Assessing innovative ICT for health information system in African rural communities

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Abstract

This paper is a positional paper that is set to take inventory of existing innovative ICT solutions in health service delivery (e-health) in rural community of developing countries and to open up researches into the acceptability and utilization of various ICT solutions in health services in developing countries. The assessment is based on the existing e-health model of Peter Dury (2005) and other subsequent works of other Authors who have researched into electronic health solutions in developing countries.

The 5Cs model as refered to by Dury 92005) was used as a framework for assessment, from this model; checklist was developed for assessing the eHealth solutions in rural communities in developing countries of Sub-saharan Africa to measure innovation, accessibility and sustainability. Further research is set to examine the role of an innovative information system and also factors within the five components that are needed to be considered to have a successful implementation of eHealth.

Introduction

Advances in information and communication technologies (ICT) have raised expectations for health(Dury 2005), high expectation of coverage, service delivery and data management even in the remote rural communities of developing countries. ICT has the potential to impact upon almost every aspect of the health sector. In public health, information management and communication processes are pivotal, and are facilitated or limited by the available information and communication technology. In addition, beyond the formal health sector, the ability of impoverished communities to access services and engage with and demand a health sector that responds to their priorities and needs, is importantly influenced by wider information and communication processes, mediated by ICT.

It is noted that emergence of ICT supported health service also known as electronic health (e-health) has show to reduce the cost of health care and increase efficiency through better data management and transfer, better management of diseases, better knowledge transfer (Oladosu *et al.* 2009) among many other positive effects. In view of this, international health organizations have invested in developing ICT for health service delivery and monitoring, some are for urban environment while others are for the rural communities where there is low accessibility to health services. These types of investment are meant to develop ICT solutions for health services most especially at rural community.

However, the level of technology possibilities in rural areas is very low due to non availability of basic amenities and utilities like electricity and communication facilities. Therefore there is the need to go extra mile in finding solutions that will be sustainable in such communities with lack of basic amenities, poverty ridden with low economic value. Peter observed that eHealth model that can be established in wealthy countries which have developed national and local ICT infrastructures with robust health information is different from the ones that ban be implemented in developing countries with high poverty level and low infrastructure. Efforts to establish eHealth in developing countries is been faced with provision of alternatives for infrastructures as in the case of using solar panels for health information, provision of personal computers (PCs) and mini laptops with internet connections, before thinking of the information system implementation itself. Also due to low level of economy, developers have to think in terms of adopting open source software (FOSS) for health services monitoring.

Therefore putting innovation in the context of health service delivery in these deprived communities, the approach to ICT support for health is different. Development of health information systems on portable devices such as personal digital assistance (PDA) and mobile phones that require less sophistications of electrical and communication infrastructures replace the provision of huge infrastructures. Such light applications use simple messaging for information transfer built on light mobile application to support health services in rural communities.

The above solutions is innovative ideas in ICT to solve health service challenges as it has provided a new way of ICT intervention in health service delivery which will require radical change of process, products, thinking and organization. However, this health innovation in Africa is rather an emergent between indigenous practices and customs and new technology which inspires new product and services than research and development in richer nations. The direction of mobile IT in many of these developing countries have been a major factor, hence giving room to rapid and crooked development of application without. There is need to put these innovations into research tests and assess their substantiality based on standardized parameters and suitability based on accessibility.

Purpose of the Study

The study is aimed at assessing the use of innovative technologies in health service delivery and information management targeted at rural communities in developing countries of Africa. There is need to study the existing implemented solutions using the five component (5Cs) framework as developed by Peter Drury, assess their prospects and challenges so far, also identify the key improvement in using such innovative technology in community health service delivery.

Problem Definition

There are sudden developments towards electronic and mobile health services with the support of ICT. There have been frameworks, systems and applications developed in different regions of Africa to support health services and capture health information. These developments are rather growing towards several directions as each country determines standards and context for developments. While some are targeted as service rendering alone (patient based) some others are particular about health data capturing, few others are concentrating on knowledge transfer to the health workers.

Whereas electronic health (e-health) encompasses telemedicine, telehealth, health management information system, medical transcription, health awareness (Adesina 2007; Oladosu *et al.* 2009) service and data flow all together to have a complete health service, hence ICT support should cover all these aspect as one. There is need to assess existing ICT solutions in order to harmonize their purpose, usefulness, implementation strategies and prospects.

