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# Underlying Challenges of E-Health Adoption in Tanzania

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## ABSTRACT

We describe the underlying challenges on the adoption of ehealth (or e-health) in Tanzania which encompasses the use of Information and Communication Technology (ICT) in healthcare services. The study aimed at bridging the knowledge gap of ehealth adoption for improved healthcare services in Tanzania. The survey was conducted in regions namely Iringa and Morogoro, Tanzania using a structured questionnaire to health service recipients and providers. The findings show that the challenges include inadequate ICT skills, high cost of ICT in relation to economic status of community members, less developed infrastructure including lack of imaging equipment, small proportion of Internet users and lack of information about suitable ICT solutions. The findings have an important implication in various sectors including policy formulations aimed at increasing the adoption of ehealth for improved services.

**Keywords:** *ehealth, ICT challenges / constraints, ICT adoption, Health-care, ICT, Iringa, Morogoro, Tanzania*

## 1    INTRODUCTION

In general, Information and Communication Technology (ICT) facilitates the processing and transmission of information and the sharing of knowledge by electronic means. Many organizations use ICT in their activities to increase their efficiency and effectiveness [19]. Developing countries have recognized the benefits of using ICT in various public services for enabling the community to get quality and affordable services easily. The quality of information about the ICT situation in African countries, however, differs from country to another and is limited to few countries [9, 15]. This is one of the reasons for conducting this kind of study in Tanzania because results from other countries can not be directly applied to another country.

The term ehealth refers to healthcare services that are supported by electronic means. E-health includes all medical healthcare services and technologies relying on modern information and communication technology (ICT). It encompasses: (a) healthcare information networks and electronic record systems including information systems for healthcare professionals and hospitals, online services e.g. electronic prescriptions, databases used for patient care, research and public health, health portals and online health promotion services; (b) Telemedicine systems and other similar services; (c) Specialized tools or machines for healthcare professionals and researchers including robots used for diagnosis and surgery; simulation and modeling equipment; healthcare grids and equipment for training [5, 6, 8]. This includes mobile health [3]. This paper in addition to the modern technologies, considers classic technologies such as Radio and Television.

According to [11, the main purposes of ehealth are broad. Firstly, it extends geographic access as such overcoming long distances between physician and patient by replacing a traditional office visit. This could include Telemedicine by use of facilities such as g. video-conferencing with patients in rural areas; helplines; instant messaging with a health practitioner for medical advice. Secondly it facilitates patient communications between health workers and patients outside regular office visits with the aim of general health education; encouraging patient compliance; and enabling emergency care. Thirdly, ehealth improves diagnosis and treatment by enhanced methods and equipment. This also improves clinical performance during training or in the field through real-time assistance. Fourthly, ehealth improves data management by enhancing data collection, organization and analysis. Fifthly, it helps in streamlining financial transactions by simplifying payment methods by patients and for the physician to receive the payment. This can be through mobile insurance premium payments, vouchers over the phone. Sixthly, ehealth can mitigate fraud and abuse. This can be achieved through texts and pin codes to detect counterfeit drugs, using biometric data to confirm that a health worker has actually visited a patient.

The use of ICT can result into higher in quality and safer healthcare [6]. It can also result into more responsiveness to patients' needs. Furthermore, ICT can improve the functioning of healthcare systems including delivery through improved management, access, diagnosis, mapping of public health threats, training and knowledge sharing [10, 11]. ICT can facilitate information access, dissemination, utilization and exchange of information on combating debilitating diseases such as malaria, tuberculosis, and HIV[#]/AIDS[£] [3]. It can be argued that managers in the health care sector need ICT for provision of effective health care services, at lower cost and with a high quality. ICT can improve public access to health care and information. ICT can be a means to reach a series of desired outcomes such as better decisions of health workers, quality and safe health care services, awareness of the public about health risks, responsiveness of the Government about health needs and better information access and knowledge to the people about ICT [7, 11, 14].

The Ministry of Health and social welfare in Tanzania has developed an ICT Policy and Strategy [13] to improve the

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\#   Human Immunodeficiency Virus

£   Acquired Immunodeficiency Syndrome

efficiency and quality of health care service delivery. Health sector is one of the important sectors which need ICT to improve the quality of health care delivery. To provide optimal care, health care institutions need patient information timely from various sources. The health sector needs a comprehensive, complete and fully functional system to fulfill all these needs. One way to achieve this is adopting ehealth [2].

