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A framework for implementation of e-health in Kenya public hospitals

Odhiambo, M. E.
Faculty of Information Technology (FIT)
Strathmore University

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Middii Edwin Odhiambo

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Middii Edwin Odhiambo

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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Name: Middii Edwin Odhiambo

Signature……

Date……

Approval

The thesis of Middii Edwin Odhiambo was reviewed and approved by the following:

Dr. Cyrus Wekesa

Faculty of Information Technology

Strathmore University

Dr. Joseph Orero

Faculty of Information Technology

Prof. Ruth Kiraka

Dean, School of Research and Graduate Studies

Appreciation

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Abstract

E-health has fundamentally shifted the way patients' information is accessed and shared across health system. This advancement has greatly improved healthcare which is associated with the mission critical services that are connected with the well being of life, by providing comprehensive, reliable, accessible and timely patient information for evidence based decision to the healthcare providers. However, there are still a problem of gaps and weaknesses in the existing e-health frameworks. The main purpose of the research was to explore on ways in which e-health can be successfully be implemented. The research adopted qualitative and quantitative research methodology to investigate and come up with a framework for the implementation of e-health in public hospitals. The research instruments used were survey questionnaires, interviews. The research identifies the benefits of implementing e-health as; Enhanced health services availability and access, Improved health quality, safety and outcomes, Increased service efficiency, productivity and cost effectiveness, Improved teaching methods facilitated by e-learning system, Knowledge sharing by practitioners, Improved decision making and Reduced healthcare cost. The challenges encountered in E-health implementation are; E-health standards, ICT capacity, E-legislation, e-health infrastructure, Security and privacy issues and technical organization. The research found out that there are various areas and components that should be considered in order to successfully implement and scale up e-health uptake in the public hospitals. The areas and components include; Education/awareness, infrastructure, stakeholders, form of e-health to be implemented, challenges in e-health implementation and uses of e-health. These findings were used to build a framework for implementation of e-health in Kenya public hospital. The framework is composed of the mentioned components and areas. The research therefore, will enhance the quick implementation and uptake of e-health in public hospitals.

Keywords: e-health, information communication technology and infrastructure

Abbreviations/ Anonyms

B2B	Business to Business
B2C	Business to Consumer
C2B	Consumer to Business
E-Health	Electronic Health
EHR	Electronic Health Record
GoK	Government of Kenya
HIS	Health Information System
HL7	Health Level 7
ICT	Information and Communication Technology
IT	Information Technology
KNBS	Kenya National Bureau of Statistics
M-heath-	Mobile health
MOH	Ministry of Health
SPSS	Statistical Package for the Social Science
WHO	World Health Organization

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CHAPTER 1: INTRODUCTION

1.1 Background

According to Haglund (2002) healthcare services are increasingly needed by people and should be efficiently provided and made fully accessible to all. Healthcare is associated with mission critical services that are connected with the well being of life.

According to Rodrigues (2003) advances in information and communication technologies (ICT) and the dissemination of networked data processing have led to widespread access to information resources and globalisation of communications, businesses, and services. In the health sector, this trend is expressed by the growing consolidation of e-health. The incorporation of new technologies, specialization of health services and the increasing mobility of patients has modified the form in which healthcare organizations provide their services.

The Kenyan health system is currently struggling to cope with the rising cost and demand for quality care service, against the backdrop of a shortage of skilled health care professionals Ministry of Health (MOH, 2011). Recognizing the importance of good health in support of human capital development, (Government of Kenya (GOK), 2009) strives to provide quality healthcare for all its citizens in a bid to enable them lead economically and socially productive lives.

Joaquin (2010) noted that e-health is the use of information and communications technologies (ICT) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research. Joaquin (2010) further noted that e-health has the potential to greatly improve health services efficiency, expand or scale up treatment delivery to thousands of patients in developing countries, and improve patients' outcome.

Ministry of Health (2011) notes that e-health should be viewed as both the essential infrastructure underpinning information exchange between all participants in the Kenyan health care system and as a key enabler and driver of improved health outcomes for all the Kenyans.

1.1.1 The Kenyan Health System

Kenya is the world's 47th largest county with an area of 582,646 km^2. The Kenya National Bureau of Statistics (KNBS) places its current population at 38.6 million people with approximately 6 million living in the urban areas. The population is diverse, comprising 42 ethnic groups. Its annual population growth rate is about 3% (Government of Kenya (GOK), 2009).

There are public, private and mission hospitals in provision of health services. Kenya's healthcare system is structured in a step-wise manner so that complicated cases are referred to facilities at a higher level. A gap in this structure is filled up by private and church run units.

The structure before the implementation of the new constitution in 2010 comprises: Dispensaries, health clinics, Health centres, Sub-district hospitals and nursing homes, District hospital and private hospitals, Provincial General Hospitals and National referral hospital (MoH, 2005). Figure 1.1 illustrates Kenyan health system before the enactment of the new constitution in 2010.

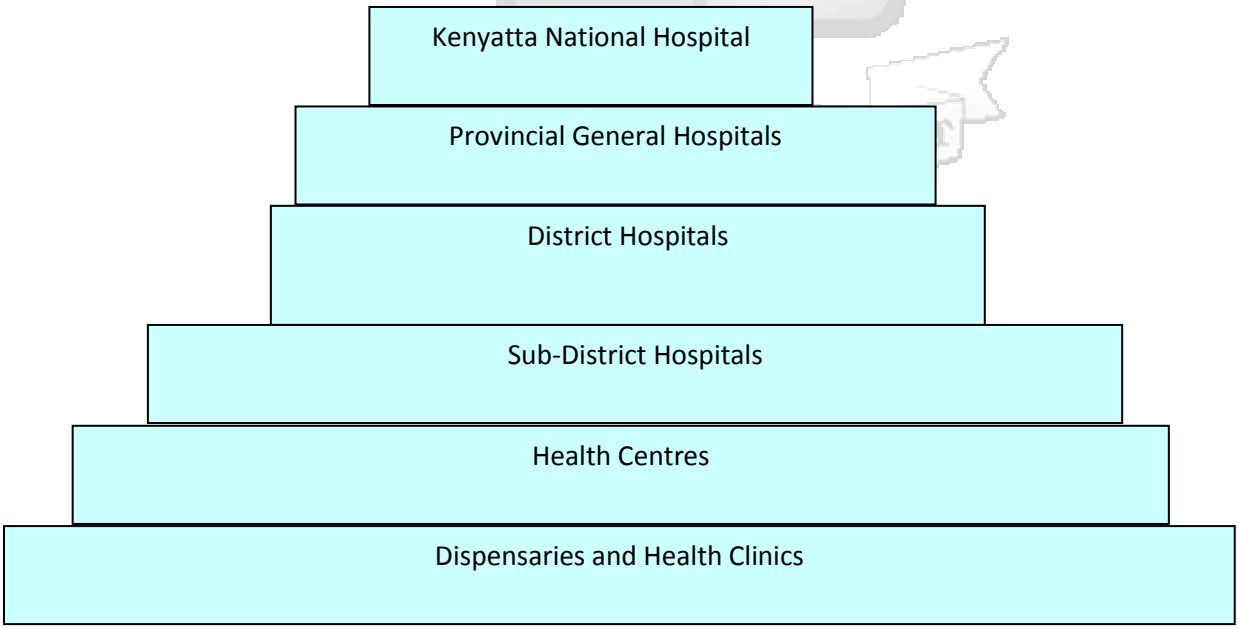


Figure 1.1: The Kenyan health System (Odongo, 2004)

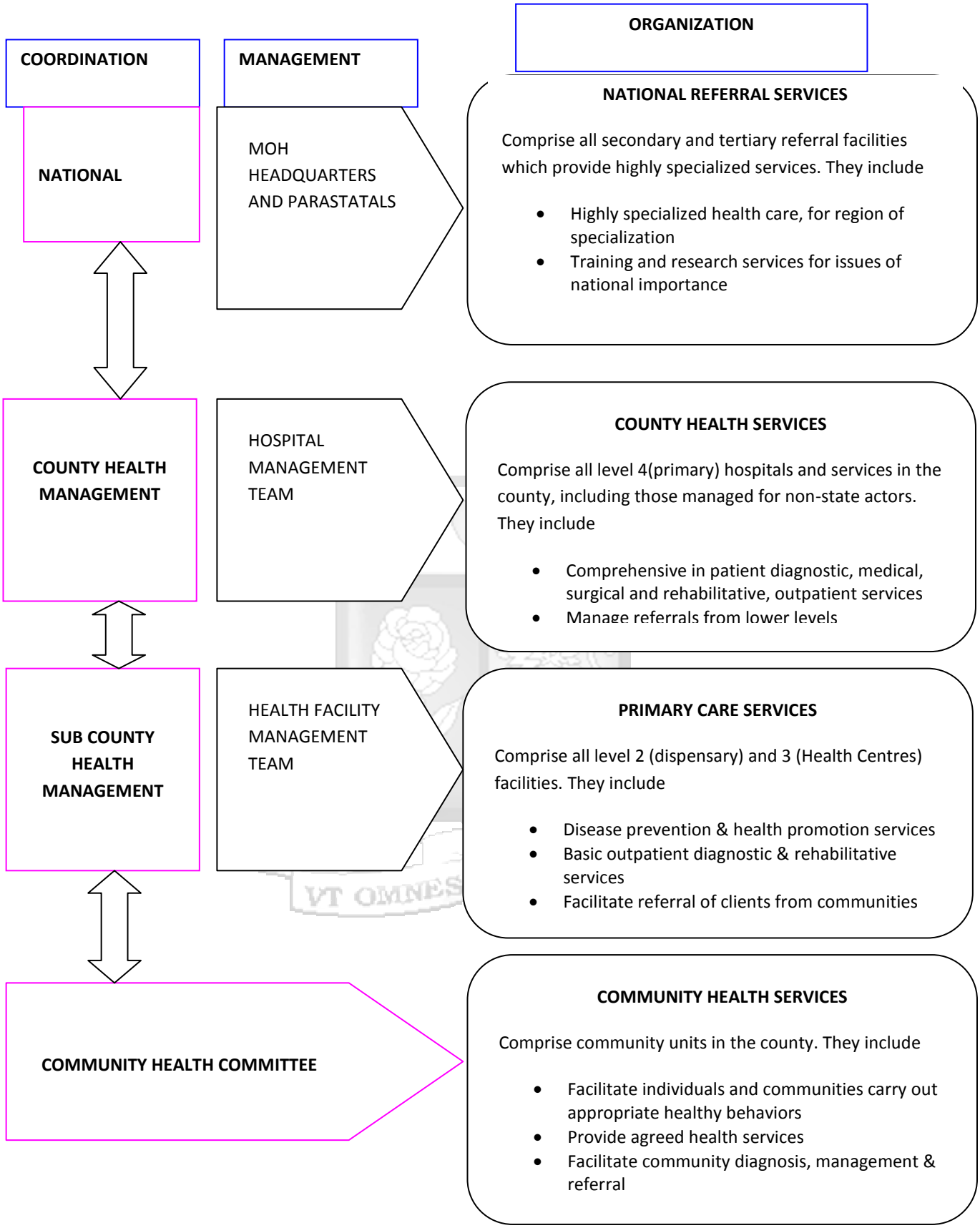


Figure 1.2: Organization of health services delivery (Kenya health policy, 2012)

Figure 1.2 above illustrates the current organization of health services delivery in Kenyan health facilities i.e. after the enactment of the new constitution in 2010.

1.1.2 Human Infrastructure

The Kenyan population in remote and inaccessible areas find it difficult to access medical care from health facilities which are far away from their places of living. This population is poor and can hardly afford to get money to pay for transport to seek medical attention resulting to the poor quality of health.

There is poor road network and finding means of transport to urban areas where the health facilities/ hospitals are located is very hard. Residence of these areas therefore finds it hard to access timely medication from specialist physician who are located in urban areas.

The physicians who are located in urban areas are only able to reach 20% of the population. Meaning 80% of the population who are in the rural areas are not reached. The residence in the rural areas forms larger percentage of the population i.e. 80%. According to MOH (2011) 80% of clinicians serve only 20% of the population who are residence of the urban areas.

The following table 1.1 shows the summary of the situation:

Table 1.1: Type of registered healthcare personnel per 100,000 populations

	2008	**2009**	**2010**	**2011**
Doctors	17	17	18	19
Dentists	3	3	2	2
Pharmacists	7	7	8	8
Bsc Nursing	2	2	2	3
Registered Nurses	37	40	75	83
Enrolled Nurses	83	81	86	87

Table 1.1 above shows the ratio of personnel per 100,000 populations from 2008 to 2011.

The low number of health personnel as illustrated in table 1.1 demands that there should be new strategies and ways to communication amongst doctors and also to ensure maximum use of the available personnel.

The rise of new technologies in computers means that the patients and the health providers don't have to be in the same geographical area for medication or consultation to take place. Doctors and health personnel can therefore be able to attend to several patients who are geographically dispersed without the patients travelling to the facilities.

1.2 Problem statement

The Kenya health system is currently struggling to cope up with the ever rising demands for quality healthcare services and the high costs of medication against the backdrop of shortage of professionally skilled health personnel.

Healthcare delivery is being transformed by advances in e-health which is now recognized as an enabler for support of health systems across the world (Kilwake, Wanyembi, & Ogao, 2012).

Healy (2008) notes that Implementation of e-health systems and services in all countries, particularly in developing countries, is a challenge which is shared by the United Nations agencies and health authorities at the international, national and local levels. This challenge is attributed to the existing gap in the e-health implementation framework.

Ministry of Health (2011) indicates that there is a need of developing e-health implementation framework to scale up successful implementation of e-health systems in health sector.

1.3 Research Objectives

i. To identify the challenges of e-health implementation

ii. To review existing e-health implementation framework

iii. To develop a framework for e-health implementation in public hospitals

iv. To validate the framework

1.4 Research Questions

i. What are the challenges of e-health implementation?

ii. What are the existing e-health implementation framework?

iii. What framework can support e-health implementation in public hospitals?

iv. How does the output compare with other theoretical e-health implementation framework?

1.5 Significance of the research

The study will enable Kenyan health sector to operate more effectively by offering timely, accessible and quality health services to its consumers at a reduced cost. To the consumers or patients, the study will give them the opportunity to view their electronic health records in a timely and convenient manner.

Furthermore it will ensure that the right patients' health information is electronically made available to the right person at the right place and time to enable informed care and treatment decisions. Health care managers on the other hand will have access to timely and complete information about health system activities and outcomes. For the university students and researchers, the study will provide a basis for further studies not covered in this research.

1.6 Scope

The study is to come up with an implementation framework which will guide and hasten the successful adoption of e-health in health facilities. The study will help in understanding e-health, its advantages and challenges encountered in its implementation in Kenyan public health facilities.

