The Benefits and Challenges of E-Health Applications in Developing Nations: A Review

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ABSTRACT

This paper is presented to contribute to the benefits and challenges of the Healthcare system in developing nations with daily increase in population, how ICT could be of important aid to the cause. First, its argues that the health sector is best conceptualized as a 'knowledge economy'. This supports a broadened view health service provision that includes formal and informal arrangements for the provision of medical advice and drugs, this is particularly important in countries with a pluralistic health system with relatively underdeveloped institutional arrangement. By using ICT, the quality of healthcare can be increased, or standards can be maintained with fewer people and at lower cost. Many companies are now working on excellent eHealth innovations, as we all know the aim of Information and Communication Technologies (ICT) for Health (also known as eHealth) is to improve significantly the quality, access and efficacy of healthcare for all citizens. ICT for Health describes the application of information and communication technologies across the whole range of functions that affect the health sector.

Keywords: eHealth, mHealth, ICT, Healthcare System, Education.

1. INTRODUCTION

In developing countries, preventable diseases and premature deaths still inflict a high toll. Inequity of access to basic health services affects distinct regions, communities, and social groups. Under-financing of the health sector in most countries has led to quantitative and qualitative deficiencies in service delivery and to growing gaps in facility and equipment upkeep. Inefficient allocation of scarce resources and lack of coordination among key stakeholders have made duplication of efforts, overlapping responsibilities, and resource wastage common and troublesome problems. The World Health Organization's definition of health is not merely the absence of disease but the attainment of a state of physical, mental, emotional and social well-being.

Information and communication technologies ,ICT is used to describe a range of technologies for gathering, storing, retrieving, processing, analyzing, and transmitting information. Information is seen as a key element to achieving these objectives, as is a workforce trained in the appropriate health information skills (Berland G.K et al, 2001). It is an unfortunate reality that healthcare is not as safe as it should be. Adverse events and preventable errors that cause patient harm and death are commonplace in healthcare. These errors are most often not the fault of individuals, but of a system that fails to provide safe and effective care. The cause of preventable errors can be traced to gaps in the flow of information and communication failures both within organizations and across different healthcare service providers. The personal cost of these errors is immeasurable.

One very common form of ICT health (eHealth) is patient self-care and education, including for example interactive web sites and medical devices for self-monitoring. Along with adapting health ICT the patients are being involved more and more in their own health care process. This also seems to be a welcomed trend from the patient side, as more and more people are interested in their own health and proactively looking for health information in internet.

Obviously, with modern ICT also the communication between health professionals and patients and other actors can now be done faster than ever, even real-time. Furthermore, one of the most commonly referred use of health IT is the electronic data storage and data sharing across providers. This has also received attention in the European Union, and the European Commission envisions a common health database for the European Union. In addition to the increasing importance of self-care, modern forms of communication and electronic data processing, there can also be very complex technologies that combine all these. These technologies make it possible to do certain monitoring tests at home and send the data to health care professionals to be analyzed, resulting in an intervention when needed. (Christensen et al. 2007).

2. LITERATURE REVIEW

The rapid pace of mobile phone adoption, with its promise of universal connectivity, lends credence to beliefs that the latest generation of information and communication technologies (ICTs) will support substantial beneficial changes in the organization of the health sector. This has led donor agencies and foundations to invest in many digital health interventions in low and middle-income countries, in the hope that they will provide a way to address major deficiencies in access to safe, effective and affordable health services, especially by the poor. It has also stimulated large private sector investments in pursuit of niches in rapidly changing markets.