However, the challenges facing the adoption of ehealth were not clearly understood in Tanzania. Consequently, the extent to which health service provider's (HSP) use ICT for health service delivery and the extent to which the patients utilize the available ICT to get health care service is not understood. Unknown challenges can hinder quick intervention and planning of ehealth programs.

Therefore, the main objective of this research was to determine the underlying challenges of ehealth adoption in Tanzania. The specific objectives included:

i. To determine the use of ICT devices and services in health service delivery in Tanzania.

ii. To identify the challenges facing adoption and the use of ICT effectively for health service delivery in the health sector.

These specific objectives were mapped into the following research questions:

i. What are the current used ICT tools in health care service delivery in Tanzania?

ii. What are the challenges facing the adoption and the use of ICT for health service delivery in Tanzania?

Due to the increased importance of ICT and its usage in many countries in the world and the need to improve the quality of service provision in many organizations, it was crucial to study on the challenges of ehealth adoption in Tanzania. It is important to understand these challenges so that recommendations can be made which can help in improving the situation. This study therefore concentrated on these research questions as guided by the objectives outlined above.

## 2 METHODS

### 2.1 Area of Study

This study was carried out in Iringa and Morogoro, Tanzania involving four districts. The projected population of Iringa is 2,112,000 in 2010 [17]. Iringa urban area had a population of 118,000 and Kilolo district 221,000. Morogoro region is the second largest region with a projected population of 2,115,000 in 2010 [17]. The population included patients attending healthcare facilities as well as key informants from healthcare workers preferably supervisors or staff in-charge in health institutions.

### 2.2 Sampling and Data Collection

We used a sample size of 549 including patient respondents and key informants from healthcare workers. Data from patients was collected from a total of 490 respondents on the other hand, 59 healthcare key informants from health institutions were involved. Patient respondents were recruited to the survey to obtain information from end-user stakeholders particularly on the services that involve their activeness such as accessing online information. Key informants from health institutions were involved to capture the current situation prevailing at the point of health service delivery rather than at Government side. Data collection includes use of structured questionnaires and interview. The interviews used involved key informants using a questionnaire. Review of existing documents such as journal articles and official reports related to the topic under study was done.

### 2.3 Data Analysis

Data analysis was done using the Statistical Package for Social Sciences (SPSS) where findings are presented as descriptive statistics. The findings are also presented in the form of tables, and charts to enable easy report interpretation and readability. In addition statistical significance testing to gain more insight was done. As such significant values (p-values) are provided in various sections of results. In addition p-values were validated using a statistical software called R[+].

## 3 RESULTS AND DISCUSSION

### 3.1 Demographic Characteristics

Table 1 summarizes the number of key informants from healthcare workers and the percentage of patient respondents who participated in the survey and interviews. It can be seen that out of 490 respondents, 53.9% of them were female and the rest were male. Large proportions (47.4%) of respondents aged between 21 and 30 years. This kind of distribution does not vary from the Tanzanian Population in terms of age and gender (NBS, 2006). It therefore follows the population distributions.

### 3.2 The Adoption and Use of ICT by Patients

Figure 1 provides the overall picture on the use of ICT devices and services of the areas surveyed. It is clear that Radio is dominant such that 75% of the respondents said that they use Radio for their health-care information needs. This is followed by Television (TV) which accounts for 52% of the patient respondents. The least of all was the fax machines. Personal computers are the second from the bottom. This means traditional ICT device are still heavily used by patients in Tanzania. The implication would be that modern ICT that include use of personal computers is not as common as in the developed world. Another implication could be that public health services need the inclusion of Radio and Television to reach larger proportions of the population with health information.

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+   R is an integrated suite of software for statistical data manipulation, calculation and graphical display found at http://www.r-project.org/

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## 3.3 The Adoption and Use of ICT by Healthcare workers

We were interested in finding out the ICT devices and services that healthcare workers use in the support of provision heath services. In Figure 2, we summarize the extent of adoption and use of ICT in the areas surveyed. It is also surprising to note that mobile phones are the popular type of ICT that is used by a largest proportion. Over 93% of the healthcare institutions use mobile phones in this regard. While radio takes the first place on the side of patient respondents, on the side of healthcare institutions is used by less than 50% of them. However the data match on the fact that it is also a considerable large proportion on the side of patient respondents. Modern technologies that include image based diagnosis are rarely found. The implication is that diagnosis requiring imaging technologies might not being done whenever required.

