

**THE EFFECT OF MOBILE PHONE TECHNOLOGY IN BRIDGING THE GAPS IN
ARV UPTAKE CARE SERVICE DELIVERY IN KENYA: A CASE STUDY IN
KIBERA, NAIROBI COUNTY**

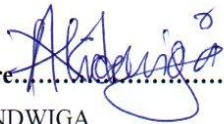
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**A THESIS SUBMITTED IN PARTIAL FULILLMENT OF THE REQUIREMENT
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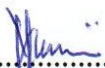
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This thesis is my original work and has not been presented for a degree or any other award in any other University.

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DEDICATION

To my parents Mr. Clement Ndwiga and Mrs. Priscilla Ndwiga and my late brother Andrew Ndwiga who assiduously motivated me to complete this project.

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I would like to acknowledge Kenya Methodist University for the given opportunity to study for the courses and my supervisors Dr. Makobu Kimani and Dr. Bororo Oirere- Kenya Methodist University, without a doubt for their incessant support during my research up to completion. I wish also to earnestly express gratitude to all the respondents who provided important information for this study, as well as the staff of MSF Clinic who worked with me at their clinics and their tremendous effort that cannot go unnoticed.

ABSTRACT

The Kenyan constitution seeks to guarantee every citizen the right to quality healthcare services but is hampered geographical location, socio-economic statuses, and education among other factors of intended recipients. The country has a high mobile phone penetration rate and mobile devices have revolutionized the way people interact. Digitalization of the healthcare sector is a vital aspect that contributes to effective delivery of care services. This study set out to assess about the impact of mobile technology in closing the gaps within the health care service delivery. It focused on Kenya as the case study, where, just like many other developing countries, the challenge of unequal healthcare services delivery. The objective of the study was to identify the gaps in healthcare delivery in Kenya with a focus on Kibera, an informal settlement in Nairobi by the use of mobile technology on clinical services to MSF patients. To evaluate how mobile technology would help in bridging gaps in healthcare service delivery by assess how it improves self-care among the visiting patients, to establish how far the mobile technology has change lives of patients in healthcare service delivery. The study target population was patients visiting Médecins Sans Frontiers (MSF) clinic. A cross-sectional study design was employed in this study. Purposive and simple random sampling method was used to select the study sample of 210 participants. Quantitative data was collected using survey questionnaire as the instruments of data collection. Pretesting of the questionnaires was carried. To analyze the data, SPSS 17 software was used. The main findings showed that n=66.12% of the respondents (n=14.29% strongly agreed + n=55.24% agreed) that the use of mobile phone technology improved their access to healthcare services. Hypothesis testing using p value of 0.05 also showed that use of mobile phone technology positively impacted the delivery of healthcare services. The findings showed that n=66.12% of the respondents agreed that the use of mobile phone technology improved their access to healthcare services. The study recommends that governments should strive to equip healthcare clinics and hospitals with mobile technology such as internet enabled communication devices as a way of linking healthcare providers with patients for easier access to free health information and concluded that with those interventions in place, we would be able to deliver healthcare services that are equal and efficient to all.

TABLE OF CONTENTS

DECLARATION	ii
©COPYRIGHT	ii
DEDICATION	iv
ACKNOWLEDGEMENT	v
ABSTRACT	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF ABBREVIATIONS AND ACRONYMS	xi
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background of the Study.....	1
1.2 Statement of the Problem.....	8
1.3 Purpose of the Study.....	9
1.4 Research Objectives.....	9
1.5 Research Questions/ Hypotheses.....	10
1.6 Justification of the Study.....	11
1.7 Limitations of the Study.....	11
1.8 Delimitation of the Study.....	12
1.9 Significance of the Study.....	12
1.10 Assumptions of the Study.....	13
1.11 Operational Definition of Terms.....	13
CHAPTER TWO	14
LITERATURE REVIEW	14
2.1 Introduction.....	14
2.1 Healthcare Service Delivery.....	15
2.2 Studies on Mhealth in Developing Countries.....	24
2.3 Effects of mobile phone technology on healthcare delivery.....	30
2.4 Benefits and Challenges for Mhealth in Kenya.....	42
2.5 Chapter Summary.....	48
2.6 Conceptual Framework.....	49
CHAPTER THREE	50
RESEARCH METHODOLOGY	50
3.1 Introduction.....	50

3.2 Research Design.....	50
3.3 Target Population.....	51
3.4 Sampling Procedures	51
3.5 Instrumentation	53
3.6 Methods of Data Collection	53
3.7 Methods of Data Analysis.....	54
3.7 Data Presentation	54
CHAPTER FOUR.....	55
RESULTS AND DISCUSSIONS	55
4.1 Introduction.....	55
4.2 Social Economic and Demographic Characteristics of Respondents	55
4.3 Responsiveness of HIV Uptake at the MSF Clinics	58
4.4 Cost of uptake of HIV Services	59
4.5 Healthcare Services from the Clinics over the Phone.....	60
4.6 Frequency of Information Given Over the Phone by Clinics	61
4.7 Perception on the Use of Mobile Phone Technology in Healthcare Services Delivery	62
4.8 Use of Mobile Technology to Influence Delivery of Healthcare Services.....	64
4.9 The Use of Mobile Phone Technology Improves Access to Healthcare Services.....	64
4.10 Appointment Clinic Visits Increased for HIV patients Due to Use of Mobile Technology?.....	66
4.11 Technology Improves Communication between Healthcare Providers and Patients	67
4.12 Hypothesis Testing Results.....	69
CHAPTER FIVE	71
SUMMARY, CONCLUSIONS & RECOMMENDATIONS.....	71
5.1 Introduction.....	71
5.2 Summary of the Study	71
5.3 Conclusions.....	77
5.4 Recommendations.....	78
REFERENCES.....	80
APPENDICES	87
Appendix I: Students Questionnaire	87
Appendix II: Student Consent Form.....	90
Appendix III: Research Permit	91

LIST OF TABLES

Table 4.1: Social Economic and Demographic Characteristics of Respondents N= (210)	56
Table 4.2: Influence Brought by Mobile Technology in Delivering Healthcare	64
Table 4.3: Chi- Square Test	69

LIST OF FIGURES

Figure 2:1: Eastern African Countries Healthcare budgets	21
Figure 2:2 Performance of Healthcare Sector in Kenya	22
Figure 2:3: Conceptual Framework	49
Figure 4.4: Delivery of Healthcare Services	58
Figure 4.5: Differences in Care Delivery.....	59
Figure 4.6: Healthcare Services over the Phone	60
Figure 4.7: Frequency of Information Given Over the Phone	61
Figure 4.8: Perception of Using Mobile Phone Technology in Healthcare Services Delivery	63
Figure 4.9: Improvement of Healthcare Services Due to Mobile Phone Technology.....	65
Figure 4.10: Increased Clinical Visits Due to Mobile Technology	66
Figure 4.11: Mobile Technologies Improves Communication	68

LIST OF ABBREVIATIONS AND ACRONYMS

ACA	Affordable Care Act
APHRC	African Population and Health Research Center
ARVs	Antiretroviral
CAK	Communication Authority of Kenya
GDP	Gross Domestic Product
HHS	Health and Human Subjects
HSSP	Health Sector Strategic Plan
MMR	Maternal Mortality Rate
MOH	Ministry of health
M-Pesa	M for mobile, pesa is Swahili for money
MSF	Médecins Sans Frontiers
NHIF	National Health Insurance Fund
NMR	Neonatal Mortality Rate
OECD	Organization for Economic Cooperation and Development
SMS	Short Message Service
SPSS	Statistical Package for the Social Science
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Access to high quality healthcare is a right to every individual globally (World Health Organization [WHO], 2002). Healthcare is a basic need (WHO, 2010). Healthcare is an important amenity for all people but its accessibility differs due to geographical location, human resource ability, and financial ability. Healthcare is a broad terminology that involves restoration of body or mind health (WHO, 2002). This involves diagnosis, treatment, and prevention of illnesses, diseases, injuries, and other physical or mental problems in human beings. It is the responsibility of every government under the World Health Organization to ensure that all citizens are provided with quality healthcare services regardless of their financial standing, geographical locations, and social statuses (Mankiw, 2009). Provision of healthcare involves the work done in providing primary care, secondary care, and public care. As noted by Lester et al. (2009), access to healthcare varies across groups, countries, regions, cultures, and individuals and is largely influenced by socio-economic conditions, and geographical locations. For instance, the United Kingdom has a strong policy on healthcare which supports free healthcare to every citizen. According to Steinbach (2009), inequalities in the distribution of health are related to gender, social class, and ethnicity for in Kenya for example, many stay-at-home women suffers most compared to men. In addition, a patient is treated in Kenya hospital according to her social status; the means his/her finances. If one has resources, he is able to go to private and quality hospitals either in the country or abroad while the poor struggle for medication in public hospitals (Steinbach, 2009).

As Lien et al., (2014) reported, healthcare is a significant contributor to a country's economy. In the year 2011, the healthcare industry consumed over 9.4% of the GDP of the 34 members of the Organization for Economic Co-operation and Development (OECD) countries. Netherlands, France and Germany are the top spenders on healthcare with 11.9%, 11.6%, and 11.3% respectively of their Gross Domestic Product (GDP).

A country that does not have good healthcare policies that support provision of high quality healthcare does not contribute towards the development of their citizens. Developed countries such as the United States, Japan, France, the United Kingdom, and Germany among others have invested heavily in ensuring that their citizens get proper high quality healthcare without discrimination. Africa as a continent is facing a big challenge in provision of healthcare whereby majority of the poor people do not have access to high quality healthcare services (Klynveld Peat Marwick Goerdeler [KPMG], 2012).

In Kenya, healthcare system is structured in a step- wise strategy whereby complicated cases are referred to the higher level. This creates a lot of socio-economic, gender, geographic, and ethnicity gaps in the system which are filled by private and faith based units (WHO, 2010). The country promulgated a new constitution in the year 2010 (The Kenya Law Review Commission, 2011) which recommended the decentralization of healthcare services to the county level. In the devolved system, the Kenya Health Policy 2012-2013 (Ministry of Health [MoH], Government of Kenya [GoK], 2015) offers guidance to the health sector by identifying and outlining the most important activities that would help in the achievement of the government's health goals (Kramon & Posner, 2011). By the year 2011, the Kenyan Government had made very little progress towards the achievement of a pledge by African states as contained in the Abuja declaration of allocating 15% of the national budget to the health sector (Chuma & Okungu, 2011).

The private health sector in the country is growing at a very high rate owing up to 49% of health services in the country and this has remained a major challenge to effective delivery of healthcare services to all people (Chuma & Okungu, 2011).

Access to health care is one of the major components of a country's economic development. Having a healthy workforce results in steady growth of the country's Gross Domestic Product (GDP) (Munyua, Rotich, & Kimwele, 2015). Kenya has a population of approximately 44 million people. Healthcare services in the country are provided by a network of 4,700 health facilities with the government running or owning about 51% of these facilities (Mwangi, 2013). The Kenyan healthcare system is currently faced by challenges of rising cost, continued demand for quality healthcare services against the backdrop of lack of enough medical practitioners (MOH, 2011). This presents a major deficit in expectations given that in the Kenya Vision 2030, Kenya targets to achieve access to healthcare for all its citizens by 2020. There is therefore a compelling need to come up with ways and means of closing the gap between the current situation and the vision (MOH, 2011). Among the people in the population who get sick and choose to seek medical attention from the health facilities 44% of them are hindered by cost and corruption, another 18% are hindered by the long distances they have to travel to the nearest health facility since some areas in remote Kenya do not have public transport facilities or are not accessible by any motorized form of transport (Mwangi, 2013). Low numbers of health workers from midwives, clinical officers, nurses and doctors is also a major hindrance to the access of healthcare in Kenya (MOH, 2011).

The idea of using mobile phone to improve health services has a comprehensive history. Some argue that the use of phone communication started long ago with the introduction of telecommunication which was born back in 1861 during the Civil War (Kramon & Posner, 2011). However, the exact date that telecommunications commences is open to debate. However, despite this long history, majority of the public across Kenya and even in

developed nations find the concept of telemedicine or using phones to communicate to health providers as unfamiliar and new. Telemedicine also known as e-health or telehealth is a form of a medical intervention where health care givers use telecommunications technology to attend, diagnose, treat and evaluate patients in remote areas. With this telemedicine, patients don't need to travel to access medical expertise. The concept of phone health or medicine seem confusing however comparing the evolvement of telemedicine and telegraph, it becomes clear that the model for using phone communications to deliver health services has been evolving for decades. Telemedicine gave birth to other forms of using technology to deliver health services such as mHealth among others. The mHealth technology is the process of delivering care services via mobile devices such as tablets and cellphones. However, the basic idea is exchanging health related messages over long distances using social networks such as mobile phones, Skype and FaceTime. In that sense, use of phones to get health services can be viewed as an accessible way to form two-way communication between health providers and publics which is easier in the current age of technology (Kramon & Posner, 2011).

The use of mobile technology in health realm is discussed within the context of telemedicine. In that regard, mobile phone technology offers smart solutions for improving the wellness and health of individuals. This new form of healthcare is mutually beneficial for medical professionals and patients. The technology meets the demands and criteria of the International Affordable Care Act of World Health Organization by giving more individuals access to quality care. The most powerful attributes of mobile technology include its widespread access of care, convenience, and reduction in medical spending. Today, mobile technology gives rural, isolated communities the opportunity to make connections with health care professionals. Electronic communications allow patients to link with physicians through means of electronic communication (WHO, 2002)

Globally, advanced telecommunications, portable computation and combined functionality of a pager, a cell phone and a personal digital assistant (PDA) have been replaced by a single handheld device called a “smartphone”, which is becoming extremely well-liked among healthcare practitioners as well as the public. The number of mobile phones and in particular smart phones users has grown exponentially among the healthcare practitioners over the last few years (World Bank Group, 2012). The most modern invention of smartphones are increasingly viewed as handheld computers rather than as phones, due to their prevailing on-board computing ability, large memories, big screens and open operating systems that encourage application development. Additionally, developed countries such as Germany, Russia, United States of America among others have been able to administer third-party software such as Opera, Firefox, Safari and Thunderbird. Lately, the blockchain communication is being extensively practiced in China. Blockchain communication is a type of information passage via distributed ledger shared Intel cloud to multiple computers that are connected (World Bank Group, 2012).

The International Telecommunication Union (ITU) reported that is the regions with a deepening of the regional digital divide since 2011. In the information and Communication Technology rankings, the index ranks three African countries (Nigeria, Kenya and South Africa among the most dynamic in the realm of mobile penetrations. However, although the ICT strongly advocates the enormous growth of mobile phone penetration in Africa, little has been known about the application of mobile phone-based health models which might drive significant advance in surveillance of disease systems. However, claims hold that the mobile penetration will cause unprecedented growth of mHealth in Africa (Shields, Chetley, & Davies, 2013).

mHealth platforms heavily rely on technology integration with the health sector to improve the provision of healthcare (Shields et al., 2013). The use of mHealth solutions for health

service delivery is facilitated by a convergence of a myriad of factors which are an increase in the penetration of mobile networks, increase in the affordability of mobile handsets, the increase in individual income and technology innovations that integrate the mobile applications with the traditional health care delivery models (Shields, et al., 2013). In this respect mobile phone usage has been growing rapidly and consistently over time and according to the Communications Authority of Kenya (CAK), for example in June 2014 the number of mobile users was 32.2 million up from 31.1 users in the previous quarter. This clearly indicates a 5.6 percent growth in a period of three months (Oteri, Kibet & Ndung'u, 2015).

According to a Groupe Spécial Mobile Association (GSMA) global mobile economy report the mobile phone industry continues to grow rapidly with a total of 3.6 billion individual users by the end of 2014. It estimates that half of the world's population has a mobile phone. It is estimated that mobile broadband connections will account for about 70% of the world connections in 2020 (Groupe Spécial Mobile Association [GSMA], 2015). The adoption of smartphones is already reaching a vast majority in developed worlds and the increase in the affordability of these devices is driving further the use of smartphones in the developed world. The developing trends shows that adoption of M-health in developing countries like Kenya is feasible and the growth in mobile broadband infrastructure further supports the adoption (GSMA, 2015).

According to (GSMA, 2012) M-health market is made up of a variety of services and applications that exploit mobile broadband system and devices for health service delivery. M-health technologies can be categorized or segmented into two distinct areas based on the intended impact of the M-health technology in achieving particular health outcomes and also in the consideration of the skillsets needed to deliver the specific outcome. The two categories are Solutions across the Patient Pathway-these are services and applications that

are used directly by patients and Healthcare Systems Strengthening- these are solutions that do not interact with patients but are rather focused on improving the efficiency of healthcare provision in patient care (GSMA, 2015)

The two segments are further broken down into various categories as follows; Patients Pathway perspective is broken down into; Wellness, Prevention, Diagnosis, Treatment and monitoring. In all these categories the patient is the main end user and therefore interacts with the M-health services or application directly. Healthcare System Strengthening is broken down into; Emergency response, healthcare practitioner support, healthcare surveillance and healthcare administration. In all of these categories the patient does not directly interact with the M-health system it rather focuses on improving the provision of healthcare system so as to enhance service delivery (GSMA, 2012).