1.7 Limitations

This research is limited to public health facilities/ hospitals within Nairobi County. The researcher did not consider other privately owned health institutions and mission run hospitals within the County. The framework was also not tested in the actual operational environment.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The literature review focuses on understanding e-health, the advantages and benefits of implementation of e-health in the health sector, and the challenges and factors affecting e-health implementation. Literature on e-health frameworks touching on factors considered for e-health systems and readiness of its implementation have also been looked at to guide in coming up with the final implementation framework

2.2 Understanding e-health

There is no one single definition of the term e-health this is because of its ubiquitous and dynamic nature. The e-health information is widely used with different meanings and purposes.

E-Health has been defined as an amalgamation of healthcare system and Information Communication Technology (ICT) to enable better health and healthcare (Nykanem, 2006). According to Silber (2003), e-health is an application of information and communication technologies (ICT) across the whole range of functions that affect health.

It is an emerging field in the intersection of medical informatics, public health and business, and refers to health services and information delivered or enhanced through the Internet and related technologies (Eysenbach, 2001).

Wickramasinghe, Fadlalla, Geisler & Schaffer (2005) noted that e-health is a broad term that encompasses various activities which are related to the use of many e-commerce technologies and infrastructure, most notably the Internet for facilitating healthcare practices.

The World Health Organization (WHO, 2004) defines e-health as being the leveraging of ICT to connect providers, patients and governments; to educate and inform healthcare professional, managers and consumers; to stimulate innovation in healthcare delivery and health system management, and to improve our healthcare system.

Figure 2.1 shows the diagrammatical representation of this view.

(a) Business to consumers (B2C) – This is the capability of healthcare institutions to be able to communicate with its consumers or those who make use of its services online.

(b) Business to business (B2B)-. Health personnel will be able to share and exchange knowledge and skills easily which will enhance improved service delivery.

(c) Consumer to consumer (C2C) - This makes it possible for health consumers who are at the same level to interact and communicate with each other easily.

(d) Consumer to Business (C2B) - this is the demand which is normally from the consumers to the heal care facilities to provide specific services to the consumers basically using online facilities.

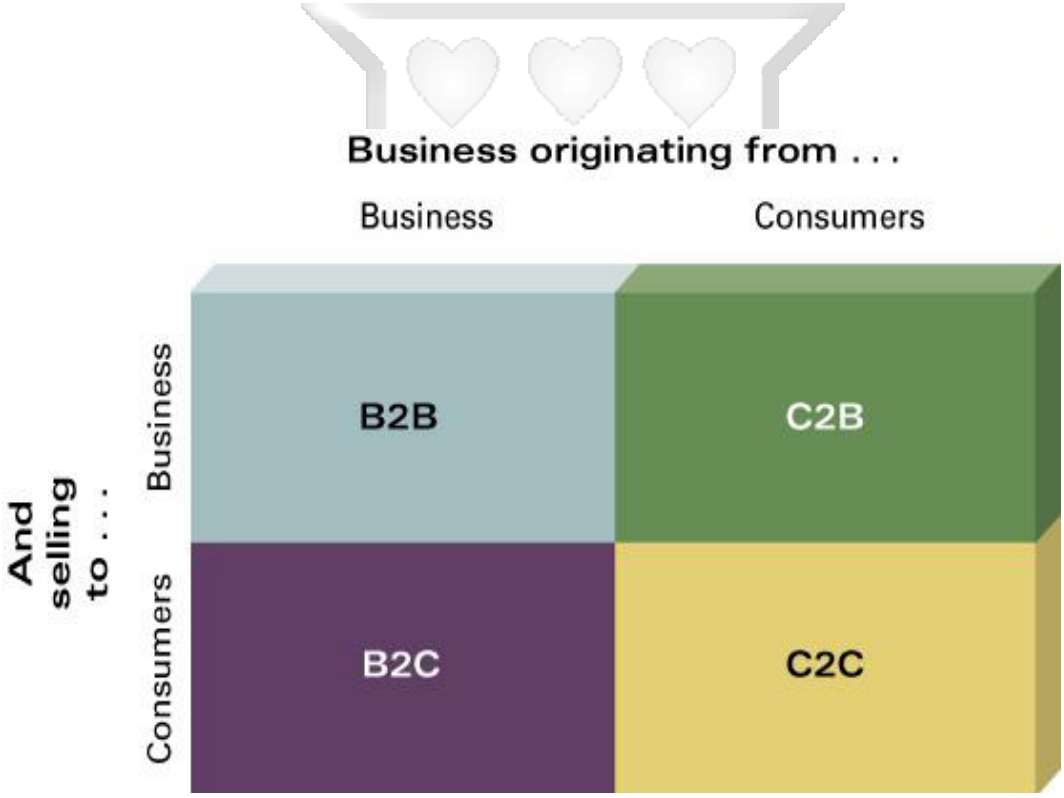


Figure 2.1: The different categories of e-health in the healthcare sector (Wickramasinghe et al, 2005)

2.3 Benefits of E-health

Silber (2003) states that e-health is expected to improve various aspects of healthcare services including the following;

a) Enhanced healthcare services availability and access- this is by having online access to Medicare and eliminating the fact that the consumers have to travel to the facilities for health care

b) Improved health quality, safety and outcomes- this is because new and better technologies will be embraced in offering healthcare.

c) Increased quality of health and efficiency of service delivery to population to ensure they are satisfied.

d) Enables better and evidence based decisions in health service planning

e) Better teaching methods facilitated by e-learning systems

f) Improved financial accessibility to healthcare services

g) Knowledge sharing amongst practitioners in different facilities

h) Better decision making

2.4 Challenges of e-health implementation

The challenges of e-health implementation in a report of commonwealth secretariat on e-health initiatives in 2008, falls in five priority areas namely;

i. E-health standards-the portability of medical record, privacy and ownership of the record have not been addressed. Also lacking is the national standards for unique person identification

ii. E-legislation- the legal and ethical implications of using health information technologies in terms of confidentiality of data is not available in most countries. Users of e-health want to be sure that their confidentiality is protected. There are no guidelines for clinical/technical practice in an e-context.

iii. ICT capacity- inadequate ICT skills in health sector, such as ICT maintenance staff, shortage of skills in health informatics, lack of ICT in health professionals' curricula, there is a need to raise awareness of ICTs in the health sector

iv. E-health infrastructure- minimal infrastructure is in place in countries and there is a lack of knowledge or awareness of what is available to countries, lack of strategy of getting connectivity to the 'last mile', lack of relevant content essential to ensure community needs are met

v. Lack of policy and strategic plan in most member states, including Kenya, lack of synchronism between e-health and ICT policy, lack of ICT policy integration into health and e-health policies

2.5 Objective of e-health

It is important to emphasize that the objectives of e-health are flexible and adjustable as Wickramasinghe et al., (2005) state them to be:

a) Reducing the cost of healthcare efficiently by preventing unneeded repetitions of diagnostic procedures, concentrated on diagnosis and accurate use of medicines.

b) Evidence based healthcare clinical practice should be guided by precise scientific research not by insignificant assumptions, insights and beliefs, in order to lower medical errors by employing evidence-based-acquired-knowledge by the physicians to facilitate timely accessibility of such evidence leading to support of diagnosis or treatment decision

c) Health-related privacy issues, combining informed consent and security of patient's information more effectively during the online clinical practice

d) Increasing the healthcare quality by increasing the awareness level of both the patients and the healthcare professionals through sufficient education about health and hygiene

2.6 Uses of e-health

E-health has great potential to promote healthy lifestyles, improve decisions by health professionals as well as patients, and enhance healthcare quality by improving access to medical and health information and facilitating instantaneous communication in places where this was not previously possible (Shields, 2005).

The increased use of technology can help reduce health care costs by improving efficiencies in the health care system and promoting prevention through behavior change communication. It also has the potential to advance clinical care and public health services by facilitating

health professional practice and communication and reducing health disparities by applying new approaches to improve the health of isolated populations.

E-health promotes the quality of the services offered in the healthcare sector by reducing redundant tests and medical errors through facilitating electronic health records. In addition, it saves patients from going to hospital needlessly, allowing the patients to be served in their own communities or at home (Alvarez, 2002).

2.7 Forms of e-Health

2.7.1 Healthcare/Medicine and Technology

According to Kilwake et al., (2012), forms of e-health encompass various services or systems that are at the edge of healthcare/ medicine and technology including the following:

i. Electronic Health Records (EHR) which enable the storage, and communication of patients' data between different healthcare professionals. In most cases, people change their locations and do not move with the paper based medical records.

   This wastes time and increase costs since more tests have to be repeated. Moreover, in case of emergencies patients do not usually have medical records at hand. A system that can serve patients without regarding the changes in patient's location and additionally, act as a backup during emergencies is beneficial.

ii. Telemedicine (physical and psychological treatments at a distance). Globally this is being applied in many areas as medicine such as cardiology, dermatology, dentistry, gynaecology, internal medicine, neurology, oncology, paediatrics, trauma, radiology and surgery.

iii. Telemedicine can be used to offer medical consultation and diagnosis through e-health. Categories of telemedicine that exist are real time and pre-recorded telemedicine which allows for consumers to have instant interaction. Telemedicine can provide learning opportunities to the doctors and nurses in the rural areas and also provide a platform for second opinions among professionals.

iv. Consumer health informatics: use of electronic resources on medical topics by healthy individuals or patients

v. Health knowledge management: e.g. in an overview of latest medical journals, best practice guidelines or epidemiological tracking

vi. M-Health: includes the use of mobile devices in collecting aggregate and patient level health data, providing healthcare information to practitioners, researchers, and patients, real-time monitoring of patient vital signs, and direct provision of care

vii. Medical research using Grids: powerful computing and data management capabilities to handle large amounts of heterogeneous data

viii. Healthcare Information Systems (HIS): software solutions for appointment scheduling, patient's data management, work schedule management and other administrative tasks surrounding health.

2.8 Stakeholders of e-health

The role of ICT is critical in the healthcare sector and has enormous benefits that affect the daily operations of hospitals. E-health stakeholders have, therefore, embraced its use to effectively make use of the gains that it provides (Ouma & Herselman, 2008). Austin and Boxerman (2003) state that e-health stakeholders are;

a) The employers- employers would want to know the costs of providing healthcare and costs incurred by the health service providers they have employed

b) The patients- the patients would want to get easy access to information concerning their health without necessarily travelling long distances and incurring high costs to travel to the health facilities which are far away from their domicile.

c) The providers- the health providers' main aim is to ensure that information is disseminated in a timely and a cost effective manner, in real time.

d) The government authority- the government is a key player to ensure that e-health projects are successfully implemented within the public health facilities.

The government is responsible of coming up with the required legislation and guidelines which should be adopted by the public health facilities. The government is also capable of providing budgetary allocation and creating conducive environment to

enable quick scaling up of e-health services. Other stakeholders who are important for the implementation of e-health include;

e) Insurers- who will want to get accurate information of patients being treated in a given health facility

f) Researchers- this provide a good area for carrying out research which will enable health sector come up with even better strategies

g) Educators- they would want to know the relevant and necessary content to be delivered to the practitioners.

2.9 Co-ordination between key players in healthcare

According to Rodrigues (2003) the essence of e-health is reliable transaction delivery in a fast-changing environment involving people, processes, and a service or business infrastructure focused on the ill or healthy citizen.

E-health solutions have emulated e-commerce and e-government strategies and experiences in using internet-based networked technologies to rethink, re-design and rework how businesses and public services operate and, typically have aimed at the improvement of productivity, effectiveness, and efficiency, both internally and in the external relationships with clients, customers, suppliers and partners.

Figure 2.2 as illustrated, has three points which are core. They are discussed below.

a) Social and political stakeholders- the political class to by ensure there is adequate budgetary allocation for health sector and especially e-health. Politicians can also promote and advocate for the use of new technologies.

   There is need to convince political class on uptake for example in the use of Telemedicine to reach for the locals who are in remote and far to reach areas. This will make them easily accessible and save on cost of travelling long distances. The use of Tele-consultation by health professional enable them reach to lager population within a short period of time.

b) Health professionals- health professionals need to be convinced in the benefits which will be achieved by the e-health solutions. Embracing these solutions will lead to

improved quality of healthcare and easy access to health information. For example getting results are made easy by use of e-Prescription

c) Economists- The economist should be brought on board as there will be need to demonstrate the reduction of cost which will be brought by embracing solutions such as use of smart cards to monitors the costs of healthcare for patients.

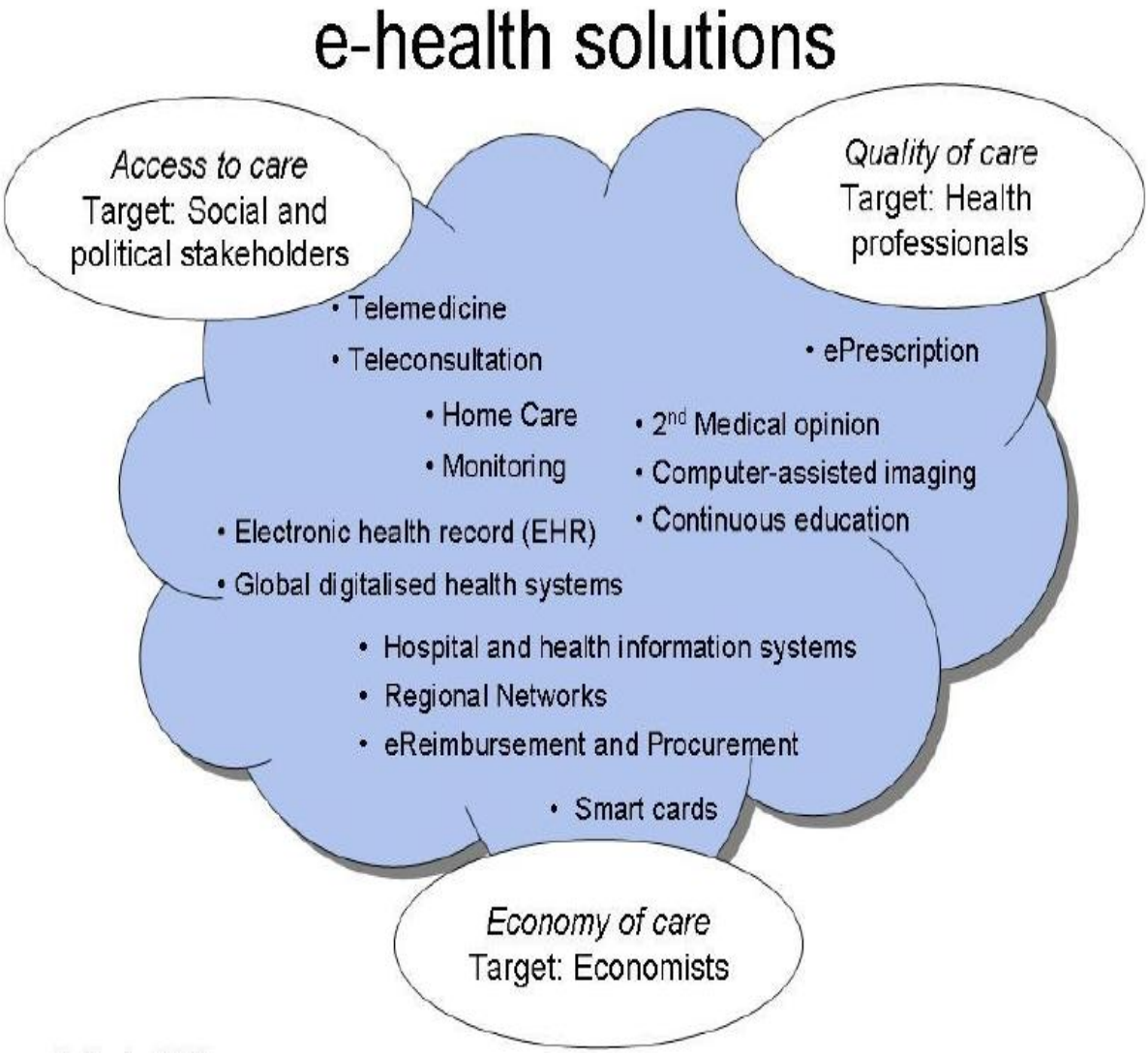


Figure 2.2: E- health solutions (Joaquin, 2010)

2.10 E-health in developing countries

Healy (2008) noted that the first step in implementation of e-health depends on the degree to which applications are dependent on technologies (networks, high-speed transmission, access facilities and the associated costs), local network infrastructures- which in turn are highly dependent on local economies

Healy (2008) noted that after 20 years of inertia and silence, most players are now convinced of the value of e-health solutions an are contributing both individually and through health professionals' and patients' associations, to their advancement and all of the economic and social prerequisites for the viability of e-health projects are in place on paper.

