TONY BLAIR INSTITUTE FOR GLOBAL CHANGE

The Urgent Need for Universal Genomic Sequencing: Vaccine Supply Is Not the Only Challenge for Africa

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Introduction: Omicron Is a Wake-Up Call

For some months there has been a growing desire to move on from Covid-19, coupled with a belief that we are at the beginning of the end of our struggle against the virus. This optimism is misplaced. The recent emergence of a new variant of concern (VoC), Omicron, has thrust Covid-19 and the threat it poses into the spotlight once again. While the true health impact of Omicron, its transmissibility and severity, and the effectiveness of vaccines and therapeutics against it will take several weeks to understand, its emergence is a canary in the coalmine.

South African authorities first alerted the World Health Organisation (WHO) about the Omicron variant on 24 November; [1] it has since been detected across 16 countries and is almost certain to be circulating in others. There are 194 confirmed cases and over 1,300 probable cases. [2] Omicron is expected to drive future Covid-19 surges, leading to a strain on health-care systems, especially in countries with low vaccination rates.

This is a stark warning and has serious implications for the fight against the virus worldwide. To date, vaccination programmes have prioritised nationalism over an equitable global response. Without immediate regionally led and globally supported action, Covid-19 will continue to circulate unchecked in Africa. This could result in an unvaccinated Africa becoming a "reservoir" for infection and mutation, leading to more infectious and deadlier variants with impacts that will be felt around the world – measured in lives lost, borders closed and economic recovery suppressed.

The global pandemic response will not end until Africa has the tools and resources it needs to succeed.

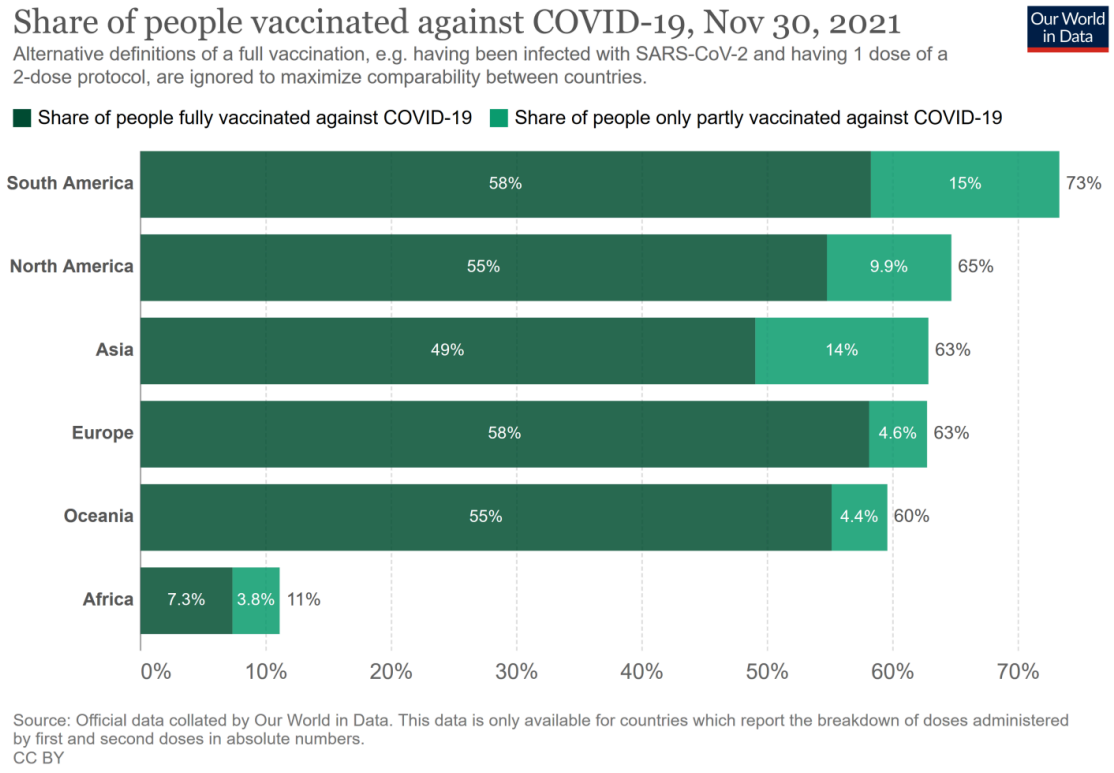
What is needed is a plan that will achieve vaccination across much of the African continent by the middle of 2022. This plan needs not only to tackle a complex range of logistical, financial and political issues – but it also must address inconsistent vaccine supply and donation of near-expired doses, vaccine-absorption capacity, vaccine hesitancy, and PCR testing and genomic sequencing across Africa, connected to a global surveillance system. The faster that new variants are detected and reported, the faster the world can respond.