It is noted that like other countries Kenya is keen on implementing M-health as a way of complementing the strategies set for strengthening health systems (MOH, 2011) in tandem with meeting its obligation of fulfilling the Sustainable Developmental Goals (SDG) (ITU, 2010). This given interest has resulted in a number of M-health deployments worldwide which have provided evidence of the great potential for the exploitation of the mobile network. This has seen M-health being applied to child health and maternal care, Human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS), malaria and Tuberculosis observation, treatment and also prevention. M-health is applicable in various areas of the healthcare industry. It facilitates timely access to emergency services, reaching out to the public on general healthcare services, in the management of patient information which includes collection and also dissemination to the various healthcare organizational units, maintenance of drug stock level at health clinics as well as enhancing clinical diagnosis and treatment adherence among other areas (WHO, 2011).

In Kenya, mobile technology has played a pivotal role in the development of communication and business transactions such as in mobile phone-based money transfer (M-pesa; where M=mobile, pesa is Swahili for money) business. According to Communication Authority of Kenya (CAK) report in the year 2018, with this rate of mobile subscription which stands at 91% of the adult population, Kenya has a significant percentage of mobile penetration rate. Majority of these mobile phones are owned by people residing in urban areas with Nairobi having the largest number of subscribers (Oteri et al., 2015). This indicates that the high rate of mobile penetration can be an advantage to the implementation of mobile technology in bridging the gap in healthcare provision in the country. The healthcare sector has developed a new innovation in the use of mobile phones and tablets in support of the delivery of healthcare services (Steinbach, 2009).

1.2 Statement of the Problem

The uptake of HIV services by patients in Kibera going to the MSF Clinic has been very low possibly due to social economic factors, negative attitude towards the treatments and care among other reasons. The healthcare sector in Kenya has suffered a major setback in the years 2009-2019 due to the high rate of economic inequalities. Though the Kenyan government has tried to address the problem of healthcare delivery inequalities as well as poor performance through a number of policy documents, these efforts have not yielded significant outcomes. The mobile technology solution would then enable the on-going services provided to them by having receiving SMSs on the Mobile Phone for follow-up on regular appointment visits. However, the implementation of the National Health Insurance Fund (NHIF) which has led to enhanced contributions by members has enabled many Kenyans to access healthcare services regardless of their current economic statuses (Mitra, 2014). The large rift between the rich and the poor has continued to create different services not only in the economic sector but also in healthcare services. For instances, most public

hospitals have private wings where the rich and middle class seek their services while leaving the poor segment of the population scrambling for the free and quite often, poorly maintained public wing (WHO, 2015). These gaps in healthcare services delivery are creating a worrying trend as the majority of citizens feel ignored by the Government. It is for this reason that the introduction of mobile phone technology based healthcare services might improve greatly on delivery of healthcare services despite the lack of financing and unaffordability, it provides equality on healthcare services. This mobile phone technology is an application based technology where the hospital or clinics that the patient attends gets automated messages either to remind them of their scheduled appointment or time to take their medication. However, only a few hospitals have embraced the mobile telephone technology based healthcare services innovation (WHO, 2015).

1.3 Purpose of the Study

The purpose of the study is to assess the influence of mobile technology on the uptake of HIV services in Kibera.

1.4 Research Objectives

The main objective of the study is to investigate the effects of mobile phone technology in bridging the gap in healthcare service delivery in Kenya with a focus on Nairobi, Kibera informal settlements. The study seeks to achieve this through the following specific following objectives:

- i) To determine whether mobile phone technology increases responsiveness among HIV patients in Kibera.
- ii) To assess whether mobile phone technology improves self-care among HIV patients in Kibera.

iii) To evaluate if mobile phone technology influences HIV patient appointment visits in Kibera.

iv). To examine whether the mobile phone technology charges affects uptake of services among HIV patients in Kibera.

1.5 Research Questions/ Hypotheses

In achieving these objectives, the extant study seeks to answer the following research questions;

i) Does mobile phone technology increase responsiveness among HIV patients in Kibera?

ii) Do mobile phone technology improve self-care among HIV patients in Kibera?

iii) Does mobile phone technology influence HIV patient appointments visits in Kibera?

iv). Do the mobile phone technology charges affect uptake of services among HIV patients in Kibera?

Research Hypotheses:

H₁: Use of mobile phone technology increases responsiveness among HIV patients in Kibera.

H₂: Use of mobile phone technology improves self-care among HIV patients in Kibera.

H₃: Mobile phone technology influences HIV patient appointment visits in Kibera.

H₄: Mobile phone technology charges affect uptake of services among HIV patients in Kibera.

1.6 Justification of the Study

Kenyan healthcare system is characterized by numerous gaps in service delivery especially among HIV patients in Kibera. The manner in which healthcare services are delivered in the country, the poor and less privileged have fewer opportunities of benefiting.

Devising a way whereby all people regardless of their socio-cultural and economic status would be served equally is very vital. This study therefore seeks to establish how mobile phone technology when used effectively would increase uptake of HIV care in Kibera. Already there are several hospitals and clinics that are trying to use the mobile technology to evaluate how effective it can be in improving terminal ill care. Since, majority of people in Kenya have some degree of access to a mobile phone connection, it is prudent to invest in this technology has the potential to reach many people currently not reached by the healthcare delivery structures in the country.

1.7 Limitations of the Study

With this study, it does not provide the true picture of the implementation and the effects of mobile technology when it comes to healthcare delivery especially on interventions and its studies. Similarity, observations and interviews given a different approach on the type of services given could also acquire different results if they were observation or focus group discussions with the locality of the clinic.

As a solution, the study was very specific to the patients who were aware of the services given on the mobile phones and expressed any challenges that they had especially on the literacy level and options of language was given including translation on how to interpret the messages to its full capacity.

1.8 Delimitation of the Study

For the succession of the study, all the participants had to be engaged and had the correct devices that would be able to have access to SMS platforms and be able to read through and receive messages on the mobile phones to be able to respond to the messages in a timely manner.

The participation from the MSF clinic staff also played a major role in ensuring the support was given through the implementation and guided the patients on areas where they had questions especially on the privacy and confidential aspect of it and that the bio-data wasn't captured on their records. This was affirmed to them while they had their regular weekly meetings with the patients at the clinic.

1.9 Significance of the Study

It is a right for every citizen in Kenya under Chapter 11 of the constitution to access quality healthcare (Kenya Constitution, 2010; chapter 11). Therefore, establishing ways of collecting data and dissemination of key messages as well as good practices among communities in on healthcare; is an important aspect of development in the healthcare sector.

This study identifies and discusses the various gaps in healthcare delivery in Kenyan informal settlement and shows how mobile phone technology can be used to bridge these gaps. Therefore, this study will offer good information both to the public and private healthcare providers on how to improve delivery of healthcare services. This study will positively impact the future studies on healthcare delivery under mHealth by offering significant insights and data on how the technology works, challenges facing the technology, and its impacts in the healthcare sector. mHealth is a practice of public health and medicine supported by mobile technology. The study findings will be used as a point of reference by future researchers to argue their case. There are limited studies conducted in Kenya targeting

mHealth hence the findings of this study will be of great importance in the field of healthcare delivery not only in Kenya but also in other developing countries which share similar economic and social factors. This study will act as a challenge to the Kenyan government to improve the provision and delivery of healthcare services in order to bridge the existing gaps.

1.10 Assumptions of the Study

For the study, the collection of data was taken from the participants who were active patients at the MSF clinic and gave the consent to take the questionnaire for the services that they received from the SMS messages. In addition, the responses they gave were true and gave the true picture on exactly what was happening of having them response to the SMS that came to their mobile phones.

1.11 Operational Definition of Terms

There are no unique terms given at this study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews and discusses the ideas presented by previous researchers and authors concerning mHealth.

“mHealth stands for mobile-based or mobile-enhanced solutions that deliver health. The ubiquity of mobile devices in the developed or developing world presents the opportunity to improve health outcomes through the delivery of innovative medical and health services with information and communication technologies to the farthest reaches of the globe (Mechael, 2015). The author noted that, due to improved mobile technology in the developing countries contributed by increased penetration of smart phones and other conventional handsets, healthcare providers and agencies find it easy to gather information concerning health issues and change behaviors of recipients through the mobile technology. This literature review; therefore, is undertaken in the healthcare setting to gather information on the impact of mobile technology in healthcare services delivery. In this study, technology acceptance change was implemented that showed how the patients were more receptive to accept the use of technology. According to Fred Davis, 2000, he discusses two factors that play a major role in the model, first, the perceived usefulness, that states how an individual is able to believe that when they would enhance their performance, in this study, the outcome of how it would affect them when they respond to the SMSs send to them. Second, he continues to illustrates about perceived ease –of – use, that one can be able to engage on a particular system and they wouldn’t need to feel like they had to put too much efforts to get a result, in this study, the HIV patients were receiving an SMS on the mobile phone to prompt them to come for either appointment visits and counselling without much struggles (Venkatesh & Davis 2000 & Venkatesh 2003).

2.1 Healthcare Service Delivery

Quality healthcare is an important aspect of life to all human beings. Healthcare is the treatment or diagnosis in human beings. Healthcare is mainly delivered by practitioners in healthcare centers, dentistry, nursing, psychology, and other health professions. Therefore, healthcare is the work done in the provision of primary healthcare, secondary healthcare, public health, and tertiary healthcare. WHO requires all governments to ensure that their citizens are provided with quality health (WHO, 2015). However, this has not been the case in many of the developing countries because of the high cost involved in providing quality healthcare.

Developed countries are economically able to offer their citizens with the required healthcare services though at huge costs. However, in the developing countries delivery of healthcare services is a big challenge due to low economic growth and overreliance to the donors (KPMG, 2012). Accessibility to healthcare is highly influenced by social and economic factors and the health policies enacted in a country (KPMG, 2012).

Different countries and jurisdictions vary on plans and policies in relation to the population and personal- based healthcare objectives. National budgets on healthcare vary between countries depending on their economic statuses (WHO, 2015). The WHO recommends the minimum national spending on healthcare of US\$34 per capita. However, several countries especially in the developing world are unable to reach this level due to their economic status and burdens of other social amenities such as education. How healthcare services are delivered significantly determines the general physical and mental health of people across the globe; hence, acting as a catalyst for the economic and social developments.

Before the promulgation constitution in 2010, the health sector in Kenya was under the national or central government. The implementation of the constitution requires

decentralization of the health sector to be managed by governors at county levels (Kenya Constitution, 2010; chapter 11). Though the private sector is increasingly overtaking the public sector in the Kenyan healthcare delivery sector through infrastructure, organization, coverage and staffing, the public healthcare services delivery is less costly as it has been subsidized by the government (introduction of free maternity) and easily accessible to many citizens as compared to the private sector. Article 43 Sec 1 of the constitution states that every individual in the country has the right to the highest achievable standard of health including the right to health care services (Kenya Constitution, 2010; Article 43). Thus, equitable delivery of healthcare services in the country is supported by the constitution.

Provision and Access to quality health cares is a basic right guaranteed by the constitution of Kenya. The government vision 2030 targets to have the entire publics access to effective and quality health services. Lately, the targets have been emphasized by the Big Four agenda advanced by President Uhuru Kenyatta which aims at providing Universal Health Care (UHC). Further the devolution of healthcare services has place additional emphasize on primary health care, sanitation, public health, disease surveillance, ambulance services and response strategies. The national government coordinates and manages the national referral hospitals and laboratories, planning and budgeting for national health services, and Health Information Management Systems (HIMS). The roles of the two government systems are coordinated by the County Health Bill 2016 that provides a regulatory framework for health care services and service providers, health products and health technologies.

To further promote access to and provision of quality health services, the constitution encourages public participation (Hearn, 2018). The recent health issues have led to emergence on new health policies where the publics are expected to be involved in the budgeting and planning of health care in attempt to improve health services and outcomes. However, limited awareness of public participation is hindering the realization of the public

participation policies especially in health sector. This can be attributed to limited access to information by citizens on how they can engage with county duty bearers as well as lack of structures for health public participation to guide the process (Hearn, 2018).

One of the primary indicators of effective health service delivery is the health services uptake as well as the general satisfaction of the citizens indicating how household heads rate the delivery and quality of health services (Tsofa, Goodman, Gilson & Molyneux, 2017). Following this proxy measurement of effective service delivery, there has been improved quality and delivery of health over the last five years with more citizens accessing health facilities and essential drugs than before.

Additionally, the utilization of public health facilities has increased since the commencement of devolved government. There has been more usage of the public health centres and dispensaries especially in rural areas. In addition, maternal health care access has increased significantly and more female are receiving the health attention which has been lacking in previous decades. However, Tsofa et al., (2017) as notes, health facilities need to improve the supply and stock of essential drugs and each county be allocated enough budget to adequately cover the whole system of health service delivery. (Tsofa et al., 2017)

Although previous survey indicates that the government initiatives to promote and improve health care service delivery over the recent five years, there is need for the governments to address the issues regarding the unavailability of medical officers. The recent demonstrations by nurses have curtailed the levels of service delivery of health sector in many counties. According to Tama et al., (2018) it is important for counties to regularly monitor the performance of the health sector under devolution and address any emerging gaps to meet the high expectations among citizens given that universal health is enshrined in the bill of rights in the constitution (Tama et al., 2018)

Over the recent years, Kenya has seen significant improvements of service delivery in health sector. However, the country still lags behind on various international benchmarks declared by health organizations such as WHO and the Abuja Declaration of 2001 (Bitta, Kariuki, Chengo, Newton, 2018). The service delivery in Kenya is reflected in child survival rates which have improved in the last five decades with reduction of infant, under-five, maternal and neonatal mortality. Additionally, communicable diseases have declined significantly as a consequence of sustained efforts by the government to prevent and combat diseases like Tuberculosis and Malaria. Although, HIV prevalence has declined with country achieving its ART coverage target of 1.03 million people in 2016, adolescents continue to be highly exposed to the HIV.

Moreover, the government continues to place effort required to address the increasing death rates as result of non-communicable diseases such as diabetes, hypertension and cancer (Bitta et al., 2018).

While mobile phone technology has the potential to revolutionize the public health. There are certain limitations such as availability of mobile phones. Saunders, Lewis and Thornhil (2018), conducted a study on mobile phone interventions for tuberculosis should ensure access to mobile phones to enhance equity. The authors of the study argued that mobile phone interventions have been advocated for tuberculosis care, but little is known about access of target populations to mobile phones. They studied mobile phone access amongst patients with tuberculosis, focusing on vulnerable patients and patients who later had adverse treatment outcomes. The study approach was cohort study in Callao, Peru, we recruited and interviewed 2,584 patients with tuberculosis between 2007-2013 and followed them until 2016 for adverse treatment outcomes using national treatment registers. Subsequently, we recruited a further 622 patients between 2016-2017. Data were analyzed using logistic regression and by calculating relative risks (RR) (Saunders et al., 2018).

The study found that between 2007-2013, the proportion of the general population of Peru without mobile phone access averaged 7.8% but for patients with tuberculosis was 18%. Patients without access were more likely to hold a lower socioeconomic position, suffer from food insecurity and be older than 50 years. Compared to patients with mobile phone access, patients without access at recruitment were more likely to subsequently have incomplete treatment (20% versus 13%) or an adverse treatment outcome (29% versus 23%) Between 2016 and 2017, the proportion of patients without access dropped to 8.9% overall, but remained the same (18%) as in 2012 among the poorest third. Access to mobile phones among patients with tuberculosis is insufficient, and rarest in patients who are poorer and later have adverse treatment outcomes. Thus, mobile phone interventions to improve tuberculosis care may be least accessed by the priority populations for whom they are intended. Such interventions should ensure access to mobile phones to enhance equity. (Saunders et al., 2018)

Other factors that are influencing the effectiveness of mHealth in health care service delivery are related to the unified theory of technology acceptance and use such as perceived usefulness, ease of use among others. These were justified in a study by Hoque, Karim and Amin (2015) who investigated the factors that affect the adoption of mHealth services among young citizens using structural equation modeling approach. The study was conducted in Bangladesh. The authors argued that mobile phone is playing a very significance role with pervasive services. Dissemination of health related information to the general people was a great challenge for this highly populated country, but this problem is going to be erased by application of mobile phone in this regards. The study attempted to determine and measure the various usages of mobile phone in Bangladesh among the young age group (patients) how they use Mobile phones to solve health related problem. Technology Acceptance Model (TAM) is used as the theoretical underpin to conduct this study. A questionnaire survey

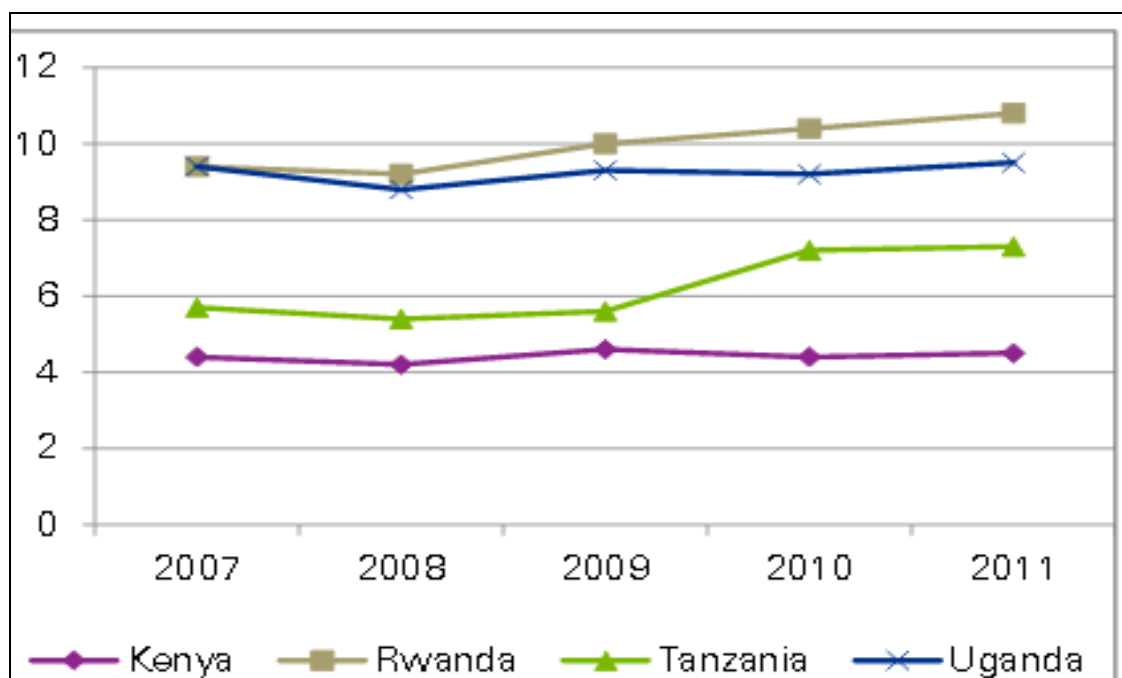
method was used to collect data from respondents in different public and private universities of Bangladesh. The data was analyzed using the Partial Least Square (PLS) method, a statistical analysis technique based on structural Equation Model (SEM). Findings revealed that perceived usefulness ($p < 0.05$) positively predicted the intention to use mHealth services, while perceived ease of use ($p > 0.05$) was identified as a less significant factor in the mHealth adoption in Bangladesh. The findings from the study can serve as input to promote citizen's use of mobile phone for better self-management of health (Hoque et al., 2015).

