

# Digital Health Information System in Africa's resource poor countries: current challenges and opportunities

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**Abstract.** Inequitable digital advance is widely considered as responsible for the widening gap in health and socioeconomic prosperity of many developing countries, particularly Africa's resource poor nations. Digital Health Information System, a useful health care delivery tool, has globally evolved rapidly over the past decade alone. Health institutions furnished with state of the art health information system have benefited their service users, through easing of patient health information retrieval, dissemination, exploratory research, and ultimately efficiency of care provision. This review article aims to examine the current challenges and opportunities faced by Africa's developing countries.

**Keywords.** Health information systems, Developing Countries, Digital age, Health Care Delivery, Africa.

## 1. Introduction

Health Information System (HIS), a useful health care delivery tool, is an important component of the health system building blocks.[1] Health information system is not new. Begun over 4,000 years ago, physicians in medieval Islamic era were the first to record patient medical information and have transformed medical records earlier than their western counterparts [2, 3], establishing the precursor for modern health information system[4, 5].

As technological advancement transformed the world of records keeping, a front foot in patient information documentation has accelerated into digital medical records. This influenced how patients are categorised, treated and managed in faster and often in an easier manner. Hospitals in the United States being among the first, in the 1800, to embrace this revolutionary health services have begun to organise patients records, first primarily aimed as an aid for teaching.[2, 5] Over the recent decades, as the volume of patients' information rapidly increased and with the appearance of technological and digital advancement, the development and use of electronic health records for various purposes evolved and advanced, sometimes outpacing other scientific utilities.[4, 5] This has thus resulted rapid growth over the past decade that contributed to the advancement of diseases management and health service delivery efficiency.[6]

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Health information helps service providers identify the progress and regress of health conditions of patients and populations. Systematically organised to record, generate and monitor health status data of patients and populations, HIS helps increase essential health services delivery and restore the health of communities, ultimately empowering nations[6]

This review aims to examine the current challenges of digital health information system faced by Africa's developing countries and the gaps responsible for such challenges. It further describes the current and potential opportunities. While suggestive solutions to Africa's lag in the digital frontier are not exhaustive, the article concludes with suggestions of some practical proposals on ways to harness such challenges.

## **2. Methods**

This article used a review methodological approach, which systematically examined studies pertaining to health information system in the African region, particularly south of Sahara. The keywords and search terms used included; health information, digital health information, history of health information, sub-Saharan Africa, developing countries, health care delivery, and millennium development goals. The databases examined were particularly; Pubmed, Google Scholar and books.

## **3. Results**

Two thousand three hundred and thirty six articles relating to health information in Africa were first retrieved. Using the above mentioned meSH terms, the search retrieved 731 articles, with only 53 articles relevant to the particular objectives of the study, of this 17 articles were declined, as they were only abstracts with no full articles retrievable.

## **4. Discussion**

### *4.1 The role of HIS*

Health institutions furnished with state of the art digital health information system have benefited their service users, through easing of patient health information retrieval, dissemination, exploratory research, and ultimately efficient and quality care provision. Further, HIS contributes to the control of diseases and epidemic predictions that result the reduction of population morbidity and mortality.[2] Digital Health Information System (DHIS), which has evolved from the traditional paper records, is used to create digital medical records for easy access and retrieval of patients' records, resulting considerable reduction of human errors.

The role of DHIS in health care research is considerably far and wide. DHIS plays pivotal role in integrating patient health information, population surveillance, and health facilities service delivery information to enable the health sector plan, monitor and evaluate its past and current service delivery. This way an evidence based service

improvement and policy enactment can be conducted.[7] Generating data through health information provides evidence that would answer essential questions about how to improve population health.[8]

With the coming of medical informatics, DHIS has further been transformed and used as more informative tool that not only help organize patient records but track treatment, monitor recovery and health intervention outcome.[6] Digital technology is therefore now used as a vehicle to support medical and public health planning thus not only assisting personal patient management but also community wide healthcare management, planning and policy development.[9]