Healthcare is an information intensive industry and healthcare professionals rely on access to correct and comprehensive information, when and where they need it, to inform the daily decisions they make about a person's care. Information and communications technology is largely absent from the way we generate, capture and share health information as we continue our reliance on handwritten paper records. To say that this reliance on paper is inefficient, wastes money and scarce resources and compromises patient safety and the quality of care is an understatement (Nichols et al, 2008). In order to meet these challenges and ensure the sustainability of healthcare, we need to change the way healthcare is funded and delivered. Failure to do so means these challenges go unchecked, needs go unmet, and the health system continues its downward spiral of unsustainability with resultant detrimental flow on effects for workforce participation, productivity and economic growth. The challenges facing healthcare, if not addressed appropriately and soon, will become overwhelming. They call into question nation's ability to deliver efficient, equitable, affordable, portable, universal, highly accessible and safe, high quality healthcare.

According to the World Health Organization, the life expectancy of the country is low and about 20% of children die before the age of 5 (Health care system, Wikipedia). While the CIA World FACTBOOK believes that the life expectancy at birth for male is 48.95 and female is 55.33 years of age (FactBook, CIA). With all this facts and figures there is no argument that the need for improvement is needed effective immediately. With Different climate change, there is always a different type of diseases; the common ones are malaria and fever. A country like Nigeria with daily rising in population of over 190 million people with most of its citizen attending a public hospital (Government owned) should have a more advanced way of attending to people and giving them proper care, also making a move away from the paper based approach which is commonly used in the health sector instead of the database approach which is faster and more accurate.

2.1 ICT In Health Care
ICT in Healthcare is powerful in monitoring the outbreak and spread of disease, disseminating health information about health-promoting and disease-preventing, training and long distance support to health care practitioners. A specific challenge for developing countries is ensuring that Information and Communication Technologies are effectively mobilized to develop health outcomes and combat disease amongst the poorest and most isolated populations. The applications of information and communications technologies in medicine are commonly referred to as telemedicine and medical informatics. Although these terms are often used together and confused with each other, they are separate and have their own definitions. The Institute of Medicine (1996) defines telemedicine as the use of electronic information and communications technology to provide health care when distance separates the participants. It includes all forms of electronic communication between patients and providers and among providers, starting from telephone to interactive video and web-based communication. Medical informatics is defined by The National Library of Medicine (2001) as the field of information science concerned with the analysis and dissemination of medical data through the application of computers to various aspects of health care and medicine.

Medical informatics can also be referred to as the intersection of information science, computer science and health care. For example, medical informatics includes health care delivery processes that are supported by computers that help in analyzing electronic data. (Christensen et al. 2007).