2.1.2 Transformation of the Healthcare Sector in Kenya

Chapter 4 Article 56 of the Kenyan constitution states that, the government shall put into place positive action programs to ensure that the marginalized, minorities, and less privileged groups can access healthcare services.

However, the sector is still faced with several challenges of inequality in delivery of services especially to the marginalized and less privileged people. The mandate of the ministry of health (MOH) is to develop a national policy, provide technical support at all levels, monitoring quality and standards in the provision of healthcare services, and conducting researches required for administrative and management reasons (United Nations Development Program [UNDP], 2013). On the other hand, the county government is required to provide and create an enabling environment for the coordination and management of the delivery of healthcare services at the county level. The formation of county management teams helps in identifying health crisis in a county and recommending for actions (Smith et al., 2016).

In Kenya, healthcare is funded from three major sources; donors, public, and out of pocket payment (consumers). The largest contributions come from the consumers which represent about 35.9% followed by the government and donors at 35% each (Muchangi, 2011). Over the past years, the Kenyan government budget for healthcare has been slightly about 4% of the GDP which is the least in the region (Rwanda, Uganda, and Tanzania) (Muchangi, 2011). As indicated in the figure below, Kenya is ranked last behind Tanzania, Uganda, and Rwanda.



Source: (World Bank, 2010)

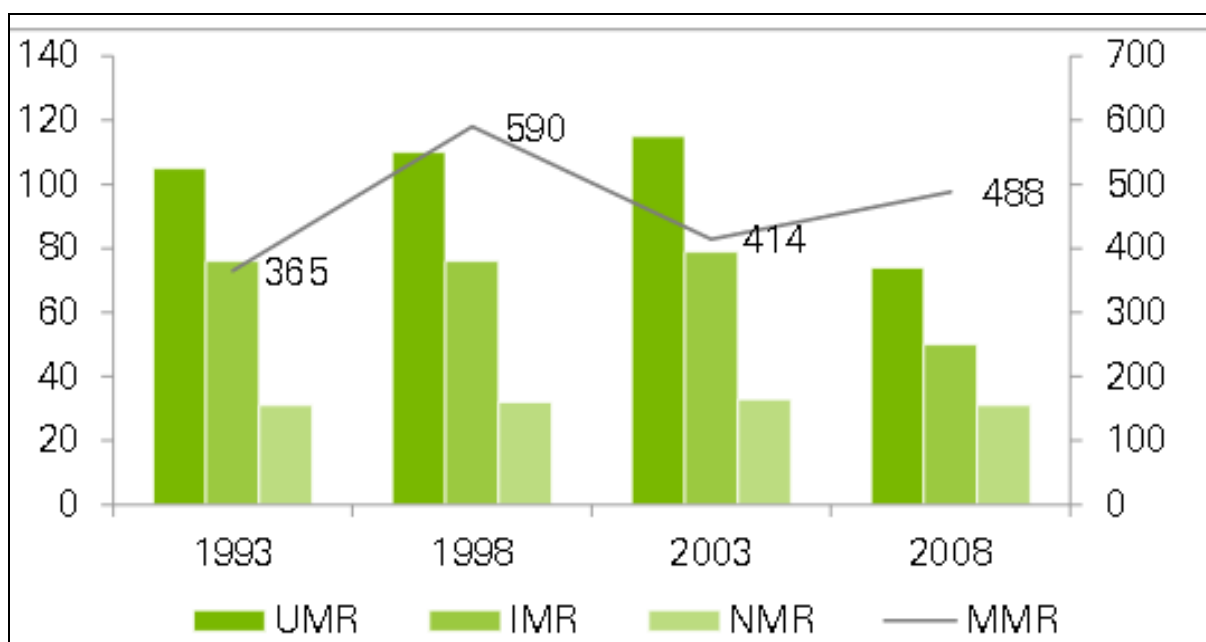
Figure 2:1: Eastern African Countries Healthcare budgets

As a signatory to the Abuja Declaration, Kenya is committed to allocate at least 15% of the national budget to health but due to competing interest from other social amenities such as education, the allocation to health is very low (WHO, 2010).

The allocation of national budget to health is low not only in Kenya but it is uneven in many developing countries. According to a health action report released in the year 2011 by Shah on healthcare around the world, secondary and tertiary healthcare facilities have been

allocated 70% of the health budget throughout history. The report indicates that the allocation of health budget to primary healthcare is usually poor. This has resulted in many poor people failing to access high quality healthcare services in the country.

According to the 2010 review on the performance and outcomes of the healthcare situation in Kenya by the Ministry of Medical Services and Ministry of Public Health and Sanitation, there have been very small improvements in healthcare in the last few decades. As indicated in the figure below, the performance of healthcare sector in the country is worsening.



Sourced from Kenya Service Commission Assessment, 2010 (World Health Organization, 2010)

Figure 2:2 Performance of Healthcare Sector in Kenya

As indicated in the figure above, Maternal Mortality Rate (MMR) and Neonatal Mortality Rate (NMR) have worsened in the last few decades while Infant Mortality Rate (IMR) has slightly improved.

About 50% of the deaths experienced in the country arise from malaria, tuberculosis, and HIV/AIDS (UNDP, 2013). These diseases have received most attention in the country

especially in the informal settlement with the government focusing on treatment, prevention, and eradication efforts. The health system is facing the increasing challenge of infectious diseases such as cancer, high blood pressure, diabetes, and cardiovascular diseases (Goel, Bhatnagar, Sharma & Singh, 2013).

Despite major improvements of health care service delivery in Kenya in the last few years. There have also been some aspects of the health care which are limiting the public health delivery services. For instance, Pyone Smith and Broek (2017), investigated the implementation of the free maternity services policy and its implications for health system governance in Kenya. The study acknowledged that to move towards universal health coverage, the government of Kenya introduced free maternity services in all public health facilities in June 2013. User fees are, however, important sources of income for health facilities and their removal has implications for the way in which health facilities are governed. The study explored how implementation of Kenya's financing policy has affected the way in which the rules governing health facilities are made, changed, monitored and enforced. Qualitative research was carried out using semi structured interviews with 39 key stakeholders from six counties in Kenya: 10 national level policy makers, 10 county level policy makers and 19 implementers at health facilities. Participants were purposively selected using maximum variation sampling. Data analysis was informed by the institutional analysis framework, in which governance is defined by the rules that distribute roles among key players and shape their actions, decisions and interactions.

The study revealed that lack of clarity about the new policy (eg, it was unclear which services were free, leading to instances of service user exploitation), weak enforcement mechanisms (eg, delayed reimbursement to health facilities, which led to continued levying of service charges) and misaligned incentives (eg, the policy led to increased uptake of services thereby increasing the workload for health workers and health facilities losing control of their ability

to generate and manage their own resources) led to weak policy implementation, further complicated by the concurrent devolution of the health system (Pyone et al., 2017). In that regard, it is clear that there exist discrepancies between formal institutions and informal arrangements. In introducing new policies, policy makers should ensure that corresponding institutional (re) arrangements, enforcement mechanisms and incentives are aligned with the objectives of the implementers. Therefore, if in anyway the mHealth is to succeed in Kenya, the government and county governments need to address these discrepancies.

2.2 Studies on Mhealth in Developing Countries

The use of mobile technologies for health related activities (mHealth) is a new but rapidly progressing activity with global penetration. However, few programs have been implemented at scale. The objective of this paper is to review the background and evidence on mHealth, particularly with respect to the benefits and challenges of scale-up. mHealth innovations vary broadly in purpose, delivery channel and target population. As a result of its broad applicability and geographic reach, the benefits of successfully, safely and widely implemented mHealth are numerous and promising. However, these benefits can only be realized if the associated risks are minimized and the barriers are purposefully overcome. Government stewardship and leadership is crucial in overcoming these barriers and scaling up mHealth (Vesel et al., 2015).

Harnessing the potential of mobile phones for health can be beneficial to stakeholders across the spectrum—from Ministry of Health officials to rural health workers. Mobile phones can break down gender and social barriers, reduce logistical inefficiencies, and foster the capacity of CHWs to provide high quality care (Thatcher, Llewellyn & Wong, 2014). While these benefits can all strengthen health systems as a whole, mHealth plays a particularly important

and beneficial role in MNCH and reproductive health (Mechael, 2010). Related initiatives have resulted in increased emergency obstetric care accessibility, stronger communication and information sharing between midwives and health workers, more reliable maternal health data collection and a stronger support system for midwives and women (Chib & Chen, 2011; Mechael, 2010). mHealth can support MNCH programming and policy by allowing health workers to more easily register births and deaths in real time using text messaging.

Chib and Chen (2011) note that improving knowledge through mobile devices is itself empowering, because women are better able to make more informed decisions. It is important to note, however, that increased autonomy for women may be viewed unfavorably by men as the primary decision-makers, so mHealth should be implemented in a culturally and context sensitive manner (Thatcher et al., 2011).

According to Pozzi et al., (2016) developing countries need telemedicine applications that are essential and will help in situations where the number of physicians with respect to the country population is small. Most importantly, mHealth technological services are critical when physicians and patients in rural areas need health care assistance. However, Pozzi claims that the requirements of mHealth applications in developing countries are more complex and demanding as compared to those of developed countries. This is because there are a lot of factors in play, which are to be considered for effective mHealth and other mobile phone technology services in health service delivery to work in developing countries.

Examining existing patterns of use might reveal areas of potential demand for more formalized hardware or software development that will enhance user experiences. In relation to mHealth, several studies have specifically explored linkages between the general public and the health sector in Bangladesh, Laos, and Egypt. They show that telecommunications improved after mobile phones were introduced, leading to a more direct link between clients

and health care workers and to a perceived increase in demand for health services and health-related information, particularly from mothers and known health care workers (Mechael, 2006).

Furthermore, as Shareef, Dwivedi, Simintiras, Lal and Weerakkody (2008) noted, mobile phones are increasingly becoming smarter and the accessibility as well as availability of extensive mobile broadband provides more opportunities for monitoring health data and situation in real time. Additionally, integrating GPS and GIS with the mobile technologies has been cited to improve geographical component of service delivery that let users tag voice as well as set data communication to a particular geographical location. The authors of the study have also indicated that the functionality is already in effect for disease surveillance and mapping gaps in demand as well as mitigate outbreaks. In that regard the technology has helped map demand gaps and service providers allowing them users to make better decisions regarding allocations of resources (Shareef et al., 2008).

However, the main feature that has also been extensively document in developed countries in the context of health is mobile phones text messages which have gathered increasing attention in the United States, United Kingdom, Sweden and Norway as a means of reminding patients their appointment status (Economist, 2014). However, this feature has recently gained momentum in developing countries. Free, Gagnon, Ngangue, Payne-Gagnon and Desmartis (2014) mentions that the preliminary results of health text messaging in India and South Africa indicate that more people show up at their scheduled appointments, hence resulting into significant health cost reduction for practitioners and facilities (Economist, 2014).

In that regard, the benefit can be viewed in the context of cost effectiveness of the health business rather than the health outcomes (Economist, 2014).

Combi, Gagnon, Ngangue, Payne-Gagnon and Desmartis (2016) study mentions that the Sub-Saharan Africa with a population of more than 725 million inhabitants is severely affected by HIV/AIDS, malaria and other communicable diseases. The study notes that the current physician-to-population ratio ranges from 1:5000 to 1:30,000 as compared to that of developed countries which typically is 1:300. The study argues that the conditions in SSA suggest an urgent need of mHealth and telemedicine projects to substantially improve the service delivery in health care. According to the study, the main projects over the last decade majorly focus on transmission of biomedical images. Senegal was the first country to make initial step in that realm which involved introduction of referrals and schedule consultations. In Ethiopia, there was introduction of scientific cholera epidemic infections literature over the phone. Additionally, there have been other developments in South Africa, Egypt and Zambia. In Particular, Teleconsultation services for diagnosis and treatment of infectious diseases, like hepatitis, for under-served regions in Egypt in 2009. In Zambia, Macro and Micro images are stored locally and remote consulting is done by physicians' experts from Italian hospitals. Additionally, the web application allows the users to conduct video conferencing (Combi et al., 2016).

Among the major challenges encountered by the aforementioned countries include the financial, technical and human resources aspect. Other challenges include resistance to change, unclear business models from health care delivery side, the lack of efficient infrastructure for mobile medicine and the ineffective regulatory bodies to successfully accredit the mHealth systems and healthcare delivery plan as well as provisioning and for issuing best practices and guidelines (Sakr & Elgammal, 2016).

In addition, in their India case study, argues that the country despite facing a number of economic challenges has made huge steps in telemedicine (Bhatta, Aryal, Reif & Bell, 2015).

They assert that the main projects are Otri, Apollo and Asia Heart Foundation which are majorly involved in needs from cardiology, radiology, nephrology and ophthalmology departments. The study revealed major difficulties experienced by the country in mobile phone health service delivery are the protectionist policies and bureaucracy. In an attempt of managing these challenges, the study argues that the country has placed effort on improving the quality of user-friendly interfaces and increasing the landline coverage connectivity due to low teledensity levels (Bhatta et al., 2015).

In their systematic review, Thatcher et al., (2014) identified several ways in which mHealth can reduce barriers to gender and social equity. The provision of mobile-based health information can facilitate knowledge sharing and communication to both men and women (Sakr & Elgammal, 2016). A study in Tanzania allowed men to access information about family planning methods through a free and anonymous SMS portal, thus avoiding the obstacles involved in getting men to health facilities for such counseling or relying on their female partners to relay the information directly (L'Engle, 2012). Moreover, mHealth initiatives that are easily accessible, such as a hotline, can increase a woman's autonomy in seeking care for her child as she can receive useful advice on the phone without having to depend on her husband to provide money for travel to a health facility if home-based care is possible. In the event that a referral is needed, a woman's desire to seek care would be further substantiated through a formal recommendation by a trained health provider via a mHealth platform (L'Engle, 2012).

A number of studies have focused on the mHealth in Kenya. Goel, et al. (2013) in a study on how mHealth helps in bridging the human resource gap indicated that, mobile technology has the potential of addressing the human resource issues in the healthcare sector in developing countries. The study used a narrative literature by reviewing and analyzing various literatures focusing on mHealth and human health resources in low income countries (Goel, et al. 2013).

The study was conducted in India and the results indicated that mHealth helped in addressing health issues such as supervision, disease surveillance, data collection, health education, monitoring, and providing feedbacks. The study concluded that mobile phone technology is very potential in addressing issues facing the healthcare sector thus, bridging the gap in delivery of this care (Goel et al., 2013). However, this study focused mainly on how to bridge the gap resulting from healthcare human resources in the delivery context but left out other resources such as accessing healthcare and high quality treatment.

Lester et al., (2009) conducted a study on cell phone adherence trial. The main objective of the study was to compare the effectiveness of mobile phone- supported short messaging systems to standard care on equality of life, mortality, retention, and adherence in a population supplied with antiretroviral therapy (ARVs) in Nairobi Kenya. The study found that as mobile phones have revolutionized the communication world, they have potential of revolutionizing the healthcare sector especially in the delivery of healthcare services to the less privileged people. Currently, almost every individual in Kenyan urban areas own or use a mobile phone on daily basis hence it makes it easy for healthcare providers to effectively delivery the services with ease and at reduced costs. The study found that the mobile phone technology offered an opportunity to improve healthcare delivery in Kenyan resource limited settings. Lester et al., (2009) found that patients who received the SMS support had improved ART adherence as compared than those who did not receive the SMS. This indicates that mobile phone technology helps in improving healthcare delivery through effective communication.

These findings were compared to a study by Sikelianou, Maniota, Manousaki and Tzirvelaki, (2013) that delivery of healthcare services in Greece can be improved through the use of mobile phone technology. This study focused on the impact of efficient communications on the patient care. Basically, many people in resource limited settings such as informal

settlements in developing countries face a gap in healthcare delivery because of lack of efficient communication by the healthcare providers. For instance, the patients do not know where they can access certain services or do not have effective ways of accessing them (Sikelianou et al., 2013).

