

COMPARATIVE ANALYSIS OF THE STATUS OF ICT USAGE IN HEALTHCARE: SOUTH AFRICA, TANZANIA, MALAWI

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ABSTRACT

Information and Communication Technology (ICT) is increasingly playing a pivotal role in the delivery of healthcare services. Effective use of ICT in the health sector has the potential to improve the efficiency of health care and public health service delivery. Health is affected profoundly by the application of ICT, which changes the way people can access knowledge and the way they communicate with one another daily (Mechael, 2005).

Telemedicine, mobile health and electronic health applications have improved the delivery of healthcare services, disease management and disease awareness. It cannot be overemphasised that the deployment of these technologies has enabled the timely access and the sharing of more accurate health information between healthcare professionals and patients.

This paper discusses a comparative analysis of the usage of ICT in health care, specifically in the countries of South Africa, Tanzania and Malawi. The study was conducted by examining scientific research papers in journals and conference proceedings.

The paper has revealed that there are disparities in the usage of ICT within the Southern African Development Community (SADC) regions, especially among South Africa, Tanzania and Malawi. In general, SADC faces a lot of challenges such as lack of financial resources, poor infrastructure and lack of cyber-legislation. However, the situation in the SADC region can improve if there is a harmonization of cyber-legislation. Apart from improving infrastructure, there is also a need to increase trade and e-commerce among member countries.

KEY WORDS

ICT usage, electronic health, m-health, telehealth, e-health, Malawi, South Africa, Tanzania, public health care, developing country.

1. Introduction

ICT is increasingly playing a pivotal role in the delivery of healthcare services. ICTs have a well-established role in efforts to improve the delivery of healthcare in the developing world (Toussaint, Verhoef, Vliet Vlieland, 2004). Health is profoundly affected by the application of ICT, which changes the way people can access knowledge and the way they communicate with one another in daily behaviour (Mechael, 2005).

ICT can be generally used in various areas in the health sector, especially in developing countries like Malawi and Tanzania among others. Firstly, ICTs may play a mediator role between the different groups of healthcare providers and between the health system and its beneficiaries (Sultana, 2004). In this case, healthcare providers can share health information at the same time patients can interface with the systems in order to get timely information.

Secondly, ICT applications have been proven to provide a platform for coordination and collaboration among health care professionals at different levels by opening up new communication channels (Idowu, Ogunbodede, 2003). For instance, mobile phones can assist to improve the skills of healthcare workers by providing them with access to timely information and professional advice (Chandrasekhar & Ghosh, 2001).

Even in rural areas where roads are impassable, mobile phones can play a major role in accessing health information. With mobile devices, people become better equipped to respond to health emergencies by being able to contact peers and health professionals regardless of where they are.

The World Health Organisation defines e-health as the use of ICTs for health to treat patients, pursue research, and educate students, track diseases and monitor public health. The following summarises a range of services or systems in healthcare that can be supported by ICT.

- a) Electronic health records (EHR): Gunter, 2005 defines EHR as a systematic collection of electronic health information about an individual patient or population. It is a record in digital format that is theoretically capable of being shared across different health care settings.
- b) E-Prescribing: This is a computer-based electronic generation, transmission and filling of a medical prescription, taking the place of paper and faxed prescriptions. E-prescribing allows a physician, nurse practitioner, or physician assistant to transmit a new prescription or renewal authorization to a community or to mail an order to a pharmacy electronically.
- c) Telemedicine: This involves the remote diagnosis and treatment of patients by means of telecommunications technology.
- d) Consumer health informatics: This is the use of electronic resources on medical topics by healthy individuals or patients. This helps bridge the gap between patients and health resources.
- e) Health knowledge management: This involves the creating, organizing, sharing, and using of information and experiences in the health sector, often using ICT.
- f) Virtual healthcare teams: This consists of healthcare professionals who collaborate and share information on patients through digital equipment.
- g) M-Health: This 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 vitals, and direct provision of care.
- h) Medical research: This involves systematic investigation in medicine for new knowledge using ICT tools.
- i) Healthcare Information Systems: These are referred to as software solutions for appointment scheduling, patient data management, work schedule management and other administrative tasks surrounding health.

The importance of using ICT in Health cannot be overemphasised. Effective use of ICT in health care delivery may have the following benefits. Firstly, it may improve the safety and quality of the delivery of health care services. Secondly, it increases the efficiency of health care and public health service delivery. Thirdly, it may improve the public health information infrastructure. Fourthly, ICT may support efficient community and home health care. Lastly, apart from ICT facilitating the sharing of skills and knowledge, it may also play a role in facilitating clinical and consumer decision-making.