In developing or poor countries, Healy (2008) noted that almost everything is lacking: electrical and ICT infrastructures, money, credible political backing in some cases, a minimum of meaningful administrative regulations, and local human resources.

2.11 Kenya National e-Health strategy

The National e-health strategy was developed in April 2011. The strategy is to ensure achievement of Vision 2030.

The overall goal of Vision 2030 in health is to have an equitable and affordable healthcare at the highest achievable standard to all citizens both in the rural and urban areas.

Kenya already have a national ICT infrastructure which will be used by the e-health strategy developed, the environment for its implementation is good and this will improve on the rate at which ICT is implemented in the health sector.

This strategy will go along way to ensure that the quality of health

The five key strategic areas of intervention that form the pillars of the e-health strategy are:

(i) Telemedicine

(ii) Health Information Systems

(iii) Information for citizens

(iv) M-health

(v) E- Learning

Figure 2.3 below shows the different forms of e-health that can be implemented. These different forms of e-health form the key pillars which enables the development of health systems.

The e-health will stand on the five pillars namely;

i. M-health

ii. E-learning

iii. Health information systems

iv. Information for citizens

v. Telemedicine

For the strategy to be achieved, the details of consumers/ patient will be in electronic format. Some basic information will also need to be easily accessible online by the consumers. This will enable easy sharing of patients' details among professional health personnel who are geographically in different parts of the country.

This health strategy also provides for clear guidelines of on the legislation needed to be put in place so that the use of ICT's is greatly enhance throughout the country for all population to enjoy the benefits which comes with its implementation.

The governance structure on top of the pillars is what roofs the pillars in that it gives the necessary support required to ensure that the implementation is smooth and is done according to the set plan.

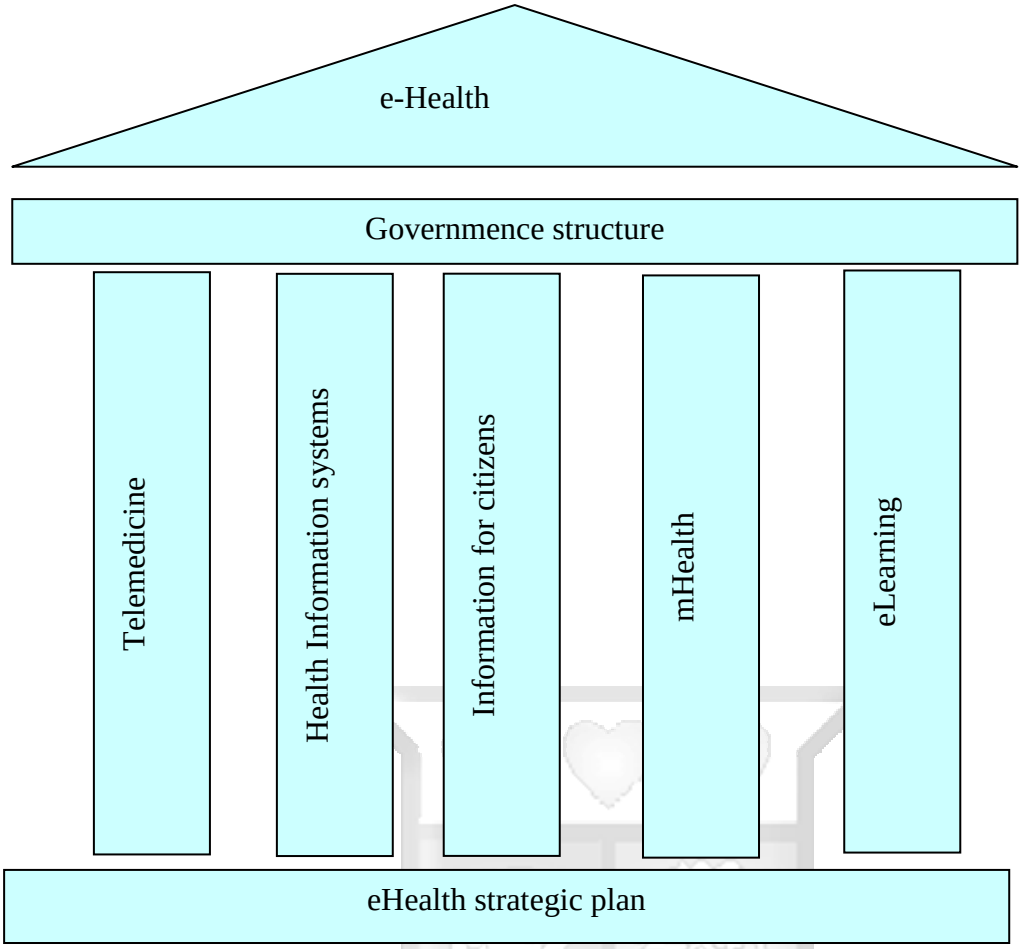


Figure 2.3: The five e-health strategy pillars(MoH 2011)

2.12 E-health framework

2.12.1 Drury 5Cs framework 2005

Drury (2005) proposed a framework comprising of five components- the 5Cs, to inform the development of e-Health in developing countries.

i. Firstly there is the **Context** of poverty, meeting the Millennium Development Goals.

ii. There is the **Content** of health information provided to health workers and how it can be migrated from being paper-based to a digital format, providing wireless

iii. **Connectivity** within and between health facilities that supports the transmission of health knowledge and management information, to build workforce

iv. **Capacity** as well as support

v. **Community** development, via the delivery of information to enable better decision making in health.

This model was too general as it focused on a national scale and lacked focus on the adoption perspective.

2.12.2 Ouma and Herselman framework

Ouma & Herselman (2008) developed a model for e-health implementations in rural areas in developing countries. The model was developed based on the challenges experienced in the hospitals in the rural areas. It has the following components for implementation;

i. **Training** some basic form of training is needed for majority of staff who do not know how to use computers,

ii. **Infrastructure** need of electrification and improvement of transport allowing service providers of ICT technologies to render services in such places,

iii. **cross-sector linkages** the government ministries need to work hand in hand to help deal with some of the rural sector problems,

iv. **ICT expertise** rural hospitals need to contract ICT professionals to maintain their systems or support them in maintaining networks and training of staff members,

v. **ICT infrastructure** more computers need to be purchased for rural hospitals and networks and internet connections need to be in place. This is because of the inadequate computers and infrastructure in the rural areas hence hindering the quick implementation of ICT in health

vi. **Government policies** should be changed to support the use of IT within hospitals, the government is suppose to come up with legislation which are able to encourage quick adoption of ICT in the health sector

The weakness of this model is that it solely focused on the rural areas hence cannot be adopted for implementation in the urban areas.

2.12.3 Wickramasinghe Framework

E-health readiness framework by Wickramasinghe et al

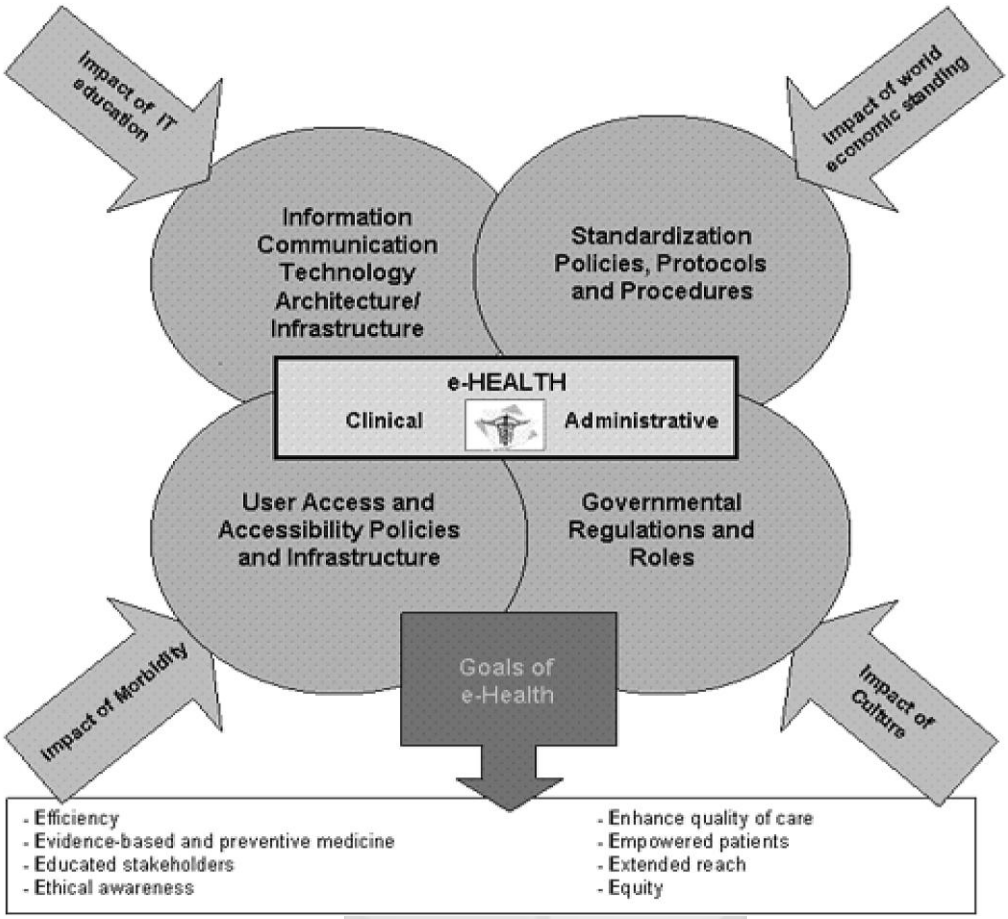


Figure 2.4: Framework for assessing a country's/region's e-health potential (Wickramasinghe et al, 2004)

The Wickramasinghe framework assesses the e-health potential and preparedness of countries. It is concerned with three domains relevant to e-health readiness-practitioner, organisation and public. The framework identifies

(i) Information communication technology infrastructure- Reliable ICT infrastructure must be in place for successful implementation of any health system. There should be trained personnel with adequate skills to enable successful implementation of e-health systems. This is impacted by education by health providers.

(ii) Standardised policies, protocols and procedures- standardised policy will provide guidelines on transmission of data and use of standard protocols across different networks.

(iii) Users access and accessibility policies and infrastructures- this will guide on how data and information of consumers is accessed and used

(iv) Government regulations and roles- this provides required legislation and guidelines in accessing electronic data/information

Also highlighted in the framework are four key impacts of e-health (depicted in rectangular boxes)

a) Impact of IT education, a sophisticated, well educated population boosts competition and hastens innovation

b) Impact of morbidity rate a more health conscious society is more likely to embrace e-health initiatives

c) Impact of cultural/ social dimensions, healthcare has been shaped by each nation's own set of cultures, traditions, payments mechanisms and patient expectations

d) Impact of world economic standing, economies of the future will be built around the internet

2.13 Weaknesses of the frameworks

Although the three framework discussed above are useful, they have the following weaknesses; They mainly focuses on the preparedness of the facilities and countries to allow the implementation of e-health however they don't focus on the actual implementation of e-health, they don't give emphasis in the benefits as a major area of discussion, stakeholders are not considered as a major component in the implementation. None of the framework focuses on the challenges as a major area or component for implementation of the e-health framework.

2.14 Technology infrastructure

According to Chetley (2006) there is little investment in ICTs for health in most developing countries. Poor telecommunications infrastructure, lack of access to international bandwidth is readiness issues that are major impediments in e-health implementation (Rodrigues, 2003). Chetley (2006) further noted that very few government-run health services have properly functioning ICTs within them and there is no infrastructure to enable inter-organizational transfers of information.

2.15 Privacy and security concerns regarding health information

According to Rodrigues (2003), data security and privacy of personal health data are universal concerns and a high-priority issue in many countries and there is a growing concern regarding the protection of health records against intrusion, unauthorised use, data corruption, intentional or unintentional damage, theft, and fraud.

