

# Application of Genomic Medicine to Advance Healthcare in Africa



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## Policy Brief

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### Key Messages

- ✓ Genomic medicine enables the use of genetic information in disease prevention, diagnosis and treatment.
- ✓ Genomic medicine is underdeveloped and untapped in Africa. The genetic profiles of the continent's diverse populations have not been adequately studied, compared to those of other continents.
- ✓ To facilitate genomic medicine across the continent, multidisciplinary expertise is required, including expertise on genetics, bioinformatics, clinical medicine, and social sciences.
- ✓ African governments and the private sector should invest in this field, to build local capacity.

### Context

Genomic medicine is a health technology that uses an individual's genetic information to guide decisions on diagnosis, treatment, and disease prevention, particularly for inherited conditions. It is especially valuable for prospective parents with a family history of genetic disorders, such as sickle cell, and helps them to assess their carrier status and the future health risks of their offspring even before symptoms appear. It can also be applied to study the genetic variations of pathogens and parasites causing infectious diseases in Africa, as well as in cancer research. Genomic medicine is also used in analysing genetic variations that influence drug metabolism and response, which helps medical staff to tailor medication regimens for improved treatment, and to minimise adverse drug reactions for patients.



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**A multidisciplinary approach is vital for the effective application of genomic medicine within healthcare systems.**

Africa has significant genetic variation, critical to understanding human evolution and disease susceptibility, with its rich cultural diversity and the oldest genetic heritage. The continent's diverse environments and lifestyles contribute to unique regional genetic adaptations, highlighting the need for focused genomic studies. However, the continent is underrepresented in genomic research. There is a pressing need for investments in genomic health initiatives within resource-limited African countries, to develop tailored health interventions that reflect local genetic contexts while learning from global practices.

### Methodology

The data and other information used to compile this brief were drawn from a review of existing sources, including scholarly and conference papers, books and reports, newspapers and reputable online literature. The authors reviewed the sources to identify opportunities, benefits, and challenges of using gene drive technology in the health sector. The brief was further enriched with information gathered during meetings with experts on emerging technologies convened by the African Institute for Development Policy (AFIDEP) and the African Union Development Agency (AUDA-NEPAD) in August, September and October 2024. The meetings included the emerging health technologies expert meeting, biannual statutory meeting for the African Union High Level Panel on Emerging Technologies (APET) and a Regional Dialogue on Leveraging Emerging Technologies to Improve Healthcare Delivery Systems in Africa.

### Findings

While the adoption of genomic medicine in Africa is still evolving, there are several notable examples of its successful application on the continent to tackle local healthcare challenges. The Human Heredity and Health in Africa (H3Africa) initiative for instance, focuses on collaborative research into the genomic basis of common diseases across African populations, highlighting the region's rich genetic diversity. Nigeria's African Society of Human Genetics emphasises research and capacity building in genomic medicine, while Ghana has established the National Genomics Programme to develop infrastructure and training for healthcare professionals. Additionally, Ghana's

Sickle Cell Disease Genomics Consortium investigates the genetic factors of sickle cell disease to enhance treatment strategies.

Genomic medicine can be applied in resource-constrained healthcare systems in Africa to enhance the following:

- Point-of-care genomic diagnostic tools to enable healthcare providers in resource-limited settings to rapidly diagnose infectious diseases.
- Genomic surveillance of infectious diseases such as Ebola and Lassa fever outbreaks and monitoring genetic changes in pathogens to inform public health responses.
- Genomic profiling of cancer patients, to enable healthcare providers to identify specific genetic mutations driving cancer growth and personalise treatment.
- Non-invasive prenatal testing, for early detection of genetic conditions; genomic screening of newborns to enable early detection of metabolic and genetic disorders.
- Drug testing, to optimise medication selection and dosing in resource-poor health systems.
- Building of genomic medicine capacity, which include training healthcare professionals, researchers, and policymakers in genomic literacy, laboratory techniques, and bioinformatics skills.

A multidisciplinary approach is vital for the effective application of genomic medicine within healthcare systems. This requires building diverse teams with expertise in genetics, bioinformatics, clinical medicine, and social sciences. Integrating emerging and complementary technologies for health, such as artificial intelligence, mobile health apps, gene-editing technologies, can also help advance genomic medicine in Africa. Research to investigate the genomes of pathogens such as HIV and malaria can enhance understanding of their evolution and resistance patterns. Large-scale studies to explore the genetic diversity within African populations can provide evidence on risk factors for common and rare diseases, and how genetic variations influence treatment responses.

However, significant challenges remain, including

inadequate healthcare infrastructure, limited funding, and a shortage of professionals trained in genomics. Moreover, the absence of comprehensive regulatory frameworks and policies governing genomic technologies raises concerns about ethical considerations, such as informed consent and data privacy, which must be carefully addressed within the context of local cultural norms.

Social considerations also play a crucial role in the equitable and ethical implementation of genomic research and practice. To build trust and promote public acceptance, it is important to engage community leaders and stakeholders in the process to develop genomic tools. Researchers and stakeholders should make efforts to improve the public's awareness and knowledge regarding genetic testing and its implications, ensuring that individuals understand the

benefits and risks.

Additionally, equitable access to genomic medicine must be prioritised to avoid exacerbating existing health disparities among socio-economic groups. Safeguarding the privacy and confidentiality of genomic data is essential, as is enacting legislation to prevent genetic discrimination in various sectors. Regulatory oversight is necessary to maintain the safety and integrity of genomic testing. Equally important is the creation of ethical frameworks for the collection and use of genomic data, to ensure privacy while addressing disparities in access to genomic benefits, ultimately fostering equitable healthcare advancements across the continent.

### Policy Recommendations

To promote the effective application of genomic medicine in Africa, policymakers should consider the following actions:

1.

Allocate resources for the establishment and maintenance of genomic sequencing facilities, bioinformatics expertise, and laboratory equipment to support genomic research and healthcare delivery.

2.

Develop regulatory frameworks and governance mechanisms to ensure the responsible collection, storage, sharing, and use of genomic data while safeguarding patient privacy and confidentiality.

3.

Oversee the quality, accuracy, and validity of genetic tests and ensure compliance with ethical standards and guidelines.

4.

Provide funding for genomic research and forge collaborative partnerships to drive innovation, discovery, and translation of genomic discoveries into clinical practice.

5.

Develop training programmes and educational initiatives to build the capacity of healthcare professionals, researchers, and laboratory technicians in genomics, bioinformatics, and related fields.

6.

Engage with local communities, patient advocacy groups, and civil society organisations to ensure that genomic medicine initiatives are culturally sensitive, responsive to community needs, and aligned with local priorities.



### Conclusion

Integrating genomic medicine into Africa's healthcare systems offers a significant opportunity to tackle local health challenges, by leveraging the continent's genetic diversity. Some African countries are making notable progress, but challenges remain, such as inadequate infrastructure, funding, and regulatory oversight, which inhibit equitable access and ethical practices. It is important for African countries to invest in research and innovation, public education and the right policies and regulations, for them to harness genomic medicine for improving public health and achieve greater health equity among their diverse populations.

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