2.3 Effects of mobile phone technology on healthcare delivery

According to Riley et al., (2016), healthcare providers need to use new mobile technologies that have the capability of facilitating higher quality of care in every patient interaction. Both developed and developing countries are facing the health care crisis especially in the delivery of services. For example, the United States is divided on the Affordable Care Act nicknamed Obamacare and Medicaid (Blase, 2011). The Medicaid in America is the medical scheme funded by states and federal government through taxes to help the poor access healthcare services while Obamacare (ACA) is a President Obama initiative passed as an Act to make sure people with income purchase private insurance (Blase, 2011). In Kenya, the constitution is not clear on which aspects of the healthcare should be under the national government and which should be taken up by the county government. This division has even created more confusion to patients who do not know which is the right course to follow. According to a report released by the WHO on the accessibility of quality healthcare in Kenya, more than two thirds of the populations are unable to access high quality care services despite the constitution provisions that all people have the right to quality healthcare (WHO, 2010). The main challenge here is corruption in the distribution of the taxes and money allocated to the ministry of health. Most health officials together with tender winners lack to deliver their assigned work or deliver substandard goods in order to embezzle swindle the public funds. (Blase, 2011).

As noted by Quanbeck et al. (2014), the challenge of healthcare services delivery is global and should be solved with technology to ensure that it is solved globally. The authors continue to state that mobile technology has the potential of transforming the healthcare sector by ensuring that all individuals have the access to care services. Sikelianou et al., (2013) argue that, the previous solutions have focused on legislation but this has turned to be very slow. The authors therefore proposed technology which is a bit fast and has long lasting impacts. Technology can be implemented gradually in a country in order to save costs. Lien et al., (2014) assert that, due to the low number of doctors in developing countries doctor's time is very scarce and expensive hence a better way should be sought to enable them be more efficient and effectively manage more patients. Mobile phone technology is viewed as the best way of enabling physicians to manage more patients and empower them to improve the quality of care they provide. With mobile phone technology, doctors or healthcare services providers can track patients' treatment compliance and progress and offer to patients' remote access to their expertise. Providers can reach the patients with the required healthcare information hence bridging the gap in care delivery. In Kenya for instance, only the rich and wealthy can afford to pay the scarce and expensive time of the expert physicians while the poor are left without good and quality services (Chuma & Okungu, 2011).

However, this view is challenged by Iredale, Hilgart and Hayward (2011) in a study on the perceptions of patients on the mobile cancer support unit in South Wales. The authors note that, there is no need of focusing on mobile technology because technology apps do not treat patients but people do. This implies that however much we try to show that use of mobile technology can help in improving delivery of healthcare services, we must not forget to increase the number of doctors motivate them. In developing countries, healthcare providers are very few and some are paid low to the extent that they move out of the country to search for higher compensations. The government and the health sector may try very hard to

implement mobile technology in the delivery of services but without the adequate number of providers, the technology would not be of any benefit (Iredale et al., 2011).

In Kenya mobile phone technology is used in several activities other than communication such as money transfer such as M-banking and Mpesa. However, use of this technology in the healthcare sector is very limited. Mobile technology is mainly used in transferring money to the NHIF accounts through Mpesa. Despite that the mobile phone penetration in the market being high; it has been put to limited use in the healthcare sector. Majority of the Kenyans are not aware of how mobile phone technology can be used to improve healthcare services delivery in the market. In Kenya registration of mobile subscribers by the Communication Authority of Kenya (CAK) is a great milestone in getting information about the people living in a particular area. Gaps in healthcare delivery are created by the existing gaps in knowledge transmission and economic challenges (Iredale et al., 2011).

2.3.1 Effects of Mobile Phone Technology Responsiveness among Patients

Several empirical studies have been conducted on the effect mobile phone technology has on the diagnosis of various disease across the globe. Brinkel, Krämer, Krumkamp, May and Fobil, (2014) in their study reviewed the mobile Phone-Based mHealth approaches for public health surveillance in Sub-Saharan Africa shown that studies which have concentrated on malaria surveillance in the region using the RDT diagnosis reported various challenges. The study indicated that various challenges were reported which include lapses in data collection as a result of medical stock outs in addition to inconsistencies to the proportion of malaria tests used (Brinkel et al., 2014).

Additionally, the malaria diagnosis monitoring and evaluation using the technology faced challenges arising from the sufficient competencies in mobile-based applications by the health staff. Moreover, errors in data transmission were reported as the main challenge

however, in child registrations the error rate was lower than in paper-based systems. The review found that since the surveillance data was stored on the phone, there was a risk of unintentionally deleting the data instead of sending it the central server. Additionally, specificity and sensitivity of case definition contributed to inadequate disease diagnosis. However, validated disease diagnosis tools like RDT for malaria can be used while other challenges as electricity supply and telephone maintenance can be addressed.

The study recommends developing countries to commit to innovations of the mobile phone-base health surveillance in order to achieve the desired outcomes of malaria diagnosis (Brinkel et al., 2014).

Ajey and Prabhakaran (2011) conducted a study on the scope of cell phones in diabetes management in developing country health care setting. The study argued that diabetes is a major concern for public health in developing countries. The study noted that health care services were yet to develop effective control and prevention programs for diabetes and integrating them into routine health services. Additionally, given the insufficient resources both financial and human were the main factors curtailing the development and improvement of under-functioning health systems in the developing nations? In that regard, the authors of the study set out to investigate the advances and contributions of mobile phones on harnessing and improving diabetes care (Ajey and Prabhakaran 2011).

The study argued that cell phones are important tools for collecting surveillance information, service delivery, supply systems, evidence-based care and management of diabetes from primary care settings as well providing a channel for communication through health messages as part of the diabetes management and education. The study findings indicated that as a screening tool, cell phones can help health workers to undertake screening and diagnosing diabetes in conjunction with patient follow-up care for patients with diabetes. The study

concludes that cell phones are capable of creating avenue and platform for continuous and effective medical education, as well as assisting as decision support system. Evidence-based management requires cell phones to be tools for self-management through patient education and compliance. However, the study did not indicate the widespread or prevalence of cell phone use in developing countries as an efficient tool for diabetes intervention and management (Ajey & Prabhakaran, 2011)

According to global health institute (WHO, 2010) report, data on population movement is pertinent for monitoring and surveying the progression of an outbreak and predicting the future spread of a diseases. Vital questions such as how the affected places are connected by population flows which is a major aspect of mobility hubs, the kind of movement typologies and how the factors change as people react to the outbreak are essentials in effective mHealth application in developed and developing countries. The study posits that obtaining the data relating to these factors was difficult and considered as impossible to find in the last few decades. However, mobile phones have made that possible in recent years because data can be collected in real-time and remain largely unused. The report details the important of mobile phone call data records usually known as call data records (CDRs) giving complete information on time and text messages and associated cell tower of calls from anonymous users hence providing a valuable indicator of human presence and population movements over time among other important sequence. The report reveals that this information has been transformative in public health allowing accurate surveillance and diagnosis of various diseases across the globe (WHO, 2010).

Additionally, Kumar and Nilsen (2014) assessed the state of science in mobile health for health research, treatment and diagnostic. They argued that creative use of mobile information related to health and sensing technologies have huge potential for cost reduction of public health and health care in general. Basing on the assessment findings, mHealth is

improving diagnostic in the novel ways. The study found that by promoting patients to conduct assessments remotely the number of assessments increased greatly while the cost incurred by health care service providers reduced significantly. Additionally, the study revealed that mobile devices are providing new exposures that have given insights on the state of various diseases.

Among the exposure assessments examined in the study include activity and behavior whereby accelerometry has enabled surveillance, environmental exposure using GPS, visual exposure using smart eyeglasses among others. Still on diagnosis, the study noted that mHealth devices have empowered patients to be responsible and take control of their health through sharing data with health providers to improve accuracy in diagnostic decision making (Kumar & Nilsen, 2014)

In addition, according to Georga, O'Connor, and Andrews, (2014), smart mobile devices have been used in self-testing of blood glucose. The authors report that researchers have developed NMR unit chip that can be integrated with smartphone to power analysis of a range of DNA, viruses, bacteria and other bio-markers. Recent advances of mHealth particularly in microfluidics have led to the creation of microfluidic chips which are used to perform HIV tests which are extremely lab-quality. These findings were consistent to the Food and Drug Administration (2013) report which indicated that physiology assessment such as heart rate, respiration, blood pressure among others are being done by mobile units and giving extremely high quality results (Georga et al., 2014).

Furthermore, Kalem and Turhan (2015) published an article on mobile technology applications and their effect on disease management in healthcare industry. The study revealed that use of information technology and mobile phones and internet were pivotal in enhancing diabetic care. Further, it indicated that the role of mobile phone in the management

and prevention of mental disorders has been successfully deployed in various therapeutic situations. Use of mobile phone enable patients to track their symptoms as well as garner more data correctly hence improving self-efficacy and providing more relevant information to the physicians which in turn has improved the wellness and recovery processes of the patients (Kalem & Turhan, 2015).

Majority of the studies uncovered in the reviewed literature have revealed important and contextual aspects of mHealth and disease as well as medical diagnosis. However, majority of the studies were conducted in developed countries while others were conducted in Sub-Saharan Africa countries hence the geographical gap. Although the findings of the study are conclusive and consistent, the findings cannot be generalized to fit into Kenyan context since Kenya is socially and economically different from other studies. In that regard, it is important to investigate whether mHealth in Kenya is improving the medical and disease diagnosis. (Kalem & Turhan, 2015)

2.3.2 Mobile Phone Technology and Self Care among Patients

Studies have also been conducted on the impact mobile phone technology has on the patients. Although majority of the studies have focused on the benefits, most of them have approached the concept of mHealth on the context of self-care and how it is improving lives. Quin et al., (2014) investigated how smartphone technology is changing the health. The asserted that despite the recent proliferation of health applications and smartphones, little was known on smartphone technology and how it promotes health care related practices. After various 3-month experimental survey, the study found that patients have actively engage with their physicians and fully taken control of their health status. The study revealed that patients recorded daily activity, set individual and daily goals, as well as received daily videos and messages from physicians hence getting immediate feedback on their self-care progress.

These actions increased self-efficacy and positively correlated with depression and anxiety decrease as outcome measures (Quin et al., 2014).

These findings were conceptually similar to those of Baron, McBain and Newman (2012) who reviewed the effects of mobile monitoring technologies on Diabetes. The study posited that the mHealth method of care is relevant in the management as well as diagnosis of chronic conditions like diabetes, which demand behavioral adjustment and daily monitoring. In that sense, the study geared to the fact that diabetes self-management involves self-monitoring, dietary management, exercise and foot care. However, the study argued that empirical evidence support the SMBG is a limited version of clinical effectiveness (Baron et al., 2012).

The reason for the limitation stem from the notion that patients are unable to understand or interpret results accurately to make self-care adjustments. The study therefore, reviewed how mobile phones are used as a tool for enabling needed review, improving self-care to enhance self-management. The results of the study found that patients who used mobile phone communication to improve self-care reported accurate reporting as compared to those who did not. However, the study warns that there are inconsistencies with regard to the effectiveness of mHealth as a self-care system for type 1 and type 2 diabetes (Baron et al., 2012).

Contextually, a study by Olmen (2013) found similar results to those (Baron et al. 2012). The study examined the effectiveness of text messages on self-management of diabetes in Cambodia, DRC and Philippines. The authors of the study conducted individual interviews to establish the patients' self-care assessment and the extent to which they are self-enabling. The study found that the use of text messages improved the intervention between the patients and their physicians to a large degree. However, the effect of intervention was partly determined

by the level of interaction and message personalization as well as the profile of patients such as their attitude and their competency on using mobile phones. The conclusions of the study revealed a positive and significant impact of text messaging on the patient's self-care (Olmen, 2013).

Additionally, these findings are supported by Deloitte (2016) report on the impact of digital technology on social and health care. The report revealed that mobile technology opportunities have grown tremendously in the recent years. The most notable developments and applications of mobile phone technology has been experience in health care sector. The report mentions the availability of biosensing which include glucose sensors, blood pressure monitors, and real time access to health care. The report suggests that the technology has improve self-care while also creating more opportunities for developing health care space. In the same sense as other studies, the report suggested that mHealth has the potential to empower carers and patients by providing them with more health control and reducing dependency (Deloitte 2016).

Moreover, Zha, Pandya, Choi (2018) conducted a study on mHealth application and hypertension self-management and self-monitoring. Zha noted that self-management and self-monitoring are critical components of successful chronic disease care. He argued that the integration of mHealth into health care delivery services provides good opportunity to improve hypertension self-care. The study hypothesized that hypertension patients report improved self-care and outcomes when they use mHealth. The findings of the study confirmed the hypothesis that mHealth intervention improved self-care by the patients with hypertension creating new evidence that mHealth care delivery approach is essential for the effective health care services delivery (Zha et al., 2018).

Similar to studies on medical and disease diagnosis, existing literature on the impact of mobile phone technology on self-care among patients is positive. Majority of the studies have focused on chronic diseases such as diabetes and hypertension. However, self-care entails living a healthy lifestyle which includes diet eating, exercise among other healthy lifestyle. The mobile phone technology is therefore expected to improve these aspects of healthy living hence this study aim was to investigate the impact of mobile phone technology on self-care (Zha et al., 2018).

2.3.3 Mobile Phone Technology and Patients Visits

Existing literature has also focused on the context of mHealth and patients visits in hospitals. However, some of the studies have approach the context within the concept of cost benefits and cost effectiveness. Ayo, Mazmum and Bao (2015) investigated the effect of wireless and mobile technology on the delivery services in health sector of Nigeria. Ayo et al,m argued that the healthcare industry in Nigeria ad become a state flux and turbulence. He suggested that the major developments lie in the integration of ICT with health care delivery (Ayo et al., 2015).

Further, he noted that wireless devices and are being used in healthcare field hence enabling caregivers to improve and monitor the health status of their patients. The study revealed that use of mHealth in booking of appointments and seeking for clarifications on health procedures has increased the number of patients visiting public health facilities to attend to appointments as well as seek further medications (Ayo et al., 2015).

According to a report by Economist (2015), the impact of mobile phone could have further positive implications in the economy and public health sector. The Economist Intelligence Unit investigated the impact of mHealth in 23 countries. The survey included CEOs, managers, business development strategists, pharmaceuticals and medical device

manufacturing. Majority of CEOs believed that mHealth has enabled them to take control of their health and reduce the time they visit their physicians which would then help them focus on other things. The managers believed that the capability of mHealth to collect information and store vast amount of individual health data is crucial in diagnosis and treatment. They argued that this accuracy has helped them reduce visits to health service providers due to accurate diagnosis which could have otherwise wasted times trying to diagnose the wrong disease. For healthcare providers, one challenge is how to make money from mHealth. They reported that there has been a significant decrease in number of patients visiting their health centres which has significantly reduced the consultation fees. However, the public health administrators argued that the number of visits lost is compensated in other cost effectiveness aspects of mHealth in healthcare service delivery (Economist 2015)

Mokaya et al., (2010) evaluated the use of mobile technology in enhancing postnatal care in South Africa. The study revealed that 75 percent of the health care givers were willing to communicate with their patients through the phones. The study also reported that in the RCT 83% of the mother involved in the study used SMS or phone call to communicate. This increase the rates of patient attendance. Additionally, the study found that the SMS reminders were cost-effective as compared to phone calls and the patients who received these reminders were more satisfied. Additionally, the study also acknowledged the effect of mHealth on the follow up visits. The findings of the study revealed that patients who communicated with their health service providers were more likely to get an appointment for follow up visits (Mokaya et al., 2010).

However, studies in which SMS reminders did not seem to make an impact included the study by Fairhurst, Lee, Jeong, Cho and Xu (2010) in the UK in 2008, which had a sample of 415 patients who were repeated non-attenders, 189 of whom received an SMS reminder to attend a clinic appointment. Their study did not show statistically significant reduction in

nonattendance rates with SMS reminders in patients who persistently failed to attend appointments, suggesting that appointment reminders can only increase attendance rates to clinic to a limited degree; but other factors in patients' lives outside "forgetfulness" have to be addressed in order to increase attendance rates (Fairhurst et al., 2010).

Additionally, the study by Vardoulakis et al., (2012) revealed the importance of Mhealth in service delivery. The study stressed that patients are mostly under-informed about aspects of their care. The study hypothesized that the use of mobile phone would help increase the information delivery which therefore improves the services as well as the health status of the patients. The study population was 20 patients using mHealth which provided dynamic, care plan, interactive report on their health or recovery progress. The study explored the patients using interviews. The study found positive correlation between the use of mHealth and number of visits. The authors argued that this was a result of access as well as understanding of information regarding their health status which made them visits clinics to seek for medication or more advice regarding the healthy living. Additionally, the visits increased because patients were able to reduce anxiety before visiting the clinic hence feel more comfortable to seek for health assistance (Vardoulakis et al., 2012).

According to a survey by National Health Service (NHS) 2006 in UK, several cases of cost inefficiencies were reported as a result of missed appointments. The report suggested that the major severe illness is lack of treatment and missed appointments. As a result, the report advocated for introduction of a service that sends text messages to patients to remind them of their appointment. The report argued that the service would significantly increase the number of visits by reducing the number of missed appointments hence maximizing efficiency and minimizing the waiting periods for hospitals. The same study noted that the use of mHealth would also decrease the number of visits for the diabetes patients since the mHealth service would improve self-monitoring hence increasing efficiency at hospitals NHS 2006.

