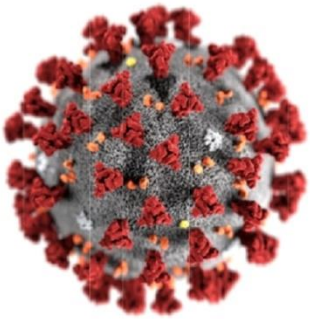
African Scientific Research and Innovation Council

African Union
SCIENTIFIC TECHNICAL RESEARCH COMMISSION

COVID-19

ASRIC Response and Intervention



Relevance of Investment in the Health Sector for Improvement of the Health Research Systems

RELEVANCE OF INVESTMENT IN THE HEALTH SECTOR FOR IMPROVEMENT OF HEALTH RESEARCH SYSTEMS

This report was commissioned by the African Scientific, Research and Innovation Council (ASRIC). It reflects the views and opinions expressed therein, which are not necessarily those of the African Union Scientific Technical and Research Commission and ASRIC. This document was developed with the aim to encourage and remind the Members States, Regional Economic Communities (REC), Ministry of Health, finance business leaders, and global partners of Africa the importance of upgrading research infrastructures, enhancing professional and technical competencies as well as improving funding for the health care sector, including the health research systems.

Preface

Better health is central to human well-being and happiness. It also contributes significantly to economic growth, given that healthier communities are more competitive and invest more. Health investment is one of the most crucial pillars of building a viable health system and an indispensable prerequisite for improving equitable access to health services. As of that, the average expenditure by AU Member States in the health sector in Africa exceeds 6% of GDP as of 2014. Despite this important fact, most of AU Member States did not meet the Abuja 2001 Declaration target to allocate 15% of their total government expenditure to the health sector (Abuja Declaration).

Across African countries there is a fairly high reliance on payments from outside the wallet that are driving people at the edge of poverty. Considering the huge funding gap and the rising burden of disease in Africa, it is clear that governments cannot bear all costs of health on their own. In helping African countries to improve substantially their health outcomes, the private sector has an important role to play. Investing in the healthcare sector is also an important part of the healthcare system and of universal healthcare coverage (UHC). This ensures that everybody can get health care without financial difficulties. The healthcare sector is one of the world's largest and fastest-growing industries.

This report brings to front the African Union Members States commitments to the improvement and strengthen of science, technology and innovation capacities at the national, regional and continental levels toward the achievement of STISA-2024 priority areas that includes its 2nd priority area which is “Prevent and control diseases and ensure well-being”. This priority area targets the research and innovation activities within the AU. It highlights the needs for a systemic investment in research in Africa. The report also advocates and highlights to National Governments; Ministers of Health; Ministers of Science and Technology; Ministers of Finance; Business leaders; and global partners in Africa for higher and improved funding of the health sector and the health research system.

Acknowledgements

Table of Contents

List of figures

Acronyms

AAS	Africa Academic of Sciences
ACDC/ CDC	African Centre Diseases Control/ Centre Diseases Control
ARIPO	African Regional Intellectual Property Organization
AUC	African Union Commission
AU-STRC	African Union Scientific, Technical and Research Commission
AUDA-NEPAD	African Union Development Agency-NEPAD
ANDI	African network of Drugs and Diagnostics Innovation
CMH	Commission on Macroeconomics and Health
FDA	Food Drug Administration
GDP	Gross domestic product
IP	Intellectual Property
MoH:	Ministry of Health
MTA	Material Transfer Agreement
PAIPO	Pan African Intellectual Property
PPE	personal protective equipment
RECs	RECs: Regional Economic Community
R & D	Research, Development
SDG	Sustainable Development Goals
SOP	Standard Operating Procedure
STISA-2024	Science, Technology and Innovation Strategy for Africa
STC	Science Technical Committees
UN	United Nation
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UHC	Universal Health Coverage
WAHO	World African Health Organization
WIPO	World Intellectual Property Organization
WHO	World Health Organization

1. Introduction

The general reason that discourage many African governments to prioritize funding of their health systems, especially health research is the fact that productivity growth in health services and research is low relative to other sectors of the economy [1, 2]. In the period 2000 to 2015, the overall spending for healthcare in Africa remained within a narrow range of 5-6 % of GDP. Although in per capita terms, it almost doubled from $150 to $292 (in constant PPP dollars) with wide variation across countries [3, 4]. The estimated amount of support for healthcare is mainly from out-of-pocket spending (36%) and domestic (35%), whereas foreign assistance is 22% of overall health expenditure [4]. Healthy populations depend on formal and informal markets to sell products; offer labour or medical services; finance their activities and of course obtain basic goods to sustain their livelihood. However, reality demonstrates that if this population may face certain restrictions in income generation they may miss out to afford quality of health and improve living conditions because of their financial status. Subsequently this situation will affect the ability of populous to perform at high level consistently and meet the required firm demand.

Better health is central to human well-being and happiness. It also contributes significantly to economic growth, given that healthier communities are more competitive and invest more. Health investment is one of the most crucial pillars of building a viable health system and an indispensable prerequisite for improving equitable access to health services. As of that, the average expenditure by AU Member States in the health sector in Africa exceeds 6% of GDP as of 2014. Despite this important fact, most of AU Member States did not meet the Abuja 2001 Declaration target to allocate 15% of their total government expenditure to the health sector (Abuja Declaration) [5].

Across African countries there is a fairly high reliance on payments from outside the wallet that are driving people at the edge of poverty. Considering the huge funding gap and the rising burden of disease in Africa, it is clear that governments cannot bear all costs of health on their own. In helping African countries to improve substantially their health outcomes, the private sector has an important role to play. Investing in the healthcare sector is also an important part of the healthcare system and of universal healthcare coverage (UHC). This ensures that everybody can get health care without financial difficulties. The healthcare sector is one of the world's largest and fastest-growing industries. Due to the indispensable nature of healthcare at all levels

of society, stocks issued by companies in the healthcare sector are somewhat insulated from the business cycle. As such, investors have the chance of absorbing shocks caused by the market by building a portfolio that includes healthcare sector stocks. Henceforth, in every Member State investing in terms of impact, special emphasis should be made on increasing domestic health funding with a focus on specific disease burdens and public health threats that have long ravaged Africa and not showing any sign of elimination. While investing for a long term impact, ensuring that available resources are allocated to the highest disease burden is essential. To this end, the need for strategic information which stratifies disease incidence, prevalence, and risk levels at national, districts, and communities level is critical.

However, investment in the health system provides an opportunity to foster economic development and prosperity, empowering countries to achieve national poverty eradication targets and to ensure social as well as political stability by saving millions of lives and preventing long-term disabilities. Investment in the health system also benefits the national economy across four main channels such as: building human capital (by improving national productivity); increase skills, jobs, and labor market mobility (responding to the market demand); alleviate poverty and inequity; and strengthening health security.

Currently, the global COVID-19 pandemic has revealed the inadequacies of health systems across developed and developing countries around the world including Africa, which is already confronted with limited healthcare facilities and services. In early March 2020, countless countries closed their borders, and citizens rich or poor had to resort to local/national health providers for treatment and other remedies to COVID 19, and other chronic health problems. A window of opportunity has been presented to African leaders by the COVID-19 pandemic to improve their national health systems, invest in research and development. This may also provide new momentum toward achieving Sustainable Development Goal number 3 (SDG 3) which is to "ensure well-being for everyone".

This document elaborates and actualizes the recommendations of the World summit on the review of the Sustainable Development Goals (SDGs) in 2015, with a notification on the challenges of infectious disease to the attainment of SDG 3, especially in Africa. This document also supports the ***Aspiration 1*** of Agenda 2063 *"A prosperous Africa based on inclusive growth and sustainable development"* which is further encapsulated in the African Health Strategy

2015-2030. Also, the Africa Health Strategy 2015-2030 advocates for the gradual improvement in the investment in the health sector accompanied by health sector reform initiatives that will led to improved health service delivery in African.

In addition, this report brings to for the African Union Members States commitments to the improvement and strengthen of science, technology and innovation capacities at the national, regional and continental levels toward the achievement of STISA-2024 priority areas that includes its 2nd priority area which is "Prevent and control diseases and ensure well-being". This priority area targets the research and innovation activities within the AU. It highlights the needs for a systemic investment in research in Africa. The report also advocates and highlights to National Governments; Ministers of Health; Ministers of Science and Technology; Ministers of Finance; Business leaders; and global partners in Africa for higher and improved funding of the health sector and the health research system.

2. Background of the African Health Systems and Health Research Systems

There is no doubt that African leaders have ramped up their efforts to achieve economic growth in recent years, as illustrated by overall GDP growth of 3.4 percent in 2019 with an expectation to reach 4.1 percent in 2021[6]. Nonetheless, the majors' gap related to the healthcare system and health research investment still not adequately addressed to foster and speed up the economy grow for the prosperity of the Africa continent. In 2015, an average of 3.3% of the population in low and middle-income countries was reported to spend up to 25% of their household consumption or income on out-of-pocket for health care expenditures [7] pushing citizen in the edge of poverty.

Numerous studies, reports, and surveys including a survey conducted by the African Union Scientific Technical Research Commission (AU-STRC) in 2019 on health research and research translation revealed that most of the challenges encountered in the healthcare sector were the inadequate human resource; inadequate budgetary allocations to healthcare; absence of supportive mechanisms to research translation; limited equipped facilities to boost research/drug discoveries and development; poor leadership and management in healthcare; shortfall in technical/professional competencies; weakness of Intellectual Property system (IPs) as well as a

database system; low quality of healthcare and research; and the fact that public is less interested to participate in clinical research & clinical trials in Africa [1, 8].

The existing COVID-19 pandemic has revealed the inadequacies in health systems among the African Union Members States. Current challenges include an inadequate number of diagnostic laboratories, testing kits, personal protective equipment (PPE), isolation centers, drug/vaccine, and foods. There is also a critical shortage of trained doctors, nurses, technologists, and other health personnel required to care for the cases and/or respond to the pandemic. The Primary Health Care (PHC) system, which would have taken care of case finding and contact tracing, is weak in most member states.

Henceforth, there is an urgent need to revitalize and strengthen the weak and overwhelmed health system and this requires urgent significant improvement in funding by Governments, African venture capitalists and privet sector. Apart from strengthening the health system, it will be possible to move faster in achieving Agenda 2063 aspiration and the Sustainable Development Goals particularly the health-related SDGs.

2.1. Health system

The health sector is a distinct sector within the economic system that provides goods and services to treat patients with curative, preventive, rehabilitative, and palliative care. It comprises of companies/conglomerates that offer clinical services, manufacture drugs and medical equipment, and provide healthcare-related support services. In furtherance, this heath sector is driven by a health system mainly composed of health service delivery; health workforce; health information system; access to essential medicines; financing and leadership/governance. This sector is intended to prevent the spread of disaster-related effects that might put public health at risk as well as prevent an outbreak of the national community, such as Cholera, Ebola virus, Influenza, Meningitis, and recently COVID-19 pandemic, etc. In other words, the health sector provides healthcare not only for patients, it also facilitates healthcare services for all those seeking care.

2.1.1. The fundamental of health system research

The health sector has a wide variety of industries ranging from research to manufacturing and management of facilities. However, the key cores of the healthcare industry can be broadly classified into the following categories in figure 1.

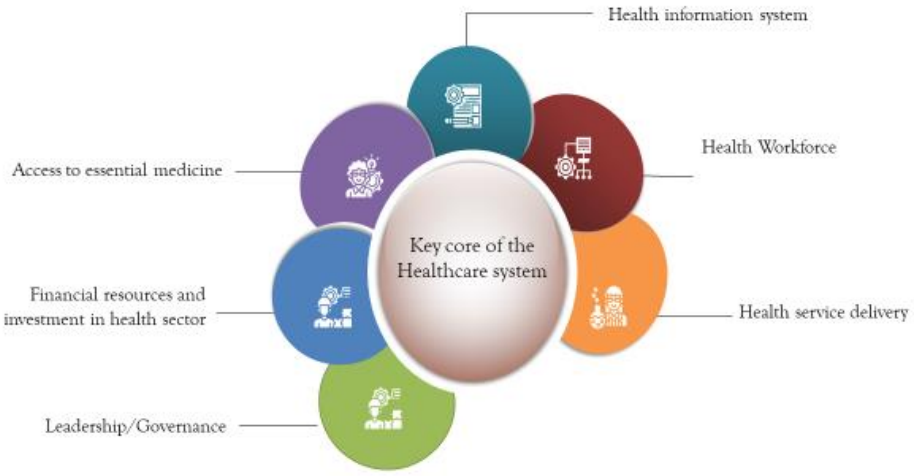


Figure 1: Key sectors of health industry

a. Health services delivery

Health service delivery is an immediate output of the inputs into the health system, such as the health workforce, procurement and supplies, and financing. It plays an important role in disaster prevention due to its unique function in the treatment of the wounded and disease outbreaks. This segment refers to any human resources and location delivering health care including hospitals, primary healthcare centres, isolation centres, emergency centers/facilities, medical practitioners, and healthcare professionals run either by government or private sectors [9, 10]. These services and facilities are centered around making health care comprehensive, efficient, accessible, high quality, and patient-centered. Additionally, they require special consideration concerning risk mitigation (coordination) during disaster/emergencies situations due to the complexity to preserve life and good health whoever seek to heal. Ensuring availability of health services that meet a minimum quality standard and securing access to them are key functions of a health system.

