

# Current Status of E-Health in Kenya and Emerging Global Research Trends

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## ABSTRACT

Healthcare delivery is being transformed by advances in e-Health which is now recognized as an essential enabler for support of health systems across the world, acting not only as an agent for reforming healthcare systems, but also as an enabling tool to share resources among countries with similar challenges without having to duplicate efforts. Lack of interoperable health systems and consensus on data standards is one of the major barriers to the use of health information. Mobile phone use has seen tremendous growth across the developing world offering opportunities to engage e-Health applications. This paper looks at the status of e-Health in Kenya exploring the efforts the government has put in place to create a conducive environment for e-Health and also explores the global research trends in e-Health. The study is carried out through an examination of scientific research papers in journals and conference proceedings. Additionally, telephone interviews with the Ministries of Health, and Public Health and Sanitation is carried out to gauge the level of adoption. The study seems to reveal that though e-Health in Kenya is still in its infancy, the potential for its growth is enormous. This is fuelled by the rapid penetration of mobile phone use, an educated and entrepreneurial populace, and conducive legal, regulatory, and infrastructural environments.

**Keywords:** *e-Health; interoperability; e-Health policies and strategies; research trends; infrastructure; adoption; standards*

## I. INTRODUCTION

The term e-Health is widely used by many individuals, academic institutions, professional bodies, and funding organizations. e-Health offers the rich potential of supplementing traditional delivery of services and channels of communication in ways that extend the healthcare organization's ability to meet the needs of its patients. Benefits include enhanced access to information and resources, empowerment of patients to make informed healthcare decisions, streamlined organizational processes and transactions, and improved quality, value, and patient satisfaction.[1] e-Health is now recognized as a key enabler for supporting health systems the world over as they strive to deliver good health to citizens in the face of growing difficulty. e-Health thus acts not only as an agent for reforming healthcare systems (from an infrastructure focused healthcare service into a more dispersed healthcare model), but also as an enabling tool for countries with similar challenges to share resources across international borders and domestic boundaries, thus providing quality without the expense of needless duplication.[2] Healthcare delivery is being transformed by advances in e-Health and by the empowered, computer-literate public. Ready to become partners in their own health and to take advantage of online processes, health portals, and physician web pages and e-mail, this new breed of consumers is slowly redefining the physician/patient relationship. Such changes can effect positive results like improved clinical decision-making, increased efficiency, and strengthened communication between physicians and patients.[3]

## 2. DEFINING E-HEALTH

There is no one single definition of the term e-Health but the various definitions encompass a set of disparate concepts, including health, technology, and commerce. Some of the definitions are sampled here. Alvarez [4] defines e-Health thus: "e-Health is a consumer-centered model of health care where stakeholders collaborate, utilizing ICTs, including Internet technologies to manage health, arrange, deliver and account for care, and manage the health care system". Eng[5] states "...e-Health is the use of emerging information and communications technology, especially the Internet, to improve or enable health and healthcare." While Pagliari C. et al[6] adapts Elysenbach's[7] definition to "... e-Health is an emerging field of medical informatics, referring to the organization and delivery of health services and information using the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology". In the context of this paper, e-Health is to be understood as "... a broad range of medical informatics applications for facilitating the management and delivery of health care, including dissemination of health-related information, storage and exchange of clinical data, inter-professional communication, computer-based support, patient-provider interaction, education, health service management, health communities and telemedicine, among other functions".[8]

### 3. GENERAL OBJECTIVE

The purpose of this study is to assess the status of e-Health in Kenya in terms of awareness, adoption, legislative and regulatory framework, and to determine the current research trends.

#### Specific Objectives

The specific objectives are to:

1. Determine the current status of e-Health adoption in Kenya
2. Establish the factors affecting e-Health adoption
3. Establish e-Health research trends in the context of global research trends

### 4. METHODOLOGY

Literature review was employed in this study. Scientific abstracts from research journals and conference proceedings from the IEEE, ACM, and Medline digital library databases (among others) were examined. Whole papers of some of these scientific publications were also examined to determine research directions. Other documents examined included the Kenya e-Government Strategy, Kenya ICT policy(2006), Kenya Communications Act(2009), Standards and Guidelines for Electronic Medical Records in Kenya(2010), Strategic Plan for Health Information Systems (2009-2014). Additionally, telephone interview with the Ministries of Health, and Public Health and Sanitation is carried out to gauge the level of adoption.