DHIS has also helped create digital medical records that can be easily accessible and retrieval of patients' records, resulting considerable reduction of human errors.[6] Documenting health services facilities help better resource allocation, helps understand constraints, eases workload, and output of facilities. The needs of the workforce, equipment, supplies, and delivery of essential medicines and sundries, all require coordination and without which may lead to poor service provision.[10] For countries that may not have a well-established DHIS, vital information will mean out of date and inaccessible data, making it difficult for policy makers to equitably distribute resources. For example, essential results and data from diagnostic services, such as laboratories and radiology require urgent reporting, but without a structured and a well maintained DHIS in place, actions will be delayed.[10] Equally, data storage, management and analysis requires robust system that can capture vital information, but with the lack of a well developed DHIS, valuable services will not be delivered or transmitted to interested parties, agencies and stakeholders.[10]

#### *4.2 Benefits of digital health information*

Patient and population health information are useful resources that can open new horizon in research and policy direction.[9] The increased use of DHIS has seen a rapidly rising health benefit outcome of many populations, health services and governments institutions.[11] Through capturing of health information data, DHIS has brought about considerably high improvements in service delivery, quality of care, patients and population health management.[12]

The digital era has also helped bridge the gap of physician-patient ratio by enabling fast track patient services through *e*-prescription allowing physicians to prescribe medicines for patients electronically. In the US, the use of *e*-prescription has seen remarkable cost savings of over US\$800 million within a five-year period.[12]

This service has also seen considerable reduction of medication errors and better patient care.[12]

#### *4.3 Africa's challenges*

Inequitable digital advance has long been regarded responsible for the widening gap in the health and socioeconomic prosperity of many developing countries, particularly Africa's resource poor nations.[13, 14] There are two main gaps in health information system in Africa; *the health information knowledge gap*, and *the synthesis of existing knowledge to utilize to better the health outcome for the population*. [6]

The gap in translation and sharing of health information and new research outcome hinders the development of functional health system and ultimately quality health service delivery.[6] Furthermore this is compounded by the lack of readiness of many African institutions for the fast pace of the technological rise.[15] These challenges are considered to be responsible for the challenges Africa faces in achieving the MDG.[6]

In its report of the 11th General Programme of Work (2006-2015), WHO has identified knowledge gap as one of the gaps responsible for developing countries lagging behind in health service delivery.[16, 17] Exacerbated by limited resources, which dictate harnessing of the duplication of services, Africa's poorly established HIS would ultimately translate to poor direction of resources.

Developed nations have hugely invested in HIS [18] as they realised the potential it has in promoting and supporting communities in the prevention and control of diseases. In recent years, with the rapidly growing stride in digital sciences around the globe, only few African countries have had considerable progress to commit significant portion of their resources to health care research and use DHIS as important gateway to reaching most of their population health care needs.[17] In acknowledging the potential DHIS brings to these nations, WHO has encouraged developing countries establish DHIS for better health care service delivery [17]

On the research front, with the coming of DHIS since the last two decades, industrialized nations have attained an unprecedented accumulation of new knowledge that is generated through research output, which enabled the use of information for better patient and population health outcome in a reliable and efficient manner.[10] This has not been the case for Africa's resource poor nations. Constant challenges with efficacy and uncoordinated HIS have been reported in many developing countries thus resulting limited output and health service delivery, particularly in the primary health care [10, 19-21]

#### *4.4 The challenges of technological divide*

Sub-Saharan Africa has the world's 33 out of 48 poorest nations in the digital sector. Much of this lag is not only associated with the lack of political and policy support but also socioeconomic challenges limiting the opportunities to increase service delivery advantages the digital age comes with.[22]

In many parts of the continent, there is considerable slowness in embracing the rapidly growing digital technology. Notwithstanding the higher costs of the technology, many African countries are unsure of their financial expenditure priorities. Furthermore, the shortage of qualified personnel and relevant software has had considerable contribution to the setback too.[7, 12, 23]

Africa's research and knowledge gap is mainly due to the underdeveloped digital health information system, leaving the continent trailing in health knowledge, and other essential research outcomes out of reach of many health care workers, especially those in remote and rural parts. Knowledge gap due to lack of well-developed DHIS is one of the key areas WHO has identified as the primary obstacle to achieving the MDG.[24] Closing this gap has not been easy. This has thus resulted the failing of the application

of important emerging or existing knowledge and research findings to improve the community's health.