Managed care and health insurance are also key component in health service delivery. The term "managed care" describes the variety of approaches designed to lower health benefit costs and improve the quality of care to the insured person see figure 2 [9, 10]. Health insurance is considered as a central mechanism in the provision of financial security for universal healthcare [11]. This insurance schemes are intended to shield any human being from catastrophic healthcare expenses by pooling funds to encourage cross-subsidy between rich and poor and between safe and ill. Hence the lack of adequate coverage makes it difficult for individuals to access the health services needed and threatens them with high medical costs when they seek treatment. Some nations, such as Ghana, Rwanda and Ethiopia, have health funding exemption programs targeting disadvantaged and vulnerable communities. Of the cited countries, Rwanda is the only one with wide coverage of the poor [12].

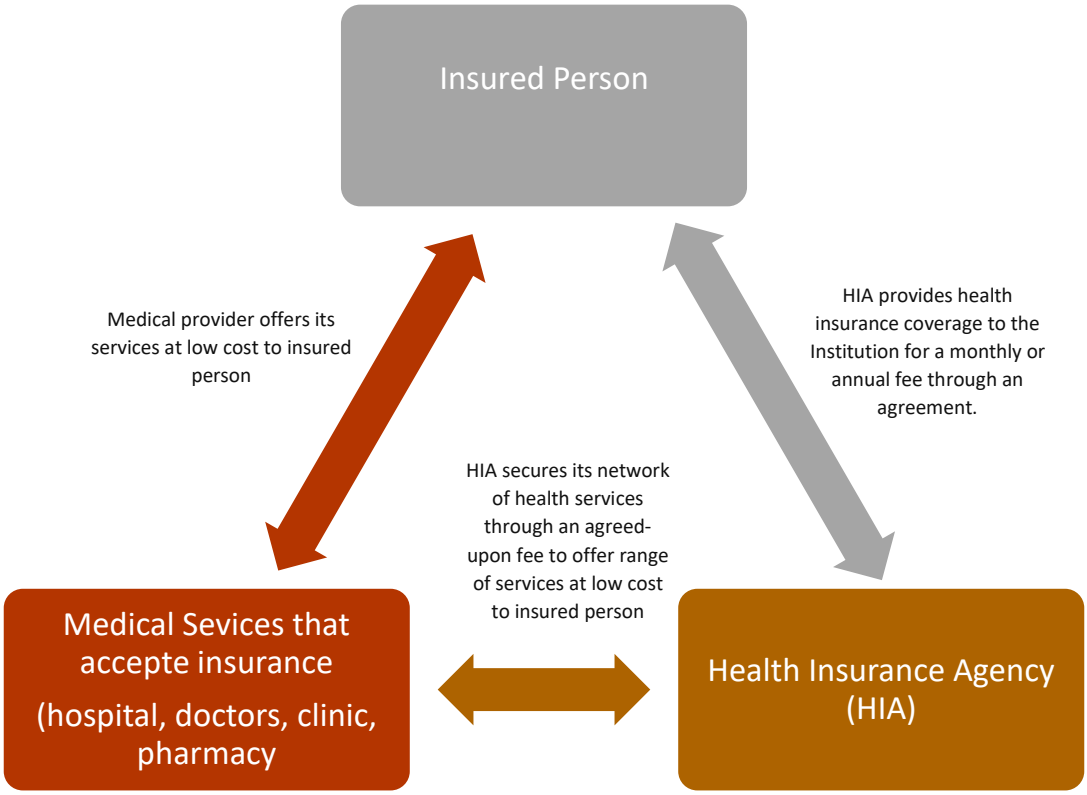


Figure 2: Managed care process

b. Health Workforce

A country's ability to achieve its health objectives is primarily based on the expertise, knowledge, skills and motivation of the people involved in the organization and delivery of

health services. These human resources include clinical staff, such as physicians, nurses, pharmacists and dentists, laboratory personnel as well as management and support staff, i.e. those who do not deliver services directly but are essential to the performance of health systems, such as managers, ambulance drivers and accountants. However, for many reasons, most countries lack the human capital to conduct critical medical interventions, including insufficient capacities in development, migration of health workers within and across countries, inadequate skills mix and demographic imbalances.

c. Health information system

The health information system provides the basis for the decision-making process and has four main functions: (i) data generation; (ii) collection; (iii) analysis and synthesis. The health information system gathers health and other fields of interest, analyzes data and ensures the accuracy, relevance and speed of data as a whole and translates data into health decisions. In addition, the heath information system is the rooter for monitoring and evaluating health system, likewise it serves broader objective such as early warning for capacity building, supporting patient and health care facilities, enabling planning, stimulating advance research, support decision makers related to healthcare as well as reinforcing the communication of health challenges to divers user. In order to enhance health system outcome, health planner and decision makers need different information including health determinants (socioeconomic, environmental, behavioral, genetic factors and the contextual environments within which the health system operates; inputs to the health system and related processes (policy and organization, health infrastructure, facilities and equipment, costs, human and financial resources and health information systems); the performance or outputs of the health system (availability, accessibility, quality and use of health information and services, responsiveness of the system to user needs, and financial risk protection); health outcomes (mortality, morbidity, disease outbreaks, health status, disability and wellbeing) and health inequities.

d. Access to essential medicine

All devices intended for medical use are listed in that group. Medical devices, equipment, and hospital manufacturers benefit patients by helping healthcare providers to diagnose, treat patients, helping patients overcome sickness or disease, and improving their quality of life [9, 10]. This sector further consists of many players including testing methods in medical device that includes testing kits, ventilators, personal protective equipment, consumables, and furthermore.

The specific characteristic of the medical device industry is its propensity to make "various incremental modifications to existing products, sometimes marked by innovation which offers a significantly new mechanism for action, design or risk profile" in order to improve the patient's survival rate. Based on the risks involved and regulatory controls needed for appropriate protections, the FDA classifies medical devices into 3 classes (Class I, Class II, and Class III) [13]. Class I devices (elastic bandages, examination gloves, handheld surgical instrument, facemask, bandage, hospital bed etc.) have low patient interaction and a low overall health effect. In general, instruments of Class I do not interaction with the internal organs of the patient, the central nervous system, or the cardiovascular system. The medical devices of Class II (blood pressure cuffs, pregnancy test, syringes, blood transfusion kit etc.) are tougher than the devices of Class I and pose higher risk rates because they have a greater chance of constant communication with a patient. These can include instruments that come in contact with the cardiovascular or internal structures of the patient, and diagnostic instruments. Although Class III is generally reserved for advanced and innovative medical instruments (breast implant, pacemakers, high frequency ventilators). These are high-risk devices that are very important to health or sustaining life Furthermore, medical equipment companies also seek licenses and insurance to ensure that certain firms do not copy their goods for a certain time or damages if they are accepted on the market.

The pharmaceutical industry is another sector that ensures equitable access to essential medical products, vaccines and technologies of assured quality, safety, efficacy and cost effectiveness, and their scientifically sound and cost-effective use. This category of the health sector can be divided into the *biotechnology industry, major pharmaceuticals industry, and makers of generic drugs* [9, 10]. The biotech industry includes companies engaged in research and development to create new medicines, devices, and treatment methods. Many of these companies are small and lack of dependable sources of revenue.

Although research and development are often the priority of the major pharmaceutical industry but seem to concentrate more on the production and selling of an established medicament portfolio than the traditional biotech firm. Generic drug manufacturers, and related pharmaceutical companies who produce and market products, produce products that are close to brand names at low cost. Product from these companies are cheap because they do not have to make the initial investment in research, development and innovation likely compared to the

brand companies. A new medication goes through a lot of testing so the FDA can approve it. Then it is patented or conferred its IP right. That means the company who developed it, is the only one who has the right to sell it for a period of time. Once the patent expires, any company can apply with the FDA to sell their own generic version of that drug. Subsequently, a rivalry is always present in order to obtain the same products, which leads to lower costs and lower margins of income.

e. Financial resource and investment in health sector

The financial resources and investment in the health sectors offer services and economic opportunities for the implementation of health care programs and it is a significant determinant of the success of health care systems in terms of quality, productivity and health outcomes. In most of AU Members States, healthcare financing is supplied by a mix of: (i) government health spending, which includes general government budgets and social health insurance; (ii) out-of-pocket payments; (iii) development assistance for health; and (iv) prepaid private spending, which includes private insurance and non-governmental organization (NGO) spending [14].

f. Governance/leadership

Governance means collaborating with other sectors, including the private sector and civil society, to promote and maintain population health in a participatory and inclusive manner. Governance in the health sector refers to a wide range of steering and rule-making related functions carried out by governments/decisions makers as they seek to achieve national health policy objectives that are conducive to universal health coverage. Governance is a political process that involves balancing competing influences and demands. It includes:

- maintaining a strategic direction of policy development and implementation;
- articulating the case for health in national development;
- regulating the behavior of a wide range of actors - from health care financiers to health care providers; and
- establishing transparent and effective accountability mechanisms.

2.1.2. Situation analysis of the existing health sector in Africa

In any community, people require access to health care facilities and treatment. Regardless of the nature of the health issue, the health outcomes depend to a large degree on individuals' ability to access health care services. Unfortunately, in many of AU Members States, health services are often planned without consulting the community members who use and pay for such services, particularly in rural areas whereas health services and facilities, drug supplies as well as financial resources are limited. Hence, the goal of this section is to evaluate the challenges of the fundamental health sector and the health care system capacity of the population in terms of expertise, efficiency, resources, finances, information technology and emergency preparedness in Africa. The analysis will further be carried out through the SWOT (Strength, Weakness, Opportunity and Threat) concept to addresses the healthcare and emergency preparedness.

a. Strength in the existing health systems

For more than a decade, calls have been made for investment in AU Member States to ensure stable schemes are built to optimize health interventions based upon evidence through health service delivery. In an effort to address the health problems and requirements of communities, particularly those who live in Africa, health policymakers, health workers and professionals have introduced global and national initiatives despite the slow progress. Proprammes and commitment in responding to different health target such as Primary Health Care system (PHC) approach, which focusses on a central role of mutual responsibility and Community involvement in the delivery of health services, was lunched by WHO in 1978 through the Alma-Ata declaration [15]; the access to essential drugs and health care services lunched by UNICEF and WHO in 1987 through the Bamako Initiative [16]; increase the life expectancy at birth in years; decrease the mortality rate per 1000 population and other disease (HIV/AIDS, TB, Malaria and Non-Communicable Diseases) withthe 2000 Abuja Declaration on Roll Back Malaria and 2001 Abuja Declaration on HIV/AIDS, Tuberculosis and Other Related Infectious Diseases; the Universal Health Coverage monitoring framework developed by the World Health Organization (WHO) and the World Bank (WB), covers promotion, prevention, treatment, rehabilitation, and palliation services for maternal, neonatal and nutritional diseases[17]. During the period 2010–2015, the average life expectancy at birth in the African Region (both sexes) increased driven by declines in adult and child mortality rate (fig 3, 4 & 5).

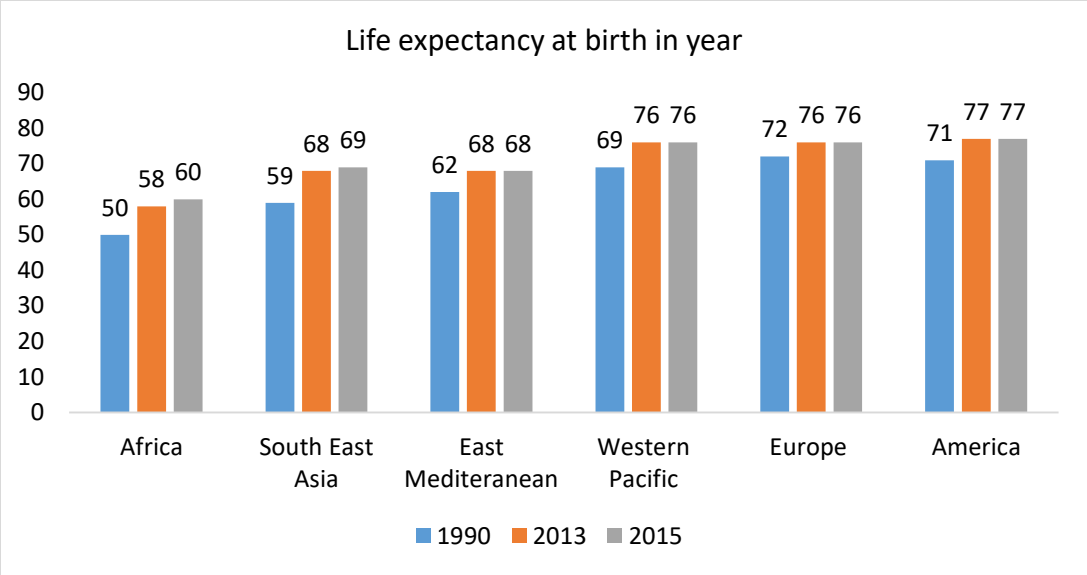


Figure 3: Life expectancy at birth in year by WHO region [18]

