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# Advancing global genomic equity: making a case for national genome projects in Africa

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Genomic data hold transformative potential for healthcare. Despite their unparalleled genetic diversity, African populations remain underrepresented in global genomics research, contributing to poorer health outcomes both within Africa and globally. Political, financial, and social challenges hinder progress, and therefore advocacy for public understanding of genomics, addressing social stigma, and aligning initiatives with national policies are critical steps forward. Africa hosts a large pool of highly skilled scientists and laboratories with DNA analysis capacity to harness for human genetics research and service provision, presenting opportunities for growth and innovation. This article highlights progress in African genomics, emphasizes the importance of equity, and proposes actionable steps for prioritizing, funding, and implementing national genome projects. It is a call to action.

## Genetics and genomics in translational medicine

Accurate analysis of genomic data and phenotypic interpretation is vital for preventing, diagnosing, and treating hereditary diseases, enabling genetic counseling and promoting evidence-based decision making[1,2]. Indeed, genomics has enabled personalized approaches in monogenic and complex diseases, such as cancer, improving subtyping, treatment, and reducing drug toxicity[2].

Despite Africa being home to the most genetically diverse human populations, African representation in global genomic datasets remains disproportionately low. According to the GWAS Diversity Barometer, only 0.15% of genome-wide association study (GWAS) participants are from Africa[3]. This imbalance reduces the power of studies to identify disease-associated variants and hinders our understanding of human evolution and disease[4,5], as illustrated by research on cardiovascular disease and malaria resistance[6]. The result is poor translation to African populations and a lost opportunity for global populations.

Including Africa in genomic research is a moral imperative to prevent the widening of existing healthcare disparities. Personalized medicine must serve global needs, not the wealthy.

## Leaving Africa behind is not an option

The immense genomic diversity within African populations and the double burden of communicable and non-communicable diseases offer crucial insights into disease mechanisms and the development of novel therapies. However, neglecting the African disease burden risks deepening the global healthcare divide, limiting benefits to those who can afford them.

There is a broad agreement on the need to increase African genomic data in global databases to improve representation and discovery power. Federated data access, where analysis occurs within the country of origin, is gaining traction as a model for equity and protecting data sovereignty. It aligns with data protection laws and supports local oversight and autonomy, but requires substantial investment in infrastructure, a skilled workforce, and long-term funding. However, it can empower countries to become equal partners in international genomic and health research. By investing in local infrastructure and expertise, African nations can exercise decision-making over the use of their genomic data, foster regional collaboration, and contribute to global genomic research on equal footing.

A dual approach, increasing African data in international databases and strengthening databases on the continent, will keep Africa at the forefront of genomic innovation while addressing the continent's unique healthcare needs through more equitable research collaborations.

Africa has an opportunity to leapfrog traditional healthcare with advanced genomic solutions. Investing in African genomics must be fair and strategic to ensure universal benefit. For example, pharmacogenetics has demonstrated that treatments optimized for populations of European descent yield poorer outcomes in African populations[7]. A one-size-fits-all approach to medicine is ineffective and inequitable. Population genetics can help resource-limited systems provide effective treatments.

Incorporating African genomes into global research initiatives enriches research into disease mechanisms and therapeutic development worldwide. It enables the discovery of biomarkers and drug targets that can improve treatment globally. As highlighted by the WHO Science Council (2022)[8] and the EU-Africa Personalized Medicine project[9] (EU-Africa PerMed), enhancing genomics research in Africa should be a priority to ensure that the continent is not left behind in the current international drive for personalized medicine and more effective health care systems across the globe. Furthermore, Africa CDC's expanding focus on human genomics aims to address this gap by fostering regional and continental collaboration.

## African genomic initiatives capacity building

While many countries are investing in national genome initiatives[10], Africa faces unique challenges and opportunities. To benefit from genomic medicine, Africa must build capacity and tailor solutions to its diverse needs and constraints.