Physician / Patient Communication in the "e-Health" Context
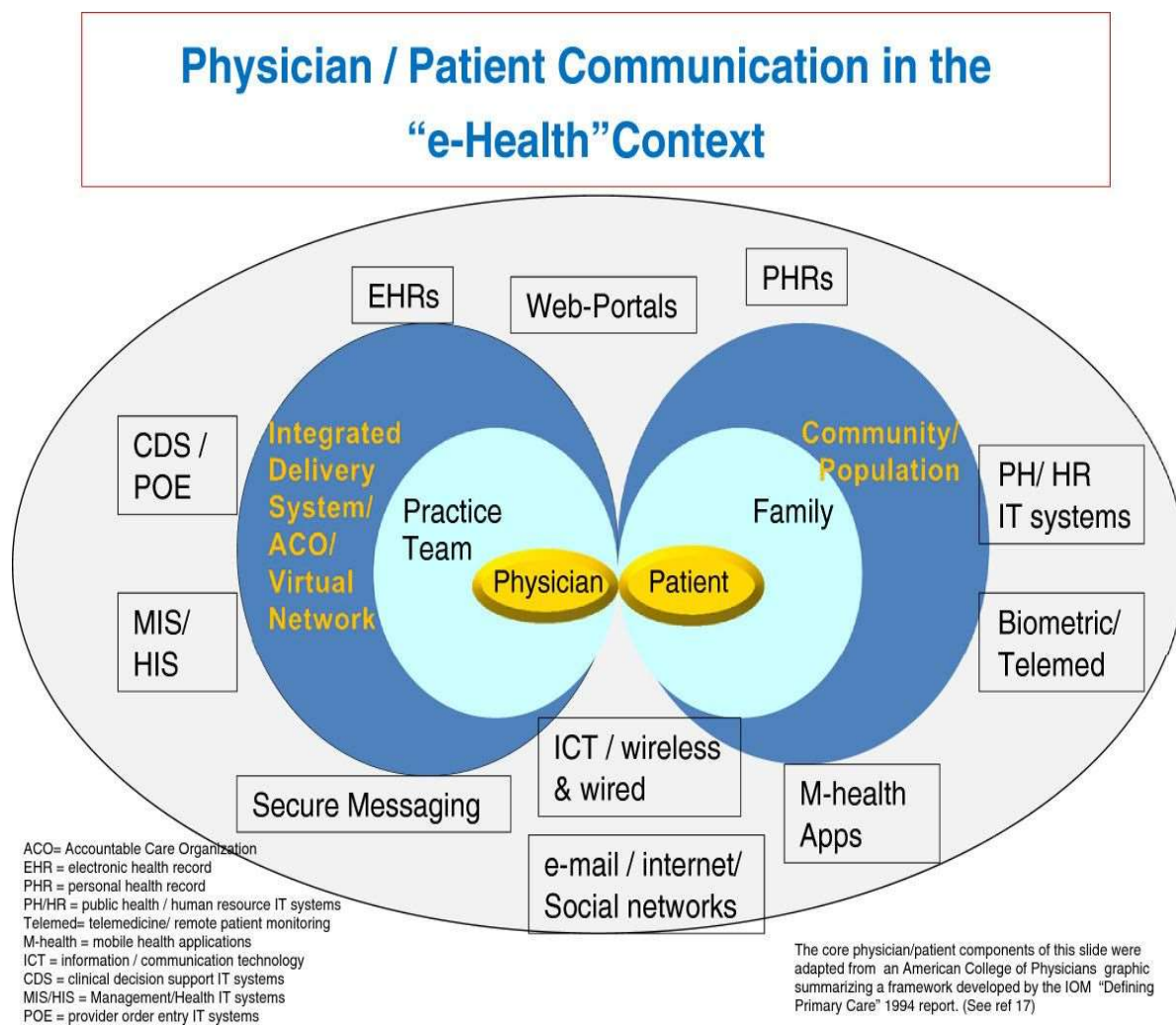
Fig.1: Physician-Patient Communication in an E-Health Scenario
Source: https://ijhpr.biomedcentral.com/articles/10.1186/2045-4015-1-33

3. E-HEALTH AND M-HEALTH

The term **eHealth** could be described as the use of ICT in hospitals. eHealth is defined as the use of ICT in provision of health care services. This means ICT can be used in various health care functions such as clinical, educational, research and administrative regardless of geographical settings. **M-Health** (Mobile Health) extends the efficiency and accuracy of the already available health systems through the use of electronic devices such as PDAs and mobile telephone networks to improve functions (such as reporting procedure) of the health systems. ICT can be used to transform the health paradigm by shifting the provider-patient configuration this typically can involve extending health care services to underserved areas by use of electronic or telecommunication means (Telemedicine) such as video chat, or health telephone hotlines. This arrangement provides patients with seamless access to doctors, improved diagnosis and treatment around the clock. E-Health and m-Health can transform the health systems by incorporating electronic means to deliver information and provide health related training. For example, mobile phones can be used to disseminate information regarding vaccination campaign and the Internet can be used to provide distance learning, share information etc.

M-Health occur mostly through mobile provision of health care services. It occurs through wireless telemedicine that involve the use of mobile telecommunications and multimedia technologies and their integration with mobile health care delivery systems. M-Health continues to mature and has been used to address health care challenges such as access, quality, affordability, matching of resources and behavioral norms through mobile technologies. M-Health is a network involving people and products; and the mechanisms that connect them using digital technologies.

E-health technologies and processes such as individual electronic health records, clinical decision support systems and intelligent, responsive buildings and equipment have enabled the delivery of safe, high quality healthcare. The culture of healthcare has evolved substantially from the days where mistakes, errors, omissions and duplication were common in healthcare delivery.