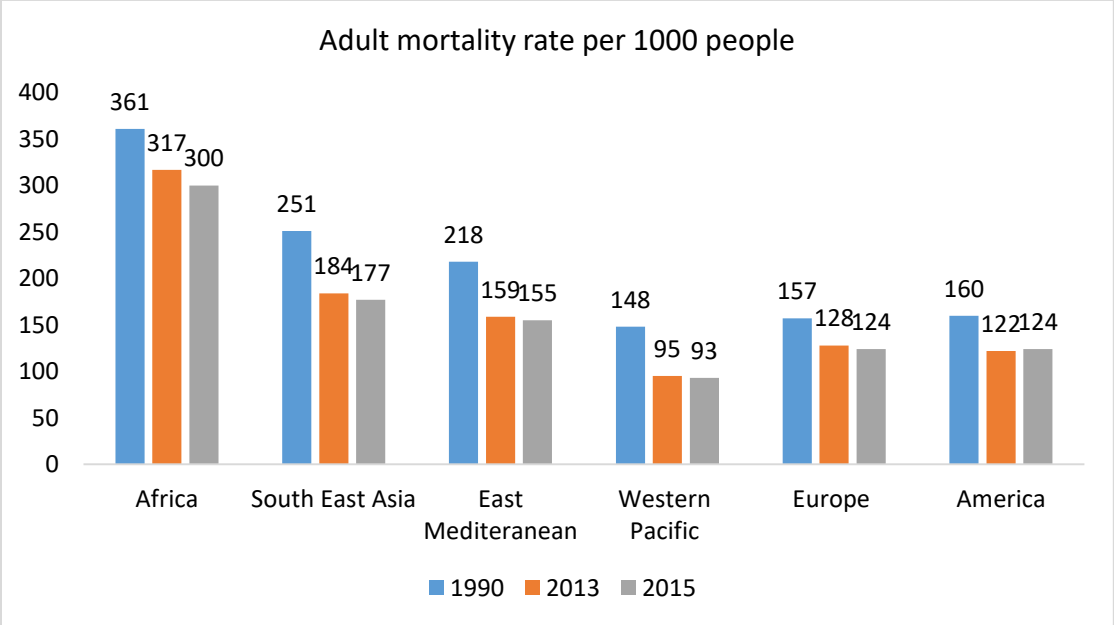


Figure 4: Adult mortality rate by WHO region [18]

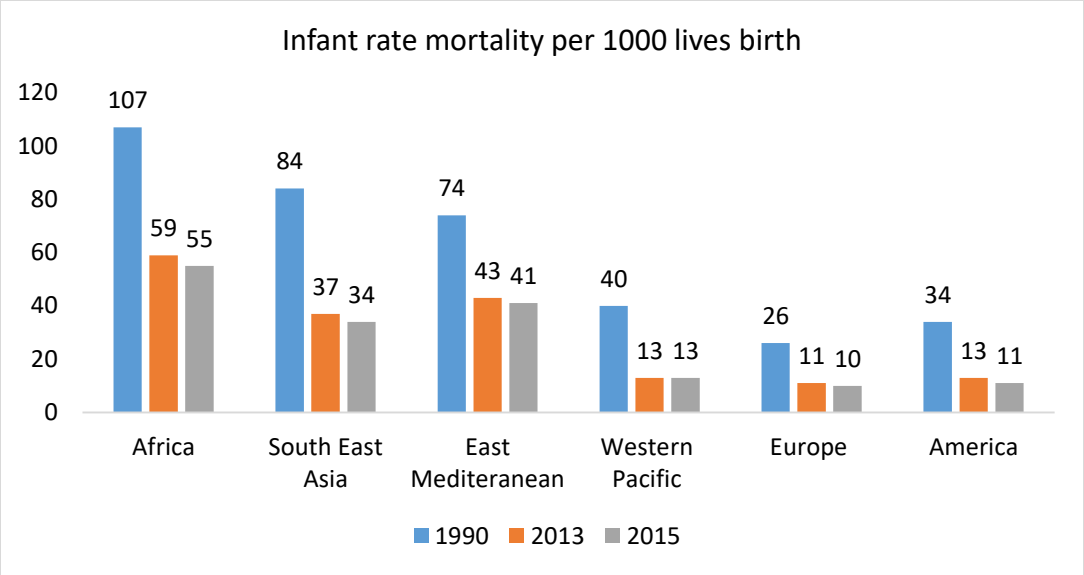


Figure 5: Infant rate mortality by WHO region [18]

The average life expectancy at birth in African is significantly lower than in other WHO regions: people in the East Mediterranean and South-East Asia live at least nine years longer, while those in the Americas, Europe and the West Pacific live at least 17 years longer than those in the African region. The adult mortality rate per 1000 people in Africa has from 59 to 55 in 2013 to 2015 this in turn has reflected due the renewed policies and commitment of the Member States. Nevertheless, this demonstrate a strong commitment of African leaders to achieve the health target

b. Weakness and Threat in the existing health sector

Africa health sector faces multifaceted challenges ranging from lack of fund and weak income for health professional; factors considered to be determinants of health like poverty; lack of safe water and sanitation; exodus of human resources, (health technologists, physician, nurses and midwife); outdated health infrastructure among others.

Health financing and funding

The total expenditure on health of the AU 55 Member States is less than 1% of the global health expenditure, considering that the continent carries 25% of the world's disease burden and has 15% of the world's population. In other words, most African countries spending less than US$10 per person per year on healthcare when at least US$27 is needed [19]. A total expenditure on public and private health is defined as the sum of the expenditure and encompasses both prevention and curative services and health services for the whole population. The recent global

health spending statistics indicates the rapid growth pattern observed in previous studies [19, 20]. The global health spending increased by 3.9% per year between 2000 and 2017. For African Members States, the rise in health spending was even higher, where it increased 7.8% and 6.4% a year in low and lower middle income countries respectively between 2000 and 2017 (figure 6).

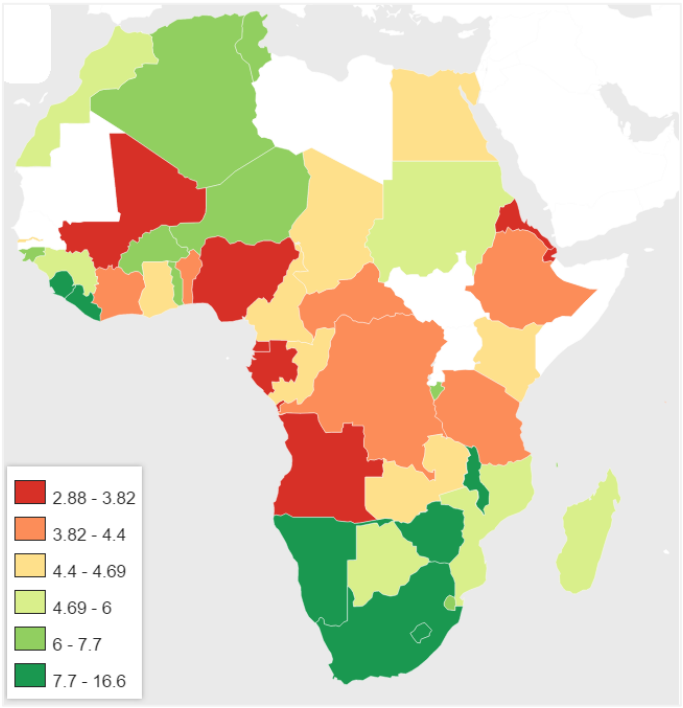


Figure 6: Fast Health spending in low middle income countries [20]

Despite the significant health spending growth across African Member States, health spending was estimated less than US$50 a person in 2017, compared with an estimate of US$2,937 per person in high income countries see figure 8. A difference of more than 70 times [20]. This discrepancy in spending is associated with differences in wealth. Hence, it is not questionable that healthcare financing in Africa remains abysmally low and a patchwork of meagre public spending and reliance on partners' fund. In some instances, health expenditure is based on out of pocket expenses or user fees which constitute great burden on the poorest members of the society.

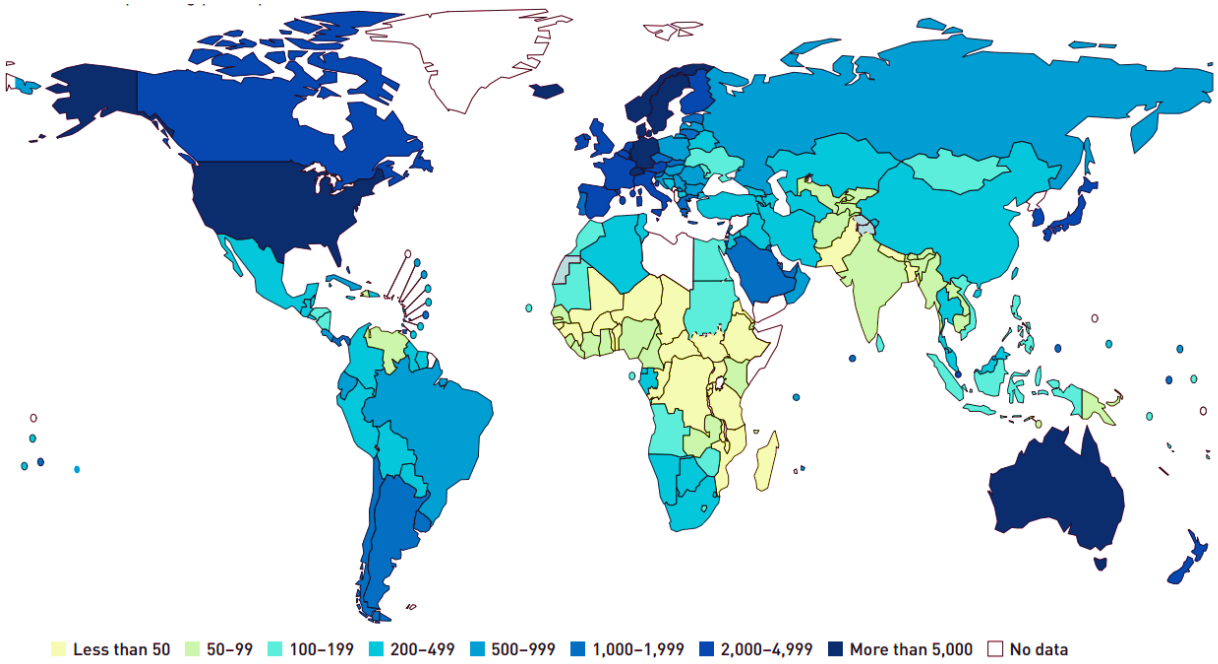


Figure 7: Healthcare spending per capita (US$) 2017 [20]

Low domestic financial resource capacity, slow economic growth in the continent, small taxable formal sector, lack of or inefficient social protection systems, health insurance coverage, among others, constrain African governments from significantly increasing the level of resources allocated to health and among the ones that are allocated, significant proportions go to salaries. In the most recent year, health government spending share from low middle income countries was estimated at 44% in 2017 with an out-of-pocket share of 40% which is low compared to upper income countries and higher income countries where government spending share stood at 69% see figure 9[20].

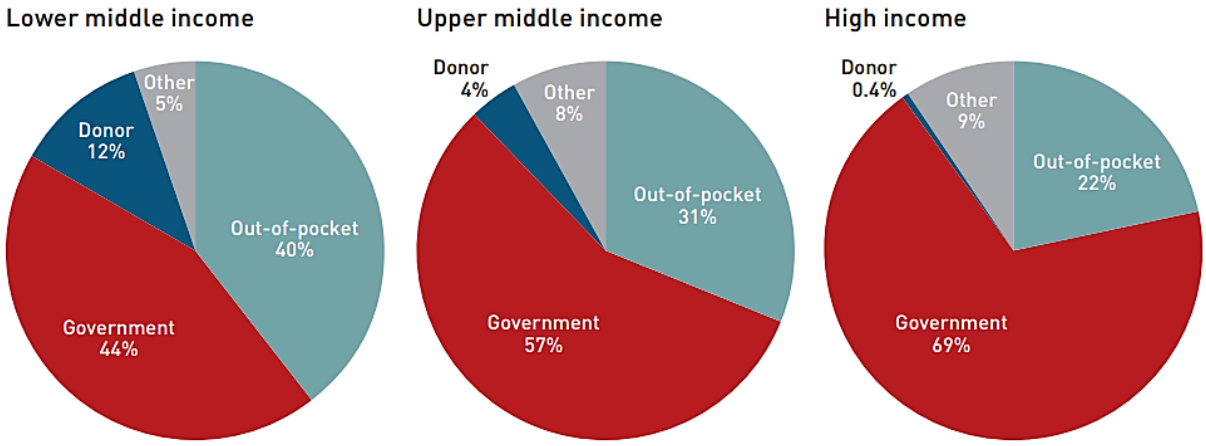


Figure 8: Source of health funding [20]

Health costs, direct or indirect, are different from one country to another. In low and lower middle-income countries, government funding for primary care (maternity and childcare, family planning and facilities, immunization programmes, physicians, midwives, public health nursing officers etc.) is limited. The median share of government spending on primary health is 45% of upper middle income countries compared with the lower middle income countries, where the share is less than 34% [20] see figure 10.. In addition, there has been a lower level of interest funding in medicine. Countries like the upper middle income countries, governments spend 80% on their prevention health and 60% of outpatient services on average compared to medical goods see figure 11.