Tuyikeze and Pottas, (2005) indicates that privacy is the right of an individual to control the use of his or her personal information. It should not be divulged or used by others against his or her wishes. Security is noted as the ability to control access and protect information from accidental disclosure to unauthorized persons and from alteration, destruction or loss. Therefore there is a need to ensure that information of patients which are held in electronic format is not accessed by unauthorised users. A sense assurance of security and privacy of information on the part of consumers will build confidence and enhance the acceptance of implementation of health information systems. Figure 2.8 shows the conceptual framework. The main components or areas identified are; Education/training or Awareness, ICT infrastructure, Challenges hindering e-health implementation, Stakeholders of health, Uses of e-health

2.16 Conceptual framework

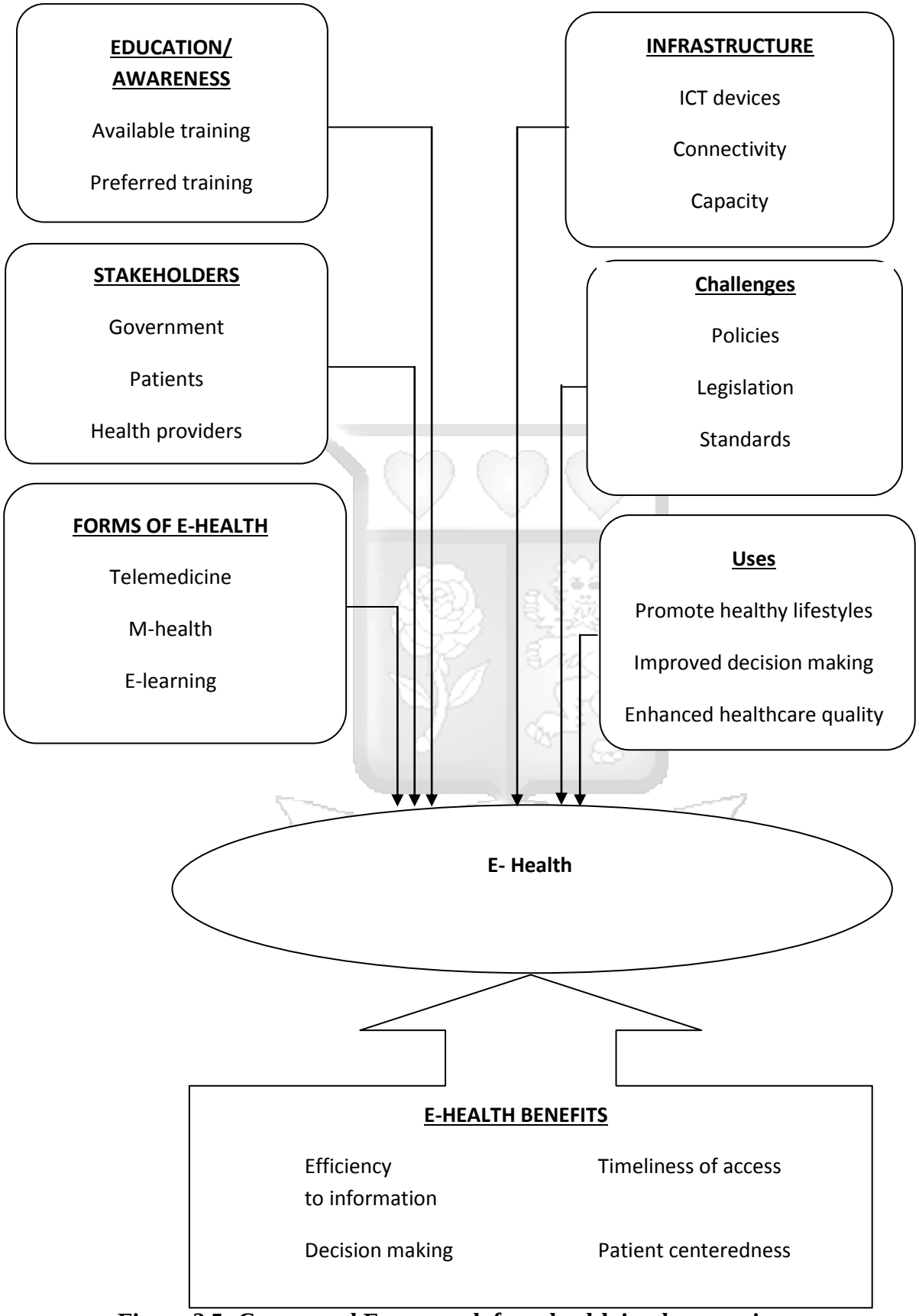


Figure 2.5: Conceptual Framework for e-health implementation

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter focus on the discussion on the research design, target population, sampling procedure, research instrument, data collection and data analysis procedure. It further presents a description and discussion of the research design instrument used to conduct the research.

3.2 Research design

The study was carried out using qualitative and quantitative research methodology. This is guided by the way in which the required data was gathered, compiled and the findings used to answer the concerns of chapter one.

According to Creswell (2007) qualitative research is used when a problem or issue needs to be explored to study a group or population

Golafshani (2003) noted that quantitative research allows the researcher to familiarize him/herself with the problem or concept to be studied. It enables the findings to be represented statistically to enable easy analysis and representation in form of graphs and charts.

This research adopted a descriptive design to gather deeper understanding of e-health and benefits and challenges involved in its implementation in order to come up with a suitable framework to guide implementation of e-health in public hospitals. A descriptive research is concerned with describing the state of affairs as it exists at present and characteristics of a particular entity.

3.3 Population and Sampling

The study focused on health services delivered in public facilities in Nairobi County.

The following are the Nairobi County Public Health Facilities (Dispensaries and health centres) according to (MOH, 2014)

Table 3.1: Public health facilities in Nairobi County

	DISTRICT	**NUMBER OF FACILITIES**
1	Kamkunji	7
2	Starehe	8
3	Kasarani	10
4	Westlands	10
5	Embakasi	5
6	Njiru	4
7	Makadara	9
8	Dagoreti	10
9	Langata	8
	TOTAL	**71**

Trochim (2005) defines sampling as the process of selecting units (population, universe or organization) from a population of interest so that by studying the sample, we may fairly generalize our results back to the population from which they were chosen.

The study used systematic stratified sampling technique. Systematic sampling is applied where members of the population are stratified or grouped into homogeneous sub-group before sampling. The strata should be mutually exclusive; every element in the population must be assigned to only one stratum and collectively exhaustive.

Stratified sampling technique was considered due to heterogeneity of the health facilities in the districts owing to their individual characteristics such as capacities and thus it ensured representativeness.

In this study the population sampled were public health facilities (Hospitals, Dispensaries and Health centres). There are a total of 71 health facilities in Nairobi County making a sample size of 71 strata. Systematic stratified sampling technique was then used to select two respondents, one who was facility administrator the other health officer from each facility.

The sampling formula was used to calculate the sample sizes as shown.

Stratified Sample Size: $n_h = (N_h / N) * n$

Where: n_h = the sample size for stratum (h)

N_h = the total population size for a stratum

N = the total population size

n = the total sample size

3.4 Data collection Methods

Primary and secondary methodologies were used for this research. Primary methods included; close-ended questionnaires- used for administrators and other health personnel, interview was also be used. Secondary methods used included; publications, earlier researches and text books.

3.4.1 Questionnaires

Kumar (2005) defines a questionnaire as a written list of questions, the answers to which are recorded by respondents. The researcher used semi-structures questionnaires i.e. both open ended and closed-ended questions in order to obtain the necessary information from a large number of respondents while maintaining uniform responses.

Open ended questions are advantageous because they permit greater depth of response, respondent's responses may also give an insight into his feelings, background and hidden motivation. On the other hand, closed ended questions are easier to analyze and administer.

The questionnaires were administered to the respondents through online. E-mail and phone call follow ups will be done to ensure the questionnaires are filled and returned for analysis.

3.4.2 Interviews

Interviews were used to get in-depth data/information from the respondents on factors challenges of implementation of e-health. A list of questions was developed prior to the

interview by the researcher. The researcher used semi-structured oral interviews i.e. both structured and open-ended questions to collect data from administrators and personnel in the health institutions.

3.5 Validation

To ensure the validity of the research, the researcher will review the measurement instruments with fellow students and conduct a pilot test. This will provide a trial run for data collection procedure.

The outcomes of the research will also be compared with the existing theoretical e-health implementation framework to verify the concurrency.

3.6 Data analysis and presentation

The data, after being collected was processed and analysed. Processing involved editing, coding, classification and tabulation of the collected data to ensure their completeness and consistency. The raw data collected was reduced to homogeneous groups to form a meaningful relationship.

The data collected was then analyzed using two statistical analysis tools i.e. SPSS and Excel. SPSS (Statistical Package for the Social Science) is a computer program used for statistical analysis. According to Kothari 2004, SPSS is a powerful application that allows you to read almost any kind of data, analyze data, and create reports and graphs. SPSS looks similar to Excel and similar spreadsheet programs. SPSS allows you to manipulate data in different ways (ITS statistics Software, 2009).

CHAPTER 4: PRESENTATION AND ANALYSIS OF FINDINGS

4.1 Introduction

The study targeted 71 health institutions in Nairobi County. Using systematic stratified sampling as indicated in section 3.3, two respondents were selected from each facility making a total population of 142. Out of the 142 questionnaires distributed, the study received 82 responses representing 57.7% response rate.

This response rate was fair and representative. According to Mugenda and Mugenda (1999) the response rate of 50% is adequate for analysis and reporting, a rate of 60% is good and a response rate of 70% and over is excellent.

The response rate was low due to the few number of health personnel in the various health institutions who are always engaged in offering services to the patients.

4.2 General Information

Part A of the questionnaire survey required the respondents to provide some kind of background information about the role they play in the hospital, the current forms of e-health in use in their health institutions and the preferred forms of e-health they would like implemented in their health institutions.

4.2.1 Role in health facility

A total of 82 respondents were received.

(i) 34 of the respondents were administrators

(ii) 31 were nurses

(iii) 17 were doctors.

These categories helped the research to further investigate the forms of e-health in their health institution. The results are shown in table 3.1 below. Out of a total of 142 respondents 82 of them gave back their feed back.

Table 4.1: Role of health personnel in the health facility

Role of health personnel in the hospital	Frequency	Percentage
Administrators	34	41
Nurses	33	40
Doctors	15	18
Total	82	100.0

The results shows that a higher percentage of 41% of the respondents were from the Administrators

Nurses and doctors respondents were low at 37.8% and 20.7% this might be attributed to the low number of the personnel in the health institutions and the heavy workload they are engaged in , in attending to the patients directly.

4.2.2 Current forms of e-health in use in the health facilities

According to Kilwake et al., (2012), there are various forms of e-health which encompass various services or systems that are at the edge of healthcare/ medicine and technology.

The respondents were asked to select the forms of e-health currently in use in their facility as discussed in section 2.7. The forms of e-health identified are;

(i) Electronic health record

(ii) Telemedicine

(iii)M-health

(iv)Health information system

(v) Health knowledge management

(vi)Consumer health informatics

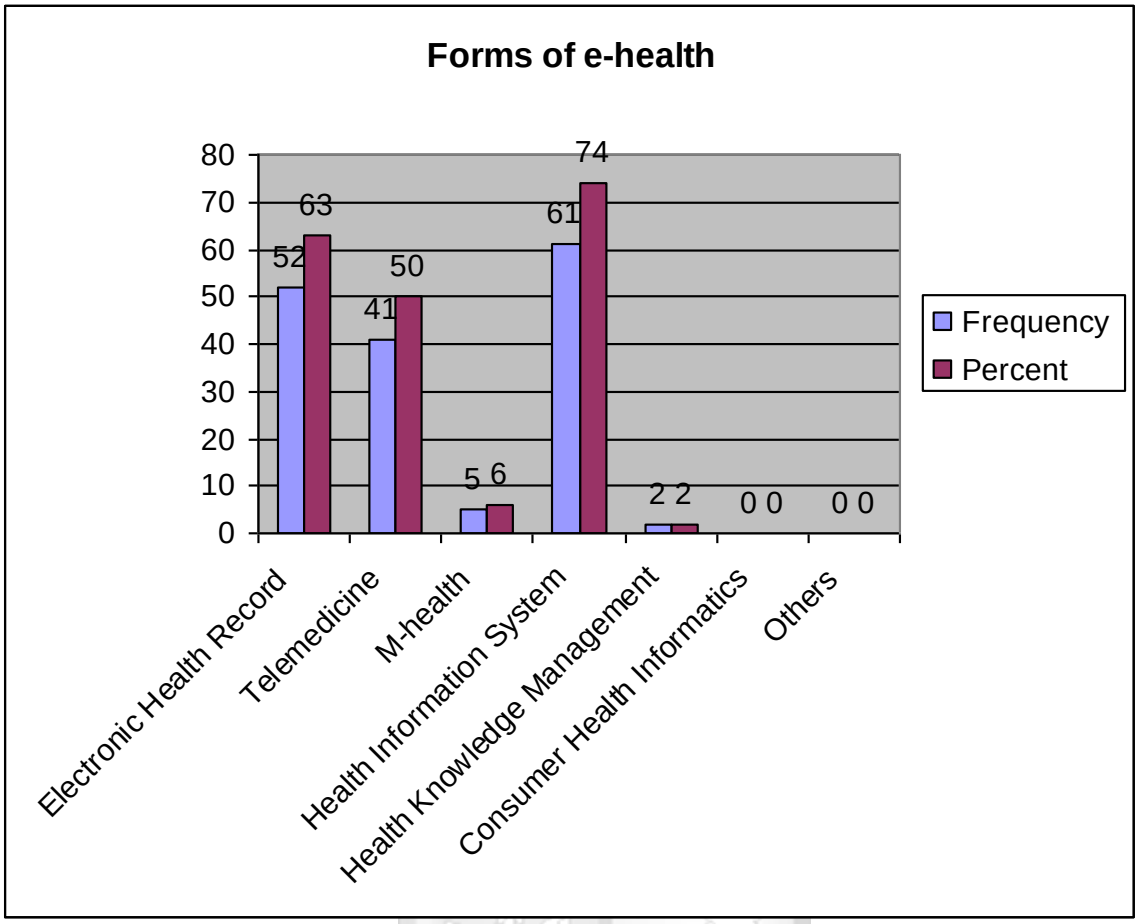


Figure 4.1: Current forms of e-health

The result shows that health information system is the highly used form of e-health in the health institution representing 74% usage, Electronic health record usage is at 63%, Telemedicine usage is at 50%, M-health usage is at 6% , Health knowledge management is at 2% and consumer health and other forms of e-health is at 0% usage.

4.2.3 Preferred forms of e-health to be implemented

The result shows that 62 respondents preferred M-health this representing 76%, 58 respondents preferred Telemedicine representing 71%, 56 respondents preferred Health knowledge management representing 68%.

50 respondents indicated they preferred Health information system representing 61%, 47 respondents each preferred Electronic health record and consumer health informatics representing 57% for each.