The studies reviewed regarding the impact of mobile phone technology on hospital visits were inconsistent. Some of the studies revealed that mobile phone technology improves the number of visits to clinics while others said that it reduced the number and time spent in clinics significantly. In that regard, there was a contextual gap in what would apply in Kenya. Additionally, none of the studies was conducted in Kenya which presented a geographical gap. Therefore, it was not clear whether the results of other studies would apply in Kenyan context given the fact that mobile technology has not been dominant in health service delivery in Kenya. The current study therefore sought to investigate the impact of mobile phone technology on the number of visits to clinics in Kenya NHS.

2.4 Benefits and Challenges for Mhealth in Kenya

Harnessing the potential of mobile phones for health can be beneficial to stakeholders across the spectrum—from Ministry of Health officials to rural health workers. Mobile phones can break down gender and social barriers, reduce logistical inefficiencies, and foster the capacity of CHWs to provide high quality care (Thatcher et al., 2014). While these benefits can all strengthen health systems as a whole, mHealth plays a particularly important and beneficial role in MNCH and reproductive health (Mechael, 2010). Related initiatives have resulted in increased emergency obstetric care accessibility, stronger communication and information sharing between midwives and health workers, more reliable maternal health data collection and a stronger support system for midwives and women (Speciale and Freytsis, 2013; Chib & Chen, 2011; Mechael, 2010).

mHealth can support MNCH programming and policy by allowing health workers to more easily register births and deaths in real time using text messaging. While there is the vast application and potential of mHealth, its use and coverage retains many risks and barriers. Evidence on barriers is presented in the following categories: financial feasibility;

knowledge, research and evidence; infrastructure, access, equity and quality; privacy, security and interoperability; and cultural context. Additionally, leadership and governance presents another challenge (Mechael, 2010).

Globally, empirical data regarding the financial feasibility of mHealth interventions, specifically with regard to operating costs and cost effectiveness, is very limited. This makes it difficult to engage with policymakers to encourage them to prioritize the scale-up of mHealth activities over other evidence-based public health interventions (Chib & Chen 2011). Operational costs of mobile communication, in particular the fees charged to clients by mobile network providers, adversely impact the frequency of user engagement with mHealth services (Everett, 2003).

Overcoming this barrier involves a detailed analysis of the incentives of various actors, including end users, investors, platform providers and policymakers. One such examination of incentives concluded that smaller mHealth programs incur larger average total costs because there is a limited volume to distribute operational costs from private platform providers. In contrast, one-way SMS-based activities incur less prohibitive maintenance costs, regardless of the program's size, because they primarily require an initial investment with a relatively low and stable operational cost.

Additionally, mHealth interventions relying primarily on donor funding encounter the issue of long-term sustainability. One consideration would be donor exit strategies involving government succession. An example of such an exit strategy is Thailand's Better Border Healthcare Programme in which the government covers the operational costs of sending text messages to obstetrical patients to alleviate the financial costs for end users (Everett, 2003). Another solution in countries where governments are key stakeholders in mHealth programs

is gradual adoption of toll-free services for health related mobile communication as demonstrated by mHealth program expansion and integration in Rwanda (Mechael, 2008).

mHealth products have increased in Africa. In the month of July 2014, Econet, Gemalto, and the GSMA launched mHealth initiatives in Kenya, Ghana, and Zimbabwe (Matinde, 2014). Experts say that mHealth initiatives in these countries have benefits and challenges. According to Kahoro (2015), there are several benefits in digitalizing medical processes like data collection and contacting patients. The researcher stated that for the first time in history, Kenya AIDS Indicator Survey was conducted both manually and transmitted data electronically and the report generated in a few months' courtesy of mobile phone technology. This was an improvement as compared to previous years where the survey was conducted manually and hence took so longer for the report to be released (Matinde, 2014).

Mitra (2014) notes that, mHealth in Kenya focuses on two major areas; data collecting and behavior change. In data collection mobile devices replace the traditional paper based tools making the process fast and efficient. This helps healthcare providers to have updated report on the number of patients diagnosed from a particular disease and their progress (Kobayashi 2014). This information is very beneficial to providers as they are able to discern patients who have followed doctors' prescriptions and those who have not. With regard to behavior change, mobile phone devices are used in dissemination of key healthcare messages and good practices among communities (Goel et al., 2013). It is important to note that use of technology in the Kenyan health sector has helped improving the sector by providing healthcare providers with the information they require. This technology has benefited patients from informal settlement and limited resources settings in the country to access healthcare information (UNDP, 2013). In urban areas, people in informal settlements are treated similar to others as the technology does not detect socio-economic status of the patients (Goel et al., 2013).

According to report by WHO (2011), lack of knowledge and evidence on the impact of at-scale mHealth interventions on key health indicators is a major obstacle to improving mHealth coverage. This includes a lack of standardization of mHealth study designs. To facilitate randomized control studies and standardized, replicable study designs, WHO has recommended changing the research focus of mHealth interventions from usability to a health outcomes-based approach (WHO, 2011). There is also a paucity of literature discussing failed mHealth interventions or studies elucidating the process of technology adoption. Collaboration between information communication technology (ICT) innovators, social scientists and public health practitioners is vital, particularly in establishing standardized theoretical frameworks, evaluation methods and guidelines for measurement (Chib & Chen, 2014).

Everett (2003), investigated on another significant hurdle for mHealth programs is poor infrastructure. One explanation for the feasibility mismatch between mHealth program requirements and the reality of infrastructure limitations in target countries may be that most mHealth research is conducted in high-income countries with advanced infrastructure not yet as widely available in LMICs. This is particularly true regarding telecommunications infrastructure that can be a barrier in mHealth applications entailing broadband internet access, the use of smart phones and remote access to electronic medical records (Betjeman, 2013). Moreover, poor coverage of and accessibility to mHealth interventions, particularly among vulnerable populations, is often a result of low ownership of mobile phones, sometimes despite high network coverage. A study in Kenya found that nearly 40% of sampled patients did not own a personal mobile phone, with disparities in phone ownership vis-à-vis gender, age, education, literacy, urbanization and poverty (Zha et al., 2011).

Additionally, Chib and Chen (2008) investigated the impact of infrastructure on the success of mHealth. They found that the potential for mHealth programs to improve quality of care

may be compromised by a lack of investment in infrastructure, and the absence of sustainable financing and technological training (Chib & Chen, 2008). Evidence from their literature on mHealth programs does not adequately address their impact on quality and efficiency in terms of improving service delivery processes, strengthening health systems and improving health outcomes (Chib & Chen, 2008).

Furthermore, one of the universal concern of all mHealth activities is that of data protection, privacy and security. Fraser and Blaya (2013), in their study of mHealth challenges recognized the right to privacy but have legal frameworks that lack an explicit data protection act. Currently, most small-scale mHealth activities in LMICs have varying security measures such as firewalls and tiered password access control codes that allow for different levels of access for CHWs and managers (Fraser & Blaya, 2013).

The study found that information security can only be adequately addressed with a large enough industry buy-in to facilitate standardization and policy implementation.

According to Betjeman, (2013) careful monitoring, evaluation and regulation are needed to overcome and address the various risks and barriers to the uptake and scale-up of mHealth interventions. Higher-level mechanisms and commitments from key stakeholders are needed to drive and control the effective, sustainable and impactful use of mHealth. Most mHealth initiatives, applications and strategies lack backing by appropriate government policies, regulations and oversight. This may create risks for both the users and providers of this technology and impact the rate of its introduction, scalability from pilot studies to integrated national health initiatives, utility and the overall cost-benefit balance (Betjeman, 2013).

Mitra (2014) and Matinde (2014) in separate studies assert that mHealth initiatives in Kenya are faced with several challenges. One of the challenges facing implementation of mHealth initiatives in Kenya is who should pay the cost of communication in order to achieve project

sustainability. This challenge has led to many projects remaining at the pilot stage because the government, private companies, and patients are not ready to pay for these costs. In order to achieve sustainability, the communication costs should be effectively paid though the cost should be very low to make it affordable (Brabham, Ribisi, Kirchner & Bernhardt, 2014).

Moreover, mHealth initiatives require steady and reliable power supply. Electricity supply in the country is not reliable (Goel et al., 2013). The initiative requires the use of graphic enabled smartphones which are highly power sensitive thus, any project relying on these smartphones in the country may face severe challenges as they will be required to keep their phones charged regularly (Goel et al., 2013). This should be addressed by the government by ensuring that all parts of the country access reliable and regular power supply (Goel et al., 2013).

However, there are several opportunities that can help in addressing these challenges. For instance, Kenya has a very strong penetration rate of smartphones. Kenyans are familiar with mobile phone services other than mHealth such as mobile banking, Mpesa, and other money transfer services such as paying electricity bills. Thus, it is easy for the mHealth project to be understood in the country. Many mHealth projects provide cell phones as giveaways for the project. This results in less accountability and responsibility as well as lack of ownership among the phone users. According to Van der Kop, et al. (2013), several phones get lost during the implementation process and no one is held accountable. Additionally, frontline workers should follow simple Smartphone apps when rolling out the project to ensure that the process is not confusing (Van der Kop, et al. 2013)

While there are notable challenges, a number of countries have been able to implement mHealth successfully. Rwanda is one of the most successful examples of developing and sustaining mHealth at scale with government commitment, integration of mHealth within the

existing health system, and collaboration across sectors. Rwanda's mHealth system--TRACnet--is the longest continuously operating national mHealth system in Africa (Nyemazi, 2011). The TRACnet system is used to track HIV/AIDS, malaria, tuberculosis and other diseases (Korvald, 2013). Data collected by TRACnet is used for a variety of purposes including monitoring program expansion and progress, driving performance-based incentive payments to health centres, delivering lab results to facilitate early infant diagnosis, monitoring pharmaceutical supplies, and providing donor reporting (Nyemazi, 2011). The system includes a national interoperable electronic health system, rollout of electronic management records and data input from CHWs through solar-powered mobile phones (Nyemazi, 2011).

2.5 Chapter Summary

The chapter has covered various aspects of health service delivery and mobile phone technology use in health sector. The first section covered the healthcare service delivery globally, regionally and in the Kenyan context. The second section covered how information technology has transformed the health sector. The third section looked at various studies on mobile technology in developing countries. The fourth section detailed on empirical studies done on the impact of mobile phone technology on various contexts of health service delivery which include medical diagnosis, disease diagnosis, self-care, and patients' visits. The fourth section discussed on the benefits and challenges for mHealth in Kenya. Kenya faces challenges in healthcare delivery and this has created several gaps in the sector. Healthcare is a basic need and the Kenyan 2010 constitution provides that every citizen has the right to access high quality healthcare services. The rate at which mobile phones have penetrated into the Kenyan market is very high to the extent that out of 100, 72 people have a phone. This makes it easy for the mHealth project to be implemented. Several projects have been tried in

Kenya but have been faced with opportunities and challenges. The high cost of smart phones in the country is one of the reasons as to why these projects are not successful.

2.6 Conceptual Framework

A conceptual framework is defined as relationship conceptualization among study variables represented diagrammatically (Mugenda & Mugenda, 2003). It diagrammatically shows the main concepts of the study. The framework indicated the direction of relationship as well as the independent variable effect on the dependent variable.

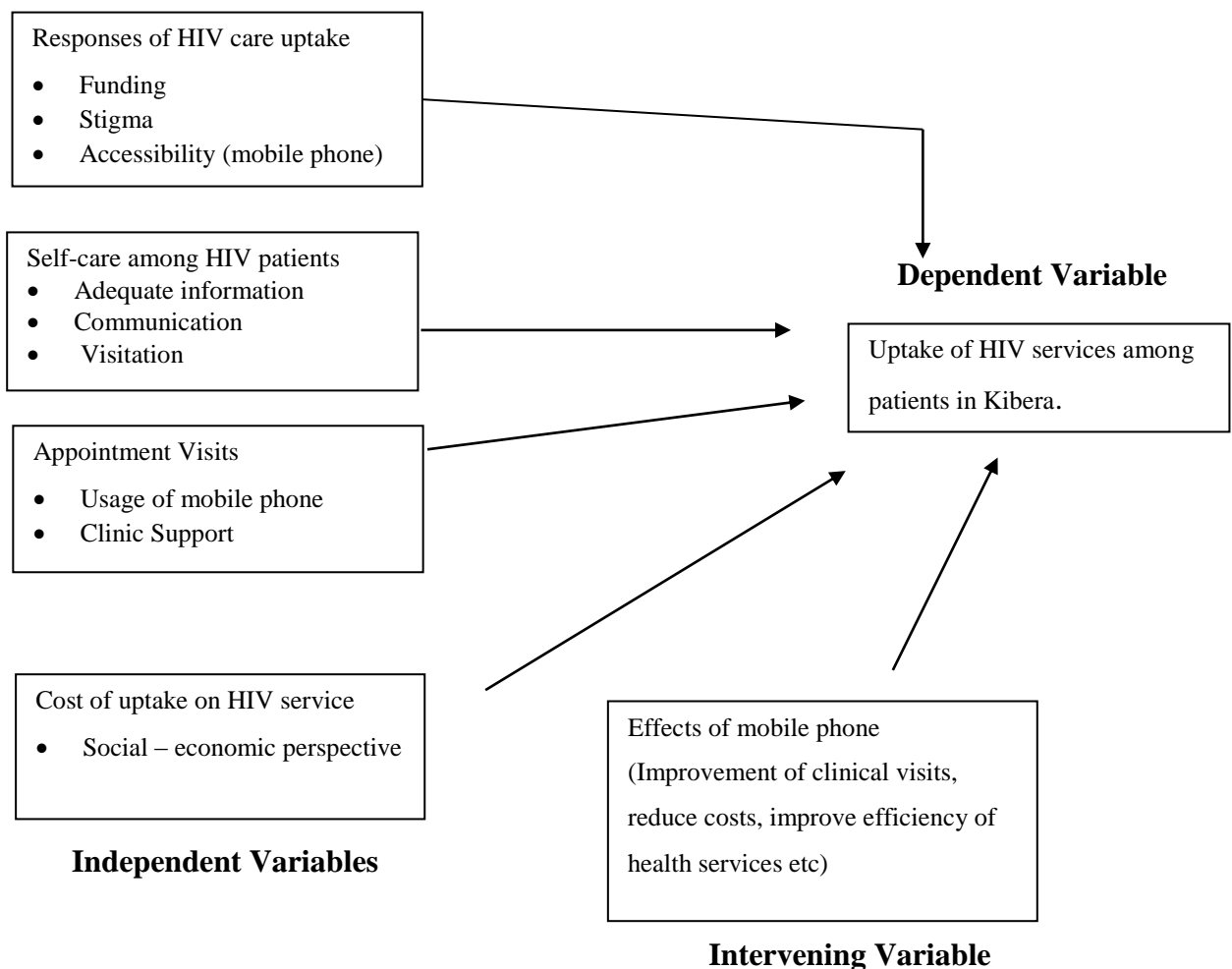


Figure 2:3: Conceptual Framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter will discuss the methodologies, processes, and procedures followed in conducting the study. Any scientific inquiry requires the most appropriate methods to get accurate outcomes. Methodologies or techniques are developed in this study to enable generation of the required information. According to the World Health Organization (WHO 2002), research methodology is an integral part of any scientific study as it guides the researcher to follow the due process in conducting the study. Additionally, this section helps the reader to follow the process adopted by the researcher in a study, Therefore, this chapter will discuss how the study was conducted and includes subsections such as research design, target and population, sampling, preparation of data collection instruments, data collection procedures and methods of data analysis.

3.2 Research Design

The main aim of the study was to investigate the impact of mobile phone technology in bridging the gaps in healthcare service delivery in Kenya. Thus, cross-sectional study design was employed in this study. Descriptive survey design was used in this study because it was easy to conduct as it relies on previous literatures to compare with the extent of study findings (Bryman & Bell, 2011). The research borrowed ideas from previous studies in making conclusions and recommendations. Using the descriptive cross-sectional design, a statistically significant sample of a population was used to establish the relationship between the dependent and independent variables.

3.3 Target Population

The study was HIV patients visiting *Médecins Sans Frontiers* (MSF) Clinics in Kibera where the population target is 250,000 people. The sample size used were selected HIV patients who came for the services at the MSF Clinic where they responded to SMSs sent to them on their mobile phone to come for their appointments visits.

The study was carried out in Kibera informal settlement in Nairobi County, Kenya The international humanitarian medical organization was selected in the study because it offers free healthcare services in the region hence each and every individual from the region can access healthcare services. Kibera is the largest informal settlement in Kenya housing almost 20% of the region has electricity (African Population and Health Research Center [APHRC], 2014). According to Kenya National Bureau of Statistics [KNBS], (2010), in the year 2009, the Nairobi County had a population of 3.138 million. About 2.5 million people live in informal settlements in the region representing about 60% of the Nairobi population and occupying 6% of the land. The organization has two clinics in Kibera serving over 40,000 patients annually (Mutisya & Yarime, 2011). The organization offers a wide range of healthcare services such as chronic diseases such as HIV, diabetes, care to sexual violence victims among others and the 3 healthcare providers from MSF clinics.

3.4 Sampling Procedures

Simple random sampling technique was used to select patients whereby patients visiting the two clinics owned by the organization were studied for a period of two weeks.

A sample of 207 patients and 3 healthcare providers at msf was selected. This was done because the study was very specific. To determine the sample size, fishers formula was employed (saunders et al., 2012).

$$N= Z^2 \times PQ/D^2$$

N= the required sample size

Z= standard normal deviation at 1.96 corresponding to 95% confidence interval

P= proportion of the target population estimated to have a particular characteristic which is 16%.