Previous pledges and drives haven't delivered for Africa. It is time to orientate around a credible Africa Pandemic Plan, led by the African Union (AU) and coordinated through the Africa Centres for Disease Control and Prevention (Africa CDC), with tangible backing by partners in the Global North and G20.

How to Vaccinate Africa as Supply Increases

Africa is the least vaccinated region in the world. Just 7.2 per cent of the continent's population is fully vaccinated. In contrast, the population of Asia – the region with the second-lowest coverage – has seven times more vaccinated people, while Europe and South America have fully vaccinated more than 58 per cent of their populations. Of the nearly 8 billion doses administered globally, just 3 per cent have been given on a continent that accounts for more than 17 per cent of the global population.

Figure 1 – Vaccination rates by continent



Source: Our World in Data

This global vaccine inequity has been the most obvious failure of the international response to the pandemic. For months, African leaders and many in the international community – including the Tony Blair Institute for Global Change (TBI) – have been sounding the alarm that unequal access to global vaccine supply would leave the virus to circulate unchecked in vulnerable communities and inevitably give rise to a mutation that turns back the clock on global recovery efforts. Alongside appealing to international self-interest to promote vaccine equity, we should also recognise the direct and humanitarian argument for fairer distribution: that vaccines are relatively cheap, increasingly available and help prevent both death and illness.

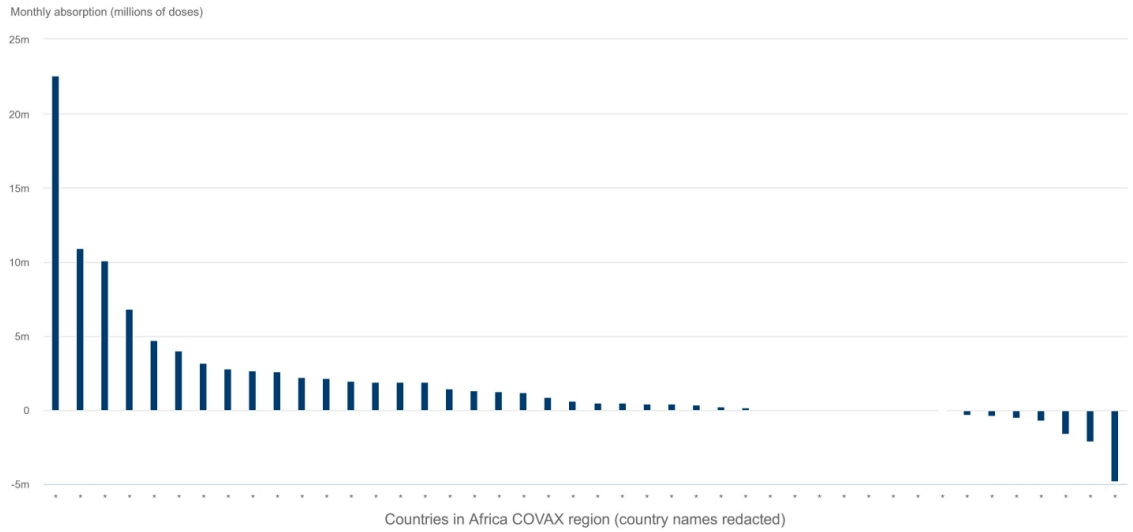
In June, the G7 committed to sharing surplus doses, but those commitments have fallen far short of expectations. [3] Of the more than 1.5 billion doses pledged to low-income countries, just 22 per cent have been received; about one-third of those have gone to Africa. The UK has only met 10 per cent of its global commitment, with 6 million doses donated to Africa in the past six months. Still, donations from the G7 account for one in three doses received on the continent to date, pointing to how few vaccines Africa has received and the important role that dose-sharing has played to close supply gaps.