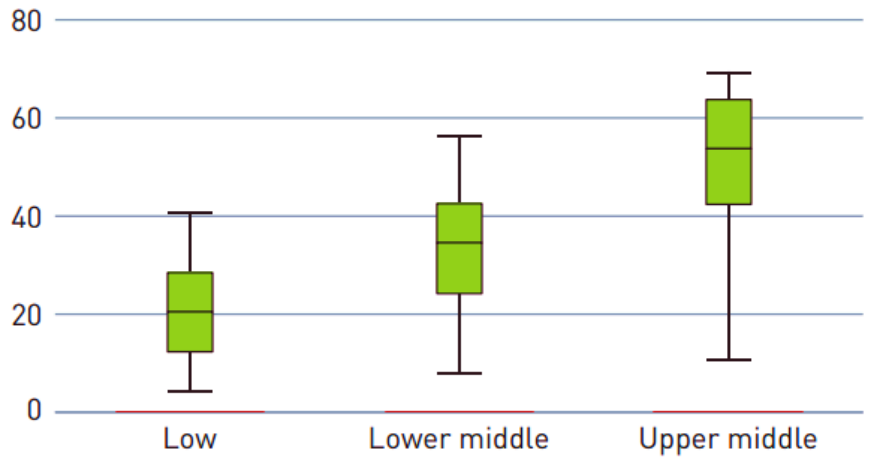


Figure 9: Proportion of primary health care funded by government [20]

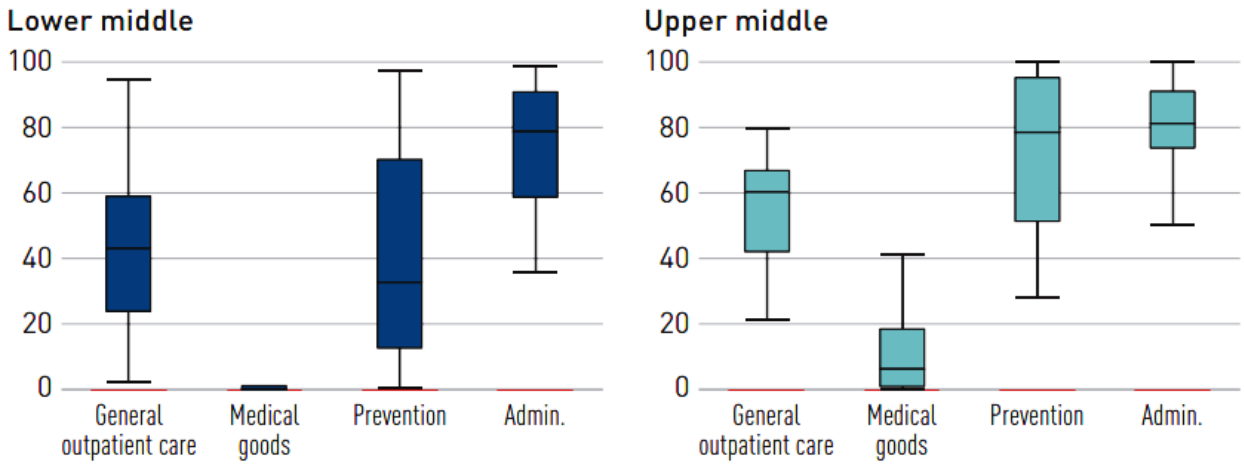


Figure 10: Healthcare categories funded by government [20]

In addition, value for money and returns on investments are not routinely considered when selecting priority interventions which has further underpinned Africa's health financing. This creates a situation whereby the Ministries of health in Africa spend a lot of time attending workshops and responding to donor inquiries and concerns, and less time providing the needed service to the households [19]. Further, the poor allocation of funds has made clinical research to suffer from inconsistency funding and made research funds to be misplaced and spent on administrative issues such as recruitment of more support staffs than the actual researchers who can do the intended research work. Other than the neglecting of African scientist's research work, the poor fund allocation is also a negative factor pushing African researchers to prefer working outside the continent, thereby causing a shortfall in technical/professional competence in Africa.

Hence, this shows that Sub-Saharan Africa still faces a grim scenario with respect to the health of its people. The only encouraging and comforting side is that for the first time in the last three decades, the continent started recording sustained economic growth of between 5 to 6 percent per annum [20, 21] that will hopefully spur growth further and health expenditures will eventually be increased.

Pervasive Poverty

Poverty is classified as living on $1.90 or less a day [22]. Poverty is a multidimensional concept while the central aspect of it is income deprivation that restricts an individual's ability to consume certain basic services such as lack of access to health. Pervasive poverty is never

considered a disease medically but it is a well-accepted social indicator of health. Africa has the slowest rate of reduction of poverty in the world, particularly in fragile countries and rural areas. Hence, poverty exerts much pressure on the health and well-being of Africans

According to Africa Progress Report 2015, stated that despite some gains over the past decade, Africa has the world's highest incidence of poverty -47% and by some distance, the greatest depth of poverty. The report also cited the International Fund for Agriculture (IFAD) which stated that 60% of rural Africans lives on less than US$ 1.25 a day and 90% on less than US$2 a day [23]. Seventy-five percent (75%) of the world's poorest countries are located in Africa, including Zimbabwe, Liberia and Ethiopia. The Central African Republic ranked the poorest in the world with a GDP per capita of $656 in 2016 [24].

Poverty limits access to social services and increase vulnerability to ill-health, which in turn affect productivity, especially in highly labour-intensive economies. The poor are the most exposed to the risks of hazardous environments, and the least informed about threats to their health.

The poverty and poor health nexus worldwide are well known and intrinsically interwoven, and based on this, it was considered as a grave challenge to health care in Africa where vast majority are poor. The causes of poor health for millions of Africans are directly or indirectly rooted in politics, social and economic injustices.

The intrinsic linkage between poverty and poor health outcome is explained [25] as follows:

- Poverty increases your chance of getting ill because of:
    - Poor nutrition
    - Overcrowding
    - Lack of clean water
    - Harsh realities that may make putting your health at risk the only way to survive or keep your family safe.
- Poor health increases poverty by:
    - Reducing a family's work productivity
    - Leading families to sell assets to cover the costs of treatment. This increases poverty and their vulnerability to shocks/emergencies in the future.

Most governments and public bodies (including international organizations) claim that they do a lot, including the vulnerable, for citizens. The most critical question is how much? From the point of view of social protection priorities, a crucial question is who benefits most from public expenditures? Because of high health out-of-pocket spending, millions of African people fall into poverty. In Africa, financial security usually is poor and most of the patients pay their own household income for health care, known as out-of-pocket. Patients in low-and low-income countries are less safe from high out-of-pocket than in countries with high middle-income. In almost all countries, out of-package payments have risen from 15 US dollars per capita in 1995 to 38 US dollars per capita in 2014 on the regional average [26]. As a result, every year 11 million Africans are poor because of high out-of-pocket payments [27]. Thus, defending people against the impoverishing impact of health payments is a pillar of UHC and will help prevent poverty in Africa.

Lack of safe water and sanitation

Africa's rising population is driving demand for the availability of water resources and hygiene sanitation. The use of contaminated drinking water and poor sanitary conditions results in increased vulnerability to water-borne diseases, including Hepatitis A, diarrhea, cholera, dysentery, and typhoid and other infectious diseases. When people do not have access to basic hygiene sanitation (water, soap, paper towel), they opt to defecate in the open area, and exposed human waste is transferred back into people's food and water resources. West and Central Africa has been reported by UNICEF with an increasing number of people who practice open defecation, one of the most unsanitary hygiene practices where people use bush, stream, local river/sea or outside area as a toilet. From 2015 to 2017, almost 45% of African population were estimated to use at least basic drinking water services in rural area compare to another region of the world, see Figure **7**. This subsequently leave half of African population depends mostly or entirely on surfaces water sources such as the rivers, lakes or wetlands in continents which is often highly polluted and not considered as reliable and safe source of drinking water. In 2017, one third of Africa's population was estimated with access of basic handwashing facilities including soap and water in urban area. Hence the above situation appeals the emergence action from Africa's leader in the improvement of health sanitation in the continent.

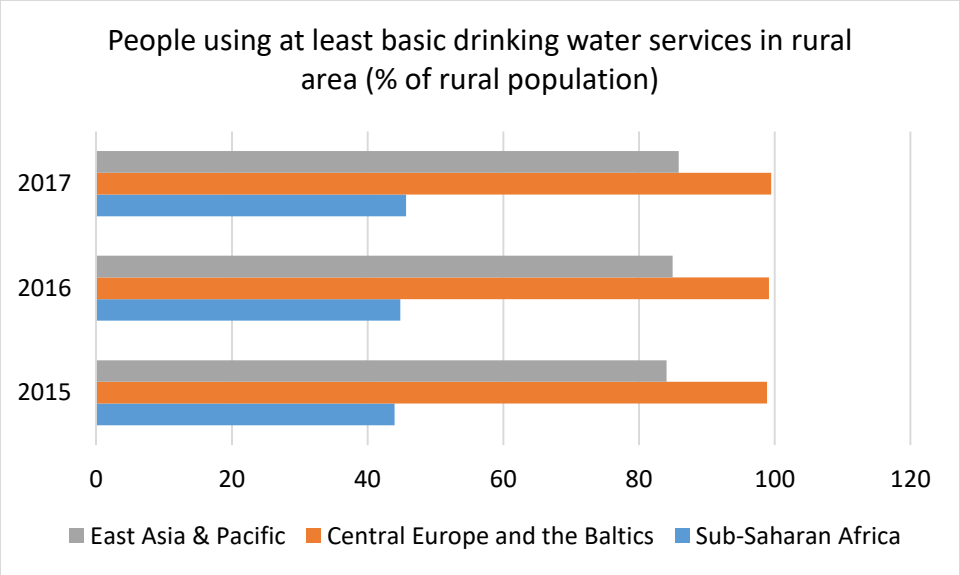


Figure 11: Proportion of people using at least basic drinking water services in rural area [28]

Exodus of human resources (health technologists, physician, nurses and midwife)

The exodus of human resources with critical skills has adverse impact on the productivity of various sectors particularly in the health sector. The over loss of scientific and medical expert, as well health workers means that the African countries will be challenged to develop their own technology and products (medical devices, equipment, application, drugs, foods) to provide better quality of service and meet the national demand.

In Ghana 60 percent of the doctors trained in the 1980s were estimated to have left Ghana, with 200 in 2002 alone. In 2003, UK work licenses for 5,880 South African medical and health care staff, 2,825 Zimbabwean medical staff, 1,510 Nigerians and 850 Ghanaian were authorized [29]. Hence Africa lacks skilled health professionals, and in some countries this shortage is quite severe. A fragile country like Togo, Niger, Chad, RDC have less than 1 physician and 1 nurses per 1000 people in the latest data. This is well below the levels health worker's capacity recommended by the WHO (3.4 skilled health workers per 1000 people) [30]. Only Algeria, Botswana, Egypt, Mauritius and Tunisia were estimated with more than 2 nurses/midwives and physician per 1000 people (figs. 7 & 8). Therefore, in the event of highs of tainted epidemic, hospitals may be threatened.

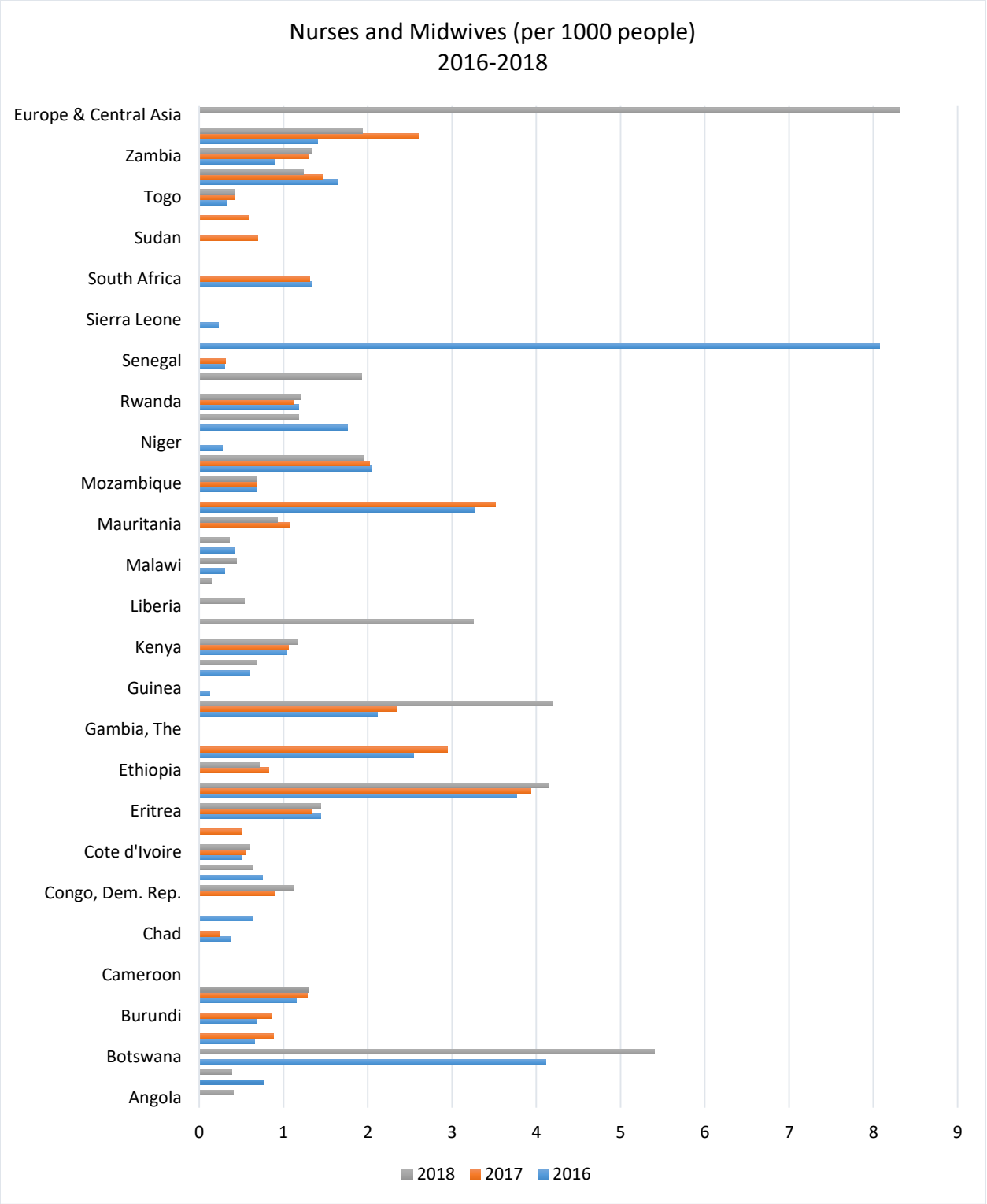


Figure 12: Capacity of Nurses and Midwives across Members States [28]