Q= 1-P =1-0.16=0.84

D= degree of accuracy desired set at 0.05

In kenyan informal settlements the rate of visiting a healthcare center is up to 16% among people going for hiv tests and other care services in kenya according to (mutisya & Yarime 2011).

$N = 1.96^2 (PQ) / D^2$

$1.96^2(0.16*0.84)/ 0.05^2$

$=1.96^2(0.16 \times 0.84)/ 0.05^2$

$= 207 + 3$ healthcare providers in MSF, the total is 210

Simple random sampling procedure was used to select healthcare providers at MSF clinics. this is because simple random sampling gives every member or character of the study equal chances of being selected (Saunders et al., 2009). since, the healthcare providers have knowledge about mobile health issues in the area they will be of great help for the study. The sample size included only patients who visited the clinics for HIV tests and other related services such as going for ARVs and the 3 healthcare providers in MSF.

The healthcare providers selected were from the MSF organization working in their two clinics within Kibera. The participants were chosen from the two sites and the other one responded.

3.5 Instrumentation

This study gathered primary data through survey methods. Questionnaires were handed out to 210 selected target respondents who were patients to collect the required information and data. To ascertain what patients was true, health care providers were given questionnaires to participate as well. All who were involved in this activity were trained on protection of human subjects and were expected to adhere to Health and Human Subjects (HHS) regulations. For those potential respondents who were unable to read or write, I guided them on how to answer set questions and translated wherever needed. Questionnaires were used in this study to ensure simplicity and easier completeness of the data collected (Marczyk, DeMatteo & Festinger, 2010).

3.6 Methods of Data Collection

The survey commenced with data collection, and then data cleaning followed to trace outliers and other wrongly entered data. Afterwards, data coding was done so that clean data could be keyed in the analysis software (SPSS) version 17.0. After the analysis, the generated results were presented inform of graphs, pie charts and tables of both descriptive and inferential statistics. The aggregated data was analyzed at the facility level and the primary analyses included but not limited to descriptive statistics, and univariate logistic regression. The analytic database was aggregated in order to get an accurate assessment of the impact of mobile technology and did not contain any names or unique identifiers. Most of the analysis was of descriptive; while significance was measured using Pearson's Chi square. All the data collected from the facilities were analyzed.

3.7 Methods of Data Analysis

The data analysis was done using SPSS 17.0 together with supporting the analysis with documented parts of literature reviewing concerning the MSF clinics. Pretesting of the tools was carried out to streamline the effectiveness of the questionnaire. Twenty-one (21) pilot test questionnaires were administered to the most frequented clinic of MSF in Kibera before the real data collection to assess the efficient of the set questions. The reconnaissance study helps a research to weed out the unnecessarily or wrongly set questions in a questionnaire (Yin, 2003). The main aim of the pilot study was to check the time it would take a respondent to complete answering a questionnaire. The gaps on service delivery noted during this exercise helped in improving the quality of questions. The data analyzed cannot be directly linked to identifiable participants and data security was given priority.

In order to maintain data integrity, data collection protocol was clearly defined so that every participant was treated consistently. The researcher ensured that respondents were seated separately to avoid discussion and maintain randomness and honesty of the responses given.

3.7 Data Presentation

The study was collected and presented in tables, charts and in narratives.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This section presents the results of the survey findings and discussions. The research data was gathered from Kibera informal settlement within Nairobi County by use of questionnaires as my research instrument. The data collected from the questionnaires, observation and interviews was analyzed in tabular form using tables and graphs. Quantitative analysis was carried out hence this chapter reflects the true ideas of the respondents. Categorization for this study was made based on gender, marital status, age group, and length of accessing healthcare via mobile phone technology and other variables, practiced on a five- point Likert scale.

The researcher administered two hundred and ten (210) questionnaires to arbitrarily chosen respondents who included patients who had visited Medecins Sans Frontieres (MSF) clinics within Kibera for healthcare services and healthcare providers. The P value to be used is 0.005 while confidence interval level will be 95%.

4.2 Social Economic and Demographic Characteristics of Respondents

This part highlights questions that were designed to identify the respondents' background details such as gender, age, marital status, academic level, occupation, length of stay, and frequency of visit made in MSF clinic. The responses availed by the respondents are reflected overleaf:

Table 4.1: Social Economic and Demographic Characteristics of Respondents N= (210)

Variable	Demographic Information	Frequency	Percent
Distribution of respondents by gender	Female	113	53.81%
	Male	97	46.19%
Distribution of respondents by age	Over 50	12	5.71%
	46-50	16	7.62%
	41-45	20	9.52%
	36-40	72	34.29%
	31-35	55	26.19%
	25-30	35	16.67%
	Single	19	9.05%
Marital status of the respondents	Married	101	48.10%
	Divorced	37	17.62%
	Separated	32	15.24%
	Widowed	21	10.00%
Education level of the respondent	High school	124	59.05%
	Diploma	59	28.10%
	Degree	27	12.86%
	Casual Laborer	76	36.19%
Occupation of the respondents	Carpenter	55	26.19%
	Mechanic	26	12.38%
	Business person	23	10.95%
	Tailor	18	8.57%
	Small scale farmer	12	5.71%
	Below 2 years	10	4.76%
Time respondents have lived in the area	2-4 years	29	13.81%
	4-6 years	61	29.05%
	Over 6 years	110	52.38%
Frequency of visit made in MSF	Rarely	34	16.19%
	Averagely	78	37.14%
	Regularly	98	46.67%

Gender: As displayed on Table 4.1 above, both male and female were surveyed and a slightly more than half of respondents at n=53.81% who participated in the study were female while the rest at n=46.19% were male. This showed that the female patients were more engaged than the male and they were more eager to learn more on the given services.

Age: As depicted by Table 4.2 above, a number of the sampled respondents at n=34.29% were aged 36-40 years; they were followed closely by who were between 31-35 years at n=26.19%. The age difference showed that older age was relatively more interested and curious to learn about the mobile technology.

Others were n=16.67% for 25-30 years, n=9.52% for group aged 41-45years and only a few of the respondents were aged over 50 years. This means that majority of MSF clinic attendants are youthful people and literacy played a major role on this as well.

Most respondents of n=48.10% stated that they were married, n=17.62% were divorced, and n=15.24% said they were separated. Other few at n=10.0% and n=9.05% said they were widowed and single.

Literacy level of the respondents was critical factor that the research required to understand how education was related with the use of technological supported healthcare services. Majority of n=59.05% said they had high school certificates, followed by n=28.10% who had diplomas and only a few of them at n=12.86%.

Occupation: Most n=36.19% were casual laborers, n=26.19% were carpenters, n=12.38% mechanics, n=10.95% business people. Others were tailors at n=8.57% while a small percentage at n=5.71% practiced farming in the small public portions that were unutilized.

Length of stay: Majority of n=52.38% of the respondents said they had stayed in the area for over 6 years. They were followed by those respondents who said 4-6 years at n=29.05%.

Only a small portion of them at n=13.81% and n=4.76% had lived there for 2-4 years and below 2 years respectively.

Most n=46.67% of the respondents said they visited the health clinic regularly, with the exception of 16.19% who said rarely and another 37.14% who said they visited the MSF clinics on average basis.

4.3 Responsiveness of HIV Uptake at the MSF Clinics

The services given for the HIV patients at the MSF Clinic had a majority n=57.14% of the respondents said it was low as there were a few hospitals or clinics, 32.38% said it was average and only 10.48% said it was high as depicted by Figure 4.1 below. The main reasons for the low uptakes were on lack of funding for individuals, stigma and accessibility of the having a mobile phone. The findings align with those of Muchangi (2011) who argues that Kenya, healthcare is funded from three major sources; donors, public, and out of pocket payment (consumers). Over the past years, the Kenyan government budget for healthcare has been slightly about 4% of the GDP which is the least in the region (Rwanda, Uganda, and Tanzania) (Muchangi, 2011).

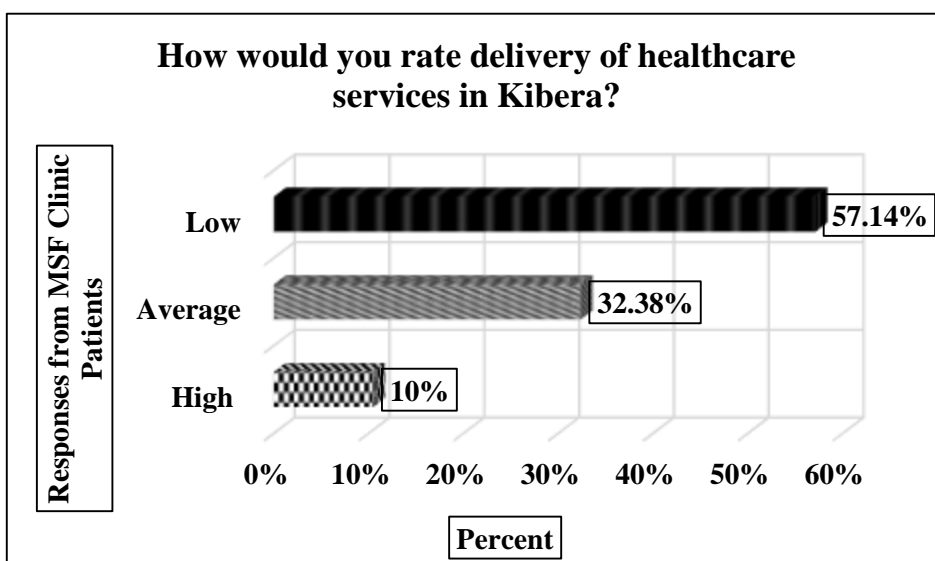


Figure 4.4: Delivery of Healthcare Services

4.4 Cost of uptake of HIV Services

The study sought to establish whether there were any differences in care delivery in Kenya.

The outcomes of the study were as shown in figure 4.2.

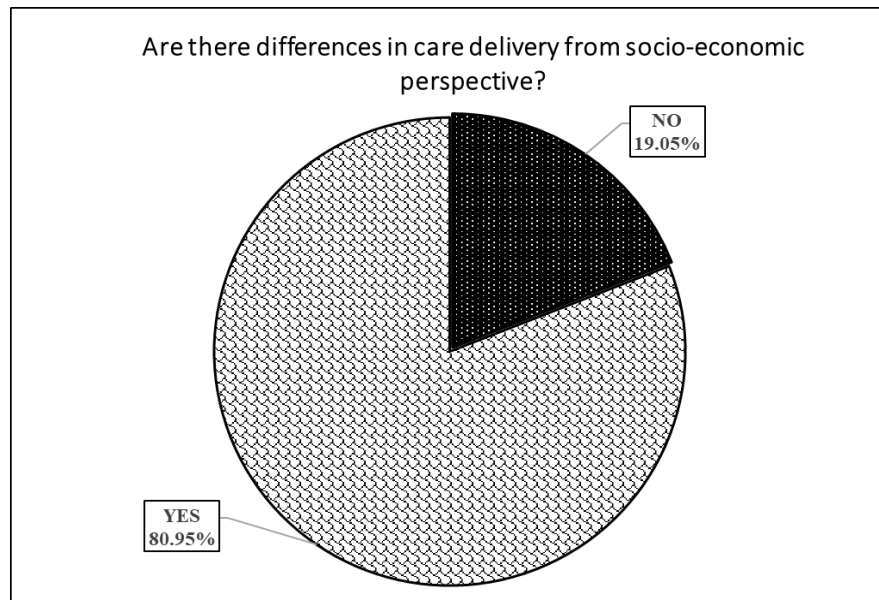


Figure 4.5: Differences in Care Delivery

As shown by Figure 4.2, when the respondents were asked whether there existed care delivery gaps from socio-economic perspective, majority of them at 80.95% said yes while only 19.05% said no. In that regard, the imperative of public health administrators is to regularly check the socio-economic changes in their counties to regularly align the health service provision to the current needs of the communities. This echoes the Tama et al., (2018) perspective who notes that it is important for counties to regularly monitor the performance of the health sector under devolution and address any emerging gaps to meet the high expectations among citizens given that universal health is enshrined in the bill of rights in the constitution. For instance, Kenya has been for long time plagued by many cases of child

mortality. However, with continuous and focused improvements in the country's health sector, service delivery in Kenya are reflected in child survival rates which have improved in the last five decades with reduction of infant, under-five, maternal and neonatal mortality. Additionally, communicable diseases have declined significantly as a consequence of sustained efforts by the government to prevent and combat diseases like Tuberculosis and Malaria. Although, HIV prevalence has declined with country achieving its ART coverage target of 1.03 million people in 2016, adolescents continue to be highly exposed to the HIV. Moreover, the government continues to place effort required to address the increasing death rates as result of non-communicable diseases such as diabetes, hypertension and cancer.

4.5 Healthcare Services from the Clinics over the Phone

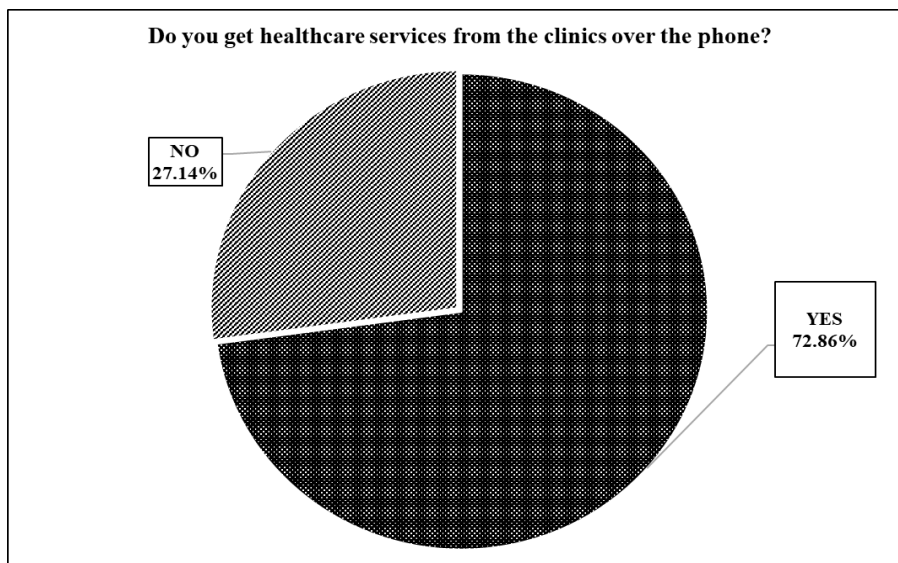


Figure 4.6: Healthcare Services over the Phone

As shown by Figure 4.3 above, majority of the respondents at n=72.86% agree to have been receiving healthcare services from the clinics over the phone while only a few at n=27.14% said no.

The other services at MSF clinic that are given to the HIV patients include the counselling and nutrition consultation information that is shared via SMS platform on the mobile phone. This is consistent with Bitta et al., (2018) who notes that service delivery in Kenya are reflected in child survival rates which have improved in the last five decades with reduction of infant, under-five, maternal and neonatal mortality.

4.6 Frequency of Information Given Over the Phone by Clinics

The study sought to investigate the use of mobile phone by the clinics in service delivery. The findings of the study were summarized in the figure 4.4.

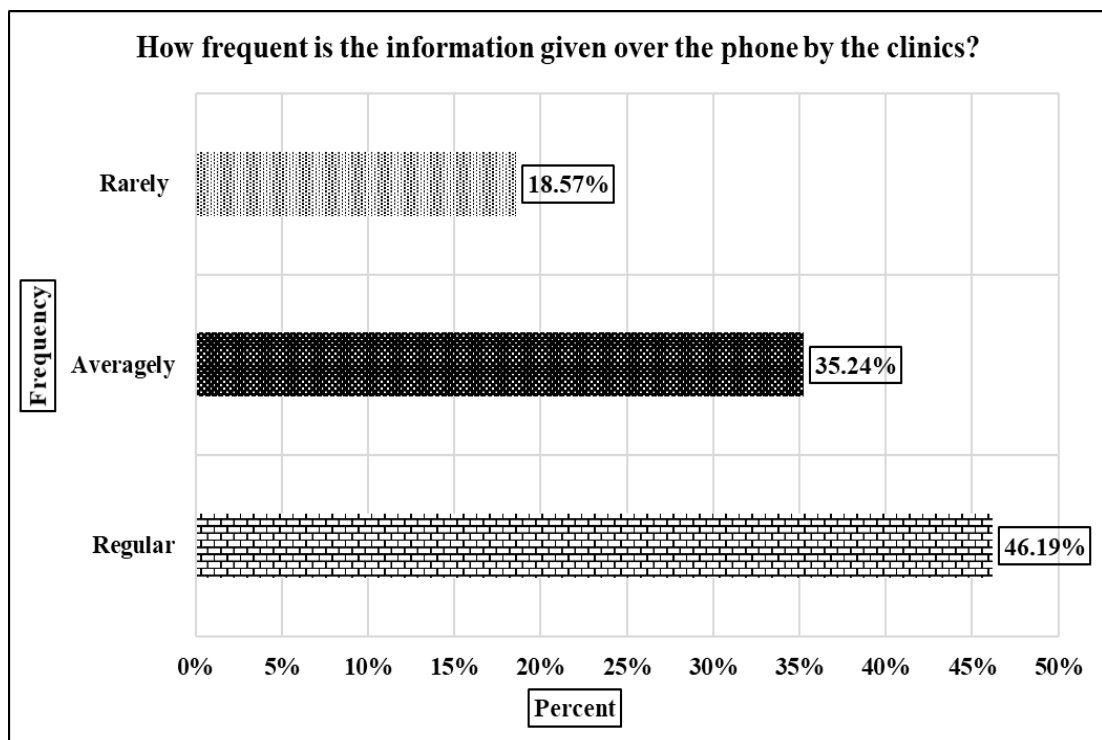


Figure 4.7: Frequency of Information Given Over the Phone

When the respondents were asked how frequent was the information they were given over the phone by the clinics, mostly n=46.19% of them said regularly, n=35.24% averagely, and small percent at n=18.57% said rarely as shown by Figure 4.4 above. The results are consistent with the Pozzi's assertions. According to Pozzi et al., (2016) developing countries need telemedicine applications that are essential and will help in situations where the number of physicians with respect to the country population is small. Most importantly, mHealth technological services are critical when physicians and patients in rural areas need health care assistance. However, Pozzi claims that the requirements of mHealth applications in developing countries are more complex and demanding as compared to those of developed countries. This is because there are a lot of factors in play, which are to be considered for effective mHealth and other mobile phone technology services in health service delivery to work in developing countries.