The success of the Human Heredity and Health in Africa[11] (H3Africa) consortium underscores the potential of Africa-led genomic research, having built local capacity and showcasing how African genetic diversity powers discoveries in human health and disease[12]. Scaling these efforts through expanded networks and funding will be key to Pan-African collaborations. Similarly, efforts like EU-Africa PerMed, PerMediNA[13] and African Populations Cohorts Consortium provide frameworks for building capacity and aligning regional efforts with global genomic priorities[14].

African national genome initiatives would emphasize the value of locally coordinated and funded efforts by providing resources, sustainability, expertise, and training the next generation of researchers and clinicians. These initiatives will foster skills retention, build local capacity, and create career paths. Expanding such projects across Africa will empower nations to make evidence-based decisions for precision medicine.

## Current national genome projects in Africa

Only a few African countries have officially launched government-driven national genome projects (Fig. 1). Tunisia's *Genome Tunisia Project* aims to sequence 10,000 healthy genomes and thousands of clinical exomes to create a national reference genome resource and integrate omics into clinical practice[15]. Launched in 2021, Egypt's *Genome Egypt Project* plans to sequence 100,000 healthy individuals and 200 ancient mummies to identify variants linked to disease[16]. Senegal's *SEN-GENOME Project* takes a decentralized approach, sequencing 1000 genomes from 31 ethnolinguistic groups across its 14 administrative regions. These projects emphasize local governance, capacity building, and integration with broader African genomic initiatives[17].

Several other government-led genome projects are emerging. Tanzania, South Africa[18], and Kenya have all announced national genome projects and presented preliminary plans at the African Society of Human Genetics Conference in Uganda in 2025. These are being led by government ministries or national science councils and should build on existing research infrastructure.

Nigeria[19] represents a public-private partnership model, and although not officially branded as a national genome project, it is a significant genomics initiative that currently faces challenges with data governance and national coordination. Some countries are leveraging existing research data to build national efforts, in collaboration between government and researchers. These include the Democratic Republic of the Congo, Ghana[20], Uganda[21], Botswana, and Gambia[22]. For example, Ghana's 1000 Ghanaian Project under the GhGenome initiative by the West African Genetic Medicine Center (WAGMC) plans to sequence children with genetic disorders, including sickle cell disease, cancer, developmental delays and rare genetic disorders[20]. The Gambian Genome Variation Project has produced datasets through international collaborations[22]. Although these are not full-scale national projects, they lay a foundation for future government-backed initiatives. In Chad[23], Mozambique, and Angola[24], there are genomic research studies, but it remains unclear whether their national governments are involved in formal genome project planning. These and other African countries have the potential to develop national genome programs using existing human genome research as a foundation.

Many H3Africa cohorts have provided important insights into rare and common diseases[11], illustrating how both population-based and hospital-based studies can inform precision medicine efforts. Notably, the Uganda Genome Resource[21] and the AWI-Gen cohort with representation across four African countries have yielded valuable findings despite the absence of formal national projects[25]. While individual efforts are impactful, the challenges of funding, governance, and policy alignment highlight the urgent need for stronger government investment to scale genomics and precision medicine across Africa.

## Funding national genomic research and sustainability

African nations should balance priorities, such as infectious disease control, basic healthcare access, and infrastructure development. Advancing genomics may seem ambitious, but it's essential for long-term health equity and resilience. Investing in national genome projects is not only a scientific necessity but a moral imperative[26].

One approach to sustainable funding is integrating genomic research into national budgets by allocating a modest percentage of health or education budgets. This approach should reflect each country's economic capacity and national priorities. Rwanda's success in leveraging pathogen genomics to improve public health highlights how genomics can align with national priorities. Rwanda is a pioneering country, hosting the first mRNA vaccine manufacturing facility in Africa[27]. Adapting such frameworks for human genomics could bridge healthcare gaps and foster precision medicine.

For countries with limited financial resources, innovative funding mechanisms offer promising solutions. Health bonds, successfully used to finance public health programs globally, could be tailored to support genomic research[28]. Additionally, countries like Botswana have demonstrated the potential of using natural resource revenues to fund healthcare and education initiatives[29]. Adapting similar models for genomic research could provide a sustainable pathway for investment.