The gap in sharing essential information, knowledge, new or existing research findings have also primarily contributed to the reasons for the challenges of meeting the MDG by the year 2015. Within seven years into the MDG strategy, only 5 out of the 46 Sub Sahara African countries have had mortality registry developed, and even this, covering only about 75% of the entire health services.[25]

As technological advance in the rest of the world flourished, Africa has made little strides forward. Despite its favorable potential, DHIS however braces significant challenges in Africa. Reluctance by many health professionals, especially in rural and resource poor settings, has been reported as some of the key obstacles to its progress.[12] Due to other competing health care demands and limited resources, many African countries have had little resources invested in digital technology. Fewer health professionals have been trained in the latest digital technology, coordination of essential data and information have been handled by several ministries, while knowledge and research generation is not conducted within these ministries thus resulting a challenged coordination of knowledge sharing.[26]

Africa's lack of physical infrastructure, inadequate resources and un-reliable data has resulted a backdrop of challenges of efficient health services provision, management and progress in curbing many diseases such as malaria, tuberculosis, HIV/AIDS among other that critically crippled its population.[9, 27]

The lack of reliable and high quality health information has also been a challenge. As diseases and death events are not almost always registered, particularly in rural and remote regions, data for mortality and morbidity as well as causes of diseases remain one of the main obstacles in getting much needed information to identify the progress and regress of population health thus unable to gauge how far countries are towards attaining the MDGs.

Data reliability plays crucial role in health information used for research, health services and patient management. Resulted by the lack of health infrastructure and other utilities such as electricity, computers among other, many of the African countries currently face this challenges where most of the reporting are often unreliable and speculative, ultimately resulting undue reporting of various medical and health conditions.[9] Further, the situation in the rural health facilities where there is total lack of electricity pose substantial challenges in setting up digital health information system.[9]

## **5. The promising opportunities**

### *5.1 Investing in Digital Health Information System*

As described above, DHIS can help facilitate the transfer and sharing of existing or new knowledge, promote research output, health service management, healthcare provision, surveillance of diseases among other. For this reason, investing in this important venture will bring important returns for population health in Africa.

Despite the mammoth challenges African countries have faced or continue to face, there is considerable reason to be hopeful that DHIS is growing in many parts of the continent. There is increasing governments and other multinational agencies involvement and interest in patient and population health improvement. Several African countries have begun important steps forward to initiate DHIS. In recent years, African countries have been collaborating and benefiting from the support of multinational and charitable institutions such as *The Doris Duke Charitable Foundation* (DDCF) that launched important *African Health Initiatives*(AHI) supporting the *Population Health Implementation and Training*(PHIT) projects, aimed at strengthening the health system of five African countries, namely, Ghana, Zambia, Rwanda, Tanzania and Mozambique.[28] This initiative has helped this countries transform their health information system from paper based medical records system to DHIS, resulting considerable efficiency in health care services delivery, service monitoring and research, and ultimately are heading towards better population health outcome.[28]

The recent rapid growth of Africa's economy has substantially played essential role and raised the monetary contribution to health care services. Many of the current surge in economic growth in some of Africa's resource rich countries breathed important re-life to the ailing health care services. Angola's booming minerals revenue has seen considerable contribution to the country's health care coffers,[29]but how this translates into the reduction of disease prevalence remains contested. Equatorial Guinea's recent oil and natural gas resources boom has seen the increase of the national health care expenditure yet again how much of this expenditure trickles down to the strengthening of the digital health information system and ultimately health care service delivery at village level remains to be seen.[30] I would, however, argue that the challenge is all about allocative and productive efficiency in resource terms. While a country's health sector allocative efficiency is an important element in ensuring health resources are efficiently utilised, it is also important to note that productive efficiency(considerable investment in human capital) is equally considered as a determining factor for the health outcome of the population.

Some African countries have made considerable strides in health sector reforms by having important health system sectors such as DHIS incorporated into these reforms. Developed from its 1985 introduced HIS, Uganda has in 1997 embarked on remarkable investment and begun transforming its HIS to digital health information system. Further the country has considerably improved the HIS resource tools such as human resources, infrastructure and other vital facilities at village level. This has enabled many parts of the country's health facilities covered with DHIS.[31]

Although in the beginning the focus was for managing its health sector resources management such as, finance, human resources, drugs supplies, service level monitoring among other, HIS has later on been steered toward epidemiological and patient centred digital records, enabling the country transform its health care delivery capability.[31]