Now, with production ramping up, the resumption of exports from the Serum Institute of India and more dose-sharing anticipated from high-income countries, Africa will need a fourfold increase in absorption capacity to keep pace with incoming supply. The US, for instance, has so far dedicated 55 million vaccine doses, with a further 17 million shots of the Johnson & Johnson vaccine to follow in the coming weeks. Access to vaccines will therefore no longer be a challenge, but capacity to absorb the vaccines will.

Solving Challenges of Vaccine Absorption in Africa

Based on the latest COVAX vaccine-delivery forecast, the anticipated influx in vaccine supply next year will be significantly higher than the vaccination rates most African countries have been used to so far. As Figure 2 shows, some African countries will need to scale up absorption capacity to administer millions more doses, even relative to their best performing vaccination levels over the past year.

Figure 2 – Scale-up in absorption capacity needed across African countries



Source: Global Health Security Consortium modelling based on data from the United Nations, World Bank, September COVAX supply forecast, Our World in Data and https://www.bmj.com/content/371/bmjm4704.

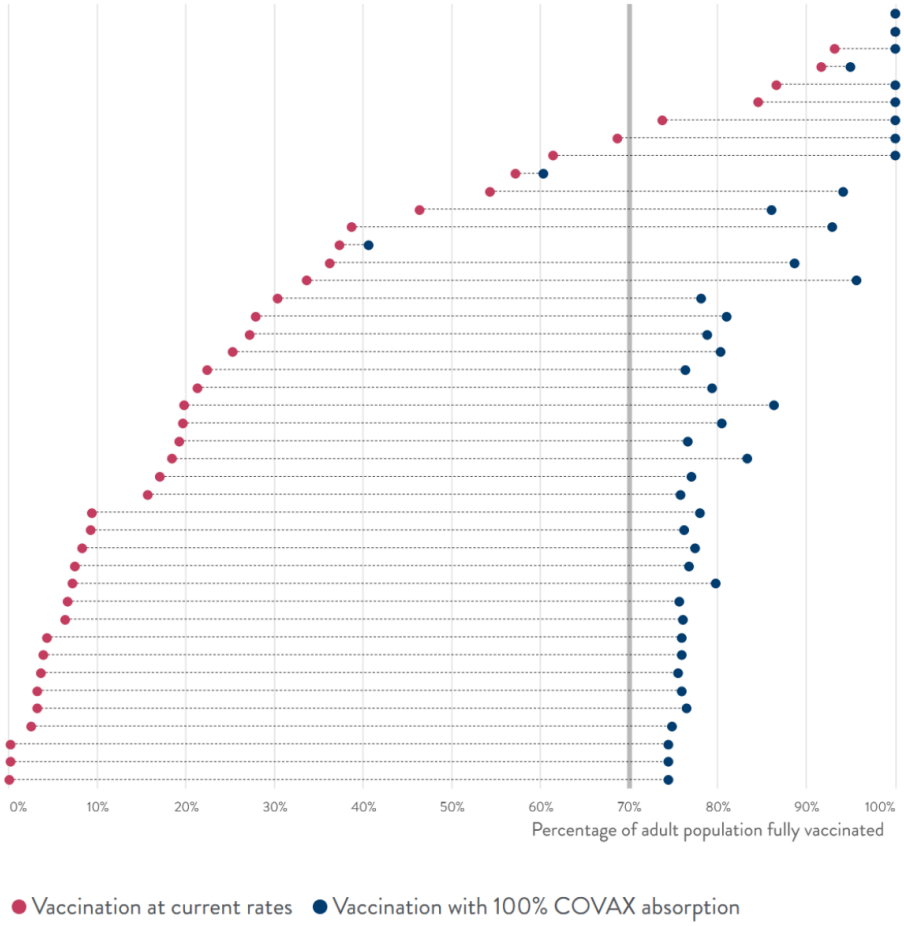
Note on our modelling: The chart above shows the difference between the total vaccinations delivered by each Africa COVAX country on their 30 best days of vaccination absorption, and the COVAX average projected monthly regional supply rate from