This restructuring entails a two-fold paradigm shift:
a) From symptom-based to preventive healthcare and
b) From hospital-centred to person-centred health systems.

Table 1.0: Difference between the traditional model of healthcare and the new model of health services delivery (Omotosho A. 2011)

	Traditional model of healthcare	New model of health services delivery
Model/Philosophy	Disease centred cure	Citizen centred and wellness focused
Interactions	Episodic , on demand	Continuously , autonomous
Data Characteristics	Fragmented, proprietary	Integrated , distributed, Shared , continuous update
Care giver	Healthcare professional	Citizen ,informal carers ,community , healthcare professional
Care receiver	Patient	All citizen (independent of social , mental , physical capacities)
Entry into healthcare system	Disease triggered	Choice
Consultation delivery	process Linear (cottage industry type)	Ubiquitous , seamless , collaborative
Consultation receiver location	Hospital , GP Office	Home , community-based

3.1 Examples of eHEALTH Benefits

The spectacular success of the use of ICT in public health is the control of river blindness or Onchocerciasis Control Program (OCP) in West Africa [15]. The effective reliable and appropriate information and communication system was required for collection of data critical for surveillance of the disease (the black fly larvae living in about 50 000 km of the waterways). OCP used sensors placed in waterways for periodic readings and transmission via satellite to the main center in Ounagadongou, Burkina Faso. It optimized the decision making for technical operations (e.g. aerial insecticide spraying by a small fleet of helicopters) and for program coordination and management. U.S. Government Accounting Office studied benefits of eHealth in 11 public and private Health Care Delivery organizations of varying sizes and settings (rural/urban) that had invested significantly in e-Health.

They were:
➢ 50%-80% reduction in medication error rates,
➢ >15% reduction in laboratory and diagnostic imaging tests due to online access to results,
➢ 30% increase in use of formulary and generic drugs,
➢ Significant reduction in time to refer patients using online scheduling and communication tools,
➢ 40% increase patient screening and preventative health care procedures,
➢ 40% increase in use of standard protocols by physicians. (Rudowski 2007)

3.2 E-Health Challenges Especially In Developing Countries

Not everyone is singing the praises of ICT in health education and practice. Coyne (1995) argued that the implementation of ICT can lead to a widening of the gap between rich and poor, as well as of the "digital divide", described by World Health Organization (WHO) as being "more dramatic than any other inequity in health or income". According to study, there are various challenges to eHealth implementation in developing countries which involves various areas of Technology. Let's have a look at some highlights of the Challenges which includes Lack of Skilled Stakeholders, Technology and Operational, Social and Cultural, Legal, Policymaking and Financial and so on.

Lack of Skilled Stakeholders

One of the challenges to eHealth implementation in developing countries is the lack of skilled users. The users that lack skills in using the system are health practitioners or patients, developers and maintainers, related ICT professionals, these maybe due to poor literacy and poor technological skills - internet and computer literacy. The stakeholders with low level of education are technical staff but are the primary users of the Health Information Systems in developing countries. A major challenge is training users in patient confidentiality.

Technical and Operational

Implementation of electronic health needs strong relations between ICT and Information Systems in various organizations, which has its own complexity. Some of the problems and facing challenges in implementing E-health, in Developing Countries are, from the technical and operational points of view, regarded as follows:
✓ Lack of a proper framework for information quality characteristics
✓ Needing suitable medical equipment
✓ Movement and Transportability
✓ Losing and missing electronic health records
✓ Maintenance, supporting and updating the project

Social and Cultural

Developing electronic health in the society has its own peculiarities which are quite important due to the cultural and social limitations in Developing Countries. Some of the problems in this field are indicated as follows:
✓ Lack of widespread and continuous education for public use of E-health services
✓ The need for nationalizing the health culture in involved areas in developing Telemedicine
✓ Cultural limitations against executing E-health services
✓ Resistance against changes due to habits
✓ Inadequate knowledge levels of people with regards to using E-health services