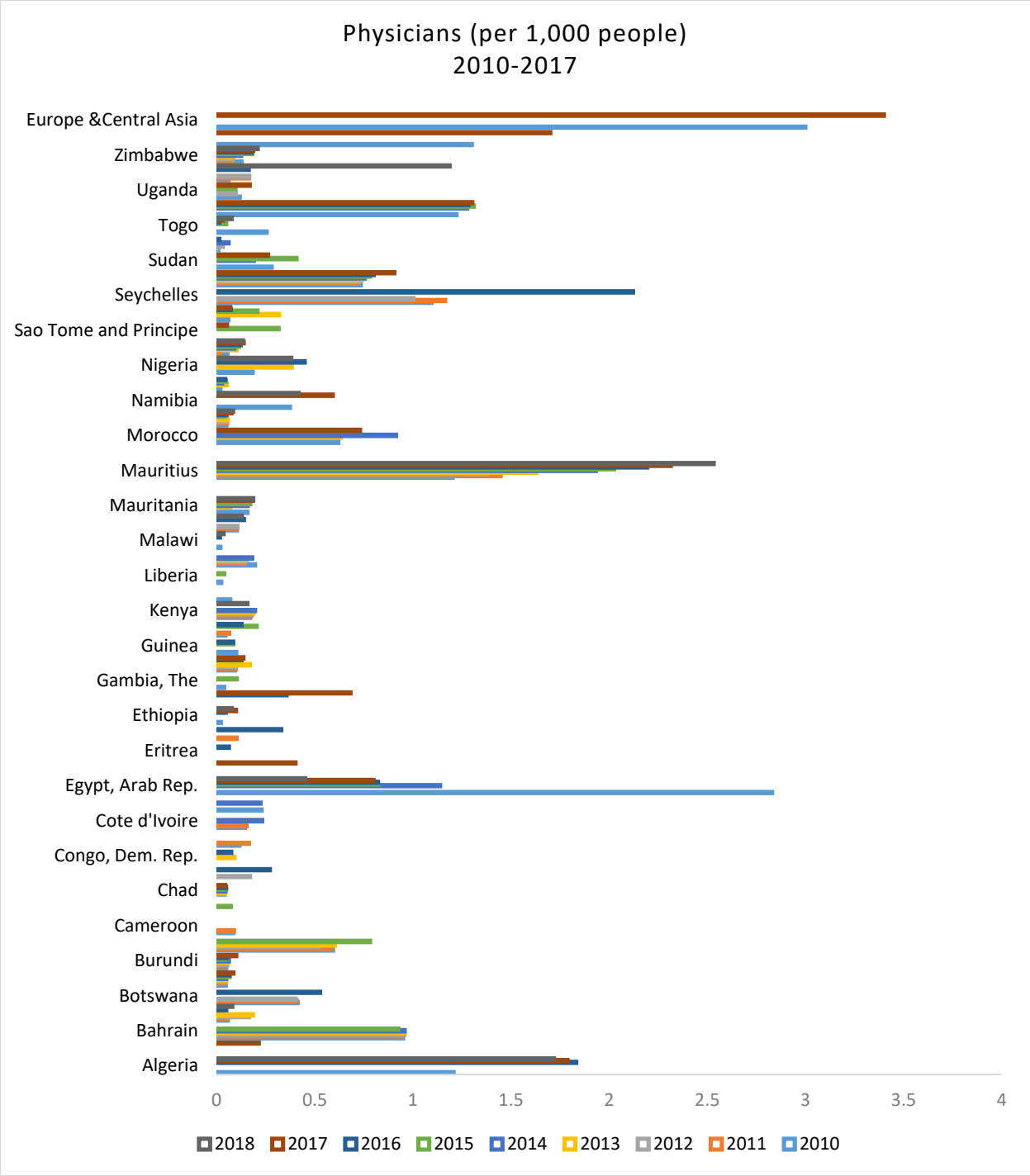


Figure 13: Capacity of Physicians across Members States [28]

Health infrastructure

Infrastructure is the foundation for planning, delivering, evaluating, and improving public health. It offers populations, states and nation the capacity for disease prevention (primary prevention) which aims to avoid the development of a disease or disability in healthy individuals; the capacity for health-enhancement, as well as planning and responding to acute and on-going chronic health challenges (secondary and tertiary prevention).

Strong health services depend on the presence of basic infrastructure and preventive intervention. rangeing from medical centers, medical services, immunization, medical equipment and drug delivery to medical insurance, sanitation, xrehabilitation, energy, roads, rails, information and telecommunication among others. Although there are barriers to access to healthcare in Africa, the quality of such facilities is generally poor. Equitable, affordable access to high-quality, reliable health services in the country has yet to be achieved. Addressing these gaps in the poor, rural and women would be critical to improved health outcomes.

Some have argued that Africa inherited the colonial health infrastructure which may not necessarily fit to our context, hence, making the populace difficult to access healthcare services. Others have argued that Africa's economy has been low for long and public spending capabilities in infrastructure grows with economic growth, hence, it may not be easy to build health infrastructure. There were many declarations and targets set by highest Decision-Making Bodies in the continent. For example, alongside the Abuja Declaration, Member States have also signed the Maputo Declaration stating that 10% of government expenditure should be for agricultural development while on the other hand, the Education for All Initiative saying that 20% should be for education. There are also agreements on spending targets relative to GDP for social protection (4.5%); water and sanitation (1.5%); 1% of GDP allocation to science and technology; and infrastructure (9.6%) as well as 15% target to galvanizes all AU Member States to a common target of Domestic Financing for Health [31, 32].

However, only a negligible percentage of Member States met these targets which involve expenditure on infrastructure. In the Member States where such infrastructure exists, they are inadequately distributed in the country. For example, 84% of Africa's urban population has access to improved drinking water sources, compared to just 48% of rural residents. The same applies to sanitation: 47% of urban residents have access to improved sanitation facilities,

compared to 26% of rural residents [33]. Moreover, less than 50% of Africa's population have access to healthcare services [34].

There are a lot of medical devices, equipment and facilities that are obsolete in the developed countries but still being used in Africa. In addition, equipment maintenance and spare parts procurement pose a greater challenge in Africa. It takes nothing less than a month or two to procure equipment overseas and import to Africa, from shipment to custom clearance and delivery to the required hospitals or clinics. To date, there are few Member States that have BSL 4/and or BSL 3 laboratories for testing and analysing high pathogenesis agents (Ebola virus, COVID 19) and the Member States that do not have any reliance on foreign laboratories as seen in the case of Ebola epidemic in West Africa. The lack of required health infrastructure contributes to poor health outcomes. For example, there is anecdotal evidence that due to the distribution difficulties caused by insufficient infrastructure in some countries, a percentage of donated drugs expire on shelves in government central medical stores without ever reaching the areas of greatest need in rural clinics and hospitals [35].

In point of view of access to medical services the lack of hospital beds, intensive care unit beds, doctors, nurses/midwife and physician is quite severe in some African countries. Although the amount of hospital beds per 1,000 people varies considerably across the world, there are less than one hospital bed per 1000 people in more than 20 of 55 African countries (including Ethiopia, Ghana, Senegal, Nigeria and Tanzania). On average, more than 2 to 5 hospital beds per 1,000 populations have been reported in Southern African countries, such as Namibia, and South Africa see Figure 9**.**

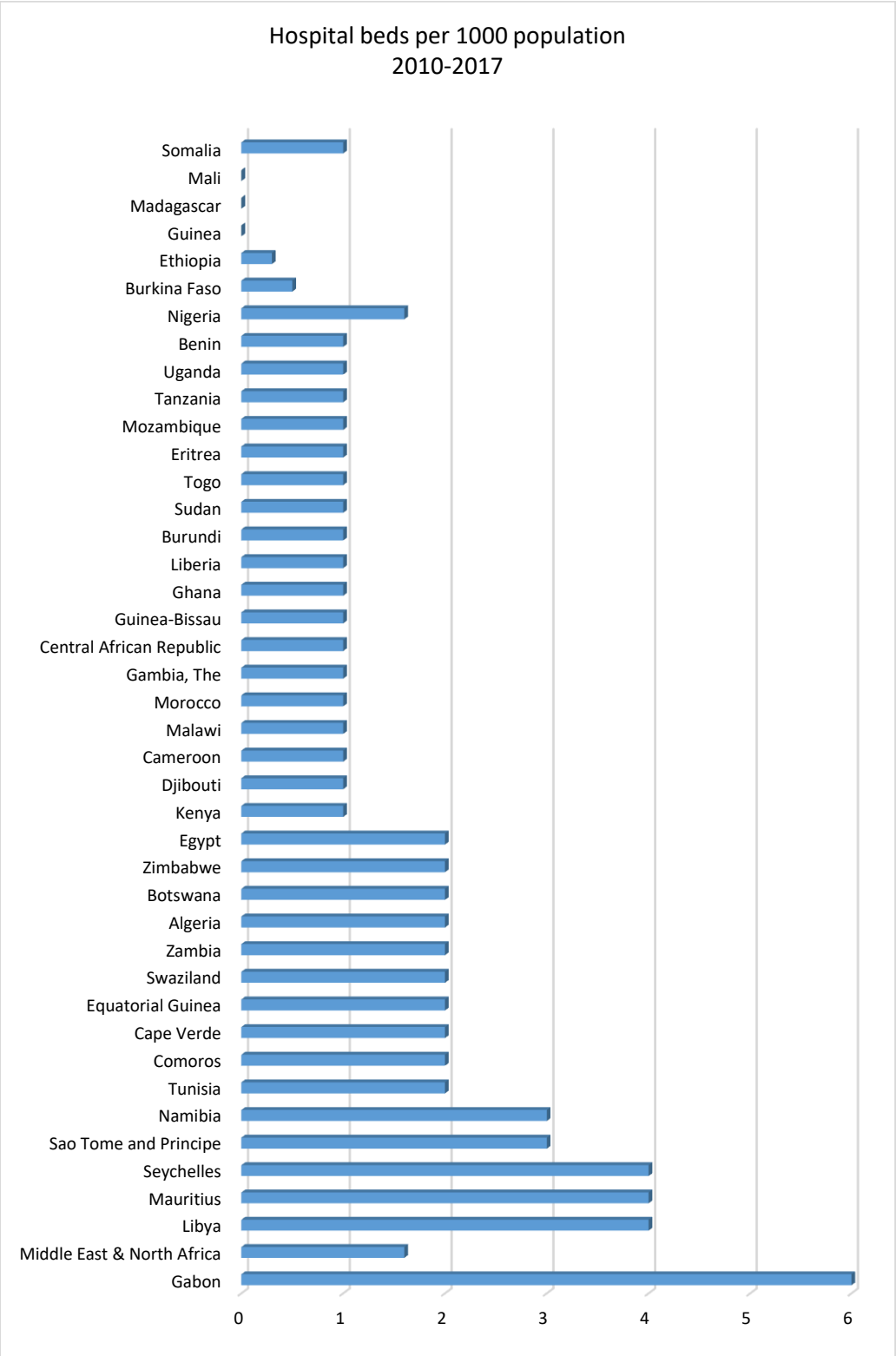


Figure 14: Capacity of Hospital beds across Members States [28]

Information technology, e-health system infrastructure has revolutionized the health sector but challenges in low bandwidth, less connectivity, and dearth of internet-exchange point in Africa is a serious draw-back. Africa has witnessed benefits of mobile phone technology but communication infrastructure is still limited. As mobile devices become increasingly common, they have become an unexpected resource in delivering better healthcare. This is further strengthened by the fact that Africa has not yet built two-thirds of the infrastructure that will be in operation by 2030 [23]. Despite the importance of e-health in overcoming the triple challenges of inadequate access, finance, and human resources in delivering high-quality healthcare services to Africans including remote areas, it also contributes to greater transparency and accountability in health services, by promoting evidence-based practice and error reduction, diagnostic accuracy and treatment but this indispensable and critical area of health infrastructure is grossly inadequate in the continent.

Nevertheless, Africa is also experiencing the emergence of private hospitals, clinics, laboratories and diagnostic outlets that has contributed to infrastructural development but it is argued that most private sector health services are out of the reach of the common man, that is, too expensive to afford. Another infrastructural challenge in Africa presently, is that health research systems are treated as a separate entity from health systems and its multi-disciplinary and multi-sectorial nature is not emphasized [36].

c. Opportunities in the existing health sector

Africa's commitment with its Diaspora and Institution brings lot of benefit to the continent but the brain drain and lack of community health workers (doctors, nurses and midwife) in most African countries are most likely to be insufficient to sustain healthcare services and facilities needed in the continent. The African ecosystem, natural therapeutic resources, indigenous knowledge as well as a highly experience manpower are the most determinant sources of opportunity that affects the competitiveness of African countries at global level. These opportunities are key player in the development/improvement of new and existing technology and can be used to provide better quality of services and national need. To boost the health sector and compete in the current competitive globalized world, African countries need to invest and encourage their highly qualified people to undertake research project, innovate, formulate and implement policies for life-long sustainability and economic growth.