## Regional collaborations and genomic hubs

In 2024, Africa CDC convened a consultative meeting to develop a continental roadmap for genomic medicine. Aligning this initiative with the African Union's Agenda 2063—which emphasizes science, innovation, and equity—will help ensure sustained commitment. The establishment of a Health and Genomics Innovation Fund, supported by contributions from member states, could further enable long-term investments in genomic research across the continent.

Regional collaborations through entities like the East African Community (EAC) and the Southern African Development Community (SADC) can foster the development of shared genomic hubs, strengthening sequencing capacities, data analysis, training, and equitable access to genomic technologies. Countries with established infrastructure, such as South Africa, Egypt, and Tunisia, can support neighboring nations in building their capacity. Initiatives like the industry Partnership for Advancing Genomics Research in Africa (PAGRA) and the African Genomic Centers of Excellence (GenCoE) are already working toward harmonizing efforts and creating regional networks for genomics research and innovation[30]. Furthermore, centers like the African Center of Excellence for Genomics of Infectious Diseases (ACEGID) have demonstrated the power of such collaborations, having trained researchers across the continent and provided crucial real-time genomic surveillance during outbreaks, such as COVID-19, Lassa fever, and Ebola[12].

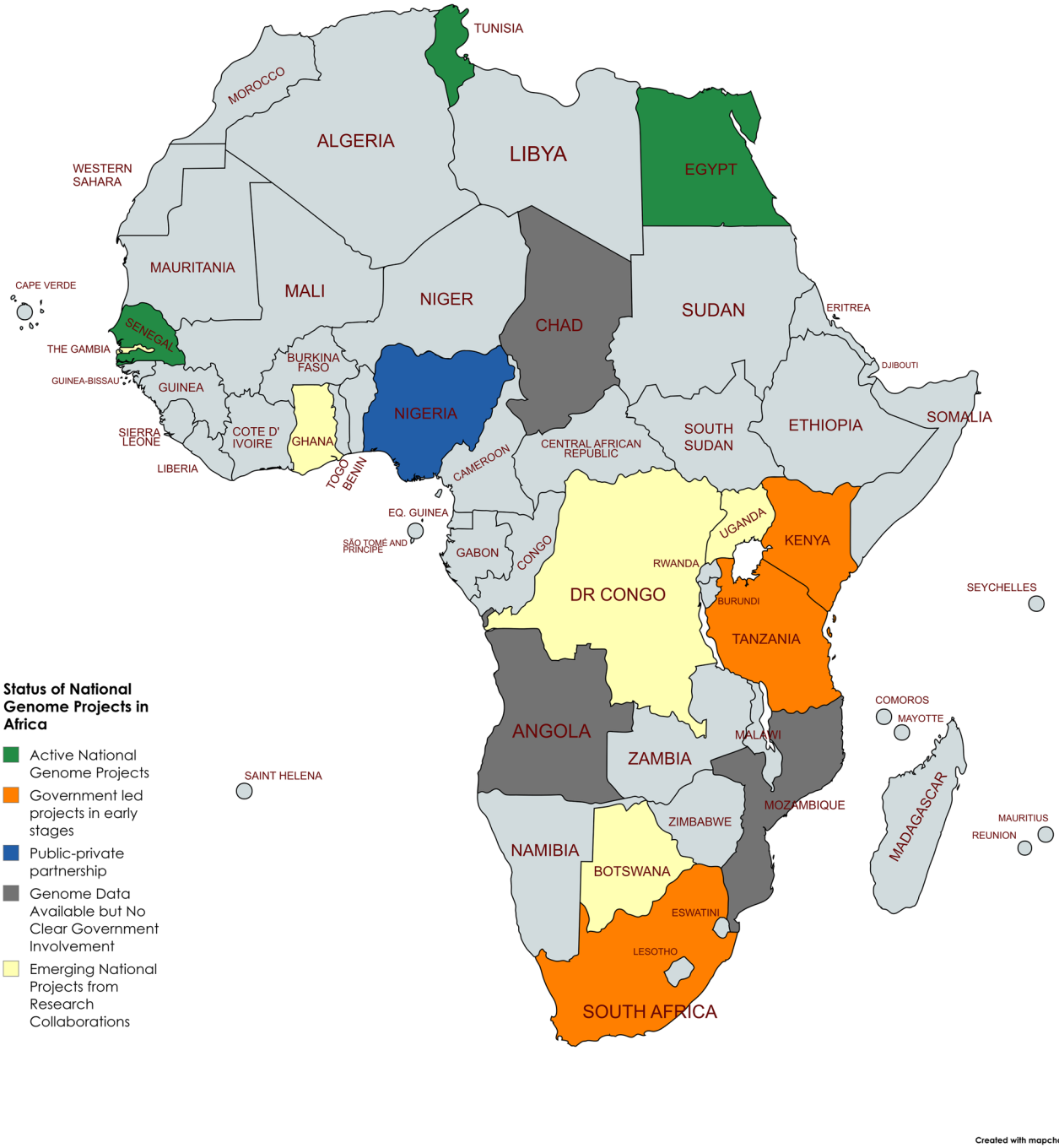


**Fig. 1 | Status of national genome projects in Africa.** The map highlights countries with national human genome projects (green), government-led projects in early stages (orange), public-private partnership (blue), emerging national projects from research collaborations (yellow), and informally planned projects (gray). This visual representation emphasizes the need for broader implementation of national genomic initiatives to improve healthcare equity and precision medicine in Africa. Map created using MapChart.net and licensed under CC BY-SA 4.0.

Regional genome projects can pave the way for national initiatives, demonstrating the feasibility and value of genomics in healthcare. Aligning efforts with pan-African efforts led by the African Union and Africa CDC can strengthen governance and impact.

## The cornerstones

To achieve equity and health care for all, African nations must expand existing genomic projects and foster new ones reflecting the continent's genetic diversity. Tunisia, Egypt, Senegal, South Africa, and