### Table 1: Demographic Characteristics of Healthcare workers and Patient Respondents

| Key Informants from Healthcare Workers | | | | |
|---|---|---|---|---|
| | **Iringa Municipality** | **Kilolo District** | **Morogoro Urban** | **Morogoro Rural** | **Total** |
| Health Facility | 15 | 24 | 15 | 5 | 59 |
| **Patient Respondents (N=490)** | | | | |
| Gender | **Iringa Municipality (N=198) (%)** | **Kilolo (N=192) (%)** | **Morogoro Urban (N=47) (%)** | **Morogoro Rural (N=53) (%)** | **Total (%)** |
| Female | 55.1 | 52.6 | 50.9 | 40.4 | 52.4 |
| Male | 44.9 | 47.4 | 49.1 | 59.6 | 47.7 |
| **Total** | 100 | 100 | 100 | 100 | 100.0 |
| **Age** | **%** | **%** | **%** | **%** | **%** |
| <21 years | 12.6 | 12.5 | 13.2 | 12.8 | 12.7 |
| 21-30 years | 50.0 | 44.8 | 15.1 | 25.5 | 41.8 |
| 31-40 years | 22.7 | 24.0 | 43.4 | 31.9 | 26.3 |
| 41-50 years | 9.6 | 12.5 | 15.1 | 19.1 | 12.2 |
| 51-60 years | 4.5 | 3.1 | 11.3 | 8.5 | 5.1 |
| >60 years | 0.5 | 3.1 | 1.9 | 2.1 | 1.8 |
| **Total** | 100 | 100 | 100 | 100 | 100.0 |
| **Education** | **%** | **%** | **%** | **%** | **%** |
| Primary Education | 9.1 | 43.2 | 7.5 | 2.1 | 25.9 |
| Secondary Education | 20.7 | 34.4 | 69.8 | 68.1 | 27.4 |
| College | 24.2 | 15.1 | 11 | 6.4 | 19.7 |
| University | 46.0 | 7.3 | 7.3 | 5.7 | 24.3 |
| **Total** | 100 | 100 | 100 | 100 | 100 |
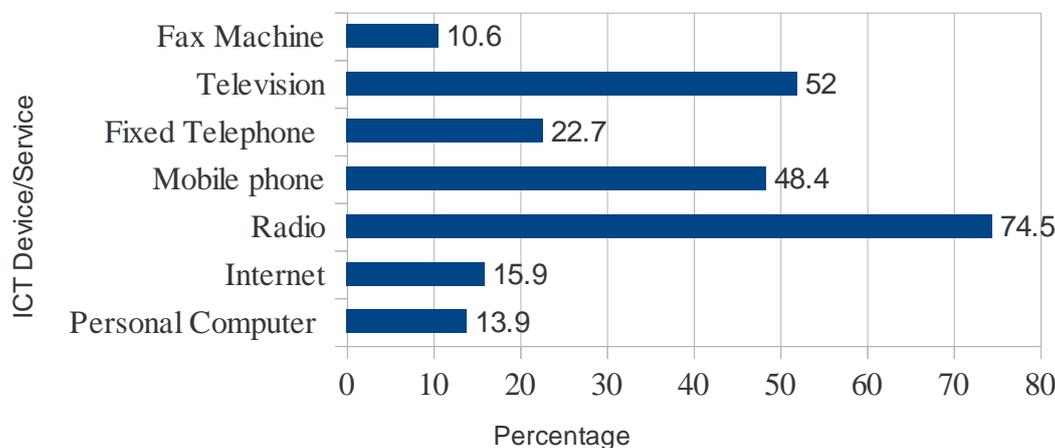