2.1.3. Quality of healthcare as fundamental feature of Universal health coverage, SDGs , the Agenda 2063, the STISA-2024 and development sectors

The African continent began the implementation of its 50-year development plan by domesticating and implementing Agenda 2063, achieving an overall score of 32 percent on its first 10 years implementation plan. Nonetheless at aspiration level, Aspiration 1 "Prosperous Africa based on inclusive growth and sustainable development" which anchors 7 goals (including healthy and well-nourished citizen target) has achieved a weak performance, with a total of 29 percent regardless the effort made by African Member States [37]. One of the challenges that resulted in weakness performance was the quality of care. Quality of care is the foundation to universal health coverage, Sustainable Development Goal 3 “Ensuring well-being for everyone”, the Agenda 2063 and STISA-2024 with its priority on Prevent and Control Diseases and ensure Well-being. Almost all of the other 16 SDGs such as SDG 1 “End poverty in all its forms everywhere”; SDG 2 “End hunger, achieve food security and improved nutrition and promote sustainable agriculture”; SDG 6 “ Ensure availability and sustainable management of water and sanitation for all” and SDG 9 “Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation” among other are related to health and their achievement will contribute to enhance quality of health indirectly. If the quality of care has not been guaranteed, access to care cannot be expanded. Access to healthcare without quality can be seen as a hollow blanket pledge for healthcare. Beyond the effects on people’s lives, poor-quality care wastes time and money. The below figure seek to show a conceptual framework of the linkage between quality of healthcare, development sectors, UHC, SDG, Agenda 2063 and the STISA 2024.

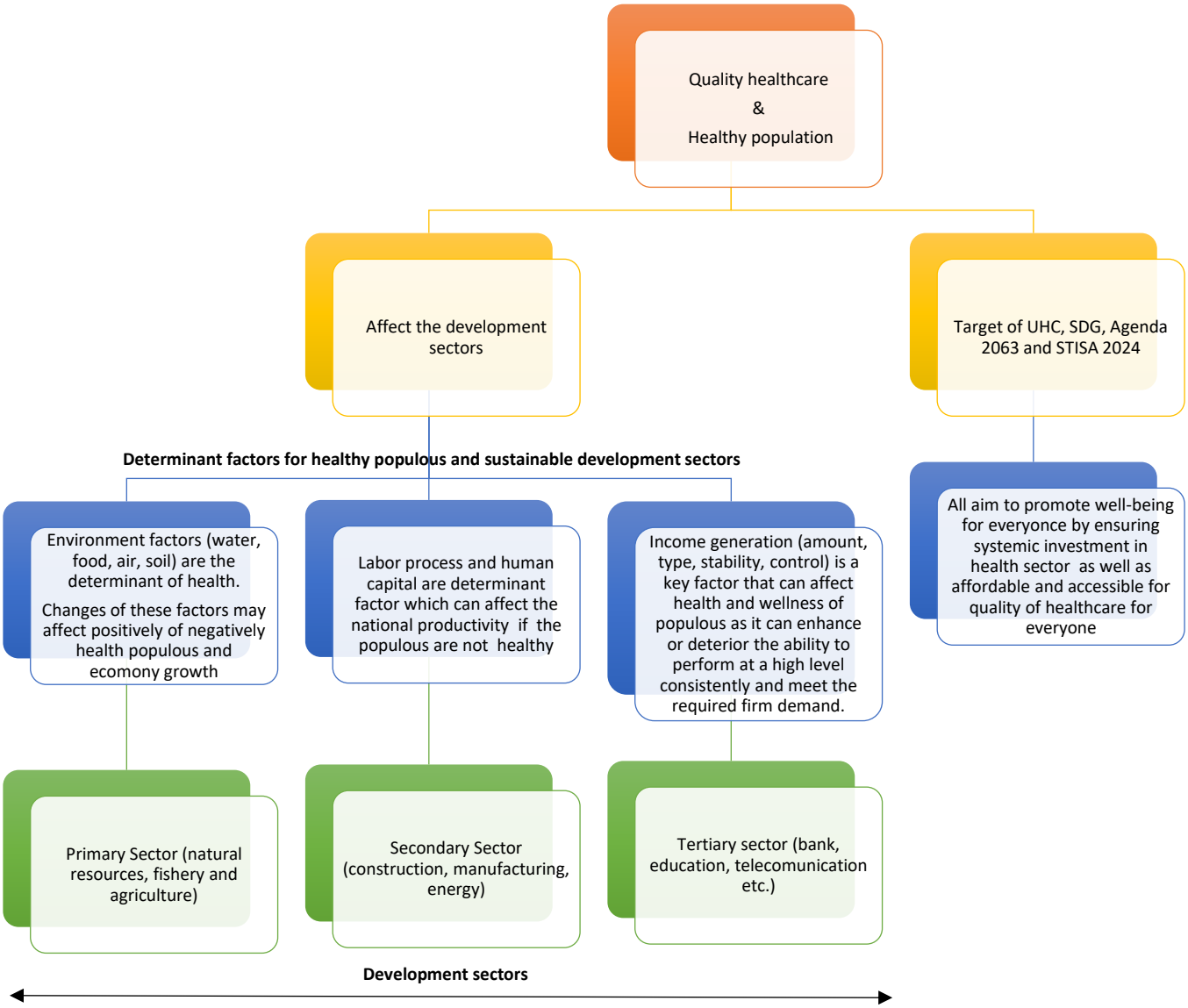


Figure 15: Conceptual framework of the linkage between quality of healthcare, development sectors, UHC, SDG, Agenda 2063 and the STISA 2024

The bottom (quality of health & health populous) is one of the pillar concerns of the UHC, SDG, the Agenda 2063 and the STISA 2024. Quality health is a one of the common goals embraced by the UHC, SDG, Agenda 2063 and STISA 2024 to reduce diseases burden in Africa and achieve the common health target by "ensuring well-being for everyone". At the continental level, in 2013, the African Union adopted the Agenda 2063 which is a 50-year vision of the aspirations of

the idea of the "Africa We Want" in 2063. The first Ten Year Implementation Plan of the Agenda 2063 which includes STISA 2024 flagship was developed on the bases at promoting science, technology and innovation, as well as the application of STI in the economic development activities of the continent. In 2014, the African Union adopted the Science, Technology and Innovation Strategy for Africa, 2014-2024 (STISA 2024), which has laid out pre-requisites, pillars, priority areas (including Prevention and control disease and ensure well-being) and investments that are required in order to meet the necessary development. At the global sense, the SDG adopted in 2015 with its 17 goals have STI programmes embedded in each of them. Similarly, the UHC is recognized as a fundamental key to achieve the SDGs particularly SDG 3 "better health and well-being for all" by promoting global public health security. The UHC was incorporated into its national health policies for most African countries. However, progress has been slow to incorporate these commitments into expanded domestic health infrastructure, productive aid for development and eventually equal and quality health services, and improved financial security. One of the country with successful UHC policy is Rwanda. The national government and individuals support the health insurance scheme through the provision of insurance and service charges. Members pay at a flat rates an annual premiums depending on their economic situation regardless of the individual health risks and can then be used in community health centres, for discounted treatments. The implementation of this scheme lifted awaiting mothers in health facilities from 50% in 2010 to 90% in 2015 [38]. Now, 80 percent of Rwandans receive health care from some type of health facility with a skilled health professional.

Development sectors (primary sector, secondary sector and tertiary sector) and quality heath interact through different path such us environmental, labors process and human capital as well as income generation.

Therefore, quality of healthcare is both a question of long and better lives, and an economic necessity. The African pharmaceutical industry and manufacturers, as we know, are not yet well-developed to provide the quality of health services necessary to meet the health requirements of our communities. Hence the African Member States should focus on priorities for investment, regulatory harmonization, development of a sustainable environment to enable local manufacturing to improve and sustain the African developmental sector, industries and health

services. Moreover, speeding-up the implementation of comprehensive policies and strengthened health systems is essential in order to protect poor and vulnerable peoples. It is evident that quality care cannot be conjured up entirely for free, it requires some capital investment and other resources. If applied intelligently, investment in quality would provide better individual and population health, and value for money; the return on investment in ensuring high-quality care is likely to far outweigh the costs.

2.2. Health Research

The term "health research" also called "medical research" or "clinical research," refers to a wide range of scientific investigations that are conducted to test more hypothesis and answering questions about the human being, animal as well as environmental health. Health research also aims to find better ways to prevent and treat disease. It is an important way to help improve the care and treatment of people worldwide [39, 40].

2.2.1. Type of health research

Depending on the scientific investigation in the health area, there are three main types of health research: population research, laboratory research, and clinical research. Population research is the type of health research that consists of identifying how and why a disease occur (i.e. risk factor quality of life issue and etc.) [27]. Laboratory research consists of investigating a problem, developing hypothesis and possible solution, then testing it for effectiveness and safety using testing tube or animal assay. While clinical research is the type of research that studies diagnostic kit, medical device, new tests and treatments and evaluates their effects on human health outcomes [41].

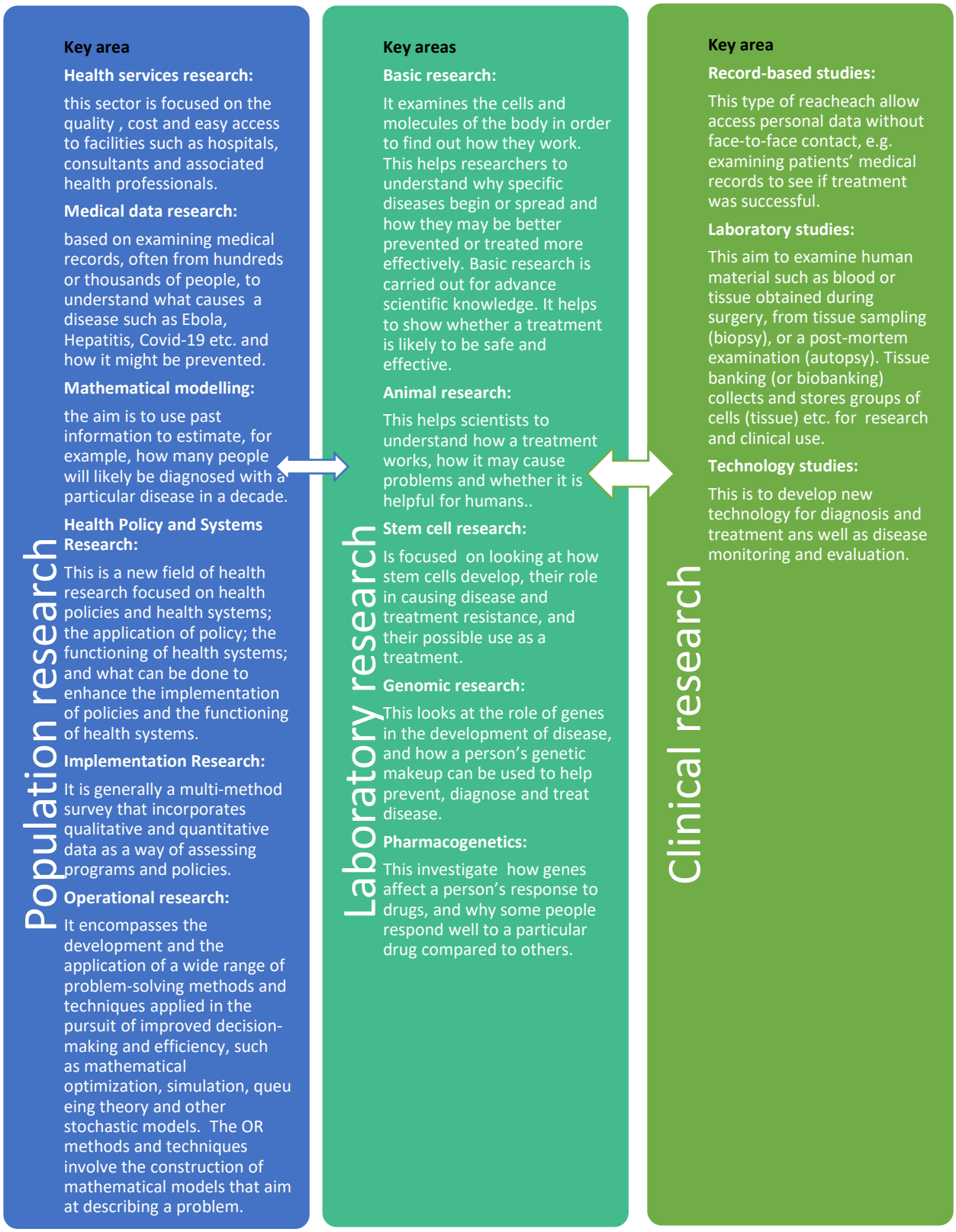


Figure 16: Types of health research

2.2.2. Health research system

Health research is important to inform policy and decision maker health system. In order to conduct a research in health or related field, a scientific approach is essential for critical evaluation in term of practices. In general, good research should be feasible (having objectives, available subject of study, required equipment, research facilities and expertise), interesting, novel and relevant by influencing clinical management, health policy or guide further research but also advance scientific knowledge. Ethics in health research is important to be considered when research involve human subject. However, the translation of research cannot stand without a health research system for the better outcomes. Hamdy et al. 2019 [8] highlighted the needs that Africa have to put in place to ensure the existences of comprehensive health research system in Africa. The system is based on the following pillars: Improved Protocols on Clinical Research; Increased Fund Allocation to Clinical Research; Boost Technical and Professional Competencies; Enhance Public Interest in Clinical Research; Increase Dissemination of Research Output and Impact; Increase Research Infrastructure; and Promote Advocacy programs for Clinical Research and Research Translation. Each pillar identified is interlinked with the other and aim at achieving a comprehensive system for health research translation in Africa.

