

HARNESSING GENOMIC TECHNOLOGIES FOR IMPROVED HEALTHCARE IN AFRICA

Background

Every 25th of April, the world celebrates DNA Day to mark the successful completion of human genome project. This feat has revolutionized sciences: be it Medicine, Biomedicals and Agriculture. This staggering achievement has enabled the use of genomic information to determine how genes are regulated and interact with each other and with the environment to control complex biochemical functions of living organisms. Genomics has clearly re-focus medicine towards prevention, early detection and wellbeing, unlike the conventional diagnosis and treatment. In addition, swift vaccine development and breakdown, immunoresponse discovery, pharmacogenomics and antimicrobial resistance insurgence are also a few highlights of genomics application in medicine.

Genomics has not only been effective in the management of communicable diseases, but non communicable diseases have also benefited profoundly from genomics, introducing the rapidly growing field of medicine known as Precision Medicine. This is also evident in the study at Centre for Research on Genomics and Global Health – CRGGH, NIH) on metabolic disorders including obesity, diabetes, hypertension, dyslipidemia, kidney diseases and related traits. Scientists across the globe especially the western world, has exploited this technology to create advancement in healthcare delivery, for example, diagnosis and personalized medicine, effective cancer management and genomic surveillance for predicting infectious disease outbreak. With the launch of the biomedical research initiative, Americans were aspiring to accelerate biomedical discoveries and provide clinicians with new tools, knowledge and therapies to generate more effective, better targeted treatments for patients.

Some countries across the globe such as United State, United Kingdom, Germany, Canada, Japan, Australia and Israel have increasingly mainstreamed genomics into healthcare in its standard-of-care. Hence, this gives birth to Genomic medicine which investigates how an

individual biological information can be used to improve their clinical care and health outcomes e.g. through effective diagnosis and personalised treatment.

The performance of research, development and manufacturing of commercial genomics technology platforms, the multitude of diagnostics products and therapeutics derived from genomics knowledge, and the associated healthcare services provided is generating economic activity and supporting a large volume of job creation. Other impact of genomics is also the indirect effect on the economic growth due to reduction in cases of workforce hospitalization. Understanding the strategic importance of genomic technology on both healthcare improvement and economy, US government invested about \$3billion on human genome project in 1990. This investment has contributed \$265 billion directly into their economy and job creation. Many other countries have recognized this new reality and are leveraging genomics knowledge to stimulate their economies. In the last 18 years, Québec has invested over \$1 billion through Génome Québec, thus building a critical mass of competitive expertise now contributing significantly to economic development. United Kingdom has consistently maintained its leadership position in Genomic industry, contributing 10% of the global genomic market valued at \$8 billion. Genomics medicine has greatly improved the wellbeing and productivity of individual life, thereby reducing the budget expenditure on healthcare services.

Africa is largely lagging behind in the utilization of this genomic technology; yet the continent is known to abhor the most genetic diversity which is a great recipe for genomic improvement. Most genomics and bioinformatics expert and research facilities are concentrated in Europe and North America, and most of the research emanating from them, has more benefit to their immediate environment. While less than 2% of genomes analysed globally are from Africa, most of the projects that aim to study, sequence, and improve biological diversity in Africa have been led by researchers and genomics facility outside Africa.

Considering one of the mission statements of Global Emerging Pathogens Treatment Consortium GET, to develop strategic tools for addressing and preventing infectious in Africa, the organization mobilized genomics experts in the April edition of its monthly webinar series to discuss- Harnessing Genomic Technologies for Improved Healthcare in Africa.

The webinar made a conscious emphasis on the contribution and benefit of genomics technology in improving the health system and wellbeing of Africans and suggested a few strategies to achieving this.