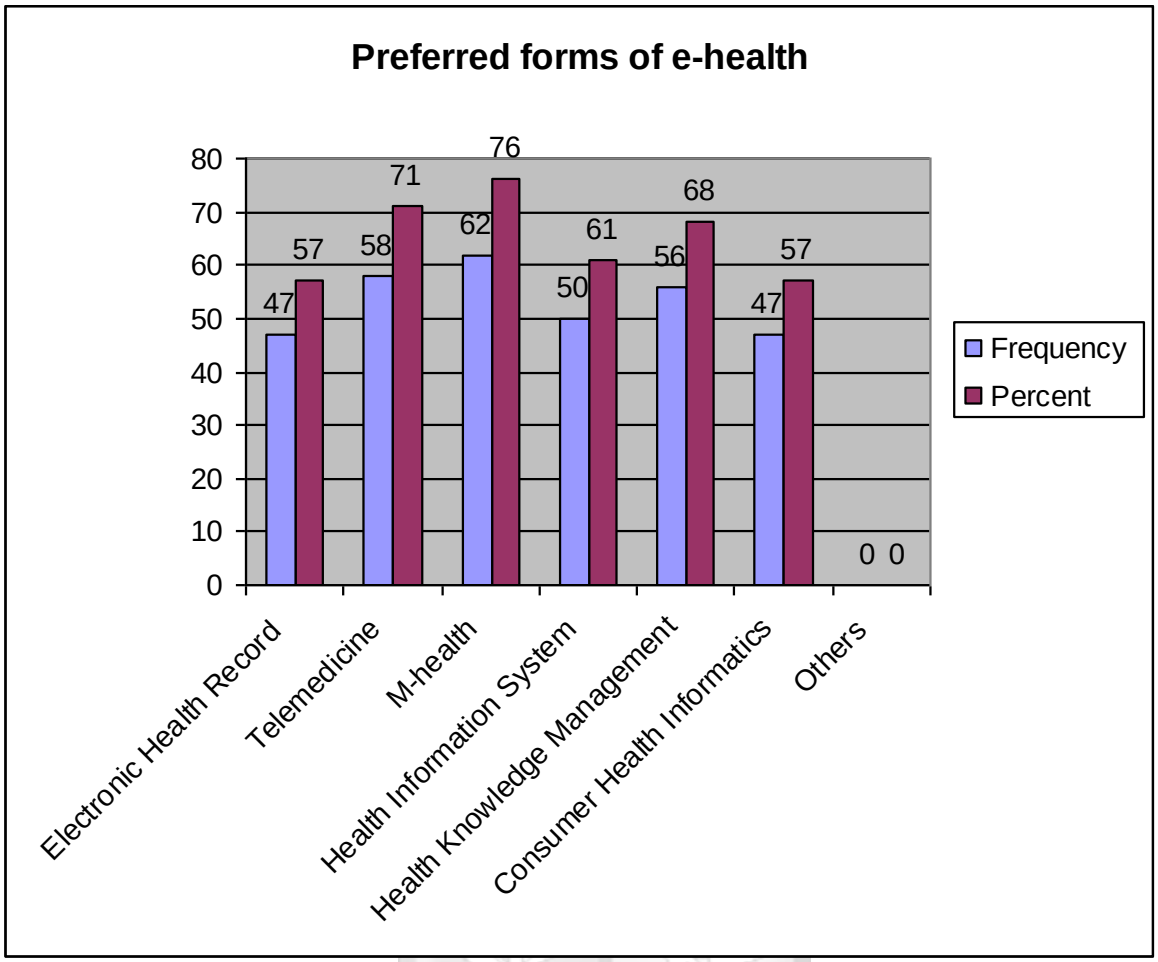


Figure 4.2: Summary of preferred forms of e-health

The result indicate that the most preferred form of e-health in the health facilities by health personnel is M-health with 62 respondents indicating that they would like to see M-health implemented in their health facilities. This represent 76% preference rate which is the highest in comparison with the other forms of e-health.

4.3 The key current stakeholders in e-health

Austin and Boxerman (2003) state that e-health stakeholders are government, patients, insurers, health providers, employers and educators. The stakeholders are important in implementation of any system in the health facilities including e-health because of their support.

The respondents were therefore asked to respond on the question concerning key current stakeholders in the implementation of e-health in the health sectors.

The stakeholders included the following;

(i) Government

(ii) Patients

(iii)Insurers

(iv)Health providers

(v) Employers

(vi)Educators

The results are shown in Table 4.2.

Table 2.2: The key stakeholders in e-health implementation

Key stakeholders in e-health implementation	**Frequency**	**Percent**
Government	80	98
Patients	66	80
Insurers	34	41
Health Providers	59	72
Employers	42	51
Educators	5	6
Others	0	0

The result in Table 4.2 shows that the respondents felt that all the above mentioned stakeholders are important in any health facility; this is shown by the number of respondents received on each stakeholder, therefore there is need to engage them for successful implementation of e-health.

Figure 4.3 shows the stakeholders and the response rate by the response on each stakeholder.

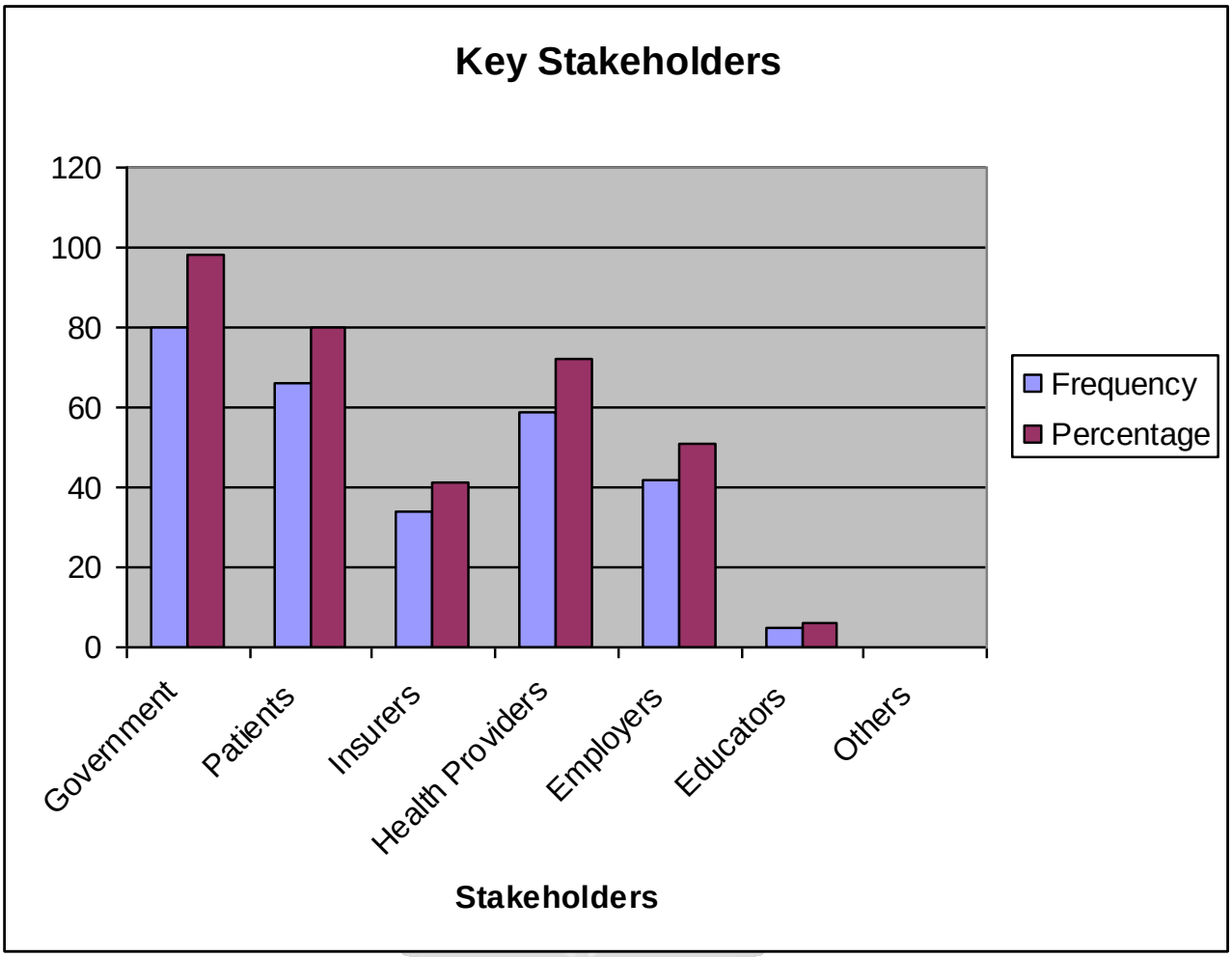
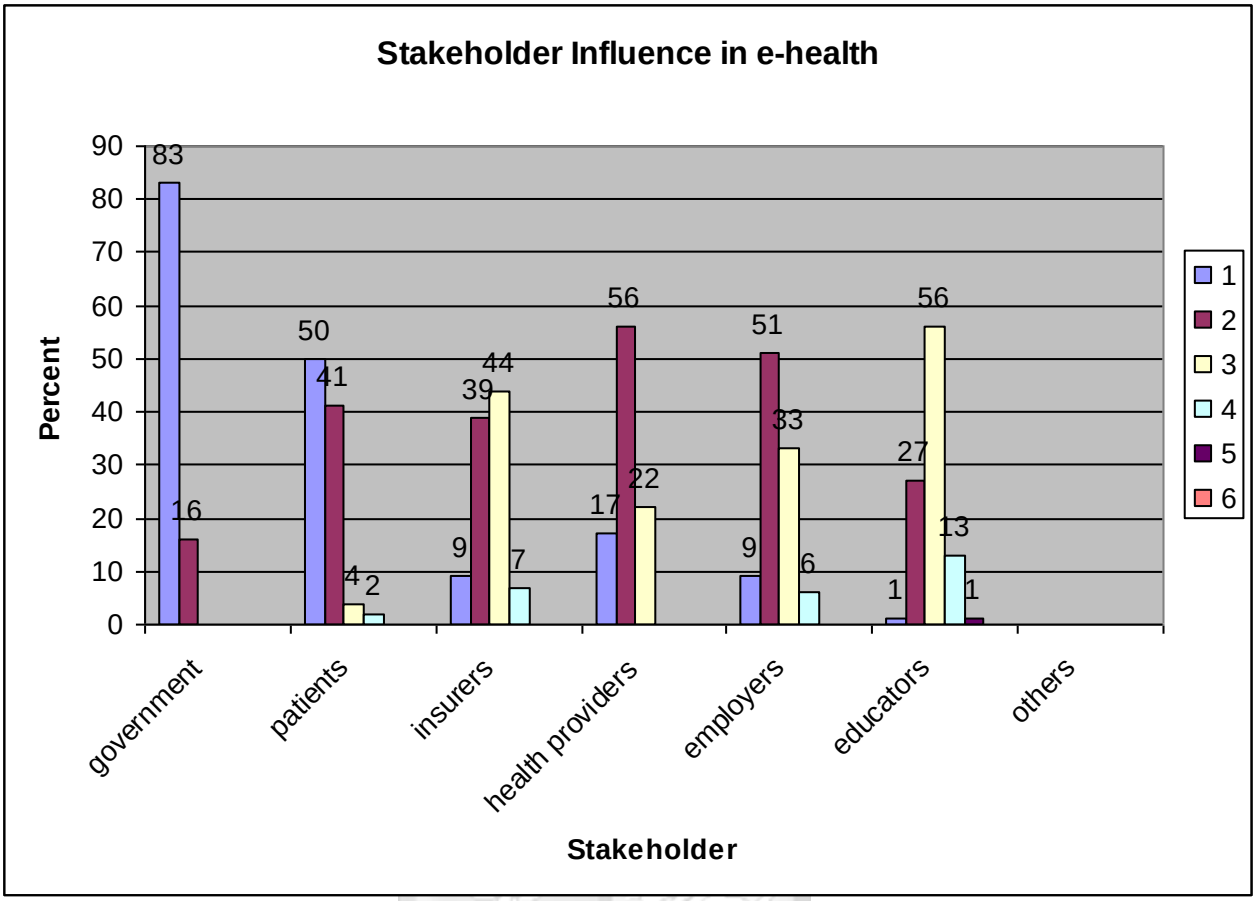


Figure 4.3: Key stakeholders in e-health implementation

4.3.1 Stake holders in order of their influence

From the identified stakeholders of e-health implementation in the literature review, the researcher further sought to identify which stakeholder has a higher stake in influencing the implementation of e-health.

The results in figure 4.4 shows that from the identified stakeholders, Government has a higher stake of influence in implementing e-health in health facility, 83% of the respondents indicated that government has a higher influence, followed by patients at 50% influence, the result on the other hand indicate that educators have the least influence in implementation of e-health at 1%. However the research findings indicate that all the stakeholders have some degree of influence in implementation of e-health in public health facilities



1-high influence, 6-Low influence

Figure 3.4: Stakeholders influence in e-health implementation

4.3.2 The ICT technology in place

For the researcher to gauge the ICT technologies in place, the respondents were asked to indicate the number of various information and communication technology equipment in their facility.

The result in Figure 4.5 shows that there are various equipment in the facilities ranging from desktop, laptop, mobile phone, printers and tablet.

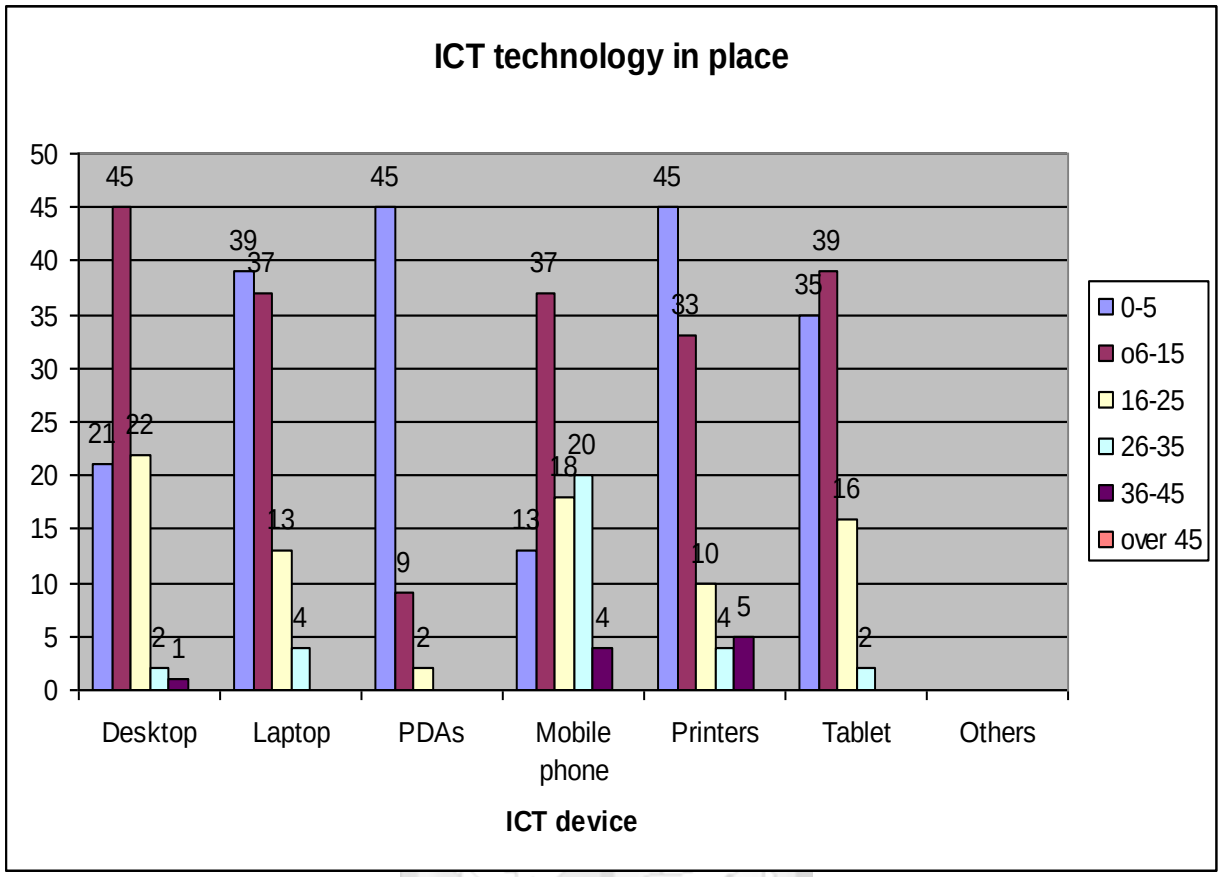


Figure 4.5: ICT technologies in place

4.4 Benefits of e-health implementation

Table 4.3: Benefits of e-health implementation

Benefits of e-health	Frequency	Percentage
Enhanced health services availability and access	80	98
Improved health quality, safety and outcomes	66	80
Increased service efficiency, productivity and cost effectiveness	34	41
Improved teaching methods facilitated by e-learning system	59	72
Knowledge sharing by practitioners	42	51
Improved decision making	5	6
Reduced healthcare cost	0	0

Table 5.4 above shows that the respondents agree to the fact that five mentioned benefits are achieved when e-health is implemented.