Different types of technologies that are used by various people have a number of advantages in healthcare delivery. Firstly, landline and mobile phones may be used for contacting a patient or a physician directly for an appointment or health counselling. The user needs to have

good telephone manners. Its main advantage is that it can be accessed universally. It is quick and easy to use. It can be used in counselling where a patient requires confidentiality without physically seeing a medical practitioner.

The Short Message Service (SMS) messaging is another technology which can be used for health appointments and basic health support services such as reminders. The user needs to have skills in mobile technology interfaces and must know how to read and write SMS messages. The advantage is that it is quick and easy to use too. Patients can access SMS anywhere at any time. Patients can refer back to the message since the record of the conversation can be stored.

Electronic Mail (e-mail) is an internet technology that is used for person-to-person contacts, relaying information alerts and booking appointments. The user needs to acquire basic keyboard skills because it is a text-based communication. Messages may contain links to other advice pages. This technology is easy to use. Patients can access the message at their convenient time anywhere across the globe. Patients can refer back to the messages since the record of the conversation can be stored.

A web page is an internet-based technology that is used for a range of uses such as health announcements and dissemination of basic health information. It can be interactive to provide information for self-assessment. The user may require skills in information management. There is a need to be clear about the purpose and scope of the source of the information. The advantage of using this technology is that it can be accessed anywhere where there is internet connectivity. Information can easily be found via a search engine.

Internet chat rooms support peer groups of patients with long-term conditions or ailments. Skills are required in designing purposeful online discussion groups. Some skills are also required to facilitate online forum discussions. The advantage of this technology is that support from peers may contribute to the acceptance by patients of their long-term conditions or ailments. This method has proven to be easy to access for many young people.

Webcam uses a visual and audio interface technology which requires the user to have skills in using visual and sound technology. With this technology, patients and health care professionals appreciate face-to-face remote health consultations.

Specialists also may use electronic monitoring system to monitor and evaluate the condition of patients remotely. Usually remote diagnostic equipment is used to collect data that can be used for clinical decision-making. Skills are needed to use the equipment. The advantage of this is that patients can take readings in their own time. Since they are engaged, they tend to have a better understanding

of the reasons for taking readings. This technology can also be used by experts such as paramedics to access remote assistance.

According to the SADC e-Readiness Review and Strategy Report (2002), there are two distinct groups of countries in the SADC region. Group 1 includes Seychelles, Mauritius, Tanzania and South Africa, while Group 2 includes Namibia, Botswana, Swaziland, Lesotho, Democratic Republic of Congo, Zimbabwe, Angola, Malawi, Zambia and Mozambique. In Group 1, countries have a more stable and well-developed ICT infrastructure than do those in Group 2. The SADC region faces challenges across the board such as a shortage of skilled labour and bad economic conditions.

According to E-Commerce Readiness Study in the SADC (2012), trade agreements between SADC countries and ICT strategies exist. However, the region does not have a good infrastructure, cyber legislation or trust. It also has poor and restrictive transport logistics and regional trade integration. Apart from having restrictive foreign exchange regulations, the region has no free movement of goods amongst all the countries. Sometimes the laws and strategies of the various countries are undertaken without consultation. However, the situation in the SADC region can improve if there is a harmonization of cyber-legislation. Apart from improving infrastructure, there is a need to increase trade and e-commerce among member countries

South Africa is at the forefront of the SADC region with regard to ICT development. It also has appropriate policies for infrastructure development. The appropriate policies have created trust in the digital economy. It is advancing in each of the following when compared with the other member countries: e-Government, education and e-Learning, e-Infrastructure, Digital Repositories Health and e-Banking.

According to Evidence for ICT Policy 2012 for South Africa, 44% of the computer users own their own desktop computer and 35% own a laptop. 61% of computer users use computers at home, followed by 40% who use computers at work, and 29% who make use of internet cafes. Writing letters and editing documents are the most common uses of computers, done by 74% of the computer users, while 71% of the computer users use computers to browse the internet.

The report further notes that more males (59%) than females (44%) have a mobile phone capable of browsing the internet. There has been significant growth in competition within the broadband internet market, with mobile broadband connections far exceeding those of fixed broadband. Unlike the case with other members of SADC, electrification is widespread, even into informal settlements and rural areas, and the basic education and health systems in South Africa are extensive. It further

pointed out that International bandwidth capacity had increased significantly in terms of quality and pricing. Customers prefer mobile broadband offerings to fixed ones.

