the means to do this. So based upon the current model of vaccine delivery, African countries have little choice but to accept whichever specific technology or candidate is offered to them – and this is whether or not they prefer it or it has been tested and shown to work on their populations.

What is clear is that a huge part of the Global South – the continent of Africa – is not being treated as an equal partner in addressing its own public-health needs. Scaling production capacity in Africa so it is not reliant on imports is therefore an important subject for debate. Investment now could catalyse wide-reaching change and save lives. If the world is to learn from Covid-19 and build back better, we need to re-examine Africa's place.

The chart below shows current and future estimates of the global vaccine market and Africa's place in it.

**Figure 1 - Size of The Global Vaccines Market, by region**




Currently, there are only seven vaccine manufacturing organisations on the continent, and not all are ready for full production.

**Table 3 – Vaccine manufacturers in Africa**

| Manufacturer | Country |
|---|---|
| The Pasteur Institute of Dakar (IPD) | Senegal |
| Biovac | South Africa |
| Ethiopian Public Health Institute (EPHI) | Ethiopia |

| | |
|---|---|
| Egyvac (VACSERA) | Egypt |
| Institut Pasteur Tunis (IPT) | Tunisia |
| Biovaccines Nigeria Limited (BVNL) | Nigeria |
| Innovative Biotech | Nigeria |

Considering this current dearth of capacity (from those listed above, only Senegal and South Africa could possibly manufacture approved Covid-19 vaccines with support and in time [37]), mechanisms such as COVAX are essential. But in the medium- to long-term, with the real risk of other potential future viral outbreaks, domestic and regional manufacturing capacity is likely to be a key element of vaccine access for Africa rather than simply relying on reserved doses from foreign producers.

Beneficiary countries of Gavi may feel little incentive to support domestic or regional vaccine production while they are receiving international support, and the economic fallout of the pandemic may well hit gross national income (GNI) per capita in 2021 and stall the path of these countries towards graduating from Gavi support. But a number are edging ever nearer to the three-year average GNI per capita threshold of US $1,630 that will make them ineligible for further Gavi support with vaccines in the future, notably the Republic of the Congo, Côte d'Ivoire, Ghana and Kenya. This makes continental manufacturing of vaccines all the more relevant, and the lead times for developing manufacturing capacity means countries should start their strategic thinking earlier rather than later.

A detailed study by the African Vaccine Manufacturing Initiative (AVMI) in 2017 into vaccine production in Africa identified many of the arguments for and against production on the continent, but Covid-19 has made it an imperative to reconsider many of these.

What Covid-19 has shown is that when everyone needs the same thing, only those who can produce it themselves can be *guaranteed* supply. A recent study noted that Africa has 375 drug manufacturers to a population of 1.3 billion. [38] China and India, which have roughly the same population each, have around 15,000 and 5,000 drug manufacturers respectively. These numbers become even more stark when the

data shows that most of African facilities are in North Africa. Between 70 and 90 per cent of the drugs Africans take are imported, at prices points they can't influence.

The goal should be transitioning the continent from dependency to greater self-sufficiency and security of supply. But this ambition faces challenges.

Among these is cost. Establishing vaccine manufacturing capacity is a substantial investment entailing tens to hundreds of millions of dollars. African manufacturers would need to manufacture at sufficiently large volumes and have access to a large market to benefit from economies of scale.

Time is also a factor. The United Nations Industrial Development Organisation (UNIDO) estimates that even modest vaccine manufacturing facilities – with low volume capacities of less than 10 million doses per year and antigen imported from abroad rather than fermented in-country – would take between two-and-a-half and five years to build and would cost $14 to $29 million to construct in the developing world. When domestic antigen fermentation is considered (which is essential for achieving fully integrated self-sufficiency in production), construction time can range beyond seven years. [39]

A further challenge is that vaccine manufacturing in sub-Saharan Africa suffers from limited commitment in both the public and private sectors. On one hand, the need for manufacturing capacity in Africa is a point that has been made repeatedly by political leaders. [40] In 2018 the East African Community hosted the East African Vaccine Symposium under the banner of "Vaccine Production in Africa for Africa", stressing the "strategic importance of local production". However, only nine sub-Saharan African countries are members of the AVMI, which aims to support and promote the establishment of sustainable manufacturing capacity on the continent through advocacy, partnership, income generation and capacity building. [41]

A missing element of public commitment is the lack of regulation and certification of health-care products. The WHO estimates that only 7 per cent of African countries have moderately developed regulatory capacity for health-care products and more than 90 per cent have minimal or no capacity. Efforts to improve this include the African Vaccine Regulatory Forum (established by the WHO in 2006) and the Pharmaceutical Manufacturing Plan for Africa (first initiated by the African Union in 2007). But the former has focused largely on drugs rather than vaccines while the latter has emphasised product development and clinical trials rather than manufacturing. Pharmaceuticals, not vaccines, continue to be the lens through which most African countries perceive the current Good Manufacturing Practices. [42]

Finally, how could the public and private sector work together to facilitate the necessary technology and knowledge transfer for regional manufacture in Africa? Many stakeholders are concerned that bilateral licensing agreements might take too long and could be excessively restrictive. Gavi acknowledges that individual technology transfer is expensive – around $4 to $5 million per recipient, depending on the

nature of the agreement – and that transferring to a sufficient number of manufacturers to mitigate against risk of failure can be extremely costly.