**Figure 1: Overview of the Use of ICT by Patient Respondents**
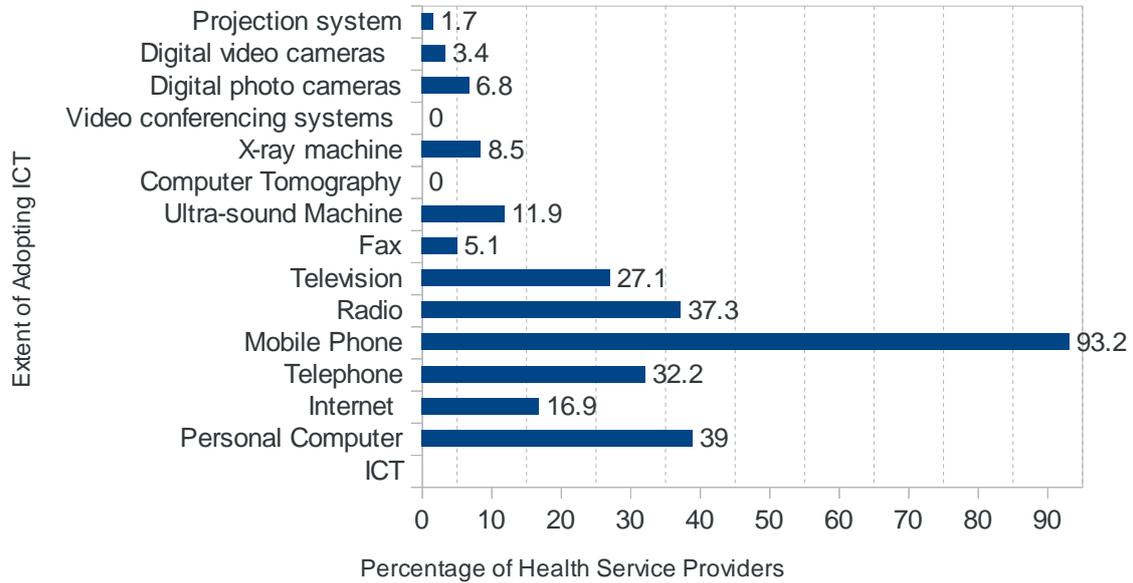
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**Figure 2: The Extent of Adoption and Use ICT by Health Service Institutions**
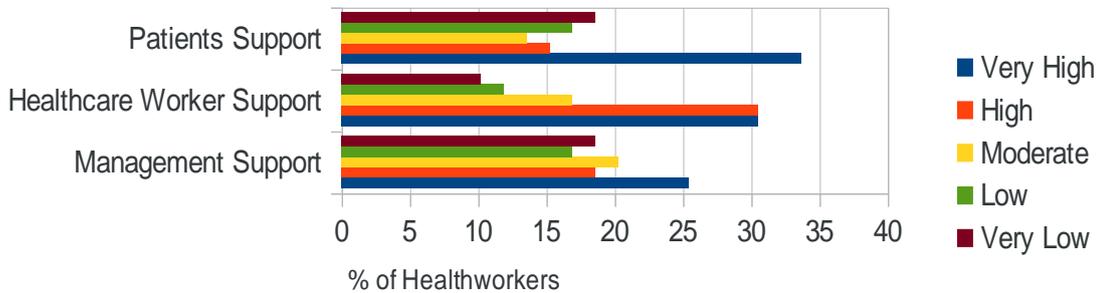


**Figure 2: Perceptions on ICT Support by Health Workers**

## 3.4 Underlying Challenges of eHealth Adoption

### 3.4.1 Inadequate ICT Training of Health-care Workers

Figure 4 compares the constraints in terms of proportions by the respondents. It can be seen that inadequate or lack of training was mentioned by the largest proportion (79.7%) of