Malawi shows fairly limited development with regard to e-readiness. One of the greatest challenges is the fact that almost 90% of the community lives in the rural areas. There are a small number of Internet access points, which limits the growth, awareness, and usage of the Internet. Only 10% of the total households in Malawi have electricity. The lack of electricity makes it impossible to have access to PCs and the internet. Malawi faces a lot of challenges in accessing health care services. For instance, owing to bad road infrastructure, it is very difficult to transport a patient from a remote village to the nearest hospital. It is believed that the use of mobile phones can assist the rural people to access some of the health services. ICT Initiatives in Malawi are currently ongoing at a national level in the area of e-Government, Education and e-Learning, e-Infrastructure, Digital Repositories Health and e-Banking. All of these are in their infant stage.

According to Tanzania ICT Sector Performance Review 2009/2010, Tanzania has one of the fastest growing ICT markets in Africa. Tanzania has made good progress with regard to internet access. The internet population boomed in the country, owing to the cyber café mode. Lack of electricity and poor accessibility are the major hindrances to radio and TV signal penetration in rural areas. Tanzania is preparing for the conversion to digital broadcasting to meet the 2015 deadline set by the International Telecommunications Union (ITU). Rural-based subscribers and students remain the main source of new subscribers for the traditional voice and text messaging services. The ITU indicates that Internet penetration in Tanzania was equal to 1.3% in June 2009

2. Method

A literature review was employed in this study in order to gain a theoretical understanding of the topic that is being investigated. Related journal articles by various researchers were downloaded from electronic databases including Science Direct and EBSCOhost. Most of the journals that have been reviewed are from 2002 to 2013. The study also examined other documents such as E-Health Strategy South Africa (2012-2016), Tanzania National e-Health Strategy June (2013 – July, 2018), Malawi Health Sector Strategic Plan (2011-2016) and The Global Information Technology Report (2012).

Keywords such as usage of ICT in health, m-health application, mobile health application, e-health application, electronic health application, Malawi, Tanzania, South Africa and public health care were used in the search engine in order to select appropriate journal

papers and related documents. Special Boolean operators like AND, OR were employed in order to alter the scope of the search. Additionally, online personal communication was conducted with key players in mobile health, especially in Malawi.

3. Literature Review

ICT plays a major role in improving the delivery of healthcare services, disease management and disease awareness. For example, The Electronic TB Register project in South Africa has enabled tuberculosis patients to receive timely reminders to take their medication using mobile phones. In Tanzania, Tutunzane Project uses mobile technology to improve communication and reporting between health clinics, home-based care providers, and clients.

3.1 ICT Uses in Health

The following summarises electronic health systems that can be used to improve the health care delivery cases:

- a) **Electronic health record**
This is an electronic record of health-related information on an individual that can be created, managed, or consulted by clinicians or staff. This helps to keep track of the history of medication of patients and hence makes sure that appropriate medication is prescribed.
- b) **Laboratory information management system**
This system keeps track of the activities of the laboratory. It helps in reporting the results to administrators and health care personnel. Hence it decreases time for the communication of results, at the same improving the productivity of the laboratory (Blaya et.al, 2007)
- c) **Pharmacy information system**
This is a system that can be used to order, dispense, or track medications or medication orders including computerized order entry systems. This can reduce the time taken to order medications and therefore provide easy access to past information.
- d) **Patient registration or scheduling system**
This is a system used to monitor and manage the movement of patients during admissions, discharge and transfer of patients.
- e) **Monitoring, evaluation, and patient tracking system**
These are systems that are used for aggregate reporting of information, program monitoring, and tracking of the status of patients. Examples include district health information systems or health management information systems.
- f) **Clinical decision support system**
These systems are designed to improve clinical decision-making, in which characteristics of individual patients are matched to a computerized

knowledge base and software algorithms generate patient-specific recommendations. For example, the Electronic Integrated Management of Childhood Illness approach in Tanzania showed that more clinical staff completed the electronic questionnaire compared to those who completed the paper booklet.

- g) **Patient reminder system**
This is a system that is used to prompt patients to perform a specific action, for example to take medications or attend the clinic.
- h) **Research/data collection system**
This is a system that is used for collecting data from different locations or for storing, managing, or reporting on data used for research purposes. This enhances accuracy in entering the information into the system.