Other types of important opportunities include electronic technologies that have been having headway in the African continent. The revolution of the internet and

digital sciences has seen the coming of telemedicine, *m*-health, digital libraries, *e*-commerce, social media among other important gadgets.[32] Various international digital services corporates have shown keen interest in tapping Africa's digital potential, setting Africa at an advantage course, thus helping many of the rural inhabitants through *e*-health services. Such institutions include, *Montana Health-care Solutions Pty Limited* and *Robertson Global Health Solutions Corporation*, the *Pan-African e-network project*, the *Fundamental of Modern Melemedicine for Africa* (FOMTA), and the *Reseau en Africue Francophone pour la Telemedicine* (RAFT), who specialise in *e*-health services, enabling countries such as Kenya, Uganda, Ethiopia, Burundi, Botswana, Eritrea, Malawi, Libya, Cote de Ivoire, Djibouti, Mozambique, Zambia and South Africa taking lead advantage.[33, 34]

Many of Africa's young researchers have also realised and embraced the advantage digital technology has brought forth in revitalising health care and health service research.[33] For instance, the role of electronic smart cards in Kenya's rural health centres has been revolutionary in the way health care is delivered, that were previously unreachable to many of the rural poor.[33]

Remarkable strides, however slow, are being made towards reducing the infection rate of many diseases through well-established strategies and new public health approaches using this DHIS initiative.[35]

Digital health technology has also revolutionised the way people see health thus bringing behavioural sciences closer to the reach of societies around the world. The use of novel health technologies has seen many young populations appreciate healthy living and better lifestyle compared to their counterpart decades ago.[36]

Africa's challenges and progress about the use of digital health information can be an important lesson for various multinational institutions that have interest in enhancing the digital revolution in the new millennia. Furthermore, many of Latin America's developing countries, Bolivia in particular,[37] have important lessons to learn from Africa's collaborative approaches with digital health information specialists from developed nations. For example the *African Health Initiatives*, *Montana Health-care Solutions Pty Limited* and *Robertson Global Health Solutions Corporation* have played key roles in supporting and strengthening many of Africa's digital health information systems. [28, 33]

**Table 1:** Summary points of the findings of the review

[1] Summary Points
<ul style="list-style-type: none"><li>• Digital Health Information System, a vital health system building block, has revolutionized the way nations tackle patient and population health.</li><li>• Africa's DHIS is underdeveloped and under-resourced</li><li>• Africa's digital health information system though weak and underdeveloped has gradually improved over the years</li><li>• Africa's DHIS has great potential, despite that it remains under-resourced and uncoordinated.</li><li>• Multinational organisations have contributed and supported ventures in Africa's DHIS and if they continue to do so, much improvement in the overall health of many African population will be seen</li><li>• Developed nations have benefited more from investment in HIS resulting better health care delivery for their population</li><li>• Challenges of sustaining thoroughfare health system development is important to be noted</li></ul>

## 6. Conclusion

This paper has primarily focused on the analysis of two particular areas of Africa's health system (Table 1). It examined the gaps in digital health information system, and knowledge generation. The continent's ailing digital health system does not only require considerable attention and investment but consistent coordination and support within its current health services. Lack of investments in health information technology, and knowledge synthesis are the key factors lacking in many of the African countries' strategic direction. However, despite that it remains under-resourced and uncoordinated, Africa's DHIS has great potential. Investing in the DHIS, as much as the rest of the health system facilities, may reap important health improvement dividends.

Despite the mammoth trials and tribulations the African continent has been through, over the last decade alone, there has been promising headway in catching up with the rest of the world in technological development. Closing Africa's health system gaps has become a major challenge for much of the health improvement and outcome of many of its population. There are gaps in health care knowledge and new research evidence, which primarily, encompasses individual as well as population health service provision. Furthermore, knowledge translation and sharing, also are key factors that still remain a challenge to untangle.

Narrowing the digital gap is an important challenge that requires concerted long term investment in digital sciences and continued commitment to building high quality DHIS, through local and international agencies working together and sharing new and valuable digital technologies.

In the above context, it does not go without proposing essential approaches to tackle such challenges. Africa needs to commit more resources to digital technology including health information system. There needs to be more coordinated information sharing and dissemination so that health care workers are well informed and up to date with emerging health care research. Most important is the strengthening of other useful services and resources such as human capital in order to complement the DHIS. More research and scientific studies will help identify key technological gaps in DHIS.

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