December 2021 to March 2022. This figure illustrates the absorption challenge facing many African countries even relative to their highest levels of vaccine absorption to date. All African countries that participate in COVAX are listed anonymously. Projected Africa COVAX supply is split between African countries each month proportionately by population, as per COVAX guidelines, based on whether a country is an Advanced Market Participant (AMC) or Self-Financing Participant (SFP).

Further details on how these supply forecasts are calculated are available in Figures 2, 3 and 4 in The Absorption Capacity Challenge, a Global Health Security Consortium paper published in August 2021.

Without increasing their absorption capacity, African countries seriously risk falling behind a target of achieving 70 per cent adult vaccination by the middle of 2022. Figure 3 shows what the hypothetical difference would be between absorbing all forecast COVAX doses and continuing vaccination at current rates, in terms of adult population vaccinated by the end of June next year.

Figure 3 – Modelled percentage of adult population vaccinated by June 2022, with and without COVAX absorption, across African countries



Source: Global Health Security Consortium modelling based on data from the United Nations, World Bank, September COVAX supply forecast, Our World in Data and https://www.bmj.com/content/371/bmjm4704.

Note on our modelling: The chart above shows the hypothetical difference in adult population vaccination levels between African countries continuing to vaccinate at current rollout rates, and increasing absorption capacity to administer all COVAX doses currently forecast for delivery by June 2022. Each African country participating in COVAX is listed anonymously.

Current vaccination rates are computed as the average vaccination rate from mid-October to mid-November, projected forwards until the end of June 2022. These rates are sourced from Our World in Data (OWID). Modelled COVAX absorption rates add projected COVAX deliveries over 2022 to current non-COVAX vaccination rates in each country. Projected COVAX deliveries are taken from the latest Gavi COVAX September 2021 forecasts, and split between AMC and SFP regional country groups proportionately by population, as per COVAX guidelines. Non-COVAX supply is the residual supply recorded in OWID from mid-October to mid-November after adjusting for COVAX donations, projected forwards at a constant level. Roughly 10% of vaccinations administered are assumed to be one-dose Johnson & Johnson, in line with COVAX forecasts; all other vaccinations are two-dose, with a one-month interval between first and second doses assumed. Figures shown are for full vaccination. COVAX estimates assume all doses in the Gavi forecast are delivered and used, which may be optimistic. Demand-side factors such as vaccine hesitance may make 100% vaccination targets difficult to achieve in some countries.

Rapidly increasing Covid-19 vaccination coverage in Africa to mitigate the emergence of the next variant of concern requires promptly resolving complex challenges related to vaccine distribution and demand. Of those surveyed, only 54 per cent of African countries are equipped to deliver vaccines to their populations. [4]

In August, TBI in partnership with the Global Health Security Consortium, put forward recommendations for the international community on how to tackle vaccine-absorption challenges, including a framework that sets out the key tenets for a successful vaccination rollout built on what we call the "four S's": settings and supply chains; staffing and equipment; science and data; and strategic communications.

The four S's framework provides an agile, holistic and forward-thinking approach to building much-needed absorption capacity. It also highlights the complexity of administering a successful vaccination campaign. Below are a few of the key challenges faced by countries in Africa, set against this framework.

Settings and supply chains: Lack of cold-chain infrastructure to handle a mass-vaccination campaign is a primary challenge across the continent. Reports from the WHO Regional Office for Africa indicate that the continent's cold-chain capacity requires significant strengthening, particularly in rural areas where more than half of the continent's population lives. [5]

The unpredictable delivery of vaccines is another complex but solvable challenge. The majority of the donations to date have been ad hoc, provided with little notice and short shelf lives, making it nearly impossible to stand up the logistical operation necessary to get jabs in arms. Africa needs predictable and reliable supply.