M-health Applications have many benefits including the following: increased access to healthcare and health-related information; improved ability to diagnose and track diseases; timelier, more actionable public health information and finally, expanded access to ongoing medical education and training for health workers

The UN Foundation and Vodafone Foundation (2007) report presents seven application categories within the m-health field:

- a) **Education and awareness:** This is concerned with the spreading of mass information from source to recipient through SMS.
- b) **Helpline:** Patients can consult health personnel via a phone line.
- c) **Diagnostic and treatment support:** They are designed to provide healthcare workers in remote areas with advice about the diagnosis and treatment of patients. This is usually called telemedicine.
- d) **Communication and training for healthcare workers.**
- e) **Disease and epidemic outbreak tracking:** Projects within this area operate to utilize the ability of mobile phones to collect and transmit data quickly, cheaply, and relatively efficiently.
- f) **Remote monitoring:** These allow healthcare workers to track patient conditions and follow-up scheduling better.
- g) **Remote data collection:** This increases the convenience and efficiency of data collection, data transfer, data storage, data analysis and data management as compared to paper-based systems.

3.2 Overview of Public Health Sector

3.2.1 South Africa

The National Department of Health (NDOH) coordinates public health informatics and telemedicine in South Africa. The country has a single National Department of Health (NDOH) and nine Provincial Departments of

Health. The Departments of Health in each of the nine provinces are responsible for individual health information systems and telemedicine in their province (National Department of Health Strategic Plan 2010-2013)

3.2.2 Tanzania

Tanzania mainland has approximately 237 public and private hospitals. Of these, 57 are district hospitals owned by the Government of Tanzania, and 35 are designated district hospitals, owned by faith-based organizations. The National e-Health Entity coordinates and oversees the e-Health investment and the execution of the implementation plan in Tanzania (Tanzania National e-Health Strategy June, 2013 – July, 2018)

3.2.3 Malawi

The Government of Malawi has put in place a health information system policy and strategy that provides a strategic framework for the development of health information systems. The Health Management Information Systems (HMIS) was implemented through the Central Monitoring and Evaluation Division (CMED), which is an integral part of the Planning and Policy Development Department at the headquarters and through the District Health Management Teams (DHMTs) at the district level and at the facility level. The CMED in the Department of Planning and Policy Development under the Ministry of Health is responsible for coordinating routine Health Management Information Systems (Malawi Health Information System National Policy and Strategy, 2003). Table 1 compares various health statistics among South Africa, Tanzania and Malawi

Table 1: Health and ICT statistics in South Africa, Tanzania and Malawi

	South Africa	Tanzania	Malawi
ICT Policy and Strategy	√	√ (Approved 2005)	√ (Approved 2013)
E-health Policy and Strategy	√	√	√
M-health Policy and Strategy	√	X	X
E-health systems	√	√	√

	South Africa	Tanzania	Malawi
M-health systems	√ (Pilot)	√ (Pilot)	√ (Pilot)
Networked Readiness Index (N RI)	72	124	132
The physician to population ratio (per 10,000 population)	<0.5	<0.5	<0.5
Hospital beds per 10,000	28	11	11
Life expectancy (WHO,2013)	61	59	58
Adult mortality rate per 1,000 (2009)	520	458	481
Under-five mortality rate per 1000	62	108	110
Political regulatory/142	23	65	47
Business and innovation /142	50	129	114
Infrastructure and digital content /142	82	125	123
Affordability (cost) / 142	94	128	138
Skills /142	101	117	115
Individual usage /142	96	131	137
Business usage /142	34	114	124
Government usage /142	89	114	124
Economic impact/142	59	133	99
Social impact /142	98	123	117

4. Major Findings and Discussion

The study has revealed that all three countries have used ICT as a tool to improve the delivery of healthcare services. All three countries have implemented e-health policies and strategies. South Africa is leading in terms of ICT usage, followed by Tanzania and Malawi according to their NRI (Global Information Technology Report, 2012). This is not surprising since South Africa and Tanzania were rated to be in Group 1 according to Southern African Development Community e-Readiness Review and Strategy report (2002)

There are some areas in which Malawi is performing better than Tanzania. For instance, Malawi has a better political and regulatory environment than Tanzania. In summary, South Africa ranked the highest in all ten pillars of NRI as compared to Tanzania and Malawi (Global Information Technology Report, 2012).