### 5. FORMS OF E-HEALTH

#### a) Healthcare/Medicine and Technology

The term encompasses various services or systems that are at the edge of healthcare/medicine and technology including the following:

1. Electronic health records which enable the storage, and communication of patient data between different healthcare professionals,
2. Telemedicine (physical and psychological treatments at a distance). Globally this is being applied in many areas of medicine such as cardiology, dermatology, dentistry, gynecology, internal medicine, neurology, oncology, pediatrics, trauma, radiology and surgery) [9]
3. Consumer health informatics: use of electronic resources on medical topics by healthy individuals or patients;
4. Health knowledge management: e.g. in an overview of latest medical journals, best practice guidelines or epidemiological tracking

5. m-Health: includes the use of mobile devices in collecting aggregate and patient level health data, providing healthcare information to practitioners, researchers, and patients, real-time monitoring of patient vital signs, and direct provision of care
6. Medical research using Grids: powerful computing and data management capabilities to handle large amounts of heterogeneous data.
7. Healthcare Information Systems: software solutions for appointment scheduling, patient data management, work schedule management and other administrative tasks surrounding health

#### b) Interoperability

According to the Rockefeller Foundation[8] report from an e-Health conference(2008) organized by Health Level 7(HL7) and World Health Organization, one of the key challenges to the use of health information is the lack of interoperable health systems and consensus on data standards. This reduces the value of e-Health across the world. Interoperability is broadly defined as the ability of two or more systems or their components to exchange information and to use the information that has been exchanged. When placed in the health care context, whether regional, national, or global, interoperability is the ability of health care information and technology systems to "work together within and across organizational boundaries in order to advance the effective delivery of health care for individuals and communities." [9] Interoperability is a fundamental component of enabling desired cross-institutional point of care access to robust patient data and to achieving better health care outcomes, cost savings, and efficiencies. Attaining interoperability across communities requires coordination and cooperation among key stakeholders. While there is consensus that commonly agreed upon interoperability rules and standards for health care information systems are needed, many questions remain about how to achieve this in both the developed and developing worlds.[8] Against this backdrop then, Kenya has made the important step of releasing the Standards and Guidelines for Electronic Medical Records(EMR) in Kenya(2010) that will guide application developers and other solutions providers in coming up with interoperable systems.

### 6. CURRENT STATUS OF E-HEALTH

#### a) E-Health Policies and Strategies

The starting point in adopting e-health is the development of coherent national e-health policies and strategies which are in tune with national development plans, national ICT policies and with buy-in from healthcare workers – the users.[10] The government in partnership with the private sector has made important strides towards creating an environment suitable for the uptake of e-Health. The release of the Standards and Guidelines for Electronic Medical Records(EMR) in

Kenya(2010), Strategic Plan for Health Information Systems (HIS)(2009-2014), Kenya ICT policy(2006), and Kenya Communications Act(2009) marks important milestones towards creating an environment with legal and regulatory framework conducive to development and adoption of e-Health in Kenya.

Currently, e-Health solutions and applications are at their infancy. But this should not be so as patients are increasingly turning to Internet for medical solutions. Physicians view this behavior as a mixed blessing: on the one hand some patients are better informed, on the other hand patients may come in with a lot of misinformation that the physician has to spend time correcting. Some physicians are spending more time keeping up to date because patients who come in are well informed. Face time with physicians per visit is also tremendously reduced. There's a chronic shortage of medical personnel in Africa and it's not going to get a lot better anytime soon. On the other hand, access to the Internet is growing fast: partly through laptops and desktop computers, but also through cell phones. Finding ways for scarce and expensive doctors and nurses to leverage online medical information and decision support tools will be a key to improving access to quality health care for resource constrained countries like Kenya in all parts of the world. [10]

## b) Technical Infrastructure

Technology infrastructure is key to successful implementation and adoption of e-Health and thus the arrival of the submarine optic fiber cables and the laying of the national optic fiber backbone linking major towns is expected to have a positive impact on e-Health going forward. This coupled with the increasing penetration of mobile phones and introduction of 3G technology will provide a necessary infrastructural impetus for e-Health.

## c) Implementations of e-Health

Examples of successful implementations of e-Health include AMPATH's computer-generated reminders in electronic health record systems that has been shown to improve care in developing countries, according to a study published in the *Journal of the American Medical Informatics Association*. Researchers at the Regenstrief Institute, the University of Indiana School of Medicine and Moi University School of Medicine in Kenya evaluated how EHRs affected care quality in clinics in Eldoret, Kenya. The Academic Model Providing Access to Healthcare(AMPATH) program provides care to more than 120,000 HIV-positive adults and children in western Kenya. The study focused on OpenMRS, an open-source Electronic Health Record system that is widely used in developing countries. The study found that the EHR system's computer-generated reminders improved adherence to clinical guidelines for CD4 blood tests, which are essential to monitoring the health and treatment of patients with HIV and AIDS. [10]

## 7. CHALLENGES TO E-HEALTH ADOPTION

In a report of the Commonwealth Secretariat on e-Health initiatives in 2008 the challenges to e-Health in ECSA region were identified as falling in five priority areas, namely: e-Health standards; ICT and health policies and strategies; e-legislation; e-Health infrastructure; and ICT capacity. [11] These are outlined as follows:

### 1. ICT and Health Policies and Strategies

- a. Lack of policy and strategic plan in most member states, Kenya included
- b. Lack of ICT policy integration into health and e-Health policies (the second Kenya National Health Sector Strategic Plan (NHSSP II) 2005–2010 fails to mention any form of e-Health and only casually in a single line mentions ICT)
- c. Lack of synchronism between e-Health and ICT policy

### 2. E-legislation

- a. The inter-jurisdictional practice of medicine must be considered. This will allow for inter-country exchange of patients, and data
- b. Legislation on confidentiality of data and ethics is not available in most countries. Users of e-Health want to be sure that their confidentiality is protected
- c. There are no guidelines for clinical/ technical practice in an e-context

### 3. E-Health standards

- a. Medical record portability, privacy and ownership have not been addressed
- b. Lack of standards for medical imaging, interoperability, software, transmission, infrastructure, architecture, medical informatics, bioinformatics

### 4. E-Health infrastructure

- a. Lack of strategy of getting connectivity to the 'last mile'.
- b. Minimal infrastructure is in place in countries but there is a lack of knowledge or awareness of what is available to countries
- c. Lack of relevant content essential to ensure community needs are met

### 5. ICT capacity

- a. Inadequate ICT skills in health sector, such as ICT maintenance staff

- b. Shortage of skills in health informatics
- c. Lack of ICT in health professionals' curricula
- d. There is a need to raise awareness of ICTs in the health sector.

## 8. GLOBAL E-HEALTH RESEARCH TRENDS

### 1. m-Health and Personal Health Systems

Recent advances in ICT and more specifically in wireless networks and mobile computing have driven new directions in the development of e-Health sector. New emerging concepts like mobile health (m-Health) and Personal Health System (PHS) are expected to revolutionize the way healthcare services are delivered. m-Health incorporate mobile computing, medical sensors, and wireless communication technologies for delivering healthcare in a non-restrictive manner. These systems are safety critical systems intended for use by the public and are therefore characterized by especially strict requirement relating to safety, security, correctness, reliability, adaptability and user friendliness. PHS is concerned with the individualization of prevention, treatment and well being procedures available through the healthcare system. The patient is put at the center of the delivery process.[12][13] There is therefore, currently, a substantial amount of research activity in these areas.

### 2. Pervasive healthcare

Healthcare to anyone, anytime, and anywhere by removing locational, time and other restraints while increasing both the coverage and the quality.[14]

### 3. Wearable sensor devices

There are research trends about the wearable sensor device that measures various bio-signals and provides healthcare services to users using e-Health technology.[15]

### 4. Intelligent Systems

Applying intelligent systems with physiological signal monitoring for e-Health is a current developing trend. This system can help medical staffs to monitor and analyze human physiological signals effectively and immediately thus help reduce medical costs and hospital visits.[16] This has therefore driven research in decision support systems.

### 5. E-Health technologies for the elderly

As the world's population ages, there is growing interest in solutions for the in-home care of the elderly as well as for the care of people with diseases such as Alzheimer's, Parkinson's and other disabilities or traumas.

This has spurred research interest in e-Health systems that integrate healthcare devices and services as well as identifying solutions for their secure communication within the home environment in order to help this group of senior citizens live more independently in their homes. Tele-monitoring and remote healthcare are two ICT techniques that promise to deliver cost-effective long-term healthcare services to the aging.[17],[18]

### 6. Security and Privacy issues

Many countries are moving towards national, international or even global e-health environments. Such a development requires advanced security and privacy services. The use of the Internet to transmit sensitive medical data, however, leaves the door open to the threats of information misuse either accidentally or maliciously. Health-care industries need be extremely cautious in handling and delivering electronic patient records using computer networks due to the high vulnerabilities of such information. To this extent, security and privacy issues have become two of the biggest concerns in developing e-health infrastructures and have thus spurred research activity to develop secure systems.[19],[20]

### 7. Local scenario

Adoption of e-Health is in its nascent stages in Kenya. For this reason development of local e-Health solutions, studies on usability of those solutions, research on adoption may dominate the scene. Thus research may be more on application of technologies than on the basic engineering technologies that enable e-Health.

## 9. CONCLUSIONS

This paper looked at the status of e-Health in Kenya and global research trends. It has been established that the starting point in adopting e-health is the development of coherent national e-health policies and strategies which are in tune with national development plans, national ICT policies and with buy-in from healthcare workers. Kenya has put in place key policies and developed important strategies to enable the uptake of e-Health. This include the Standards and Guidelines for Electronic Medical Records(EMR) in Kenya(2010), Strategic Plan for Health Information Systems (HIS)(2009-2014), Kenya ICT policy(2006) among others. Adoption of e-Health in Kenya is at its infancy but there have been innovative applications of e-Health in the management of treatment for HIV patients. Local research trends are more likely to be in the application of technologies to e-Health than in hard engineering technologies that enable e-Health.

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