Staffing and equipment: Africa already faces a shortage of skilled health-care workers. [6] A mass-vaccination campaign will require supplementing the existing workforce to not only ensure target populations are reached for vaccination as and when planned, but also to make sure that other essential health services are not compromised. Fiscal budgets are already stretched by the pandemic response, and hiring and training an army of vaccinators and support staff is difficult without adequate incentive.

Science and data: In order to track who has been vaccinated, record what vaccine they received, recall patients for multidose regimens, monitor for adverse side effects and collate this information in a health pass, digital-data collection is required. But many health-care systems across Africa still use paper-based collection, particularly in rural areas, making real-time reporting difficult. Just 22 per cent of people in sub-Saharan Africa have access to the internet, complicating these efforts. [7]

Strategic communications: Misinformation and skewed risk perception present a growing challenge to vaccine-absorption capacity. This is a global concern, but it needs local solutions. Targeted community-engagement strategies that draw on local sources of authority are key. Accessible, understandable data

must be at the heart of public messaging. Increasing the reach of accurate information and building resilience to the spread of misinformation are more effective strategies than directly challenging scepticism. Misinformation isn't the only problem – a general lack of information also breeds hesitancy. We explore vaccine hesitancy and the associated drivers and challenges in the following section.

Each country faces distinct challenges getting jabs into arms but, above all, adequate funding is needed to strengthen absorptive capacities. It is in the global interest to ensure that African countries can administer the vaccines they receive.

Consistent with conclusions of the Independent Panel for Pandemic Preparedness and Response, we call on the Global North and G20 nations to back a plan that strengthens absorption capacity across Africa, led by the AU and coordinated through the Africa CDC. This plan must:

- Quantify and centralise country-level financing requirements for the rollout of vaccines.
- Set and commit to a realistic financing target to deploy those strategic investments, including through repurposing of existing funds.
- Determine which strategic investments in absorption capacity have the greatest impact in terms of number of people vaccinated.
- Achieve the commitments set out in the Joint Statement on Dose Donations of Covid-19 Vaccines to African Countries, and commit the international community, particularly donors and manufacturers, to make donations to COVAX, to the AU's Covid-19 Africa Vaccine Acquisition Task Team (AVATT) and to African countries. This should be done in a way that allows countries to effectively mobilise domestic resources in support of rollout and enables long-term planning to increase coverage rates to adhere to standards, beginning 1 January 2022.
- Improve vaccine-tracking ability and capacity at the continental level by supporting the existing Africa CDC vaccine-tracking system and dashboard, and ensure that all donations from donor countries be logged in the dashboard four weeks before their tentative arrival in-country to reduce burden on countries, AVATT and COVAX.

Overcoming Vaccine Hesitancy

Bolstering the absorption capacity of countries to administer vaccines will not be effective if communities and individuals do not want to be vaccinated. Vaccine hesitancy is complex – a mixture of societal and individual beliefs, norms, attitudes, knowledge and trust. Tackling hesitancy requires behavioural-science expertise, which couples with rapid anthropological research to understand the context of policies and campaigns that address a community's needs and build trust.

Overcoming vaccine hesitancy is a challenge across the globe, but Africa faces its own obstacles. Findings from a 2020 Africa CDC survey of 15 countries revealed that four in five respondents expressed a willingness to take a Covid-19 vaccine; however, acceptance varied widely not only across countries but also across socio-demographic groups within countries. [8] A February 2021 PERC survey similarly found that demand for the vaccine was high at the continental level, with 67 per cent of respondents saying they would definitely or probably get a vaccine, but there were significant differences across countries, ranging from 91 per cent in Morocco to 35 per cent in Cameroon. [9] It is likely that the longer the vaccine rollout takes in Africa, the more complex and difficult it will be to overcome hesitancy challenges.