4.7 Perception on the Use of Mobile Phone Technology in Healthcare Services Delivery

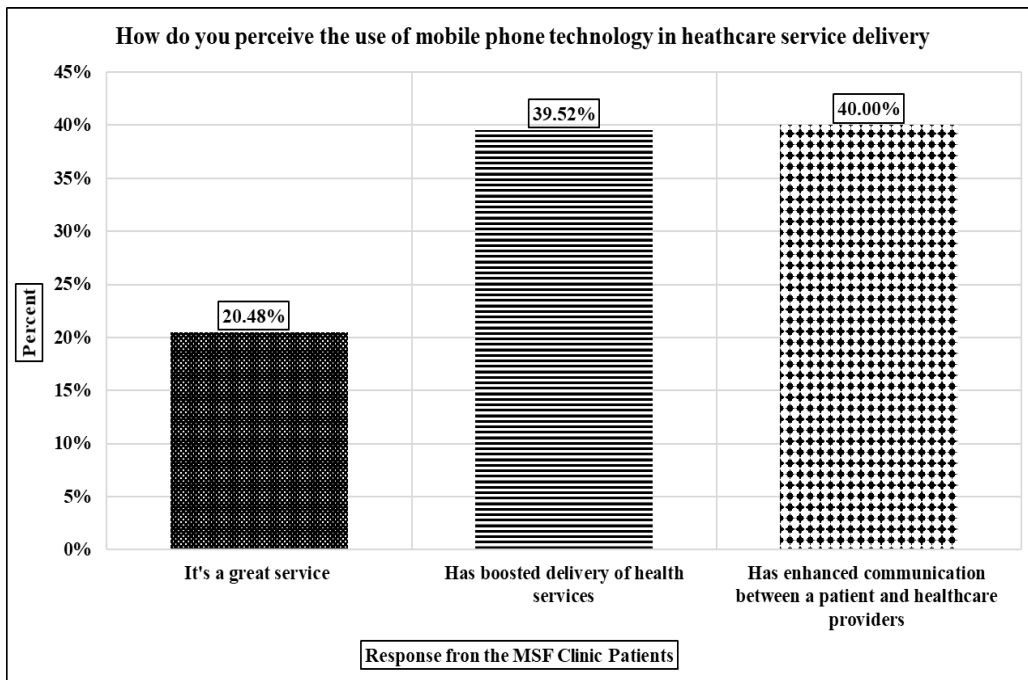


Figure 4.8: Perception of Using Mobile Phone Technology in Healthcare Services Delivery

Asked how they perceived the use of mobile phone technology in healthcare services delivery, 40.0% of the respondents said that it had enhanced communication between a patient and healthcare providers, 39.52% said it had boosted delivery of health services while a few at 20.48% said it was a great service as it had aided them in many ways to resolve their health problems as shown by in the Figure 4.5 above.

The findings were consistent with the views of Free et al., (2014) who mentions that the preliminary results of mHealth is the feature of health text messaging which in India and South Africa indicate that more people show up at their scheduled appointments, hence resulting into significant health cost reduction for practitioners and facilities. In that regard, the benefit can be viewed in the context of cost effectiveness of the health business rather than the health outcomes. Additionally, Goel, et al. (2013) in a study on how mHealth helps

in bridging the human resource gap indicated that, mobile technology has the potential of addressing the human resource issues in the healthcare sector in developing countries. The study used a narrative literature by reviewing and analyzing various literatures focusing on mHealth and human health resources in low income countries. The study was conducted in India and the results indicated that mHealth helped in addressing health issues such as supervision, disease surveillance, data collection, health education, monitoring, and providing feedbacks. The study concluded that mobile phone technology is very potential in addressing issues facing the healthcare sector thus, bridging the gap in delivery of this care (Goel et al., 2013).

4.8 Use of Mobile Technology to Influence Delivery of Healthcare Services

Table 4.2: Influence Brought by Mobile Technology in Delivering Healthcare

Responses from MSF Clinic patients	Frequency	Percent
It speeds up service delivery	82	39.0
Helps more patients to be attended	29	13.8
Aid in educating masses of an ongoing vaccine	38	18.1
Improves patient-doctor communication	61	29.0
Total	210	100.0

As depicted by Table 4.2 above, n=39.05% of the respondents stated that the use of mobile technology speeded up service delivery, n=29.05% stated that the technology improved patient doctor communication, n=18.10% said it aided in educating masses of ongoing vaccines while a few at n=13.81% said it helped more patients to be attended.

This is in tandem with Riley et al., (2016) who argued that healthcare providers need to use new mobile technologies that have the capability of facilitating higher quality of care in every patient interaction.

4.9 The Use of Mobile Phone Technology Improves Access to Healthcare Services

According to the responses from the MSF patients, mostly n=14.29% strongly agreed, n=55.24% agree while only a few at n=20.45% and n=10.0% disagreed and strongly disagreed respectively as shown in the figure 4.6 below. This states that with the use of mobile technology, we are able to improve a good significant number of healthcare service delivery.

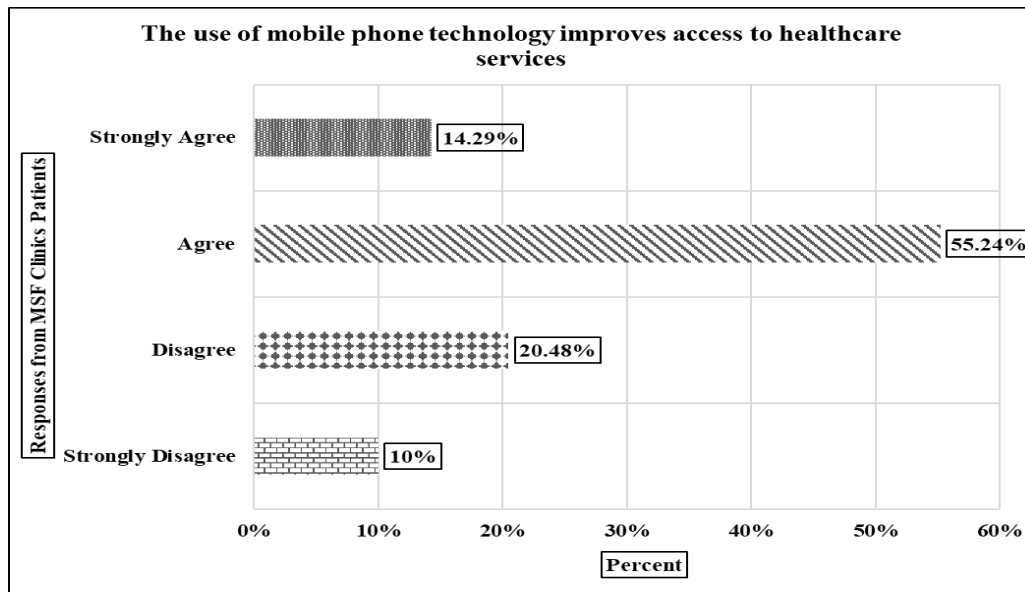


Figure 4.9: Improvement of Healthcare Services Due to Mobile Phone Technology

This is supported by the findings of Lien et al., (2014) who assert that, due to the low number of doctors in developing countries doctor's time is very scarce and expensive hence a better way should be sought to enable them be more efficient and effectively manage more patients. Mobile phone technology is viewed as the best way of enabling physicians to manage more patients and empower them to improve the quality of care they provide. With mobile phone technology, doctors or healthcare services providers can track patients' treatment compliance and progress and offer to patients' remote access to their expertise. Providers can reach the patients with the required healthcare information hence bridging the gap in care delivery.

In Kenya for instance, only the rich and wealthy can afford to pay the scarce and expensive time of the expert physicians while the poor are left without good and quality services

4.10 Appointment Clinic Visits Increased for HIV patients Due to Use of Mobile Technology?

According to the responses from the MSF patients, mostly n=25.71% and n=40.95% strongly agreed and agreed. Only a small number at n=8.10% were neutral while n=16.67% disagreed and another n=8.57% strongly disagreed as shown by Figure 4.7 below. This shows with the intervention of having the messages through the mobile phones, they were capable to access the HIV services without any barriers or stigma when it comes to healthcare services delivery.

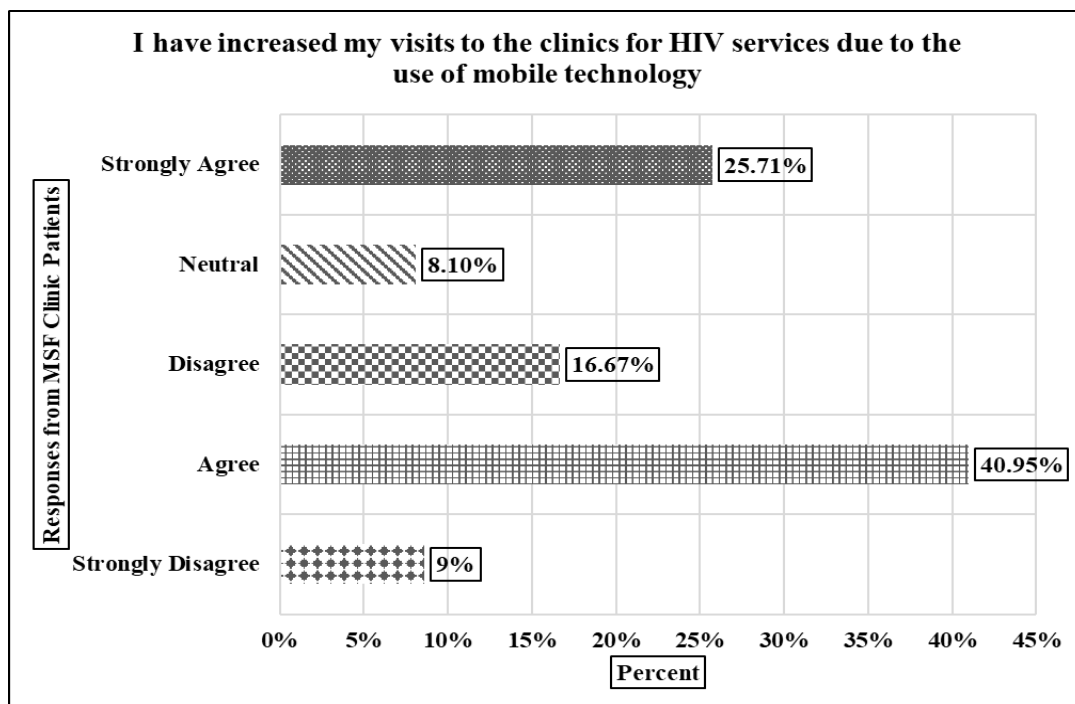


Figure 4.10: Increased Clinical Visits Due to Mobile Technology

The findings are in line with the results of (Ayo et al., 2015). He investigated the effect of wireless and mobile technology on the delivery services in health sector of Nigeria. Ayo argued that the healthcare industry in Nigeria had become a state flux and turbulence. He suggested that the major developments lie in the integration of ICT with health care delivery. Further, he noted that wireless devices are being used in healthcare field hence enabling caregivers to improve and monitor the health status of their patients.

The study revealed that use of mobile technology in booking of appointments and seeking for clarifications on health procedures has increased the number of HIV patients visiting public health facilities to attend to appointments as well as seek further medications.

4.11 Technology Improves Communication between Healthcare Providers and Patients

According to the responses from the MSF patients, mostly n=29.05% and n=43.81% strongly agreed and agreed respectively when they were asked whether the technology had improved communication between healthcare providers and patients as shown in figure 4.8 below.

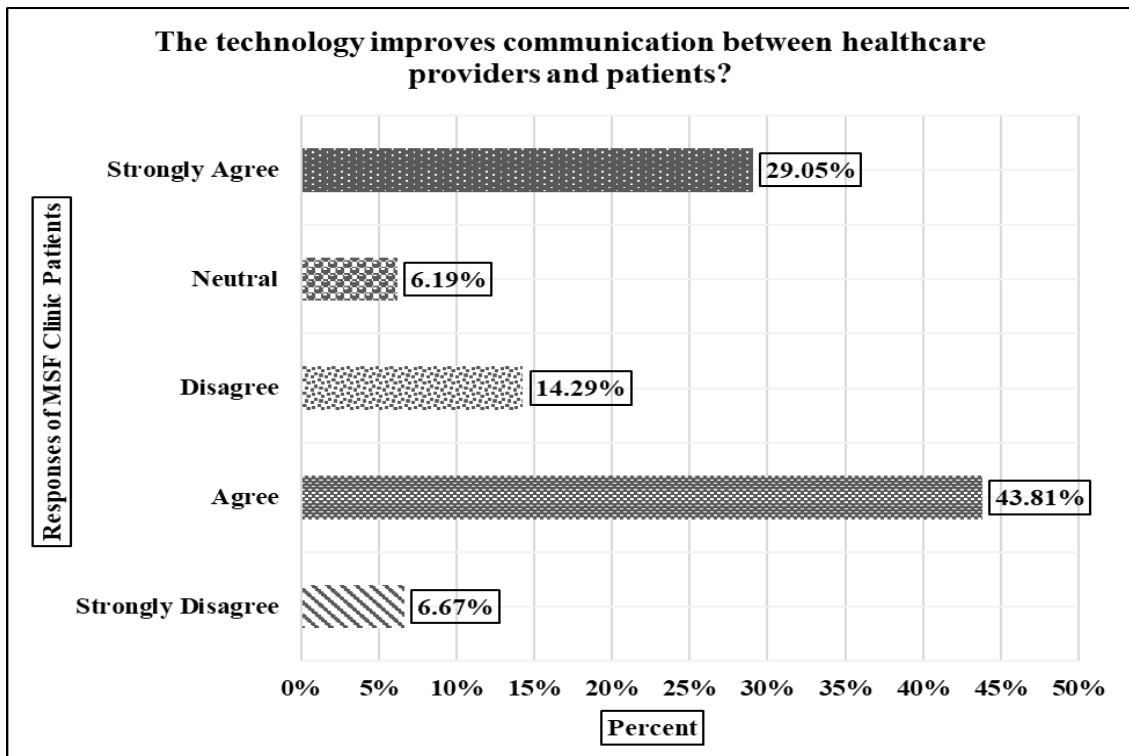


Figure 4.11: Mobile Technologies Improves Communication

In addition, it was only a few numbers of the respondents at $n=6.19\%$ who remained neutral while the rest at $n=14.29\%$ and $n=6.67\%$ disagreed and strongly disagreed in that order. That showed that with the confidence level of interactions with healthcare providers had significantly improved and increases the flow of patients to the clinic.

This finding was consistent with that of Mokaya et al., (2010) whose study evaluated the use of mobile technology in enhancing postnatal care in South Africa. The study revealed that 75% of the health care givers were willing to communicate with their patients through the phones. The study also reported that in the RCT 83% of the mother involved in the study used SMS or phone call to communicate. This increases the rates of patient attendance. Additionally, the study found that the SMS reminders were cost-effective as compared to

phone calls and the patients who received these reminders were more satisfied. Additionally, the study also acknowledged the effect of mHealth on the follow up visits.

The findings of the study revealed that patients who communicated with their health service providers were more likely to get an appointment for follow up visits.

4.12 Hypothesis Testing Results

Table 4.3: Chi- Square Test

	Observed N	Expected N	
Chi-Square	153	105.0	43.886
df	57	105.0	1
Asymp. Sig.	210		0.000
Chi-Square	153	106.0	44.774
df	57	107.0	1
Asymp. Sig.	210		0.001

Using P values of 0.005 and confidence level 95%

The research hypothesis was:

H_a: Use of mobile phone technology positively affects the delivery of healthcare services

H₂: Use of mobile phone technology does not improve responsiveness among patients

H₃: Mobile phone technology does not improve self-care among patients

H₄: Mobile phone technology has not changed lives of patients and general healthcare.

As shown by the chi-square test result above on Table 4.3, the Asymp. Sig which is the p value is 0.001.

Since this p values = 0.001 are less than ($P < 0.05$) p value we fail to reject the alternative hypothesis (H_a) and conclude that there is an effect of mobile technology on healthcare service delivery.

CHAPTER FIVE

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

5.1 Introduction

The aim of this study was to probe the effects of mobile phone technology in bridging the gap in healthcare service delivery. Thus, this chapter will delve on the summary of the study findings, conclusion of the research and suggest recommendations which can eradicate the pending challenges.