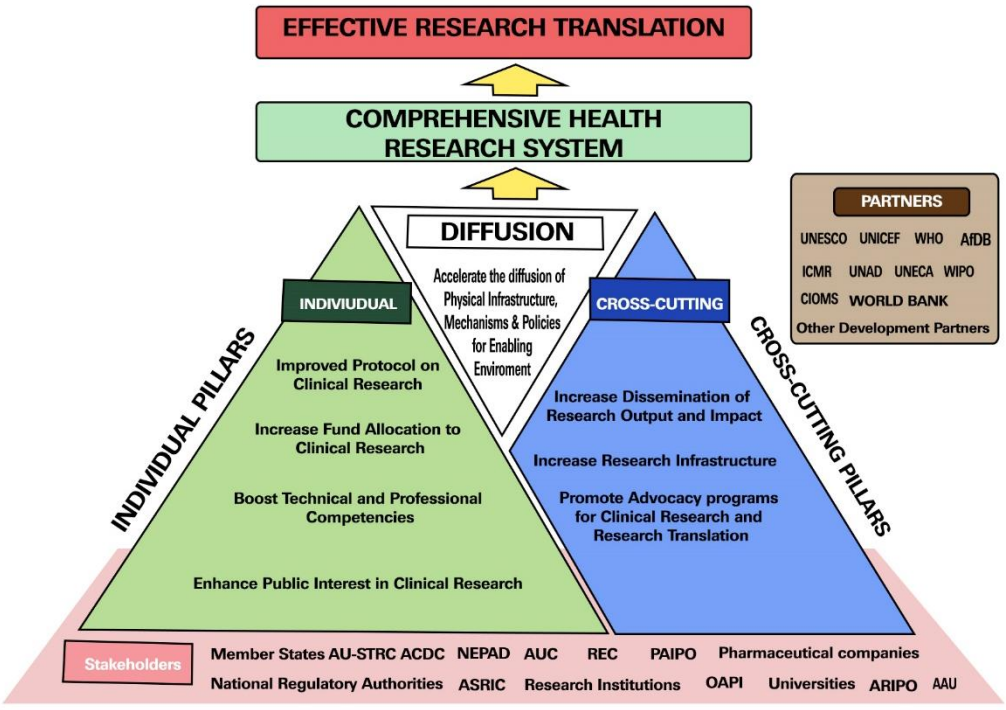


Figure 17: Components (pillars) of a comprehensive health research system

2.2.3. Inventory on Health Research

In this section, a situational analysis of the health research challenges; and research output and opportunities for progress.

2.2.3.1. Health research challenges

While Africa has achieved significant progress in responding to the three diseases (Malaria, HIV and TB) in the last 15 years, health researches commitment concerning further public health concern (communicable and Non-Communicable Diseases) needs to remain a key priority. As far as the African science background is concerned, enhancement of the standard of research in a number of African countries is a core goal of science, technology, and innovation (STI) policies. African work results, as elsewhere in the world, are required to meet appropriate quality standards of research (convinceful, knowledgeable, valid, comprehensive, and applicable). Nevertheless, the scarcity of research funding and the socio-economic problems of the continent present significant obstacles to the achievement of such an ambition. An inventory was conducted by (AU-STRC) in 2019, the inventory was developed considering two main approaches: Face to Face consultation with relevant scientists “discipline of health and health research”; and by conducting a wider consultation with the Ethics Committees of AU Member States; members of the African network of Drugs and Diagnostics Innovation (ANDI); independent Scientists from the AU Member States by instituting a questionnaire (e-survey). Among the most challenges encountered in health research, we can cite:

a) Protocols on Clinical Research

The protocols on Clinical research is the core for having a successful health research system, having a vigorous clinical research protocol there is a need to have: Ethic committee; approval guidelines; data handling protocols; strong IP system; and good clinical practices. The study shows that most of the AU member States “the study was conducted in 28 member States” do have ethic committees “23 member Statas” while the ethic approval system quality was not clearly appreciated. On the other hand, 64% of Member States that participated in the survey are confident that existing ethical research guideline is adequate to perform clinical research while 34% either denying or indecisive.

On the data handling protocol there is clear mistrust in the data handling protocols including data recording system in national and private Hospitals. The fact that there is intellectual property system in majority of our member states however the systems need to be improved and to be more effective to protect the research outputs. The study finally shows that African Union Member States have a fairly acceptable clinical practice.

b) Technical and Professional Competencies

The low income, non-administrative and government support of senior mentorship in research are the most factors that have motivated Professors and senior scientists to look for other income opportunities in private Clinics/Hospitals and projects to meet their financial obligation, demands/ expectations failing to gain out of their research works. These factors also affected the interest of senior mentors in research and made them allocate less time to develop their supervisee/mentee's capacity and drive them to focus more on ways of making money which indirectly makes mentorship for Clinical Research week and ineffective. This is also "low income" resulted dramatically to brain drain where 55% of the African researcher in the Health sciences are interesting to work out Africa [8].

Additionally, the shortfall and brain drain in technical and professional competencies as well as the predilection of governments in hiring foreign expertise rather than the neighbor expert to respond to emerging health challenges is execrable. This triggers the deficit of the rights of research protection for African researchers participating in international institutions' research work. This makes the governments neglect the research output made by African researchers which in turn demoralizes and diverts the interest of African Scientists to work outside the continent than in their homeland.

Another cause for gap in the needed competencies is that the curriculum, training modules and capacity building programmes are not really addressing the knowledge gaps needed and that makes the African researchers to be poorly trained on new research methods and equipment.

c) Public Interest /Participate in Clinical Research & Clinical Trials

The fact that the public is not well informed on the potentials of clinical research impacted on the development of Africans' lifestyle results in poor support for research from private sector and industries in the continent as well as minimal investment from public-private partnership, which overall leads to poor funding allocation to clinical research. Also, weak/insufficient communication between stakeholders and the resulting conflicts of interest can also lead to

misinformation of the public. In addition to that, insufficient communication has weakened the participation of stakeholders in clinical research and made health problems to look bigger than they appear.

The weak participation of the stakeholders has resulted in incomplete information on the beneficiary's needs. In the African context, cultural values act as barriers to clinical research alongside the absence of guidelines to protect the individual's participation in clinical trials. As a result, research is carried out on patients with no proper guidelines to protect the patient /individual participation in clinical trials. Because of the above-mentioned communication gap, the public is less interested to participate in clinical research and clinical trials.

d) Dissemination of Research Output and Impact:

To strengthen the basis of evidence of health care as well as to improve the health outcomes, translation of scientific evidence into policy is important. Research output is the fruit that comes out of research and it presents the final product of education/knowledge sharing, data sharing and all the processes that are discussed in this context. However, scientists are lacking the tools and the capacity to present their output to decision/policy makers which impact negatively on the commitment of policy maker to health research. On the other hand; the scientific community itself had a level of mistrust on research output since its motived by personal interest and it address the quantity but not the quality.

e) Research Infrastructure:

It is widely accepted that there is a huge gap between Africa's research/learning institutions (quantity and quality) and those at the rest of the world, this gap is widening when we consider heath research institutions. On the other hand, having adequate laboratory equipment and experiment materials is the backbone for conducting an experiment; building the capacity of a learner, and ultimately to conduct any meaningful research. In this aspect, majority of African Scientist (+85%) had an inadequacy in the laboratory infrastructure and materials necessary for conducting health/clinical research.

f) Fund Allocation to health Research

Most African Union Member States presently have adopted targets to enhance Science, technology and innovation as key to lead to prosperity and achieving the aspiration 1 of the Agenda 2063, the SDG 3, and the African Union's Science Technology and Innovation Strategy

for Africa (STISA-2024). Despite the commitment of the Members States to invest at least 1% of their GDP in R&D and 15% in the health sector to address the sustainability of Africa's health needs, the output has remained far from the expectation. Among the African Member States, the average portion of GDP devoted to R&D activities varied between 0.1 to 0.8% in 2017, on the most recent available year. Furthermore, 12 out of 55 Members States (Algeria, Botswana, Burkina Faso, Egypt, Ethiopia, Kenya, Morocco, Rwanda, South Africa, Tanzania, Tunisia, and Uganda) are meaningful closer to the 1% target while other Member States countries including Burundi, Côte d'Ivoire, Eswatini, Ghana, Cabo Verde and Lesotho invest less than 0.4% of GDP in R&D [20, 42].

On the other hand, this was in alignment with Hamdy, et.al 2019 study showing that governments do not prioritize health research where, 77.5% of scientists in the study claim that "the funds were insufficient or no fund had been allocated to Health/clinical research" [8].

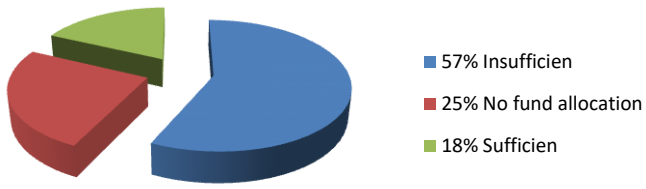


Figure 18: Fund Allocation to Health/Clinical Research [8]

Governments, in contrast with other development sectors, have a lower interest in funding research. As politicians are not willing to justify budgetary cuts in science and scientists are neglected in the process of research budget creation, accountability and corruption in the allocation of funds and opportunities are reduced.

2.2.3.2. Research output and opportunities for progress

African countries are being called upon by Agenda 2063 & STISA (2024) to raise their gross domestic research and development (GERD) expenses to at least 1% of their GDP, respectively. Such investment is important in order to build Africa's technical skills, strengthen research infrastructure, innovation and business skills and establish an effective policy climate to accelerate 'Africa"s transformation into a knowledge-driven economy based on innovation. In the last two decades, research productivity from the African continent has increased, although it varies by region. Following a bibliometric analysis and reports by Dkhili et al. 2018, Ajibade et

al. 2019 and Wilson et al. 2020 on research outputs in the African Members States consisting of articles and reviews in all languages indexed in the Web of Science (WoS) eGovernment Development Index (EGDI) and Science Citation Index Expanded database published in the past 10 years, found South Africa, Egypt, Tunisia, Nigeria, Morocco, Algeria, Kenya, Uganda, Tanzania, Ghana Ethiopia, Cameroon, Rwanda, Namibia, Zimbabwe, and Zambia are most likely the countries producing almost half the scientific publications over the period [43-46]. Several of these research outputs have been published in highly indexed journals which confirm the added value of this research and originality of the ideas. Despite these prominent publication outcomes, African economies are still resisting to development. The rising question is: why do research outputs in Africa continent not contributing enough to enhancing economic growth and address community challenges? Perhaps, this is because the use of open-source platforms, tools, and technology but also the research to address community challenges have not been adequately promoted. Additionally, institutions and policymakers with the ability to practice the findings and recommendations of academic research output are not supported.

The lack of qualified personnel, including technicians, in fast-growing sectors such as mining, energy, water, fabric, infrastructure and telecommunications is a challenge to economic diversification. On the other hand, the mismatches between skill on R&D, education in health, and the need for employment are more prevalent among youth in Africa than in other developed countries. Close to half of Africa's employed youth perceive their skills as mismatched to their jobs [6]. This subsequently downregulates the magic of creativity and productivity to address the need of the continent.

Hence, teaching health institutions, research institutions/Centres of excellence, national government, public and private sectors should clearly define the type of skills that African countries need and foster the education and skills to advance economic growth required. Moreover, collaborative academic network with industry is to be encouraged due to the important role in which industry play in the research and development process. Such collaboration may spur the availability of fund, research facilities and clinical application.

3. Strategic approaches to lever quality of health sector; healthcare system; and health research across African Union Member States

As an industry, the health sector is an important element of the economy and a significant source of jobs in most countries. Aside from being a source of employment, the health system will benefit the economy by impacting the technological development sectors, such as pharmaceutical and medical devices, as well as by connecting itself with the educational sector through clinical training, professional skills and clinical best practice. Further, different approaches could be adopted to improve healthcare and research funding.