The first research objective in section 1.3 was to identify the benefits of e-health implementation. Silber (2003) presented a number of benefits of e-health implementation as discussed in section 2.3. The various benefits by the researcher were presented to the respondents with a survey question that required them to identify them. Figure 4.5 indicate the benefits as identified by the respondents.

The results show that the respondents identify with the benefits. The following are the percentage despondence of the various benefits. Enhanced health services 98%, improved health quality, safety and outcomes 80%, increased service efficiency 41%, improved teaching methods facilitated by e-learning system 72%, knowledge sharing by practitioners 51%, Improved decision making 6%

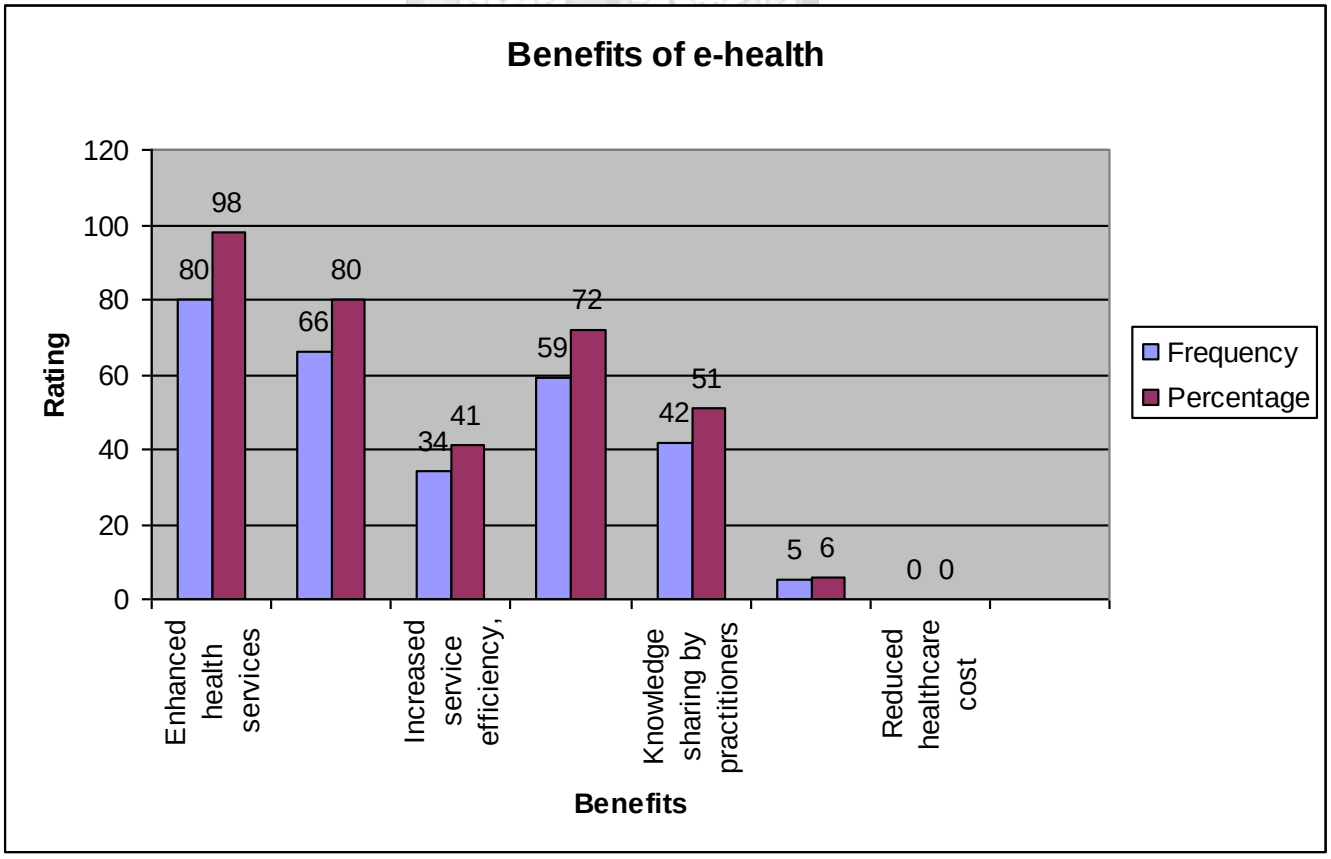


Figure 4.6: Benefits of e-health implementation

The researcher further sought to rate the benefits of the e-health. The results are shown in figure 4.6. Improved health quality, safety and outcomes had the highest percentage of 76%

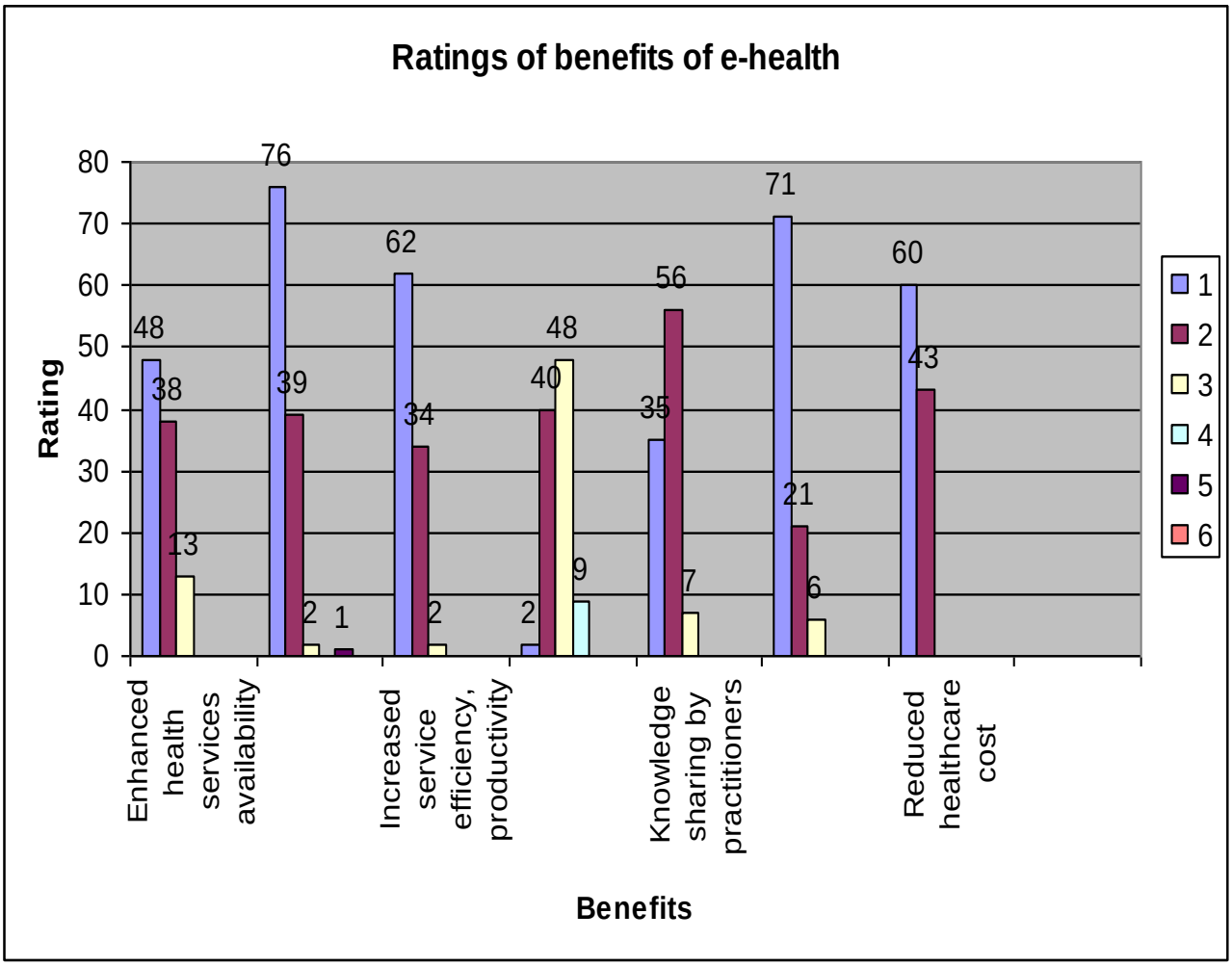


Figure 4.7: Rating of benefits of e-health implementation

4.5 Challenges of e-health implementation

This section presents the findings on the challenges encountered in implementing e-health in public health facilities.

Challenges of e-health implementation are one of the objectives of this research as indicated in section 1.3. In section 2.4 a report of commonwealth secretariat on e-health initiatives in 2008 identified the following six challenges as what affects e-health implementation.

Table 4.3: Challenges of e-health implementation

Challenges of e-health implementation	Frequency	Percentage
e-health standards	36	44
ICT capacity	73	89
e-legislation	57	70
e-health infrastructure	70	85
Security and privacy issues	76	93
Technical organization	12	15
Others		

The result in figure 4.7 shows that majority of respondent agree to the fact that the challenges identified in section 2.4 indeed affect implementation of e-health.

76 of the respondents feel that security and privacy issue is a major challenge this representing 93% of the respondents.

The result shows that ICT capacity, e-legislation, e-health infrastructure and security and privacy issues are the major challenges that affect implementation of e-health.

ICT is representing 89% of the respondents, e-legislation representing 70%, e-health infrastructure 85% and security and privacy issues 93%.

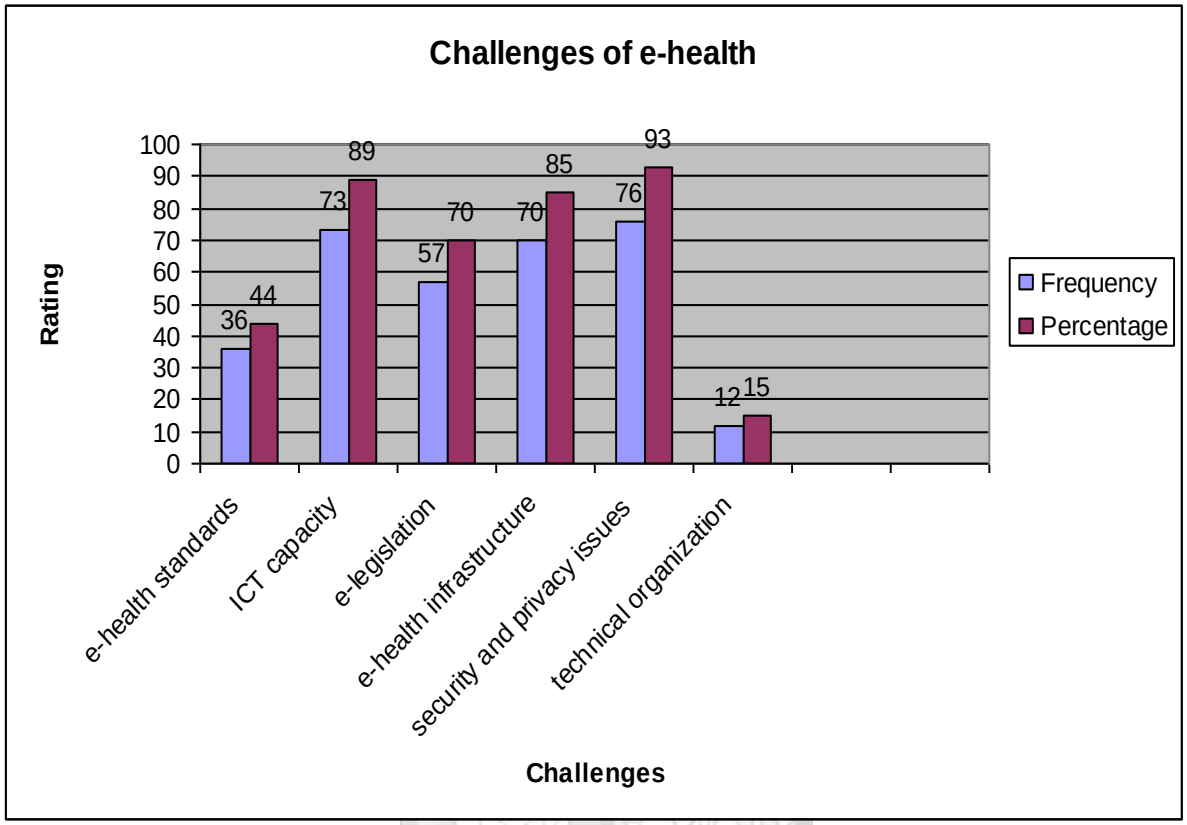


Figure 4.8: Challenges of e-health

4.5.1 Availability of internet connection

The researcher sought to know whether there is internet connection in the various facilities. \

The result as shown in Figure 4.8 below shows that 98% of the respondents saying that there are some form of internet connection in their health facilities.

This can connectivity can be in form of either;

i. LAN connection

ii. WAN connection

iii. Modem

iv. Wireless

Only 2% of the respondents indicated that there is no internet connection in their facilities.

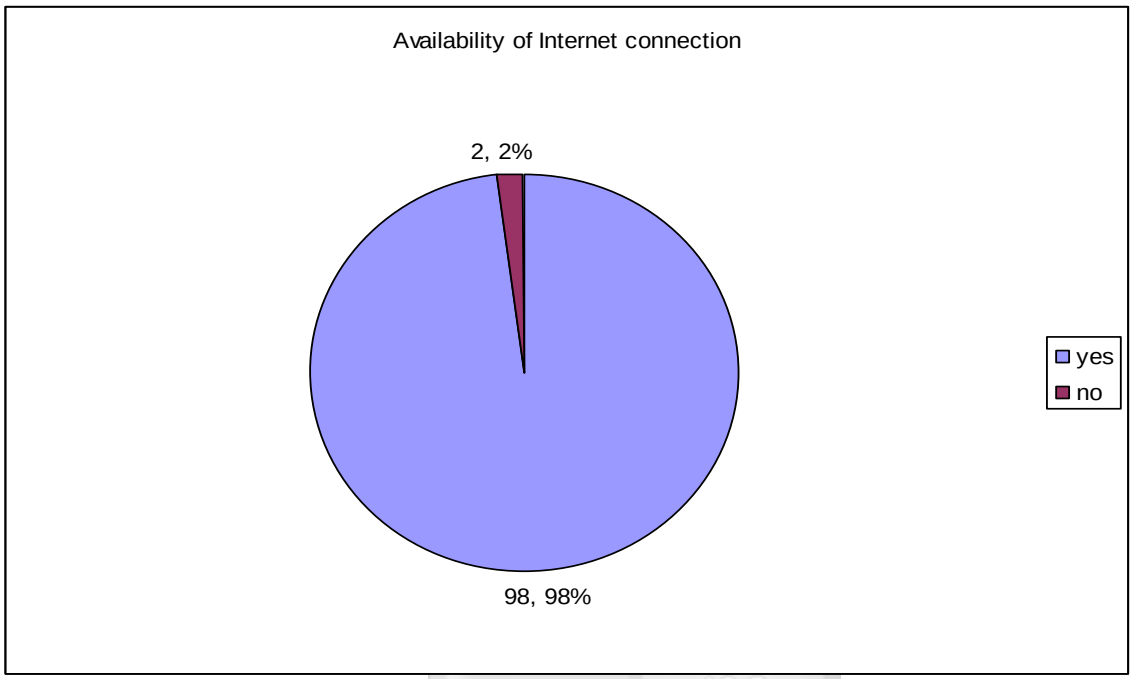


Figure 4.9: Availability of internet connection

4.5.2 The type of connectivity in use

From the literature review, some form of internet connectivity is essential for e-heath implementation. The researcher having established that most facilities have some form of internet connectivity, as shown in 4.8 above, there was further need to find out what kind of connectivity is in place.