respondents. This means that there is great cry on inadequacy of training. Respondents did not mention any ICT training programmes that take place as an initiative of the government. It is indeed that health workers have no designated places where they can get ICT training. It is therefore a stumbling block in the process of adopting ehealth services. These constraints lead to health providers to record and search patients' data in files.
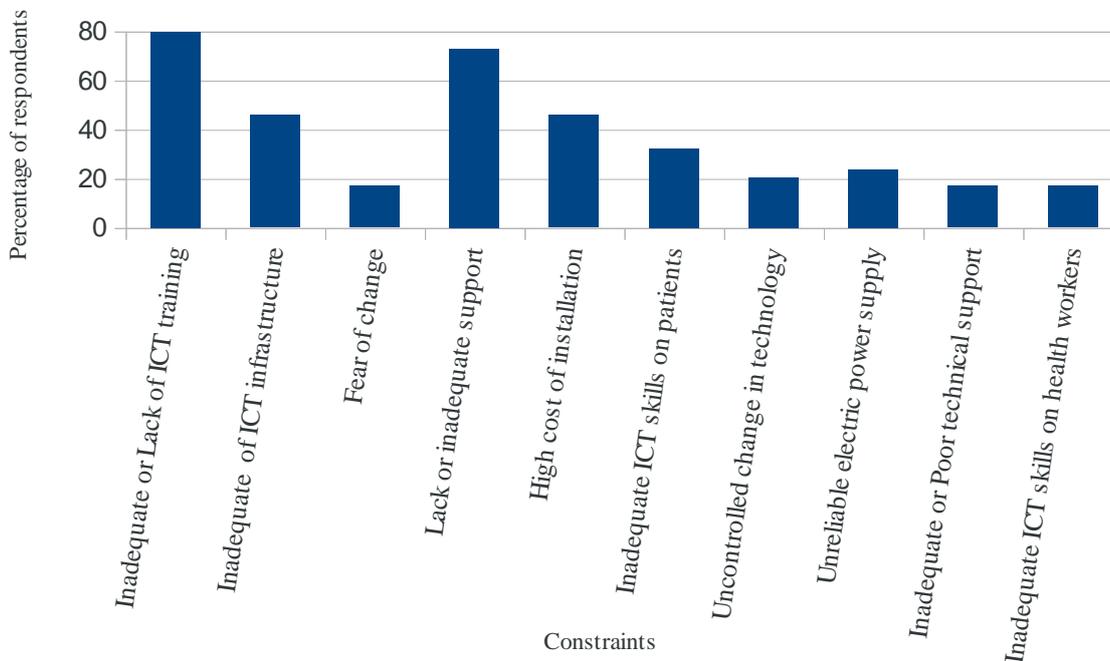
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**Figure 3: Comparison of Perceived Constraints to Uptake and Use of ICT**

### 3.4.2    Inadequate ICT Infrastructure

One of the constraints to the adoption and use of ICT is the inadequacy of ICT infrastructure. Table 2 shows that 45.8% of the key informants from healthcare workers mentioned this problem. In addition, it was found that very few and in some cases no healthcare institutions that had modern ICT infrastructure. The findings show that they do not use these ICT devices mainly because they are not available. In fact only 40% health service providers had even computers for use in healthcare services. It is evident that in this situation it is very difficult to deploy advanced ehealth systems. On the other hand, it was found that most (93.2%) of key informants from healthcare workers said that they use of mobile phones for communication of healthcare information.

While the imaging technologies in healthcare services are common in developed countries, they are not common in Tanzania. Computer tomography, ultra-sound and x-ray systems are rarely found in Tanzanian health institutions. None of the hospital had computer tomography facilities. Only 11.9% of the surveyed health institutions could use ultra-sound imaging technologies and 8.5% of them had x-ray machines.

### 3.4.3    Fear of Change

The finding shows that 16.9% of the key informants from health workers mentioned this as constraints underlying the

adoption and use of ICT in healthcare services. This is a statistically significant proportion ($p<0.001$) meaning that it is a considerable large proportion which need not to be ignored. On the other hand the largest proportion does not fear change. In other words most of health service providers are not resistant to adoption and use of ICT in healthcare services. This is good news in the sense that strategies for increasing the adoption of ehealth for better healthcare quality are likely to be well received on the side of healthcare workers.

**Table 2: Constraints of eHealth Adoption in Health Centers**

| S/N | Constraints | % (N=59) |
|---|---|---|
| 1 | Inadequate or lack of ICT training | 79.7 |
| 2 | Inadequate or lack of ICT infrastructure | 45.8 |
| 3 | Fear of change | 16.9 |
| 4 | Lack or inadequate support | 72.9 |
| 5 | High cost of installation | 45.8 |
| 6 | Inadequate ICT skills on patients | 32.2 |
| 7 | Unreliable electric power supply | 23.7 |
| 8 | Poor technical support | 16.9 |
| 9 | Inadequate ICT skills on health workers | 16.9 |

### 3.4.4    Inadequate Support

In this case we were interested to know whether healthcare stakeholders support the adoption and use of ICT in health service delivery. 72.9% of the respondents acknowledged that there is inadequate support about the use of ICT in healthcare services. This was the second constraints in terms of proportions after matters related to ICT training and skills. Further analysis show that there was significant statistical difference ($p = 0.002$) between urban and its neighbouring rural areas. In other words there is relatively higher support from various stakeholders in urban areas than in the rural areas.