Approaches	**Objective**	**Systems/Mechanism**	**Stakeholder and Partners**
Africa to admit that without strong Health care system and robust health research the SDG and Agenda 2063 aspiration will never be achieved Focus on specific intervention with high impact healthcare system and health research	• Promote well-being for everyone and achieve the aspiration of the Agenda 2063 and SDG • Promote Research and Development in health and related field	• Develop an innovative financing strategy including policy/framework for quality health care; medicine regulatory framework • Review and harmonize existing national policies on health research funding • Develop/Review national public- private partnership policies in clinical research • Formulate frameworks/guidelines to strengthen mutual benefit of research output and IP protection • Improve infrastructure • Involve scientists in research budget	Member States Universities/Research Institutions Parliaments, Government, National ministries of Health; Finance; Science, Research and Technology, World Bank/IMF, AfDB, WHO, Development partners , ARIPO, WIPO, PAIPO

Increase fiscal space for health	• Enhance resource mobilization, and the reforms necessary to secure the enabling governance, institutional and economic environment for better outcome in health sector To commit to achieve a minimum national health expenditure of US$27 per person per year	• Prioritizing health within the government budget • Build a strong partnership between Ministry of Finance and Ministry of Health for improved efficiency of government budget formation and execution, research funds allocation as well as public and private health spending for better health outcomes and resource expansion • Forge a strong partnership with public and private sector; stakeholder and actor to end diseases that threat Africa • Review reforms in the tax regime and ensure the implementation • Increase taxation relying on natural resource exported and ensure the efficiency use in healthcare system • Expanding social security coverage and contributory revenues • Adopting a more accommodative macroeconomic framework	Member States Parliaments, Government, National ministries of Health: Finance; Social Development, Public Private sector, Development partners, AUC, WAHO, World Bank/IMF, AfDB, WHO,

To design poverty alleviation programmes that to gradually cut the poverty level in Africa by 50% by the upcoming 5 years	To sustain challenges that poor and vulnerable people are facing	• Develop/revise national health policy that can assist vulnerable and poor people to manage risk better • Formulate policies for fostering housing and education, human capital and the creation of jobs • in high-productivity sectors • Build policies and programmes based on public health response, which focus on improving the access and quality of primary health care and also on the broader health implications of water and sanitation • Improve market access for artisan/farmer/agricultural workers • Stabilize domestic prices which can allow poor people to afford food and goods • Developing export promotion strategies (for encouraging domestic traders to emerge, strengthen market transmission, raise local supply responses and local labor demand, and	Member States, Government, Ministries of Health; Finance; Youth, Sport, Social Development; Agriculture and Production; Labour SADEC, FAO, IFAD, UNPD, UNICEF, WHO, AfDB, World Bank/IMF, World Food Programme, AUC, RECs

		increase relative wages for the poor).	
To address water crisis and reduce water-borne disease in the continent	By the next 5 years, to achieve equitable access to safe and affordable drinking water with adequate sanitation for a high proportion of population	• Explore available traditional plant (Moringa Oleifera, Jatropha Curca and other) and methods (sand filter) for water purification in rural area • Create and advocate the used of bio-toilets • Involve community participation in water treatment and health programmes • Drive strong oversight, monitoring and evaluation • Build/Intensify collaboration with local and international partner to strive for resource mobilization and achievement of the programme	Member States, Government, Ministries of Health; Finance; Agriculture; Education; Environment and Natural Resources Labour SADEC, FAO, IFAD, UNPD, UNICEF WHO, WAHO, AfDB, World Bank/IMF, World Food Programme, AUC, RECs, NEPAD
To develop a demand-driven education system in synchronization with employment needs in health sector and other sector	To match training, education and academic research with the skill market to meet the communities and national need.	• Encourage higher education and Technical and Vocational Education (TVE) to join hands to produce more qualified human resources for the health sector • Develop capacity building for health research and clinical trial • Improve the allocation of	Member States, Government, Universities/Research Institutions Ministries of Health; Finance; Science, Research and Technology, World Bank/IMF, AfDB, WHO, Development partners , ARIPO,

		student grants; • Review existing teaching reform/policies • Upgrade existing curricular • Upgrade remuneration schemes for medical practitioners • Formulate funding for public university and foster transparency • Ensure that the educational system adapts to the fast-emerging private sector and public positions in high demand (such as physician, nurses, medical practitioners, IT and software developers, technologists, engineers, specialists, financial consultants, data analysts and other).	WIPO, PAIPO, UNESCO, AUC, AAU, AU-DHRST, Public and Private Institutions
To identify existing or new diagnostic kit/medical device/drug/medicinal plant or treatment regime to be developed	• To develop affordable healthcare facilities • To improve access of adequate and quality healthcare facilities for citizen	• Build an environment with adequate trained human resources for strengthening creativity and technological innovation and improve healthcare products • Joint collaboration between Health institution, Research Centre, Ministries and Industries • Increase fund allocation	AUC/RECs/MS ARIPO, WIPO, PAIPO FDA, WAHO, WHO ACDC, Ministry of Health and Medical Institutions

		for research infrastructural development and including information and data management system laboratory facilities, IT among others • Strengthen the IP system for clinical research output/innovation	
To encourage African Academy of Science, Professional bodies, institutions, institutes and private researchers to intensify its efforts in facilitating the participation of scientists in health-related research particularly aimed at solving healthcare problems like global pandemic.	To develop instruments, policies and programmes to support regional organ in their work with Member States to develop STIs infrastructure, including, engineering, infrastructure, innovation and entrepreneurship	• Improving research facilities in universities/ institutions • Enhance the enrolment of students in Medical education • Formulate national and continental policies to promote knowledge exchange and brain circulation • Formulate conducive policies for bilateral and multilateral collaborations & partnerships • Review & strengthen existing policies on cooperate social responsibilities to support health research • Establish/review open data policies to promote access to data among universities • Promote network for scientists	AUC, CDC, RECs, NEPAD, UNESCO, AfDB, WHO, WAHO, Research Excellence Centers, AAS, World Bank Group, and the International Monetary Fund

		• Evaluating and monitoring the quality of health research output	
The collaboration between the health sector and other sectors (private sector and Industries) in Africa and donor agencies	To ensure judicious spending on healthcare by reducing the waste of resources	• Budget allocation should be planned in the interventions of water & sanitation, housing, environment, works, and agriculture sectors. This will solve some health issues.	AUC, World Bank Group, NEPAD, UNESCO, UNECA, RECs, AfDB, MoH, Private Bank, National Government, etc.
To improve the quality of national health policy and strategy	To encourage the government in developing national quality policy and strategy in countries where they don't have and encourage implementation where they exist	• Updating the national health policy and strategic plan. • Development and implementation of a comprehensive health management information system policy and strategic plan • Leveraging information and communications technology to assist in the selection of quality health intervention whoever needs.	Ministry of Health, Health institutions, policymaker, and National Government
To strength ethics regulation in health research as well as to establish Standard Operating Procedures (SOPs) and Material transfer agreements (MTA) for database and other	To appeal African Members States to develop their SOPs/MTA for data and biological material sharing. To ensure standard best practice comply with ethical regulation	• Establish a continental Ethical Committee • Establish Comprehensive Ethics Approval Processes • Review & Upgrade structures for ethical reviews	Ministry of Health, Health Institutions, Centres of Excellence, RECs, National Ethical Committees, PAIPO, AUDA-NEPAD, UN and STC

biological materials.		• Develop a standardized ethics guideline for clinical research • Develop data management, handling and record keeping protocols	

Healthcare is a public good that directly benefits people and is therefore a civil right to which everyone is entitled. Consequently, one of the central tenets for enhancing the well-being of African member states' communities is the funding of healthcare. Consequently, one of the central tenets for enhancing the well-being of African member states' communities is the funding of healthcare. Although, several signals are observed that there are changes in the way African leaders are responding to the ongoing global pandemic by investing and introducing a new model for preventing, controlling and treating an acute contagious infectious disease like African Academies supporting health institutions, WHO, AU and African CDC in delivering their mandates.

References

[1] Oleribe OO, Momoh J, Uzochukwu BS, Mbofana F, Adebiyi A, Barbera T, et al. Identifying Key Challenges Facing Healthcare Systems In Africa And Potential Solutions. International Journal of General Medicine 2019;12:395.

[2] Simpkin V, Namubiru-Mwaura E, Clarke L, Mossialos E. Investing in health R&D: where we are, what limits us, and how to make progress in Africa. BMJ global health 2019;4(2):e001047.

[3] Bedir S. Healthcare expenditure and economic growth in developing countries. Advances in Economics and Business 2016;4(2):76-86.

[4] United Nations Economic Commission for Africa. Healthcare and Economic Growth in Africa. Addis Ababa, Ethiopia: United Nations Economic Commission for Africa (ECA); 2019:xiv.

[5] Organisation of African Unity (OAU). The Abuja Declaration on HIV/AIDS, Tuberculosis, and Other Related Infectious Diseases. African Summit on HIV/AIDS,

Tuberculosis, and Other Related Infectious Diseases 24-27 April, 2001. OAU/SPS/ABUJA/3 ed. Abuja, Nigeria; 2001.

[6] African Development Bank. African Economic Outlook 2020. ISBN 978-9938-882-95-7 ed.; 2020.

[7] World Bank Group. World Development-Indicators 2015. 2020.

[8] Ahmed Hamdy, Harriet Yayra Adzofu, Mohammed Kyari, Gilbert Byatuhaire, Marie Johnson, Adaeze Akaduchieme. Research Translation from Bench to Bedside. Plot 114 Yakubu Gowon Crescent, Asokoro, Abuja, Nigeria: African Union Scientific, Technical and Research Commission; 2019:23-37.

[9] Alok Mishra. An Insight Into the Different Sectors of the Healthcare Industry. *Ezine Articles.* 2019.

[10] Ledesma A, McCulloh C, Wieck H, Yang M. Health Care Sector Overview. Unpublished note, Wahington State University 2014.

[11] Mathauer I, Schmidt JO, Wenyaa M. Extending social health insurance to the informal sector in Kenya. An assessment of factors affecting demand. The International journal of health planning and management 2008;23(1):51-68.

[12] Spaan E, Mathijssen J, Tromp N, McBain F, Have At, Baltussen R. The impact of health insurance in Africa and Asia: a systematic review. Bulletin of the World Health Organization 2012;90:685-92.

[13] Johnson JA. FDA regulation of medical devices. Congressional Research Service Washington, DC; 2016.

[14] Rhatigan Jr JJ. Health Systems and Health Care Delivery. Hunter's Tropical Medicine and Emerging Infectious Diseases. Elsevier; 2020, p. 214-8.

[15] Organization WH. Health systems in Africa: community perceptions and perspectives. Brazzaville: Republic of the Congo: WHO Regional Office for Africa 2012.

[16] Ridde V. Is the Bamako initiative still relevant for west African health systems? International Journal of Health Services 2011;41(1):175-84.

[17] Organization WH. Monitoring progress towards universal health coverage at country and global levels: framework, measures and targets. World Health Organization; 2014.

[18] Organization WH. Atlas of African health statistics (2018). 2018.

[19] Kaseje D. Healthcare in Africa: Challenges, Opportunities and an Emerging Model for Improvement. *Woodrow Wilson International Centre for Scholars.* 2006.

[20] World Health Organization. Global spending on health: a world in transition. WHO/HIS/HGF/HFWorkingPaper/19.4. Licence: CC BY-NC-SA 3.0 IGO ed. Geneva: WHO; 2019.

[21] Transparency International. CORRUPTION PERCEPTIONS INDEX 2016. *Transparency International.* 2017.

[22] Group WB. Global monitoring report 2015/2016: Development goals in an era of demographic change. World Bank Washington, DC; 2016.

[23] Africa Progress Panel. Africa Progress Report 2015 - Power, People, Planet: Seizing Africa's energy and climate opportunities. ISBN 978-2-9700821-6-3 ed. Geneva; 2015.

[24] Jordanna Packtor. Top 10 Facts About Poverty in Africa. *The Borgen Project.* 2017.

[25] Mark Rweyemamu, William Otim-Nape, David Serwadda. Foresight. Infectious Diseases: preparing for the future. Africa. London, UK: Office of Science and Innovation; 2006.

[26] Bank W. UHC in Africa: A Framework for Action. World Bank Washington, DC; 2016.

[27] Sambo LG, Kirigia JM. Investing in health systems for universal health coverage in Africa. BMC international health and human rights 2014;14(1):28.

[28] World Bank Group. World Development Indicators. 2010-2018.

[29] Eastwood JB, Conroy RE, Naicker S, West PA, Tutt RC, Plange-Rhule J. Loss of health professionals from sub-Saharan Africa: the pivotal role of the UK. The Lancet 2005;365(9474):1893-900.

[30] Office IL. World Social Protection Report 2014/15: Building economic recovery, inclusive development and social justice. International Labour Office; 2014.

[31] Adrian Gheorghe, Alina Lipcan, Clara Picanyol, Nouria Brikci, Tafara Ngwaru, Tomas Lievens, et al. Challenges in Financing Health Sectors in Africa The background papers. *International Conference on Financing Healthcare in Africa: Challenges and Opportunities.* Dar es Salaam, Tanzania: Collaborative Africa Budget Reform Initiative (CABRI) 2015.

[32] Union A. Maputo declaration. Maputo: African Union 2003.

[33] African Development Bank Group. Health in Africa over the next 50 Years. ESTA & OSHD; 2013.

[34] Clausen LB. Taking on the challenges of health care in Africa. Insights by Stanford Business 2015.

[35] AUC-NIDO. PHARMACEUTICAL MANUFACTURING PLAN FOR AFRICA Business Plan. Addis Ababa: African Union Commission and United Nation Industrial Development Organization; 2012.

[36] Techno-Africa Policy Monitor. Infectious Diseases and Traditional Knowledge in Africa. Abuja, Nigeria: African Union Scientific Technical Research Commission; 2009.

[37] African Union Commission (AUC) and African Union Development Agency-NEPAD (AUDA-NEPAD). First Continental Report on the Implementation of Agenda 2063. ISBN: 978-1-928527-22-0 ed.; 2020.

[38] Christin Roby. Achieving UHC in Africa requires support for most vulnerable, experts say, https://www.devex.com/news/achieving-uhc-in-africa-requires-support-for-most-vulnerable-experts-say-94411; 2019 [accessed 21/11/2020].

[39] Nass SJ, Levit LA, Gostin LO. The value, importance, and oversight of health research. Beyond the HIPAA privacy rule: enhancing privacy, improving health through research. National Academies Press (US); 2009.

[40] Salazar CR, Celedon JC. The importance of biomedical research. Revista Sociedad Colombiana de Oftalmología 2018;47(3):198-201.

[41] Organization WH. A practical guide for health researchers. 2004.

[42] World Bank Group. GDP database 2020. 2020.

[43] Ajibade P, Mutula SM. Bibliometric Analysis of Citation Trends and Publications on E-government in Southern African Countries: A Human-computer Interactions and IT Alignment Debate. 2019.

[44] Dkhili H, Oweis KA. Does Research Output Matter for Economic Growth in Sub Saharan African Countries? Quantity and Quality Analysis. RIMCIS: Revista Internacional y Multidisciplinar en Ciencias Sociales 2018;7(3):221-42.

[45] Lan G, Blom A, Kamalski J, Lau G, Baas J, Adil M. A Decade of Development in Sub-Saharan African Science, Technology, Engineering and Mathematics Research. Elservier, editor World Bank 2014.

[46] Wilson K, Kiuna A, Bruce Lamptey R, Veldsman S, Montgomery L, Neylon C, et al. Open access and research dissemination in Africa. 2020.