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PROSPECTS AND CHALLENGES OF TELEMEDICINE IN ZIMBABWE: A CASE STUDY OF NYATATE, NYAFARU AND TOMBO RURAL CLINICS IN NYANGA DISTRICT

BY

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Title page

Prospects and challenges of telemedicine in Zimbabwe: a case study of Nyatate, Nyafaru and Tombo rural clinics in Nyanga district.

Abstract

The study was carried at three rural health clinics (Nyatate, Nyafaru & Tombo) in Nyanga District, Zimbabwe. The aim was to analyse the prospects and challenges of telemedicine in Zimbabwe by taking a special look at the telemedicine pilot projects at Nyatate, Nyafaru and Tombo in Nyanga district which is a population size of 4100. From there a sample size of 52 was obtained. The purpose was to discover the scopes and barriers or challenges and prospects of its implementation within existing health care services. The objectives were to determine the attitudes of members of the community in the use of telemedicine, to determine healthcare workers perception in the use of telemedicine in their daily duties, to determine internet and infrastructure availability at the pilot clinics and lastly to recommend ways in which telemedicine can be provided for in Zimbabwe. Findings indicate that majority of patients are willing to use telemedicine as a health delivery system. Patients indicated that their attitude towards telemedicine use was determined by a number of reasons. These include; increased access to healthcare, increased quality of care, convenience and economies of scale. The other group of participants were the healthcare workers. Healthcare workers indicated that their perception of telemedicine in their daily work was determined by a number of reasons. The reasons included the level of work load, computer literacy, incentives and opportunity to learn. It emerged from the research that there is inadequate infrastructure in rural hospitals which may render even skilled professionals non useful. This inadequacy limits or compromises diagnostic ability at rural health centre level but, through telemedicine, skilled doctors will be able to offer diagnostic solutions. Integrating current health systems with telemedicine can help in the adaptation of this new technology. This can be done by starting from the national level going down to the rural health centre level. The researcher recommends the need to carry out more awareness campaigns in order to increase the level of telemedicine awareness among the members of Nyatate, Nyafaru and Tombo communities. Healthcare workers should be trained on the use of telemedicine technology, they should also be given incentives so as to increase motivation of telemedicine use and more health care workers should be employed in order to reduce work load from existing staff.

Key Words: Telemedicine, health, technology

Declaration Page

I declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a degree.

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List of Acronyms and Abbreviations

ICT	Information Communication Technology
HIT	Health Information Technology
ITU	International Telecommunications Union
ZTN	Zimbabwe Telemedicine Network
POTRAZ	Postal and Telecommunications Regulatory Authority of Zimbabwe
HIV	Human Immune Virus
VSAT	Very Small Aperture Terminal
NGO	Non-Governmental Organizations
ADSL	Asymmetric Digital Subscriber Lines
TOE	Technology-Organization-Environment
SDG	Sustainable Development Goals
UNICEF	United Nations Children's Fund
MoHCC	Ministry of Health and Child Care
SSA	Sub-Saharan Africa
ECG	Electrocardiogram
ZAPS	Zimbabwe Assisted Pull System

Definition of terms

Telemedicine refers to the use of information communication technology (ICT) for connecting patients to medical professionals in distant places

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Telemedicine refers to the use of information communication technology (ICT) for connecting patients to medical professionals in distant places. It involves the transmission of patients' data in the form of visual image videos and digital images with a view to facilitating diagnosis and care. It can also be defined as the quick access to shared and remote medical expertise by means of telecommunications and information technologies, no matter where the patient or appropriate information is located. Medical data is transferred through communicated through audiovisual media for the purpose of consulting. Sometimes remote medical procedures or examinations are also done. It is a modern and growing notion in the world. Information and communication technology (ICT) is playing an important role in improving the health care of both individuals and communities. Telemedicine health care services depend on technology. In Zimbabwe the few specialists and services available are concentrated in cities. Rural health workers, who serve most of the population, are generally isolated from specialist in the cities who support with up to date information. The situation is made worse by poor roads, scarce and expensive telephones, and a lack of library facilities. By using telemedicine, barriers of physical distribution of medical resources are overcome. Medical personnel and expertise can be accessed virtually.

Accurate and timely delivery of health care requires efficient systems and access to quality data to all the people involved in care delivery. Health Information Technology (HIT), if utilized appropriately, can help in providing the right care at the right time. Telemedicine has high potential in accomplishing this objective. According to a study

by Yap (2012), the adoption of telemedicine by care providers has not been very encouraging.