Moreover emphasis of e-health solution is on rural communities of developing countries, trying to solve various challenges of health services in these communities with ICT. These problems include communication, literacy, economy, sustainability, connectivity, poverty and so on. Provision of health information in such communities is difficult and costly until there are developments of innovative solutions that require less infrastructure provision. One basic question to ask is if these solutions actually achieved the purpose they are designed to achieve, solving the above mentioned challenges or they are just some other set of toys that is not sustainable by developing nations.

Lastly, the issue of location is always left behind in ICT innovation in application domains. Geographic information is one of the last considerations in health services which suppose not to be so as location is one key element in epidemiology and health service accessibility. Non-consideration of location information is common in many ICT solutions developed in health service delivery in Africa. There are only few applications that include GIS and these applications are mainly desktop applications. This however, leaves the gap of 'where' in health analysis. This gap will be one of the points to look for in all innovative solution to be assessed in health services in Africa.

Africa e-health systems: journey so far

Since the emergent of ICT applicability to health system in Africa, there have been several talks on finding the best way to use ICT to support health service delivery. But instead of concentrating on the existing system, many development groups have sought for solutions in technology that is yet in the plan.

Although all the detail technicalities are necessary to put eHealth on course, it is rather more beneficiaries to African system to find solutions that is accessible to these deprived communities. This paper is less concern with

the technical difficulties faced in trying to put in place good infrastructure for eHealth to function, but concerns greatly on the accessibility of the system to the targetterd

communities, assessing each solution with the aim they set to achieve. There are some solutions that have been developed

1. UHIN (Uganda): It is a mobile health solution which started in 2003. It uses existing GSM/GPRS/ WiFi links with PDAs to support (community) health workers creating a regional eHealth network. It uses solar panels for power and it is targeted at Primary Health Care service provision. Its purpose is to provide learning materials, health information and e-mail to health workers. Major benefits include enhancement of timely response to health system needs, diseases outbreaks and organisational health planning among others.

2. Cell-Life (South Africa): This is a multiplatform system for the therapeutic and logistic management of HIV/AIDS population which was started by 2 universities in SA in 2003. It is a mobile health solution that was built on mobile devices (Cellphones & PDAs) with 3G/GPRS/SMS networks. It is set to enable community health volunteers to assist their fellows HIV + management. And also enables organisational planning for drug supply and emergency situations

3. MindSet Health (South Africa): This is a PC based health information application that uses DVB wireless satellite technology to provide health education (eLearning) to rural health workers in clinics and hospital. It is also targeted at patients and citizens through broadcast of health promotion documentaries and dramas on large screens and television sets (TVs) in clinics and communities. One major benefit is to improve health workers' capacity and empowers citizens' to keep healthy.

4. LAMIS (Nigeria): This is a PC health solution that was developed by Family health international (FHI) Nigeria with Axios in 2007. LAMIS is set to be a patient management and drug inventory system for use at comprehensive sites. The full name of LAMIS is Lafiya Information System and was designed to enhance the quality of care for patients with HIV/AIDS. It was built to manage drug inventory information and include clinical, laboratory, and logistic information that enhances patient management and monitoring. This tool enables clinicians to electronically monitor their patients and quickly access information required to guide decisions related to improving healthcare services. The software also has features to help health managers monitor cross-clinical performance and provide feedback related to uptake goals and ongoing quality improvement.

5. DHIS (HMIS Countries): District Health Information System (DHIS) is developed to collect and manage health information at district level. It is targeted as collection of health data and aggregation for analysis purpose to support decision making. DHIS 1.4 is standalone PC application and DHIS 2 is a web based client-server application accessible through web browser. It has been adopted in various African countries including South Africa, Nigeria and Ethiopia.

In other developing countries around the world there has been similar efforts in health service delivery on of such effort is the ADVANTAGE Project that is been implemented in Vanuatu, South West Pacific. The application is targeted at facilitating Telemedicine in the country. The goal of the project is to provide physicians with real-time access to MEDLINE/PubMed for clinical decision support at point of care and also provide health practisioners in remote islands in the country with clinical guidelines and access to Health Workers Manual .

Quick Observations on the Existing eHealth Solutions

Form the above solution, various aspects of health services can be identified. Form a quick assessment of these applications' it is clear that there is hardly any of the existing solution that combined all the aspects that made up a complete cycle of health service delivery. Below are some importance findings which worth a detail analysis using a developed concept.