*Table 3: More Government Support is required for Successful ICT adoption (N=490)*

|  | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Strongly Agree | 236 | 48.2 | 48.2 |
| Agree | 201 | 41.0 | 89.2 |
| Agree/Disagree | 42 | 8.6 | 97.8 |
| Disagree | 1 | .2 | 98.0 |
| Do Not Know | 10 | 2.0 | 100.0 |

This could be because there are more people in urban areas who are knowledgeable about ICT. Table 3 summarizes the attitude of patient respondents on the need of Government support. The cumulative percentage shows that 89.2% agreed/strongly agreed that more support from the Government is required. This is due to the fact that Government efforts have not been realized in supporting adoption and use of ICT in healthcare service provision.

### 3.4.5    Inadequate Funds or High Cost of Installation

Budget limitation is one of the acute challenges in most institutions in Tanzania including healthcare providers. It has been reported several times that healthcare services are facing budget constraints [1, 13]. In Table 2 we can see that 45.8% of the respondents from healthcare facilities claimed that high cost of installation of ICT facilities is a challenge of ehealth adoption. We did put forward a null hypothesis that there is no difference between the urban areas and the rural neighboring areas on the issue of perceiving high cost of installation. Based on chi-square testing, we reject the null hypothesis because there was a statistical significance ($p=0.01$) different at 95% confidence interval. In general, the proportion of those who perceived that funding to be a challenge is big such that there is a need to address this challenge for successful adoption of ehealth in Tanzania.

### 3.4.6    Inadequate ICT Skills on Patients

In the survey of healthcare service providers show that 16.7% of the key informants from healthcare workers claimed that there is inadequate ICT skills on the patients. They viewed this as a problem in adopting and use of ICT in healthcare

services. When patient respondents were asked on their views on ICT skills, 95.5% of the patient respondents agreed or strongly agreed that more training is required in order to have adequate ICT skills as indicated in Table 4 in the cumulative percent column. The implication is that inadequacy of ICT skills is still a challenge in adoption and use of ICT in healthcare services. This is particularly with modern technologies including web-based services. Most Tanzanians do not have even the basic ICT skills.

It is worthy noting that a great proportion of Tanzanian have either primary or secondary school education. In our sample 53.3% of the patient respondents fall in this category. This calls for implementation of a curriculum that includes ICT in all levels of education in Tanzania if ehealth adoption has to take place. Swarts and Wachira [16] reported that the ministry of education and vocational training (MoEVT) in Tanzania recognizes the potential of ICT. They further report that while no official data exist, it appears that there is a very small number of primary and secondary schools with ICT and there was no government initiative to provide ICT for Schools. Schools with ICT have either benefited from parent contributions or donations from non-governmental organizations and some private sector companies.

*Table 4: More Training is required In Order to Get Adequate ICT Skills (N=490)*

| Response |  |  | Cumulative Percent |
|---|---|---|---|
|  | Frequency | Percent |  |
| Strongly Agree | 331 | 67.6 | 67.6 |
| Agree | 137 | 28.0 | 95.5 |
| Agree/Disagree | 2 | .4 | 95.9 |
| Disagree | 14 | 2.9 | 98.8 |
| Strongly Disagree | 2 | .4 | 99.2 |
| Do Not Know | 4 | .8 | 100 |

### 3.4.7    Unreliable Electric Power

E-healthcare needs constant supply of electricity. Reliability of electric power supply is very important. In our survey 23.7% of the key informants of healthcare workers mentioned this challenge. It was interesting to find out whether this proportion was statistically significant proportion or not. The null hypothesis was that there is no proportional difference between those who perceived the problem of unreliability of electric power and those who did not mention this challenge. The analysis shows that the proportion of those who mentioned this challenge is statistically significance ($p < 0.001$). The implication is that there is need to address this problem as soon as possible.