Key drivers of hesitancy in Africa include lack of information, misinformation, concerns about safety and scepticism of vaccine efficacy. For example, Europe's decision to suspend the use of the AstraZeneca vaccine while investigating side effects negatively affected the vaccine's reputation, especially in Africa. This influenced the Democratic Republic of the Congo (DRC) to give up the majority of its 1.7 million AstraZeneca doses. DRC's vaccination rates remain among the lowest on the continent, with just 0.06 per cent of the population fully vaccinated.

Once vaccine supply increases and everyone who is willing to get vaccinated has done so, rates will inevitably slow. Combatting hesitancy should therefore be a high priority for governments and the international community.

We call on the Global North and G20 nations to include in the AU-led, Africa CDC-coordinated Africa Pandemic Plan specific support for overcoming vaccine hesitancy. Elements of this support include:

- Investing in behavioural-science networks and the empowerment of those networks to develop a better understanding of the drivers of hesitancy to inform policies and campaigns that deepen community engagement.
- Supporting the collection of data on vaccine hesitancy and its key drivers.
- Supporting clear and consistent public-awareness campaigns that use political, religious and other leaders to highlight the benefits and safety associated with getting vaccinated.

Increasing PCR Testing and Genomic Sequencing

PCR Testing and Surveillance Capacity

Alongside efforts to vaccinate the world, we also need to accelerate investment in agile capacities for surveillance and response at national, regional and global levels that can operate together not only to share data but also to help bring coherence to an international response.

In order to identify variants of concern early in their lifecycle, wherever they arise, countries must first have comprehensive PCR-testing capacity. In this area, there is tremendous variance across the globe. As of October 2021, a mere 0.4 per cent of 3.5 billion tests performed globally were in low-income countries. This means that many cases have gone untested and, consequently, unsequenced. Much of the world has, by default, opted out of our most important warning system against new variants: PCR testing and strategic sequencing of samples.

While the WHO recommends a minimum of 100 PCR tests per 100,000 people per day, countries in Africa lag behind the rest of the world. Gabon has an average of 94 tests, Rwanda an average of 86, Botswana an average of 72, South Africa an average of 69 and Nigeria an average of three. Comparable countries include Argentina, Colombia, India and Indonesia. These figures pale in comparison to tests administered in most high-income countries, including Austria (5,265), Denmark (2,914), Greece (3,610) and the UK (1,392).

While we acknowledge the necessity of PCR-based diagnostics and the opportunity for genome sequencing it presents, we also need to recognise that PCR testing is resource-intensive and difficult to scale across large geographies. Therefore, investments in PCR testing must also be combined with increased access to rapid diagnostics and near-patient tests. While rapid tests (such as lateral-flow devices), are not explored in this paper in any detail, there is merit in considering where their routine use may help detect more cases, especially if PCR testing is hard to access, although positive cases would need a PCR test for sequencing and subsequent variant detection. Rapid tests, if used more regularly or prior to undertaking a group activity, can also provide a mechanism to mitigate restrictions. [10]

Genomic-Sequencing Capacity

Genomic sequencing is a process that involves analysing a virus's genetic code to track its mutations, and it is a critical tool in identifying Covid-19 variants. Samples of the virus are collected through routine PCR testing of symptomatic cases or through surveys of target population groups, and positive samples are then sent to a laboratory where specialised technicians extract and map the virus's DNA. This information allows researchers and public-health bodies to more accurately track the spread of Covid-19 and improve their understanding of the pandemic.

South Africa has robust and expanding genomic-surveillance systems, and these have allowed the country to first identify variants of concern – including Omicron in November 2021 (from PCR samples collected by the Botswana health system) and Beta in December 2020. The number of Covid-19 isolates being sequenced has grown from less than 10,000 at the beginning of 2021 to more than 50,000 by the end of November 2021. [11] This can be attributed to increased investment and capacity building since the pandemic began.

This is no surprise. South Africa has sequenced and shared the most data in Africa – with 12,000 genomes sequenced and shared – followed by Nigeria, Kenya and Botswana. [12] It has sequenced more data than 29 countries in Europe including Russia, Greece, Iceland and Finland. However, this represents only 1 per cent of Covid-19 isolates being sequenced. There remains limited capacity and capability across the continent to independently sequence at a high enough level to fully realise public-health objectives; this is not an issue that is limited to Africa.