One idea is to adapt the logic of the Medicines Patent Pool through an intellectual property, technology, and know-how (IPTK) bank, which would bring together the necessary intellectual property rights, manufacturing process information, know-how and regulatory expertise into a single platform that could be licensed as a package with associated training modules. In this scheme multiple manufacturers in developing countries would be licensed to sell in a defined geography. The African Union has similarly called for these assets to be made available as a full package, but it has gone further – calling for them to be shared "openly" rather than licensed, with "full rights to use, manufacture and supply globally". [43]

# Conclusion

Finally, the world is asking, what is the "social commitment" of the public and private sector to making vaccines available to all? Low-income country governments and advocacy groups have extensively used the language of moral obligation to place pressure on pharmaceutical companies to make their technology and know-how available voluntarily. But plenty of governments are now speaking of enforcement. In their open letter from May 2020, 140 world leaders and experts, including the president of South Africa and the prime ministers of Pakistan, Senegal and Ghana, called for "mandatory worldwide sharing" of vaccine materials, "freely available for all countries", with "true cost-price" supplies "fully funded by rich nations". [44] The Member States of the African Union have acknowledged the "urgent need … to make full use of legal and policy measures" to address "monopolies". [45] South Africa, which has a long history of campaigning for equitable access to pharmaceutical products in the context of HIV, has joined India to call for the World Trade Organisation to waive obligations on member states to enforce patents and other intellectual property rights on Covid-19 diagnostics, therapeutics and vaccines under the Agreement on Trade-Related Aspects of Intellectual Property Rights until "widespread vaccination is in place globally, and the majority of the world's population has developed immunity". [46]

Many pharmaceutical companies have also adopted the language of "social commitment" and a "sense of urgency" to "ensure broad and equitable access", with varying degrees of tangible action. [47] Perhaps the boldest of these has come from AstraZeneca, which has committed to making the vaccine available at cost for the duration of the pandemic and has licensed its technology to the Serum Institute of India for the supply of 1 billion doses to low- and middle-income countries. How long such non-profit commitments will last is unclear. [48], [49]

Johnson & Johnson has also pledged to sell vaccines at cost and has finalised a licensing agreement with another India-based manufacturer, Biological E, to produce at least 165 million doses, though the target market for these doses has not been confirmed. [50]

A possible benefit of more favourable licensing terms and local production is lower prices. Médecins Sans Frontières says the cost of the basic package of childhood vaccinations recommended by the UN increased to 68 times its 2001 price by 2015 for developing countries. [51] The high existing prices deepen dependence on Gavi donor countries and make things especially tough for countries once they are no longer eligible. Covid-19 could be the trigger to make all of this much more sustainable.

Additionally, companies have been previously criticised for a lack of transparency in their not-for-profit calculations, with accusations from some quarters that "cost price" is often artificially inflated to permit

back-door profit. More liberal licensing terms that permit developing-country manufacturers to develop their own pricing structures for a specific low-income market may further improve accessibility. [52]

Nonetheless, there remains a significant gap between the position of many international organisations and the pharmaceutical industry in the nature and depth of these moral obligations. This gap needs to be addressed in the new global health-security architecture if we are to ensure resilience.

It is not unreasonable to think that a significant proportion of each country's population will need to be vaccinated against Covid-19 over time – not least because the factors that contribute to an individual's risk profile are complex and our understanding of them is still developing. Indeed, the US, Canadian and Australian governments have said all of their citizens should be eligible to receive it for free, and the head of the UK's task force estimates about half will need it. [53], [54], [55], [56] The relatively lower prevalence of certain non-communicable diseases and the younger populations in sub-Saharan Africa may mean a smaller proportion of people need to be vaccinated urgently compared with Europe – but Africa has scarcer health population data, so precisely targeting initially available doses is likely to be more difficult.

But the ongoing bidding war that most countries in Africa are priced out of and a lack of infrastructure are likely to mean achieving widespread or universal coverage takes much longer than in higher-income countries. Even the well-established vaccine for diphtheria, tetanus, and pertussis (DTP), which is often used as an indicator of how well countries are providing routine immunisation services, has coverage of as low as 70 per cent in some poorer parts of central Africa. [57] Now these same governments must seek to scale immunisation against a novel virus using newly developed vaccines. This challenge is not just a matter of cost or availability of doses. It is about having the technology to record who has had what injections, the logistics to transport doses and the staff trained to administer them. We must broaden the narrative beyond the quantity of doses available for African countries to capacity to administer them.

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