Legal

Definitely, one of the most important factors related to allocation and development of E-health is provision of legal aspects and balancing whole collection of laws and regulations, with this phenomenon. Some of the legal challenges of electronic health system, in most countries especially Developing Countries, are as follows:

- ✓ Lack of following government's ratified laws
- ✓ No support of national and universal standards
- ✓ Lack of existing suitable laws regarding personal rights and keeping patients' private surroundings
- ✓ The need for developing a legal and lawful framework for managing it in health care
- ✓ The need for developing a framework for transmitting inhomogeneous data and unifying them

Financials

Management limitations in using workforce, physical and financial sources and the necessity for the managers to have systematic approach and concentrating processes productivities during operation of most resources that they have authority upon, increase the importance of existing Information Systems and their operating mechanisms. Hence, considering the following challenges is a part of management responsibilities in this field:

- ✓ The need for investment and allocation of regular budget in electronic health field and using relevant technologies in health section
- ✓ Unsettled increase of healthcare costs
- ✓ Lack of framework for economic analysis of benefits and the results of remote health control
- ✓ Lack of consideration of financial and operative situations of each of the host countries, separately

Cultural Hindrances

At its core, the healthcare industry is built on care providers using legacy technology and rigid processes, tightly holding onto data to remain within the Privacy Act. Subsequently, the largest hurdle to be faced is changing perceptions on data sharing as a whole, to foster a true culture of integration. This means that the data generated, while managed and protected, still needs to be shared among authorized entities. Re-orienting the healthcare system towards improved integration and prevention of ongoing health issues costly to the industry requires a flexible workforce enabled by technology such as e-health applications.

Table 1.1: Summary of opportunities and challenges for ICT to improve health systems

Health Sector Challenge	ICT Opportunity	ICT Challenge
Insufficient skilled healthcare workers	eLearning and telemedicine solutions can extend expertise to remote areas and provide otherwise inaccessible care.	Facility set-up and maintenance costs and efforts; sufficient will for providers to participate (liability concerns).
Lack of health information systems	Data collection and surveillance mHealth applications can monitor and track health indicators in real time, providing insight to policymakers on true challenges and providing valuable data enabling health workers to better serve and patients to be more proactive in their own health.	Requires widespread mobile connectivity and sufficient access to phone hardware, but not always the case.
Shortage of drugs, equipment and supplies	Supply Chain Management mHealth applications can decrease stock-out frequency and increase efficacy of and trust in health system.	To realize full potential, ICT solutions still rely on physical transport of goods and services. If entire system poorly organized, digitizing system likely will not help.
Inadequate public information about preventable diseases	Public health promotion applications can be used to disseminate empowering information in friendly, personal manner. Engaging without being intrusive.	To be successful, ICT solution still relies on end user to take action on information, and assumes health system is prepared to handle increased patient load.
Financing constraints	Health financing and personal insurance programmes offer increased opportunities for savings, both for patients and healthcare providers.	Participation in mobile savings programmes still requires commitment from users. Also, governments still are challenged to commit more significantly to health systems.

4. CONCLUSION

The use of ICT within the field of healthcare is becoming an increasingly important aspect of a clinicians professional practice, improving the delivery of health services and communication between HealthCare workers, as well as enhancing the decision making process through the efficient flow of information. Other important benefits include facilitating Evidence Based Practice (EBP) through access to information for research, allowing Continuing Professional Development (CPD) in rural areas and diminishing the advantages of geographical and professional isolation. While there are barriers to widespread adoption of ICT in healthcare, such as the high cost of equipment, and concerns about the credibility of information, these obstacles are not prohibitive.However, it is recommended that further investigation into the use of ICT and its specific implementations in healthcare System and professional practice are carried out in order to better inform clinicians and educators with regards the beneficial potential of technology in healthcare.

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