Tanzania offer valuable models but require more funding, better governance, and pan-African integration. Sustaining the efforts of national genome projects across Africa will require investment in local infrastructure, training programs, and ethical governance frameworks. Protecting data sovereignty and fostering public trust will be critical to ensuring equitable use of genomic data. Ethical frameworks emphasizing equity and transparency will help Africa leverage genomic diversity for regional and global health.

Advocacy must emphasize Africa's genomics' value to inform global health solutions and the potential to drive economic gains. The Human Genome Project generated 3.8 million job-years[31], demonstrating genomics' potential economic impact. Genomic capabilities also support national security, as seen during COVID-19 responses.

Public engagement is critical to the success of national genomics efforts. Outreach that elaborates on benefits like better diagnostics and vaccine development can build support and partnerships. International initiatives like "Genomics for All" promote open science, equitable data sharing, and collaboration, ensuring that African scientists lead these projects and benefit directly from their outcomes[28].

Data sharing is key to advancing genomic research in Africa, enabling collaborative efforts to address shared health challenges. To do this effectively, African nations can be guided by the WHO's Technical Advisory Group on Genomics (WHO-TAG-G) and its recently launched principles for genomic data collection, access, use and sharing[32].

Harmonizing data laws across Africa to support responsible sharing and protect data sovereignty would accelerate research, improve healthcare, and position Africa as a key player in global genomic science.

## Conclusion

Africa stands at a critical juncture in its genomic journey. Investments in national genome projects can harness the continent's genetic diversity to transform healthcare, improve health equity, and position Africa as a leader in global scientific innovation. By prioritizing capacity building, advocacy, and local data governance, African nations can become equal partners in the global genomic landscape, advancing both local and worldwide precision medicine.

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## Author contributions

M.Z.A. conceived the idea for the manuscript and led the writing process. M.Z.A. shared a first draft with R.N., G.E.K., Y.H., and M.V.C. followed by discussion and inputs from M.R. to shape a

second draft. G.E.K. and Y.H. provided insights into North African genome projects and contributed to sections on global initiatives. R.N. provided expertise on West African genomic initiatives and contributed to the sections on the SEN-GENOME project. M.R. contributed input on Southern African genomic initiatives. All authors reviewed, edited and approved the final version of the manuscript.

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The Authors declare no competing interests.

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