1. Most of these applications focused on one or two aspect of the health service delivery. For instance data collection applications like DHIS and LAMIS only concentrate on collection, management and analysis of data. They did not take care of knowledge transfer to the health workers therefore is it not useful for rural communities where there is low level of medical knowledge.

2. All these applications are either PC passed or mobile based. While MindSet is an informative system through TVs only, Cell life, UNCH and ADVANTAGE are pure mobile application for health workers, and DHIS and LAMIS are PC based that is focused more on data collection.

3. Requirement of infrastructures differs greatly between different platformsof implementation of these applications. While some largely depend on electric power supply for instance, others do not need constant power grid, they need small power source to sustain over a period of time.

There and many more variation identified prompt the need for proper assessment which will be based on a concept of applicability, acceptability and adaptability. Peter Dury already assessed the situation of developing countries and developed a model for implementing eHealth in such poverty ridden environment. Below is a key hole view into the model and its usefulness for assessing the exist eHealth applications(Ajayi *et al.* 2009).

Framework for assessment of eHealth Solutions

Although ICT development in Africa has not been based on research and development as noted earlier, there are still researchers who have worked on developing models, frameworks and concepts for implementing e-health in Africa. One of such is the model developed by Peter Dury 2005 to guide in adoption and implementation of eHealth in developing countries. He identified five (5) components that should be considered when implementing eHealth solution; they are Context, Content, Connectivity, Capacity and Community. Expanding this model, conditions for a good eHealth system can be highlighted and developed into a checklist for accessing existing and proposed application to be implemented in rural communities in developing countries of Africa.

Five Components (5Cs) Model by Peter Drury Expanded

Poverty Context: Dury (2005) identifies poverty as a major factor to be considered in using ICT on health service delivery in developing countries. He noted that low level of economy may be a great challenge in adopting a fully developed European/western based solutions for African developing countries where information systems are not fully established. Upon this macro economic factor, rural areas in developing countries still surfer more set backs as compared to urban communities in the same country.

Therefore, an information system support for health in rural areas of developing countries should consider the macro and micro economy level of the community where it is to be implemented. It should consider the form of health service support the community is getting compared to the urban settings. Issues like availability of fund, accessibility to health care, availability of energy and infrastructure, and affordability and adaptability of new technology to the communities should be taken to consideration.

Information Content: Health information is a very important part of health care and service delivery. Health information formed the base for health worker and patient alike in the treatment of diseases such as HIV/AIDs, Malaria and Tuberculosis. Peter Identify transfer of information down to the health workers in rural community in appropriate format as a necessary component of an information system as well as the medium through which the information is transferred. He stressed that the existing books and posters that carries up-to-date health information are not at the point of health services in small facilities (rural communities) and there is need for a change in the format to digital, and medium to DVDs and hand held devices in order to facilitate easy and timely transfer of up-to-date information to health workers.

Beyond the issues of the format and the medium mentioned by Peter, information content include the data that is collected at service delivery and converted to information for health workers. Some of the issues that may need further clarification included local information harmonization to the stream of health knowledge at local and global level, upward flow and national aggregation of health data to further strengthen the quality and quantity of information sent back to the facilities. One other important issue that is involved in health information content is the quality of the data that formed the bulk of the information which is to be shared with health workers. Data quality should be ensured in any information system that renders health services and collect health information.

Connectivity: The network to facilitate transfer information to the facilities is another factor highlighted by Peter. He acknowledged that most hospitals in developing countries do not have computers and networks that can allow them to share health information. Institutionalizing information system for such facilities will include setting up of computer devices as well as networks that will facilitate on time/real time information transfer.

Hence, a good information system should consider the type of connection to be set up with minimum infrastructure requirement that is cheap to maintain with simplicity and stability. Although it may be hard to come by such solutions that can absolutely satisfy these conditions, it is however reasonable for developers to critically consider these conditions and weigh options before deploying ICT based information system to rural facilities.

Capacity: Health workers migration from developing countries to richer countries is a major challenge in health systems in Africa. Qualified health workers not only migrate to European countries, they also internally migrate from rural areas to urban centers where there in more robust economy. This movement has left rural communities with few trained health workers supported with in-house trained workers.