Challenges of mainstreaming Genomic Technology to health system in Africa

Genomics researchers in African are making giant strides to compete with their peers across the world. However, their efforts are being hindered by some factors such as inherent infrastructural deficit, lack of National genomic research agenda, data protection right and inadequate intellectual capacity. These challenges could precipitate continuous increase in disparity in healthcare services between developed and developing countries. Some of the challenges of genomic medicine in Africa includes:

1. Lack of genomic infrastructures, inadequate amenities, inefficient biorepositories and inadequate computing infrastructure seriously hinders genomics research on the continent. Most African countries are in a serious deficit of adequate infrastructure to sustain effective genomic research.
2. Inadequate research funds and grants. Most African countries, allocate between 0.2%-0.5% of gross domestic product (GDP) to research. Thereby making genomic researchers to solely rely on private investment or funding from outside Africa, which often threatens continuity.
3. Lack of adequate personnel, mentorship, and training facilities.
4. Genomics medicine is rarely priorities in African countries because some health institutions in African are still struggling with preventable diseases like cholera, dysentery, malaria.
5. Lack of National research agenda due to non-availability of research funds from the governments. Due to the inability of the government to fund research, it has limited power to set research agendas for the project. Usually, the most important studies stem from long-term national initiatives, such as the UK Biobank and the China Kadoorie Biobank

Recommendations:

Understanding the genetic make-up of an individual to give insight into the predisposition to certain medical conditions is becoming a necessity and not a choice. Limited biotechnology and information technology infrastructure in many African countries has hindered the participation of African researchers and clinicians in genomic medicine, hence there should be an urgent and immediate actions to effectively address this deficit of genomic technology in Africa. The recommendations below can enhance the development of genomics technology for improved healthcare in Africa:

1. There is a need for increased investment in genomics technology in Africa. Considering the paucity of fund in most countries in Africa, increased partnership between government and private sector on the continent can be a viable means of raising money for genomic research in Africa. African government should create an enabling environment for the private sector to invest in genomics technology and maximize the benefit thereof.
2. Capacity building and training of African scientist is important to effectively develop genomics technology in Africa. There is need for continuous collaboration and technology transfer between the developed countries and Africa for African scientist to effectively compete in the ever-dynamic genomic technology space. African countries and regional bodies should set up centres of excellence in genomic research for training of experts on the continent.
3. African countries should develop appropriate national frameworks to consider the ethical implications of genomics research and its applications in their own unique social, cultural, economic and religious context. Empirical data from a broad spectrum of stakeholders and the public are needed for the development of effective genomic policies and programs for disease that affect the continent.
4. African governments should support African researchers to conduct genomic research that would address health challenges in Africa.
5. Government should enact strict rules and regulations that stipulate transparency, rewards and protection for sample donors to enforce benefit sharing. Profit and benefits accrued from samples collected from an individual or organization for genomic research, should be extended to such donor(s).

Conclusion

It is obvious that genomics has profound positive impacts not only in terms of biomedical discovery, but also in terms of the clinical practice of medicine—working to improve the lives for millions of patients and demonstrating great promise for future highly positive contributions to human health and well-being worldwide. This technology has been equally shown to exert spillover effect on building science-based economic sector not only for developed countries but also emerging economies if adequately harnessed. It is therefore imperative for all stakeholders (governments, researchers, doctors and patients) in Africa to work together to create and support platforms for using genomics technology to address healthcare challenges in Africa.

About GET

Global Emerging Pathogens Treatment Consortium (GET) was established in 2014 as a direct response to the 2014-16 Ebola virus disease outbreak in West Africa and ongoing outbreaks of Lassa Fever, Meningitis, Multidrug resistance (MDR) enteric fevers and Yellow Fever across the sub region. There was clearly a need to create an African-led multidisciplinary forum of experts capable of working together with international partners to strengthen Africa's preparedness and resilience in tackling such infectious disease outbreaks caused by emerging pathogens, public health emergencies and pandemics.

GET found the understanding of biosecurity to be a very underdeveloped area on the continent with clear opportunities for using biosecurity to dramatically improve on capacity for prevention and medical countermeasures during public health crises. GET now operates firmly in the African Biosecurity and pandemic preparedness, space and functions as a think tank, providing high level advocacy and operational and necessary expertise to support Countries and communities achieve improved resources to combat outbreaks and other public health emergencies that can threaten stability, peace and security thereby undermining economic growth and well being. The consortium is working with international collaborators with a goal of providing strategic recommendations and establishing infrastructure and research capacity to respond to highly infectious emerging Pathogens such Ebola, ongoing COVID-19 Pandemic. The Consortium creates a rapid informed response strategy and provides advice and guidance to African countries, and a point of reference for international funding and aid agencies.