The result in figure 4.9 shows that the common type of internet connectivity includes local area network which has 98% response rate, Wide area network has 71% response rate and wireless has a response rate of 50%. Modem also has a response rate of 7%

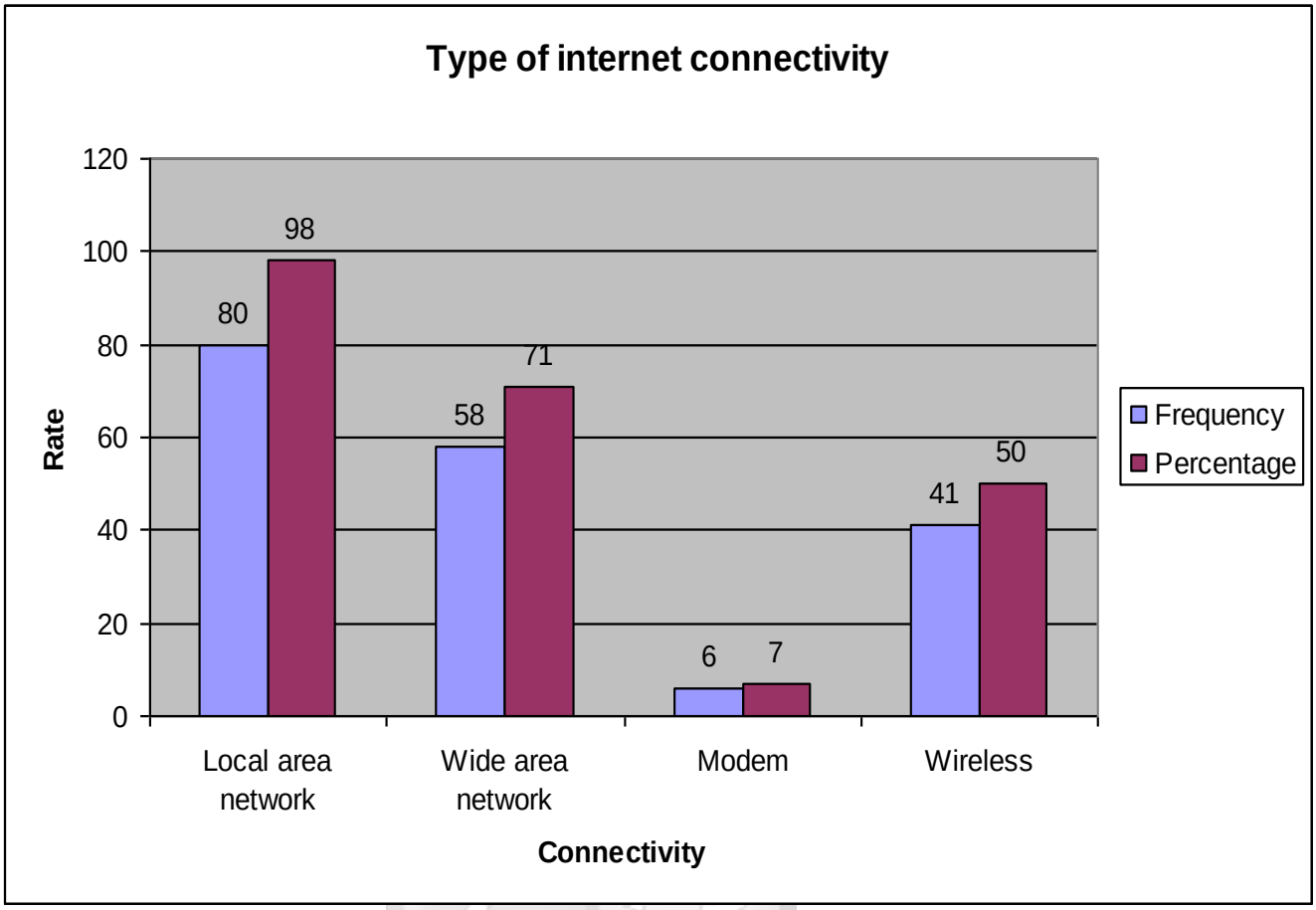


Figure 4.10: Type of internet connectivity

4.5.1 Need of training in the use of e-health

All the 82 respondents indicated that they need some training in the use of e-health system this represent 100% need for training by the respondents

Table 4.4: Training needs in use of e-health

	Yes	No
Need for training	82	0

4.5.2 Knowledge of computer usage

In the literature review it was observed that having proper knowledge and skill is key in implementing e-health in the health sector, the researcher therefore asked the respondents to rate their knowledge on computer usage.

The result in Figure 4.10 shows that 81% of respondent have average knowledge in computer use. 1% is experience.

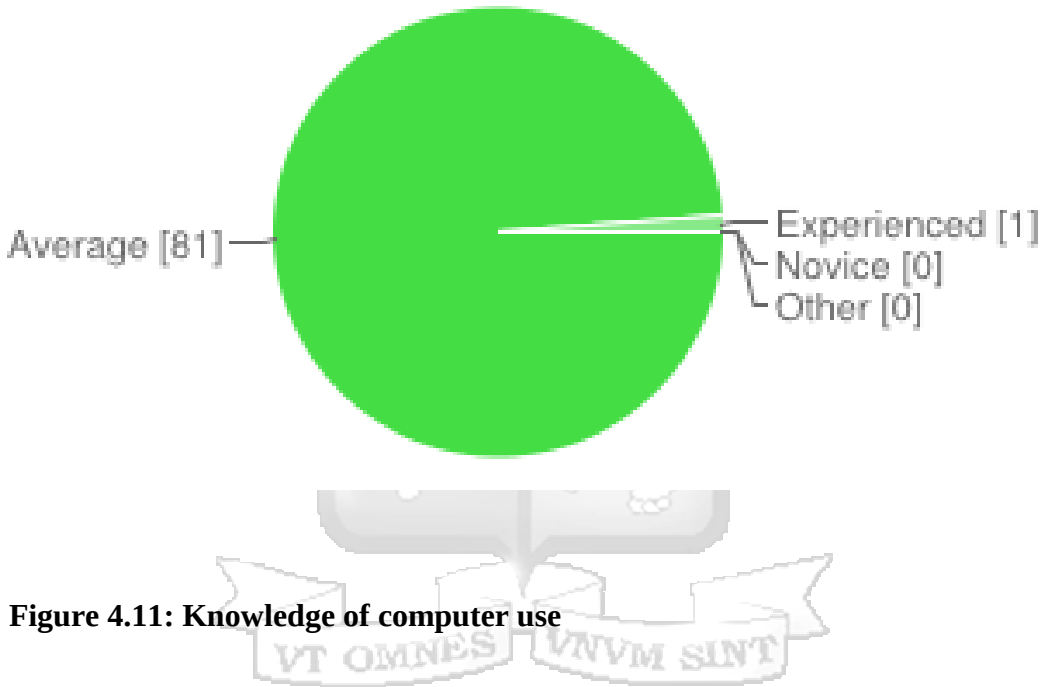


Figure 4.11: Knowledge of computer use

CHAPTER FIVE: A FRAMEWORK FOR IMPLEMENTATION OF E-HEALTH

The literature review discussed in chapter two and research findings in chapter four form the foundation for the development of a framework for implementation of e-health in public hospitals. This framework looked at the implementation framework in a different perspective by considering the pillars of e-health, various stakeholders overcoming challenges of implementation and the ICT infrastructural network.

5.1 Components of the framework

The framework will constitute various components such as stakeholders of e-health, forms of e-health, ICT Infrastructure and capacity, challenges of e-health implementation, education and training and benefits of e-health implementation discussed in sections 5.1.2 to section 5.1.6 ;

5.1.2 Stakeholders of e-health

The literature review in chapter two in section 2.9 identifies various stakeholders such as employers, patients, health providers, government authority, insurers, educators and researchers as the major stakeholders that are important for the implementation of e-health in the health sector.

The stakeholders need to work together and support each other towards the successful implementation of e-health. The research findings in chapter four section 4.3 and 4.3.1 shows that employers, patients, health providers, government authority, insurers and educators as some of the stakeholders that influences the uptake of e-health.

5.1.3 Forms of e-health

The National e-health strategy was developed in 2011 and anchored on the achievement of vision 2030, as discussed in chapter two literature review section 2.13. Of importance for consideration in ensuring successful implementation of e-health are the various forms of e-health.

The findings of the research in chapter four section 4.2.3 shows that there is need to implement e-health with various respondents indicating that they would like the different

preferred forms of e-health implemented. The analysis in chapter four shows that knowing the forms of e-health is important in implementation because it will determine the infrastructure already in place.

5.1.4 ICT Infrastructure and capacity

From the literature review in chapter two in section 2.16.1, there is no proper infrastructure The research findings in chapter four section 4.5 further shows that ICT infrastructure capacity is a challenge in implementation of e-health in the health facilities.

This therefore confirms that ICT infrastructure is a main component in implementing e-health in the public health institutions.

5.1.5 Challenges of e-health implementation

The Challenges of e-health discussed in chapter two section 2.4 shows that there are major concerns which has to be addressed to ensure successful implementation of e-health in the health sector.

The priority areas discussed in chapter two falls in five priority areas namely; e-health standards, e-legislation, ICT capacity, e-health infrastructure and lack of policy plan.

The research finding in chapter three in section 4.5 also show that the challenges indeed affect the implementation of e-health. This therefore confirms that the challenges have to be considered and looked at critically before implementing e-health.

5.1.5 Education and training

It is indicated in the literature review in chapter two that there is need to conduct training to the healthcare personnel to equip them with the desired skills and knowledge to enable them use e-health systems.

5.1.6 Benefits of e-health implementation

From the literature review in chapter two in section 2.2, Hayrinen (2008) state that data is stored electronically and it is more simpler and efficient way of data storing.

The research findings in chapter four further identified various benefits which will be achieved if e-health is implemented. Therefore this is the result achieved after general implementation of e-health in the health sector.

5.1 The Framework

The key components of the framework have been discussed in section 5.1 above and take into considerations the discussions in the literature review, the framework by Drury (2005), Ouma and Herselman (2008) and Wickramasinghe et al (2004) and the research findings in chapter four. Figure 5.1 below highlights the components that should be considered in e-health implementation.

5.2 Guidelines for the implementation framework

Table 5.4 below further explains the implementation guidelines for each listed component derived from the e-health implementation framework. Each guideline is as a result of the analysis of data done in Chapter four.

Table 5.1: Implementation guidelines

No	Components	Implementation guideline
1	E-health Stakeholders	All the stakeholders in the health sector should be brought on board from the beginning to support the implementation of any e-health solution. They should fully participate and involved in all stages of e-health implementation Support in terms of budgetary allocation and technical support will be received from the stakeholders if they are fully supported
2	Education/training and awareness	The healthcare personnel should be well trained in ICT and have the basic skills of computer operations. They are also suppose to do refresher courses to equip them skill on the various e-health solutions
3	Forms of e-health	Requirements of a given form of e-health should be considered before its implementation. What it entails to implement the given e-health solution.
4	ICT infrastructure	There should be sufficient ICT infrastructure in place to support the e-health solution to be implemented. Computers ,mobile phones and internet should be available and sufficient
5	Challenges of e-health implementation	The barriers and challenges of e-health implementation should be known in advance and done away with for successful implementation of a given e-health solution
6	Uses of e-health	The benefits to be achieved from the implementation of e-health should be known in advance. This will motivate the various participants and stakeholders in giving support to the given form of e-health to be adopted

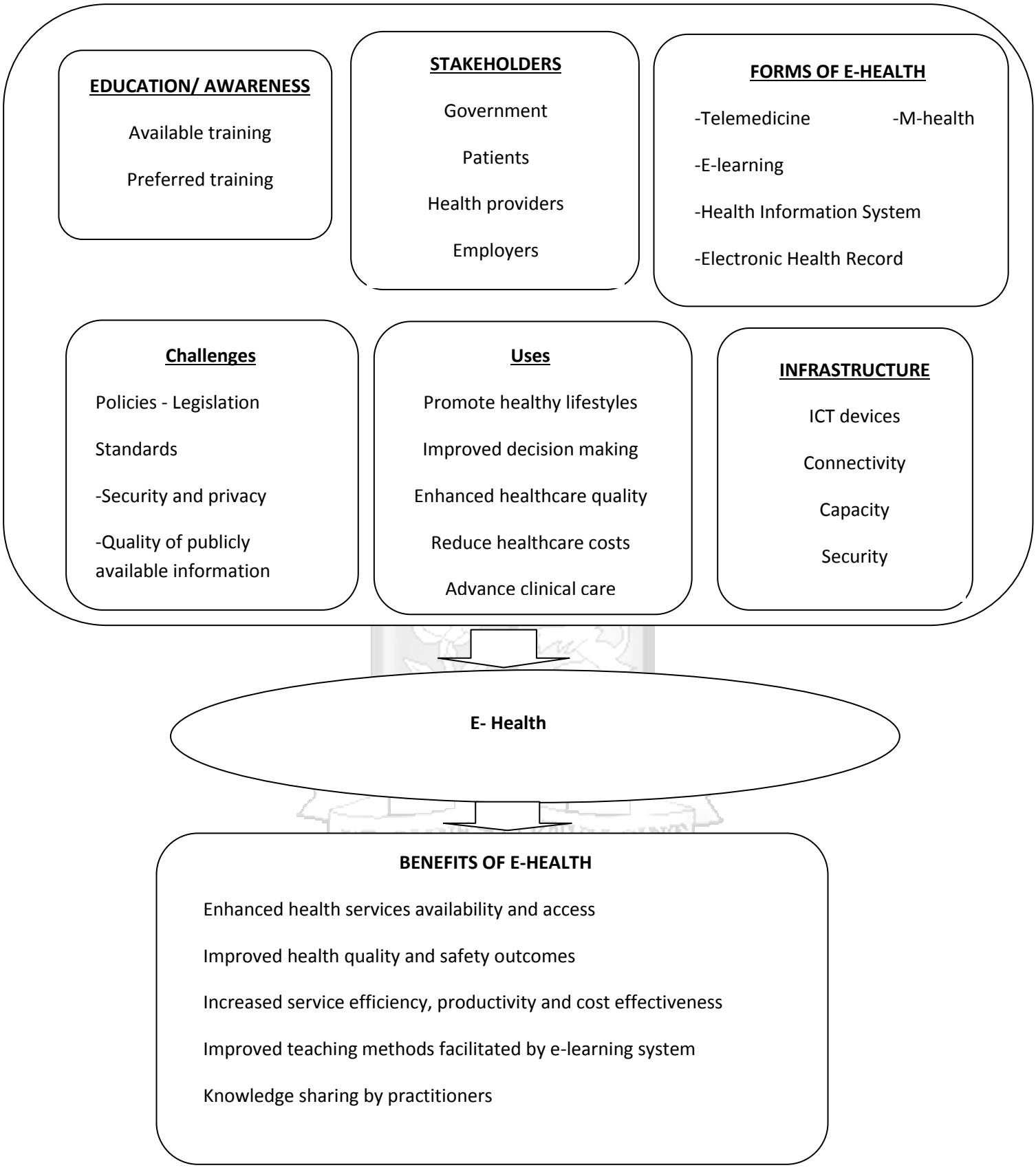


Figure 5.1: A framework for implementation of e-health in Kenya public hospitals

5.3 Implementation of Telemedicine

Telemedicine offers the ability to improve access to medical services while potentially lowering the costs associated with the delivery care.