We propose that a credible global pandemic plan must support African countries to scale up their testing capacity to be able to process 100 PCR tests per 100,000 people per day. Of these, African countries must be able to sequence positive PCR tests with minimum need for external support, and feed data into a cloud-connected surveillance software, such as Oxford University and Oracle's Global Pathogen Analysis System (GPAS). [13]

This should be the ambition for every country, supported by a global leadership that rewards those who contribute to the betterment of public health by incentivising the reporting of variants and bringing along those who need help.

To enable robust surveillance globally, we call on the Global North and G20 nations to support the AU and Africa CDC's Institute of Pathogen Genomics by backing a plan that:

- Provides financial and technical support to increase access to PCR-based Covid-19 testing to enable African countries to scale up capacity to be able to process 100 PCR tests per 100,000 people per day.
- Provides financial and technical support to increase access to genomic sequencing to enable

countries to sequence a minimum percentage of positive PCR tests.

- Adopts and rolls out a cloud-connected surveillance software, such as GPAS.
- Invests in centres of excellence for genomics, and related training and capacity-building initiatives to strengthen regional genomics networks.
- Builds on existing initiatives such as the Covid-19 genome sequencing laboratory network (jointly established by the Africa CDC and the WHO AFRO in 2020).

Implementing a Pragmatic Approach to Global Travel

Following South Africa's alert to the global community of the discovery of Omicron, the immediate response from the mightiest countries in the world was to punish South Africa and its neighbours by isolating it from the world. While travel restrictions may be well-intentioned for protecting citizens of other countries, the reality is that they may harm pandemic response. Such punitive measures only disincentivise the testing and early identification of variants that will enable us to eventually succeed against the virus.

Without the world-class sequencing in South Africa and the country's steadfast commitment to protecting the public health of all countries, the Omicron variant would have been discovered far later. The travel restrictions faced by South Africa and its neighbours, as a result of its actions to protect global public health, have set a worrying precedent and sent the message that transparency is the wrong strategy. We believe that instead the system should reward those countries that make good on their commitment to global public health.

We therefore propose practical travel and domestic measures that governments can take in the face of Covid-19 and any emerging variants. These measures are consistent with national obligations to protect their populations under the International Health Regulations (2005) [IHR (2005)] and will incentivise countries to continue to report sequenced samples to a shared, global database when new variants inevitably emerge. These travel and domestic measures include:

- Requirement of full and up-to-date vaccination for international travel.
- Implementation of pre-departure PCR testing for all travellers (whereby travellers must receive a negative test result before departure).
- Implementation of rapid diagnostic tests (such as lateral-flow tests) for all arrivals.
- Reinforcing isolation or quarantine requirements and ensuring those requirements are consistent with the latest evidence.
- Updating of public-health and social measures, including implementing restrictions on non-essential travel where necessary.

These measures stand in stark contrast to the punitive, blanket travel restrictions that have been bluntly applied since the discovery of Omicron.

In October 2021, the G20 committed to restarting international travel in a safe and orderly manner, consistent with the work of the WHO, and acknowledged the relevance of shared travel standards. We

therefore call on the G20, and Global North nations, to act on this intention and to move quickly to agree on a clear, transparent, risk-based and unified approach for a Covid-19 international-travel plan. This should aim to maintain public health, support economies and reward those countries that share vital information with the world.

Conclusion

The emergence of the Omicron variant has highlighted the clear need for better and more coordinated international action on Covid. It is time to orientate around an Africa Pandemic Plan, led by the African Union and coordinated through the Africa CDC, and with tangible backing by partners in the Global North and G20.

Such a coordinated global response requires a set of clear policy decisions.

First, vaccinating Africa isn't just about doses. It is also about absorption capacity and overcoming vaccine hesitancy, both of which require significant investment in time, effort and funding to address structural and behavioural barriers.