The significance testing is in agreement with the literature. According to [18], Tanzania's power sector is still characterized by exceptionally limited electrification (10.6%

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of the population), and poor reliability of supply, even by the standards of other low income countries in Africa. The access to electricity in urban areas was standing at 38.9% of the population in 2010 and 1.8% of the population in rural areas. CTI [4] reported that Tanzania continues to experience the obstacle of unreliable, intermittent power supply, frequent rationing and outages. The report further narrates that electrical power production in Tanzania is insufficient even to the already installed transmission and distribution infrastructure. It is notable that if the health workers would have adopted ehealth to the fullest, the reliability of electric power supply would enormously be mentioned by larger proportion. This situation therefore requires enormous transformation for successful ehealth adoption.

### 3.4.8    Inadequate ICT Technical Support

Technical support is also a challenge facing the adoption and use of ICT in health-care services. Only 18.6% of health-care facilities that were surveyed had ICT departments that would promptly provide ICT technical support. 33% of the health worker respondents from the health institutions who use personal computers indicated that ICT technical support is inadequate. This is equivalent to 16.7% of all the health institutions surveyed. Analysis show that this proportion is statistically significant ($p<0.001$). The findings are in agreement with Swarts and Wachira [16] as reported that there is very few human resources in ICT sectors in Tanzania.

### 3.4.9    Inadequate ICT Skills on the Healthcare Workers

The findings show that only 16.9% of the key informants mentioned this problem. Although it might seem to be a relatively small proportion, the fact that a number of healthcare facilities do not have enough infrastructure including equipment such as computer tomography, computerized x-ray machines and Ultra-sound for diagnosis purposes, it is therefore not appropriate to have a conclusive implication on this challenge. As it can be considered that if someone does not have the equipment might not be aware that he/she has no skills for the particular equipment. This is why whenever ICT is introduced in any organization training usually follows. It is therefore envisaged that whenever ehealth is adopted, most likely training will be required. Further analysis shows that this proportion is statistically significant ($p<0.001$).

### 3.4.10   Lack of Website or Online Health Information System

It was found that only 13.6% of the healthcare service providers had a website and 16.9% of them use the Internet. This means over 85% of the healthcare institutions do not have websites to communicate with the public. Since there are many mobile phone users (over 90%) it would be desirable to have an interactive system where patients can interactively access health information using mobile

technologies. However, this technology has not been fully adopted in the surveyed areas. No respondent mentioned the existence of such a system.

## 4    CONCLUSIONS, RECOMMENDATIONS AND FUTURE WORK

### 4.1   Conclusions

In conclusion, this study investigated the challenges facing the adoption of ehealth for improved healthcare services in Tanzania. The challenges include low ICT budgets, poor infrastructure to support health services, unreliable electricity supply and lack of ICT skills are among the bottlenecks for ehealth adoption.

### 4.2   Recommendations

According to the research findings, in order to improve the ehealth adoption in Tanzania the following are recommended:

i)   For fast adoption of ehealth it is recommended to develop or adopt Information Management Systems that support mobile technologies to be used in remote areas and for emergency services. This is due to the fact that both patient and healthcare workers are mostly (over 90%) using mobile phones.

ii)  Establishment of ICT training sessions to healthcare workers in all health facilities in Tanzania on how to use ICT tools. This will increase effectiveness and efficiency of adoption and use of ICT.

iii) Take an advantage of the use of radio, TV and mobile as a means for communication. Most patients in rural areas rely on radio for health information. Over 90% of the patients and health-care service key informants use mobile phones.

iv)  Installation of electric power generators including use of renewable energy should be a priority. This will provide enabling environment of ehealth adoption to increase efficiency and effectiveness of health services delivery.

v)   Policy makers should make policies that will change the situation in order to create an enabling e-environment for adoption of ehealth including infrastructure, and training of more human resources.

vi)  On the health information systems, Free and Open Source Software (FOSS) could be one of the recommended solutions. This can mitigate the problem of budget limitations. This is due to the fact that FOSS solutions reduce the total cost of ownership while providing scalable and robust capabilities.

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## 4.3 Further Research

This study was limited to examining the challenges facing the adoption of ehealth for improved health services delivery. Future studies should examine the ways how other countries have managed to overcome similar predicaments and on how to adopt some lessons that can fit our environment. Otherwise, a similar study could assess the readiness to use modern technologies and benefits in health service delivery.

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