4.1 E-health Solutions

In all three countries, E-health solutions have been implemented in the form of EHR, E-learning, Health Information systems and E-prescriptions. For example, in South Africa, slightly more than a third of the provincial hospitals have computerized systems in place. Meditech, Medicom and Clinicom dominate the commercial EHR market in South Africa. In all three countries, most of the EMR is implemented at the district and national level. Unfortunately, they are not fully integrated.

4.2 M-Health Solutions

South Africa is leading in terms of the implementation of m-health solutions. Most of these are implemented in the form of telemedicine, mobile learning, m-health monitoring, remote data collection, tracking diseases and epidemics and enabling effective communication between health workers and patients. Most of these m-health solutions are pilot projects.

In South Africa, there is a project called Dokoza. This system uses mobile technologies for data and transaction exchange for medical services especially via cell phone and SMS. It collects and disseminates real time data and transaction information for all patients receiving ART and TB treatments. The system was implemented at Helen Joseph hospital and the Paediatric Clinic at Johannesburg General Hospital. It offers services like patient registration and accessing HIV/AIDS patient status, among others. (Patel et al, 2007)

In Tanzania, a project called Wazazi Nipendeni promotes a free SMS service by listing the short-code on its campaign materials. Anyone interested in receiving healthy pregnancy information and appointment reminders can send the word 'MTOTO' (child) to the short-code 15001. Users receive instructional messages during registration, allowing them to indicate the current

week or month of pregnancy of the woman (or the age of the newborn baby) during the enrolment process. This process allows the recipients to receive specific and relevant text messages.

In Malawi, the Clinton Health Access Initiative is applying technology from frontline SMS to help the Ministry of Health in Malawi to track down clients (patients) missing appointments, to communicate test results and to identify patients with urgent medical conditions. This programme is primarily concerned with preventing mother to child transmission of HIV (Mahmud, N., Rodriguez, J., & Nesbit, J., 2010)

4.3 Public Health Information Systems

Though not integrated, most health systems are implemented as Patient Management Systems, District Health Information System (DHIS), Demographic Surveillance Systems and Human Resource Management Information System.

4.4 Strategies

South Africa has both an e-health strategy (E-health strategy South Africa 2012-2016) and m-health strategy (Cargo, 2013). The following are ten strategic priorities that must be addressed in order to strengthen healthcare transformation in South Africa: 1) Strategy and Leadership 2) Stakeholder Engagement 3) Standards and Interoperability 4) Governance and Regulation 5) Investment, Affordability and Sustainability 6) Benefits Realisation 7) Capacity and Workforce 8) e-Health Foundations 9) Applications and Tools to support Healthcare Delivery 10) Monitoring and Evaluation of the e-Health Strategy (E-health strategy South Africa 2012-2016).

Tanzania has an e-health strategy which has four key areas namely 1) E-health Foundations, 2) E-health Solutions, 3) Change and Adoption and 4) E-health Governance. E-health foundations describe the basic infrastructural building blocks that are required to enable electronic sharing of health information, while e-health solutions are computing systems and tools that are used to address the high-priority needs of patients, healthcare providers and healthcare managers. Some telehealth and m-health initiatives in Tanzania have been included in the e-health strategies (Tanzania National e-Health Strategy June, 2013 – July, 2018).

5. Conclusion, Recommendation and Future Research

This paper has discussed the comparative analysis of the usage of ICT in health care, especially in the specific

countries of South Africa, Tanzania and Malawi. The paper has revealed that there are disparities in the usage of ICT within the Southern African Development Community (SADC) regions, especially among South Africa, Tanzania and Malawi. South Africa is leading in terms of development in m-health and e-health solutions in SADC. It has successfully implemented many health information systems as well as mobile applications. This is because it has appropriate policies for infrastructure development. The appropriate policies have created trust in the digital economy. It is advancing in each of the following as compared to other countries: e-Government, Education and e-Learning, e-Infrastructure, Digital Repositories Health and e-Banking.

There is a need to continue working with development partners so that m-health projects are rolled out from the pilot phase to the national level. There is a need to integrate and harmonise e-health and m-health solutions at national level. Investments must be made to improve the infrastructure. As regards to Malawi that has no m-health strategies, there is a need to integrate and synchronise ICT policy into e-health and m-health. There is a need to harmonise cyber-legislation in the region. Investments must be made to improve the ICT capacity in the health sector. Future research needs to be carried out in order to find means of further promoting the usage of ICT in healthcare in SADC.

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