Second, urgent action is needed to put in place geographically comprehensive surveillance mechanisms across the world and enhanced ones for vulnerable or high-risk populations. One example of such a system is Oxford University and Oracle's Global Pathogen Analysis System (GPAS), but others exist. Such tools, which analyse strains of the virus and can turn on the red light when a new variant emerges, should be used in conjunction with the normal reporting mechanisms to the WHO through the IHR (2005).

Third, a risk-based and unified approach for a pragmatic Covid-19 international travel plan, with the proper incentives and support for countries that share data, should be agreed upon with urgency. The International Health Regulations are built on the requirement to report concerns quickly to the global system; punishing countries that demonstrate exemplary compliance, such as South Africa, makes a mockery of the IHR and of any commitment to a future pandemic treaty.

Recommendations for a credible Africa Pandemic Plan:

1. The plan should be led by the African Union and coordinated through the Africa Centres for Disease Control and Prevention.
2. It should include a Covid-19 international travel plan that is based on science, supports public health and economies, and rewards those countries that share vital information with the world.
3. The G7 and the G20 should endorse a comprehensive financial-assistance package for Africa and allow governments on the continent to decide how this money is best deployed.
4. Governments of high-income countries need to scale up support for vaccine manufacturing in Africa, and strengthen vertical and horizontal linkages. In addition to setting up new plants, policymakers need to explore how to support existing African facilities to participate in the production of Covid-19 vaccines by creating incentives for the sector and seeking to integrate the capabilities of different countries into the global production chain.

5. The G20's institutional strength should be drawn upon in supporting Africa's vaccine rollout and crisis response, including agile government systems, structures and skills.
6. The above steps should be coordinated and driven through a high-level summit convened by the African Union and supported by the G20 and Global North countries.

All of this requires a strategic approach at the global level, as recommended by the Independent Panel for Pandemic Preparedness and Response. Countries must approach this crisis as a transnational issue in need of globally orchestrated solutions:

- We need the G20 to accelerate the establishment of the Global Health Threats Council so that it draws on the very best expertise from bodies such as the WHO and the African Union, to finally secure the leadership, commitment, global public goods, finance and coordination that has been lacking thus far. It is clear from Omicron that the overarching global response to Covid-19 remains disjointed and fragmented. The current situation affords an opportunity to push for better cohesion, communication and agreed responses through a taskforce.
- The Global Health Threats Council and its subordinate functions must quickly generate a renewed and practical strategic response plan that prioritises how we will tackle variants, and also explains how surveillance and response will be both modernised and federated in such a way that no one is left behind. Omicron may not turn out to be the worst-case variant some fear, but the possibility of one emerging will endure. At the same time, it is critical that we do not allow the current response to fracture between a knee jerk to Omicron and the consistency required in the longer-term response.
- Covid-19 has already presented us with a number of opportunities to coordinate and collaborate better, a challenge to which the international community has manifestly not risen. Omicron is building a momentum that we must capitalise upon now to address future threats, be those infectious disease or not. In the short term, our plans should secure the development and fair distribution of future vaccines, which will help mitigate the likelihood of the emergence of new variants of concern that significantly escape vaccine protection; this would also help address wider global-health priorities and inequity. Longer term, we should secure an enduring international team that can effectively meet future global public-health emergencies head on.

Charts created with Highcharts unless otherwise credited.

Footnotes

1. ^ https://www.who.int/news/item/26-11-2021-classification-of-omicron-(b.1.1.529)-sars-cov-2-variant-of-concern
2. ^ Omicron figures current as of 1 December 2021.
3. ^ https://www.one.org/international/issues/pandemic-response-report-cards/
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5. ^ https://www.afro.who.int/news/risks-and-challenges-africas-covid-19-vaccine-rollout
6. ^ https://pubmed.ncbi.nlm.nih.gov/19484878/
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8. ^ https://africacdc.org/download/covid-19-vaccine-perceptions-a-15-country-study/
9. ^ https://preventepidemics.org/wp-content/uploads/2021/05/PERC-Finding-the-Balance-Part-III-12-May-2021.pdf
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