The implementation of telemedicine requires the participation of government, physicians, clinicians, health providers as well as patients.

Successful implementation should be as follows;

i. Create and maintain a steering committee composed of multi-disciplinary team of stakeholders such as patients, physicians, clinicians, health providers, government and management staff to develop mission and vision of the system implementation

ii. Identify a telemedicine coordinator to implement, asses, manage and provide managerial oversight to telemedicine

iii. Test the telemedicine framework extensively including the software and hardware

iv. Recruit and train staff who are interested in implementation and utilization of telemedicine

v. The steering committee to guide the implementation and manage the challenges of implementation

vi. Provide a feedback loop and communication plan for staff and patients.

5.4 Implementation of Electronic Health Record (EHR)

The implementation of electronic health framework follows the following phases;

i. Planning

ii. Testing

iii. Training

iv. Go-live

v. Post go- live

Planning- plan on which document to convert from paper to digital, what information to convert, who on staff will enter information, have staff who will use the HER become involved in decisions regarding the set-up of the systems files and map critical practice workflows.

Testing- Do software and hardware testing to prepare the infrastructure, and set up a test environment for use with future updates.

Training- allocate enough time for staff training. Evaluate staff's readiness to go live

Go-live- schedule the go-live in close proximity to the end of the training sessions, reduce provider schedule and provide adequate resources such as in-house project managers, super users and vendor trainers

Post Go- Live- Conduct post go-live assessment by assessing the staff's level of frustration, monitors productivity and determine whether the HER is meeting established goals. Evaluate the go-live with staff, provider on-going training and support by offering training sessions that will help reinforce and refresh staff on HER.

CHAPTER 6: DISCUSSIONS

6.1 Introduction

The findings of this research were categorised by the research objectives as indicated in chapter one section 1.3. This chapter shows that the research objectives set in chapter one were met. This research had four objectives; to identify the benefits of e-health implementation, to identify the challenges of e-health implementation, to propose a framework for e-health implementation in public hospitals and then to have the framework validated.

6.2 Benefits of e-health implementation

From the research findings in chapter four, the following are the benefits of e-health implementation;

i. The availability of health services is enhanced - Consumers of healthcare are able to easily access healthcare services without necessarily travelling long distances to the health facilities because of the availability of healthcare online which implies that the doctors are able to do e-prescription, patients are able to do e-consultation

ii. Improved quality of health- Due to easy accessibility of e-healthcare services, the quality of health of the population will tremendously improve

iii. Increased effective and efficient delivery of health services- The population will get efficient and effective healthcare services from the health facilities

iv. Improved teaching methods facilitated by e-learning system- This gives opportunity to the health personnel to refresh their skill and improve their studies online and also to access better teaching methods and quality training from specialised instructors.

v. Knowledge sharing by practitioners- The practitioners are able to interact easily and share ideas and knowledge hence improving the quality of the services offered to the consumers

vi. Improved decision making- It enable evidence based decisions to be made by the healthcare providers. There will be quality information and exact results to enable the practitioner to make a decision

vii. Reduced health cost- It reduces the cost incurred by those living in remote areas to travel long distance to the health facilities to seek Medicare. Also the cost of offering health care to consumers will be drastically lowered.

6.3 Challenges of e-health implementation

Challenges affecting e-health implementation identified in the literature review chapter two in section 2.4

The research findings in chapter four in section 4.5 are;

(i) E-health standards

(ii) ICT capacity

(iii) E-legislation

(iv) E-health infrastructure

(v) Security

(vi) Privacy issues and technical organization.

6.4 A Framework for implementation of e-health in Kenya public hospitals

The research findings were used to develop a framework for implementation of e-health in Kenya public hospitals

6.5 Validation of the framework

The researcher made use of experts' opinion to validate the framework. A total of eight experts i.e. Administrators, health providers and doctors. The experts filled out the questionnaire attached in the appendices as Appendix C. They were required to answer A- Excellent, B- Good, C- Adequate- Not acceptable to the questions. The frequency of their responses is shown in table 6.1.

Table 6.1 demonstrates that all the interviewed experts agree that e-health implementation is important and beneficial in the public health sector. To a larger extent, the experts agree that the framework proposed analyses the key challenges of e-health implementation. Half of the experts demonstrate that the developed framework excellently provides solution to the key challenges and the other half says it is good enough. They all to large extent are willing to

implement the recommendations in the proposed framework and would recommend the framework to other organizations

Table 6.1: Framework Validation Results

		A	**B**	**C**	**D**
1	Importance and benefits of e-health implementation	8	0	0	0
2	This Framework analyses the key challenges of e-health implementation	6	2	0	0
3	This framework provides solution to the key challenges	4	4	0	0
4	Willingness to implement the recommendations in this framework in the organization	7	1	0	0
5	Recommendation of the framework to other organization	8	0	0	0

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The literature review and the research findings have identified, analyzed and discussed issues regarding the development of e-health implementation framework in public health facilities.

The research gave detailed understanding of e-health as defined and described by various researchers, it then identified the benefits of implementing e-health, then it went on to identify the challenges encountered in the process of implementing e-health, the research further has proposed a framework for implementation of e-health in Kenya public hospitals and finally the framework has been validated and discussed on its applicability.

7.3 Limitations

The scope of this research was limited was limited to implementation of e-health in public hospitals in Kenya. The sampling used was also limited to health facilities within Nairobi County. The other limitation of this research study is that the developed framework has not been tested in the real environment of operation to determine its workability and also to possibly identify areas which needs improvement and also to determine the actual value which will be receive from its implementation.

7.4 Recommendations

According to the proposed framework, the research recommends that e-health implementation should consider having the following components for successful implementation;

i. Infrastructure component

ii. A given form of e-health

iii. E-health Stakeholders

iv. Challenges encountered in e-health implementation

v. E-health infrastructure

vi. Uses/application

vii. Education and training e-health users

7.3 Suggestions for Future Research

We recommend that further research should be done on implementation of e-health to include private health facilities. We also recommend that there should be a critical consideration on e-health implementation taking into account e-health security issues pertaining the handling of patient data. Since information of patients is sensitive and the sharing and storing of the information in electronic format is exposed to external threats, the issues of security and privacy should be taken into consideration by determining how best the e-health technologies can be protected and secured.

It is finally recommended that the e-health implementation framework should be tested in the actual operational environment.

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Appendices A

A-1 Questionnaire used to determine e-health implementation in public hospitals

Strathmore University,

P.O Box 59857, 00200

Nairobi.

Contact: 0727174741

edumiddii@gmail.com

Dear Respondent,

My name is Edwin Middii, a postgraduate student in Strathmore University conducting a research on 'E-health Implementation' as a partial fulfilment for the award of a degree of Master of Science in Information Technology.

The information requested will strictly be used for academic research purpose and will therefore be treated with utmost confidentiality.

I humbly request you to respond to the questionnaire and send it back by January 20, 2015.

Thank you in advance.

A-2 PART A: BASIC INFORMATION

A1 Please indicate the name of your hospital *

This is a required question

A2 Please indicate your Name (Optional)

A3 Please indicate your role in the hospital

Tick all that apply

- ☐ Doctor
- ☐ Nurse
- ☐ Administrator
- ☐ Other:

A4: Please indicate the current forms of e-health in use in your hospital
Tick all that apply

- ☐ Electronic Health Record (EHR)
- ☐ Telemedicine
- ☐ M-health
- ☐ Health Information System
- ☐ Health Knowledge management
- ☐ Consumer health informatics
- ☐ Other:

A5: What preferred forms of e-health would you like to be implemented in your hospital
Tick all that apply

- ☐ Electronic Health Records (EHR)
- ☐ Telemedicine
- ☐ M-health
- ☐ Health Information System
- ☐ Health Knowledge Management
- ☐ Consumer Health Informatics
- ☐ Other: _____

PART B: BENEFITS, CHALLENGES AND REQUIREMENTS FOR IMPLEMENTATION OF E-HEALTH

B1: Please indicate the key current stakeholders in health sector

Tick all that apply

- ☐ Government
- ☐ Patients
- ☐ Insurers
- ☐ Health Providers
- ☐ Employers
- ☐ Educators
- ☐ Other: _____

B2: Please rate the stakeholders in order of their influence in e-health implementation
1= high influence; 6=Low influence

	1	2	3	4	5	6
Government	○	○	○	○	○	○
Patients	○	○	○	○	○	○
Insurers	○	○	○	○	○	○
Health Providers	○	○	○	○	○	○
Employers	○	○	○	○	○	○
Educators	○	○	○	○	○	○

B3: Please indicate the ICT technologies in place within the hospital used to support e-health services

	0-5	6-15	16-25	26-35	36-45	above 45
Desktop	○	○	○	○	○	○
Laptop	○	○	○	○	○	○
PDAs	○	○	○	○	○	○
Mobile Phone	○	○	○	○	○	○
Printers	○	○	○	○	○	○
Tablet	○	○	○	○	○	○

B4: Do your health institution have internet connection?

- ○ Yes
- ○ No

B5: Please indicate the connectivity used in you hospital
Tick all that apply

- ☐ Local Area Network (LAN)
- ☐ Wide Area Network (WAN)
- ☐ MODEM
- ☐ WIRELESS
- ☐ Other: _____

B6 Please indicate the benefit(s) achieved from implementation of E-health in health sector
Tick all that apply

- ☐ Enhanced healthcare services availability and access
- ☐ Improved health quality, safety and outcomes
- ☐ Increased service efficiency, productivity and cost effectiveness
- ☐ Knowledge sharing amongst practitioners
- ☐ Better decision making
- ☐ Improved teaching methods
- ☐ Other: _____

B7 Please rate the benefits of e-health in your opinion in order of importance
1= Most important 6=Least important

	1	2	3	4	5	6
Enhanced healthcare services availability	○	○	○	○	○	○
Improved health quality, safety and outcomes	○	○	○	○	○	○
Increased service efficiency, productivity and cost effectiveness	○	○	○	○	○	○
Knowledge sharing amongst practitioners	○	○	○	○	○	○
Better decision making	○	○	○	○	○	○
Improved teaching methods	○	○	○	○	○	○

B8: Please indicate the challenges of e-health implementation in your hospital

Tick all that apply

- ☐ E-health standards
- ☐ ICT capacity
- ☐ E-legislation
- ☐ E-health Infrastructure
- ☐ Security and privacy issues
- ☐ Technical organizational
- ☐ Other: _____

B9: Do you think you need training in the use of e-health systems

- ○ Yes
- ○ No

B10: How will you rate your knowledge of computer usage?

- ○ Novice
- ○ Average
- ○ Experienced
- ○ Other: _____

B11: Have you ever had any training or direct experience in using e-health systems

- Yes
- No

Appendices B

B-1 Interview Guide used for implementation of e-health in public hospitals

Strathmore University,

P.O Box 59857, 00200

Nairobi.

Contact: 0727174741

edumiddii@gmail.com

Dear Respondent,

My name is Edwin Middii, a postgraduate student in Strathmore University conducting a research on 'E-health Implementation' as a partial fulfilment for the award of a degree of Master of Science in Information Technology.

The information requested will strictly be used for academic research purpose and will therefore be treated with utmost confidentiality.

Thank you in advance.

SECTION A: Background information

A1 Please indicate the name of your hospital *

_____

A2 Please indicate your Name (Optional)

_____

A3 Please indicate your role in the hospital

_____

A4: Please indicate the current forms of e-health in use in your hospital

_____

A5: What preferred forms of e-health would you like to be implemented in your hospital?
Tick all that apply

_____

PART B: BENEFITS, CHALLENGES AND REQUIREMENTS FOR IMPLEMENTATION OF E-HEALTH

B1: Please indicate the key current stakeholders in health sector

_____

B2: Please rate the stakeholders in order of their influence in e-health implementation

_____

B3: Please indicate the ICT technologies in place within the hospital used to support e-health services

_____

B4: Do your health institution have internet connection?

_____

B5: Please indicate the connectivity used in you hospital

_____

B6: Please indicate the benefit(s) achieved from implementation of E-health in health sector

_____

B7: Please rate the benefits of e-health in your opinion in order of importance

_____

B8: Please indicate the challenges of e-health implementation in your hospital

_____

B9: Do you think you need training in the use of e-health systems

_____

B10: How will you rate your knowledge of computer usage?

_____

B11: Have you ever had any training or direct experience in using e-health systems

_____

Appendices C

C-1 Questionnaire used to validate the framework

Strathmore University,

P.O Box 59857, 00200

Nairobi.

Contact: 0727174741

edumiddii@gmail.com

Dear Respondent,

My name is Edwin Middii, a postgraduate student in Strathmore University conducting a research on 'E-health Implementation' as a partial fulfilment for the award of a degree of Master of Science in Information Technology.

The framework is based on the e-health implementation in Kenya public hospitals. The objective of this questionnaire is to determine the extent to which this framework meets the requirements for e-health implementation

The information requested will strictly be used for academic research purpose and will therefore be treated with utmost confidentiality.

Thank you in advance.

Instructions

The following grade scale is used:

A- Excellent

B- Good

C- Adequate

D- Not acceptable

Please tick the grade scale that applies to every statement in your opinion

	A	B	C	D
1. E-health implementation is important and beneficial to me	☐	☐	☐	☐
2. This framework analyses the key challenges of e-health implementation	☐	☐	☐	☐
3. This framework provides solution to the key challenges	☐	☐	☐	☐
4. I am willing to implement the recommendations in this organization	☐	☐	☐	☐
5. I would recommend this framework to other organizations	☐	☐	☐	☐