Attempt to use ICT to strengthen these facilities implies that there is need to train health workers locally to be able to deliver health services as well as work with the institutionalized information system. This may rather be tough as there is more ICT skill requirement needed for health worker which include general health information literacy, computer literacy, mobile phone literacy and digital record knowledge. eHealth solution should consider simplicity of applications to low literate workers and also a user friendly application that will not involve complicated tasks.

However, ICT based health facility training will also bring training closer to health workers in their work places. Information transfer through wireless infrastructure will reduce cost of taking health workers out of the community for continuous training. Applications and programmes such as Second Opinion, Telemedicine outreach programme (AMREF) and Continuous Medical Education (CME) are some examples of such capacity building information systems (Dury 2005; Adesina and Jim 2008; Oladosu *et al.* 2009).

Community: This aspect of the 5Cs as discussed by (Dury 2005) emphasis on the use and reuse of health data collected from service delivery at the community level. It involves the ability of health worker to collate and interpret data in order to take action and also notify higher authorities of the findings from the data. Although this might have been the practice in many health systems in developing countries, they are more of paper based systems where data is sent upward to the district for analysis. At this point it is more appropriate for any ICT based information system to empower the community health workers with analysis capability within their communities. This will help them in their performance appraiser to further help them in community decision making as well as delivering of quality health services.

While the global analysis is useful for national decision making at the top level, local analysis which will be based on patient and individual is very important for community decision making. Therefore a robust health information system at the

community level should have analysis module that will help health workers interpret data collected during service delivery.

Check list from 5Cs model

Based on the above discussion on the 5Cs model, I developed check list that could be expanded to evaluate the existing eHealth solutions/applications in African developing countries with the focus on the variation of the rural settings to urban centers in the same country.

- Service delivery:
    - *Local vs international service delivery system:* Does the application create balance by offering required local services and also abiding with the international standard of minimum health service delivery?
    - *Poverty level:* Was the application built with the consideration of the community level of poverty and affordability?
    - *Rural vs Urban:* Is there differences in the service support provided by the application in rural areas as compared with urban centers in thesame country?
    - *Culture and tradition:* Was the application built with consideration of culture and tradition of the local communities?
    - *Disease and programme areas:* Was the application built around single disease or multi-diseases programme? What are the diseases that the application is built around?
- Resources and infrastructure
    - *Energy and power:* Was the application developed to utilize minimum energy available the rural communities in the country? Does the application require a stable power grid to function efficiently?
    - *Connectivity:* What are the means of data transmission used by the eHealth solutions in the rural communities and how innovative is it when there is no constant internet connectivity?
    - *Electronics and devices integration:* What platform is the eHealth currently running? How can it be integrated with other platforms and other devices?
- Health information

- o *Content (standards and quality):* What are the minimum Health data standards that are built in the eHealth solutions? How is the application assuring data quality?
- o *Collection methods (digital vs Analogue):* Is the application built to collect data at the service delivery point or does it rely on paper –based tools for its data input?
- o *Format and medium:* What is the format for the data storage and through which medium is the data transferable to other points?
- o *Transfer (data flow: vertical and horizontal):* Does the application support data transfer vertically to the national level and/or horizontal among health workers in the community? Is there clear data flow built in the eHealth application?
- o *Use and reuse (global and local):* Does the application support use of data at the community level and also at the national level?
- o *GIS (positional information):* Does the application collect location information with health data? Does it have ability to provide data for mapping or have in built mapping system?
- Capacity building
  - o *Training transfer:* Does the application have ability to transfer health information to health workers?
  - o *Continuous Education:* Is there a form of training module built in the application?
  - o *Local knowledge integration:* Does the application have ability to integrate local health knowledge in the health system?
  - o *Teleconsulting:* Is there is teleconsulting system built in the application?

As mentioned earlier, an eHealth solution may not be able to possess all these functionalities, however, it is important to assess the functions of these solutions based on the above criteria. This will help to improve on eHealth solution development thereby bringing innovation into ICT support for health services.

Conclusion

Painted on the back drop of severe challenges of health in African region is the great need for health system strengthening that will be self sustainable. The continent

need to build a system that will maximize the existing communication and information infrastructure rather than bank on futuristic solutions which are yet to be realized.

Therefore assessing the existing eHealth solution is a keyhole into expanding the support of ICT for health system strengthening, opening up innovative methods to resolving health service challenges in developing countries, most especially in the rural areas of these countries.

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