5.2 Summary of the Study

Even though the World Health Organization (2015) requires every government to ensure its citizenry has access to quality healthcare services, this was proved not to be the case in Kibera as majority of the poor people in the informal settlement scrambled for the few free MSF clinics. Moreover, n=57.14% of the respondents when asked to rate how delivery of the healthcare services were in Kibera said they were low, n=32.38% said average while the rest at n=10.48% said high. So with proper intervention of mobile technology incorporated within the healthcare service delivery, the gaps for efficiency will continuously exist and this is an indication of how the people in developing countries suffer due to poorly funded healthcare sector and few accessible health facilities. Muchangi (2011) argues that Kenya, healthcare is funded from three major sources; donors, public, and out of pocket payment (consumers). Over the past years, the Kenyan government budget for healthcare has been slightly about 4% of the GDP which is the least in the region (Rwanda, Uganda, and Tanzania)

Just like Gutman (2013) asserts that healthcare providers should use new mobile technologies that have ability of providing a platform of higher quality healthcare to every patient interaction, the study found that those patients that accessed the mobile phone technology of

MSF clinics enhanced their health by following every prescription given by their clinicians to the letter.

Though it was revealed that there existed differences in healthcare delivery from a socio-economic perspective as proved by n=80.95% of respondents who said yes and only a few at n=19.06% said no, the more moneyed a person was the better he was equipped to access the best healthcare system in his country. This is a gap that needs to be addressed by the government to yield equality in the populace. But the good thing is the advent of technology has revolutionized how things are done nowadays. More so the available of mobile communication devices has helped in bridging the gaps in the healthcare system. This is can be reinforced by the statement given by respondents when they were asked whether use of mobile phone technology influenced delivery of healthcare services. The respondents said that the mobile phone technology speeded up service delivery and it helped more patients to be attended. In addition, the technology created a platform for education masses of a planned vaccination and more importantly it enhanced patient-doctor communication thus creating a robust rapport to treat the patients.

Even though Kenya as a country is committed to the Bamako declaration (2010) declaration of allocation 15% of its national budget to the health sector a lot is yet to be implemented due to competing interest, this is echoed in the research finding where the study found out that delivery of healthcare services in Kibera was not satisfactory as n=57.14% of the respondents said it was low, n=32.38% said average, while only a few at n=10.48% said high. It remains a challenge for the government to work out a formula to cross this high gap of healthcare services delivery. The findings contrasted with those of Lester et al., (2009) who conducted a study on cell phone adherence trial. The main objective of the study was to compare the effectiveness of mobile phone- supported short messaging systems to standard care on equality of life, mortality, retention, and adherence in a population supplied with

antiretroviral therapy (ARVs) in Nairobi Kenya. The study found that as mobile phones have revolutionized the communication world, they have potential of revolutionizing the healthcare sector especially in the delivery of healthcare services to the less privileged people. Currently, almost every individual in Kenyan urban areas own or use a mobile phone on daily basis hence it makes it easy for healthcare providers to effectively delivery the services with ease and at reduced costs. The study found that the mobile phone technology offered an opportunity to improve healthcare delivery in Kenyan resource limited settings. Lester et al., (2009) found that patients who received the SMS support had improved ART adherence as compared than those who did not receive the SMS. This indicates that mobile phone technology helps in improving healthcare delivery through effective communication.

Like found out by Goel, et. Al. (2013), that mobile technology has the ability to mitigate or address and resolve completely the human resource challenges in the healthcare sector more so in developing countries, the study found out that in Kibera for example, when the MSF clinics started applying mobile phone technology to influence delivery of their healthcare services, the technology speeded up service delivery, helped more patients to be attended, it also aided in educating masses of an ongoing vaccine and improved patient-doctor communication. This was also supported by report by Economist (2015), which reported on the impact of mobile phone could have further positive implications in the economy and public health sector. The Economist Intelligence Unit investigated the impact of mHealth in 23 countries. The survey included CEOs, managers, business development strategists, pharmaceuticals and medical device manufacturing. Majority of CEOs believed that mHealth has enabled them to take control of their health and reduce the time they visit their physicians which would then help them focus on other things. The managers believed that the capability of mHealth to collect information and store vast amount of individual health data is crucial in diagnosis and treatment. They argued that this accuracy has helped them reduce visits to

health service providers due to accurate diagnosis which could have otherwise wasted times trying to diagnose the wrong disease.

For healthcare providers, one challenge is how to make money from mHealth. They reported that there has been a significant decrease in number of patients visiting their health centres which has significantly reduced the consultation fees. However, the public health administrators argued that the number of visits lost are compensated in other cost effectiveness aspects of mHealth in healthcare service delivery. These findings reveal the importance of mobile technology in increasing the efficiency of health service delivery by improving accuracy and efficacy of human resource.

In addition, as supported by Lester et al., (2009), who conducted cell phone adherence trial and found out that mobile phones have changed the way communication is done nowadays, the gadget are capable of revolutionizing the healthcare sector in matters regarding delivery of healthcare services to the less fortunate in the society. This is because it was found that the patients who received SMS support had enhanced their ART consumption relative who did not get a reminder via effective communication. Just like this study found and confirmed that the use of mobile phone technology improved access to healthcare services as n=14.29 % strongly agreed, n=55.24% agreed to that notion. These results were also supported by various studies. Vardoulakis et al., (2012) revealed the importance of Mhealth in service delivery. The study stressed that patients are mostly under-informed about aspects of their care. The study hypothesized that the use of mobile phone would help increase the information delivery which therefore improves the services as well as the health status of the patients. The study population was 20 patients using mHealth which provided dynamic, care plan, interactive report on their health or recovery progress. The study explored the patients using interviews. The study found positive correlation between the use of mHealth and number of visits. The authors argued that this was a result of access as well as understanding

of information regarding their health status which made them visits clinics to seek for medication or more advice regarding the healthy living.

Additionally, the visits increased because patients were able to reduce anxiety before visiting the clinic hence feel more comfortable to seek for health assistance.

Additionally, Olmen (2013) whose study examined the effectiveness of text messages on self-management of diabetes in Cambodia, DRC and Philippines found that the use of text messages improved the intervention between the patients and their physicians to a large degree. However, the effect of intervention was partly determined by the level of interaction and message personalization as well as the profile of patients such as their attitude and their competency on using mobile phones. The conclusions of the study revealed a positive and significant impact of text messaging on the patients' self-care. Moreover, these results were conceptually similar to those of Georga et al., (2014), who acknowledged how smart mobile devices have been used in self-testing of blood glucose. The authors report that researchers have developed NMR unit chip that can be integrated with smartphone to power analysis of a range of DNA, viruses, bacteria and other bio-markers. Recent advances of mHealth particularly in micro fluids have led to the creation of microfluidic chips which are used to perform HIV tests which are extremely lab-quality.

As said by Lien et al. (2014), due to the low number of doctors to patient ratio mostly in developing countries, a method ought to be sought to make the services of these few doctors are utilized effectively. It is thus, the use of mobile phone technology which is seen as one of the best way for doctors to improve their services by reaching to more patients and improve quality of care. Lien et al., assertion were confirmed by this research finding that found that many of the respondents agreed (n=25.71% strongly agreeing and n=40.95% agreeing) that they had increased their clinical visits for HIV services as result of using mobile technology.

In that regard, mobile phone technology could be the best way of enabling physicians to manage more patients and empower them to improve the quality of care they provide. With mobile phone technology, doctors or healthcare services providers can track patients' treatment compliance and progress and offer to patients' remote access to their expertise. Providers can reach the patients with the required healthcare information hence bridging the gap in care delivery. In Kenya for instance, only the rich and wealthy can afford to pay the scarce and expensive time of the expert physicians while the poor are left without good and quality services.

Additionally, Iredale et al., (2011) adds the concept of self-care and self-management as a technique of improving public health. In a study on the perceptions of patients on the mobile cancer support unit in South Wales. The authors note that, there is no need of focusing on mobile technology because technology apps do not treat patients but people do. This implies that however much we try to show that use of mobile technology can help in improving delivery of healthcare services, we must not forget to increase the number of doctors motivate them. In developing countries, healthcare providers are very few and some are paid low to the extent that they move out of the country to search for higher compensations. The government and the health sector may try very hard to implement mobile technology in the delivery of services but without the adequate number of providers, the technology would not be of any benefit.

However, going by the views of Quin et al., (2014) mobile phone technology is essentially pertinent in improving the self-care of individuals if the public, government and the physicians collaborate appropriately. The study investigated how smartphone technology is changing the health. They asserted that despite the recent proliferation of health applications and smartphones little was known on smartphone technology and how it promotes health care related practices. After various 3-month experimental survey, the study found that patients

have actively engage with their physicians and fully taken control of their health status. The study revealed that patients recorded daily activity, set individual and daily goals, as well as received daily videos and messages from physicians hence getting immediate feedback on their self-care progress. These actions increased self-efficacy and positively correlated with depression and anxiety decrease as outcome measures.

5.3 Conclusions

Since the start of using mobile phone technology to deliver healthcare services in MSF clinics in Kibera, many patients who claimed to have forgotten taking their medications or clinical visits were reminded and effectively adhered to clinicians' prescriptions via SMS or reminder setting by their mobile phone applications. From the study itself, acknowledge that from the positive responses from the MSF clinic patients, that mobile phone technology is able to address challenges facing healthcare sector in developing countries and thus cross the big gap existing in delivery of medical care especially of ARVs interventions for HIV patients. Furthermore, the findings showed that n=66.12% of the respondents agreed that the use of mobile phone technology improved their access to healthcare services. The results hypothesis also proved that use of mobile phone technology positively impacts the delivery of healthcare services.

In addition, the uptake of having the SMS so accessible on the mobile phones and the supporting systems as well, it significantly shown with current situations, how revolutionized communication in healthcare and improved and therefore, they are capable of changing how healthcare services are delivered. Due to many people living at Kibera informal settlement in Nairobi, the study was able to identify several gaps (health delivery gaps such medication and responsiveness uptake of ARVs) existing in delivery of healthcare services. However, it was found that the introduction of mobile phone in reminding the patients of pending healthcare

clinics, related health care education and importance of attending all the clinical visits prescribe by the doctor improve the health of the patients.

5.4 Recommendations

The following recommendations were drawn from the conclusions acquired from the study findings.

5.4.1 Recommendations on Research Findings

1. According to the study findings, the adoption and utilization of mobile phone technology in health service delivery in Kenya is low and constrained by plethora of factors. It also had its effects as well when it came to having responsiveness of HIV uptake to the MSF Clinic patients. This could be attributed by large population of more than 1 million slum inhabitants is severely affected by HIV/AIDS, malaria and other communicable diseases that becomes a common factor. This large population should also be a driver to completely adopt the use of mHealth in an attempt the efficiency of health service delivery in Kenya more so in Kibera.
2. Employing digital literate professionals is another method the government can use to enhance the mode of healthcare delivery among the staff in the healthcare centers and hospitals. With this, the HIV patients attending the MSF Clinic become beneficial on the know how regarding mobile technology services.
3. The government ought to equip the facilities with modern means of communication. For example, the government can use high speed internet and install it to every hospital so that it can be used to communicate to patients via social media platforms and emails.
4. Additionally, the healthcare donors should work out a formula where the current medical staff are retrained and equipped with basic digital skills to enlighten them on how to use emails, short message services and the bodies responsible in making technological related

policies should either zero rate the tax for the devices for communication or make the prices for mobile phones affordable to every citizen so that it will be easier for doctors to send message to their patients. Also create sustainable outreach programs HIV patients that can equip them that can contribute to their financial gain.

5. To be considered as well, if the Government can fund free healthcare awareness blogs or SMS deliveries to increase health awareness among its population.

5.4.2 Recommendations for Further Research

1. On the other hand, this study was constrained by using only a few variables namely; social economic and demographic status, gender, age, academic level of the respondents as indicators. To study lengthily the effects of mobile technology in bridging the gaps in health care system, a comprehensive future study is important to include all the variables related with mobile phone technology like values, religion, and culture of the respondents.

2. This study was only carried out in a single place i.e. Kibera Constituency for only MSF clinics, meaning that the data collected was limited to only urban area in a single location. Thus, the research recommends the future research to be done in other regions and the world at large as a way of increasing the research precision. The implementation of future mobile technology platform would make sure a remarkable change on how delivery of healthcare in the near future.

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APPENDICES

Appendix I: Students Questionnaire

KENYA METHODIST UNIVERSITY – NAIROBI

My name is Alice Ndwiga; I am conducting an external study on the effects of mobile technology in bridging the gaps in the healthcare service delivery in Kenya with a focus on Nairobi County, Kibera informal settlement. This is part of my academic research for completion of my higher education in the Kenya Methodist University.

The information provided will be kept confidential under all circumstances, and will only be used by the researcher in analyzing the findings obtained. This is an assurance that, your privacy in filling out this questionnaire is guaranteed since you are not required to indicate any of your names in this questionnaire. The questionnaire is divided into three parts A, B, and C. Please answer all the questions accordingly.

Tick appropriately (√)

PART A: BACKGROUND INFORMATION

1. Gender of the interviewee? (a) Male (b) Female
2. Age
 - (a) 25-30
 - (b) 31-35
 - (c) 36-40
 - (d) 41-45
 - (e) 46-50
 - (f) Over 50
3. Marital Status?
Single Married Divorced Separated Widowed
4. Educational Level of the respondent?
 - (i) High school
 - (ii) Diploma
 - (iii) Degree
 - (iv) Master's
 - (v) PhD

5. What is your occupation?
- i) Casual Laborer
 - ii) Carpenter
 - iii) Mechanic
 - iv) Business person
 - v) Tailor
 - vi) Small scale farmer
6. How long have you lived in this area?
- (a) Below 2 year
 - (b) 2-4 years
 - (c) 4-6 years
 - (d) Over six years
7. Have you ever visited Médecins Sans Frontiers (MSF) clinics in Kibera?
- (1) Yes (2) No

If yes, what is the frequency?

- (1) Rarely
- (2) Averagely
- (3) Regularly

PART B: IDENTIFY THE GAPS IN HEALTHCARE SERVICE DELIVERY

8. How would you rate the delivery of healthcare services in Kibera?
- High
- Average
- Low
9. Do you feel that you do not receive the amount of care you are supposed to receive due to your geographical and economic setting?
- Yes No

PART C. USE OF MOBILE TECHNOLOGY IN HEALTHCARE SERVICES

10. Do you get healthcare services from the clinics over the phone?
- Yes No

11. The use of mobile phone technology improves access to healthcare services

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

PART D: BRIDGING THE GAPS USING MOBILE TECHNOLOGY

12. I have increased my visits to the clinics for HIV services due to use of mobile technology?

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

13. The technology improves communication between healthcare providers and patients

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

14. The technology improves collection of health- related data

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

THE END ☺

Thank you for your participation in this study and for all the valuable responses provided.

Appendix II: Student Consent Form

**KENYA METHODIST UNIVERSITY – NAIROBI
SCHOOL OF HEALTH SCIENCES**

My name is **Alice Ndwiga**; I am carrying out a study on the impacts of mobile phone technology in bridging the gaps in healthcare service delivery in Nairobi County. Your clinic has been purposively selected to take part in this study.

You are therefore, at liberty not to answer the questions that might be injurious to you and your participation in this interview is purely voluntary, you can then choose to participate or not. In addition your participation is anonymous and all responses provided will only be used for this research purposes and no information will be made available to any third-party.

Finally, your participation in this research is highly valued and appreciated.

Are there any questions about what I have just explained? Are you willing to participate in this study?

Interviewee:.....

Signature:.....

Date:.....

Appendix III: Research Permit



KENYA METHODIST UNIVERSITY

P. O. BOX 267 MERU - 60200, KENYA
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FAX: 254-64-30162
EMAIL: INFO@KEMU.AC.KE

14TH APRIL, 2016

Alice Ndwiga
PHT-3-4231-D/2013
Kenya Methodist University

Dear Alice,

SUBJECT: ETHICAL CLEARANCE OF A MASTERS' RESEARCH PROJECT

Your request for ethical clearance for your Masters Research project titled "The Impact of Mobile Phone Technology in Bridging the Gaps in the Health Care Service Delivery in Kenya: A Case Study of Nairobi." has been provisionally granted to you in accordance with the content of your project proposal subject to tabling it in the full Board of Scientific and Ethics Review Committee (SERC) for ratification.

As Principal Investigator, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the project
2. Changes, amendments, and addenda to the protocol or the consent forms must be submitted to the SERC for re-review and approval prior to the ratification of the changes. The Proposal number assigned to the project should be clearly indicated in all correspondence.
3. Adverse events should be reported to the SERC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for SERC review. The SERC and outside agencies must review the information to determine if the protocol should be modified, discontinued, or continued as originally approved.
4. Only approved consent forms are to be used in the enrollment of participants. A consent forms signed by subjects and/or witnesses should be retained on file. The

NIB In 2016 NACOSTI requirement was not mandatory for school of Medicine & Health Science. They only needed ethical clearance. prof Gicunge

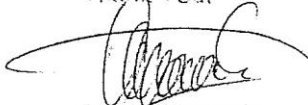
1/10/2019

SERC may conduct audits of all study records, and consent documentation may be part of such audits.

5. SERC regulations require review of an approved study not less than once per 12-month period. Therefore, a continuing review application must be submitted to the SERC in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion will result in termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.

Please note that any substantial changes on the scope of your research will require an approval.

Thank You.



Dr. A. Wamachi
Chair, SERC

Cc: Dean, A.Da.PGS