Due to the progression in medical technology, the cost of treatments becomes higher. Hospitals cannot manage to pay for high cost equipment used for diagnosis and treatment. Due to shortages of resources for treatments of complex cases, such as bypass surgery of heart, surgeries, trauma care, etc., people living in rural areas need to travel long distances to access more costly and complex levels of care (Rasid and Woodward, 2005). Well-equipped hospitals are privately owned and located in the urban areas like Harare.

Telemedicine links between hospitals and other medical institutions could bring overall enhancement of health-care services by centralization and management of resources, such as specialists, hardware and software packages. The maternity units in the rural clinic could be allied by a telemedicine link to the maternity service in a large district hospital or to the referral hospital. This will allow distant monitoring of the health of pregnant women, especially those with pathological problems. The modernization of internal communication in the hospitals could considerably improve the efficiency of health-care delivery. It could be the basis for the introduction of telemedicine services in Zimbabwe.

1.2 Background to the study

Despite an increase in the use of information communication technologies in various sectors and internet penetration in Zimbabwe, the use of such applications in telemedicine has been limited to voice and text (Tsokota &Solms, 2013).With a teledensity of 100%, a nation like Zimbabwe could exploit the digital expansion by introducing telemedicine in rural areas where access to medical care is a nightmare

(Muvoti, 2013). According to the International Telecommunications Union (ITU) by Dec 2011, Zimbabwe had about 1.4million (12% of the population) accessing the Internet. The country continues to increase its access into the World Wide Web through numerous fibre optic links linking the country to the rest of the world through international links such as the SEACOMM cable in the Indian Ocean (Zimbabwe's E Health Strategy, 2012-2017). The mobile phone communications rate was estimated at 78.5% by the Postal and Telecommunications Regulatory Authority of Zimbabwe by March 2012.According to POTRAZ's Third Quarter Sector performance results of 2018, mobile internet and data utilisation increased by 21.1% to record 7,395TB from 6,104TB recorded in the second quarter. These increases in internet use pose an opportunity for telemedicine in Zimbabwe.

According to Hill (2014) barriers that prohibit residents of rural and remote areas from accessing medical care services can potentially be alleviated using telemedicine. Telemedicine is primarily used by physicians to diagnose, treat and follow patients at distance. The literature commonly uses the terms telehealth and telemedicine interchangeably but, in this dissertation, telemedicine will be used to define the use of ICT to diagnosis, treat and prevent illness at a distance.

According to the triple Aim framework (2012) developed by the Institute for Healthcare Improvement, there are three modes of telehealth, namely, telemedicine, health help lines, and online mental health therapy. These are evaluated for their ability to simultaneously improve population health through improved access and to improve the patient experience in rural and remote areas while maintaining or decreasing the per capita costs of health care.

In 2014, telemedicine pilot projects were introduced in Nyanga District at three rural clinics, namely Nyatate, Nyafaru and Tombo. This was done through Zimbabwe Telemedicine Network (ZTN). Clinical consultations where introduced remotely and in real-time via video conferencing between a rural health centre (Nyatate, Nyafaru and Tombo rural clinics) and a doctor located at an urban site (Nyanga District Hospital). The aim was to establish a telemedicine link between Nyanga District Hospital (an urban site) and the rural health centres and to demonstrate the potential of telemedicine in remotely managing non-communicable diseases such as hypertension.

This research analyses the prospects and challenges of telemedicine in Zimbabwe in terms of health care delivery and demonstrates how this technology can improve health care delivery in Zimbabwe as a whole. This research will explore the condition of ICT infrastructures, current status of telemedicine and the future of telemedicine in Zimbabwe. The central focus is on the current use of telemedicine in the three pilot projects (Nyatate, Nyafaru& Tombo) under study with particular emphasis on the prospects and the challenges in healthcare delivery in those areas.

1.2.1 Case study

A cross sectional study was conducted at Nyatate, Nyafaru and Tombo rural clinics that are located in Nyanga district in Manicaland province. Nyanga district has 11 referral clinics. These clinics refer appropriate cases to the district hospital. With the unavailability of adequate health professionals and other essential resources needed for the provision of health services, a telemedicine pilot project was launched in 2014 in Nyanga district. During the first four months of the service, 1 April to 30 September 2015, 976 tele-consultations were carried out. Of the 976 consultations; 718 were new consultations and 258 were reviews (out of 285 scheduled). 153 patients were referred

to the hospital after a tele-consultation. The patients selected for tele-consultation were those that nurses were going to refer and those that the nurses were unsure whether referral was warranted. None of the patients refused a tele-consultation. 74% of the patients were female. The percentage clearly reflects the demographics of this Nyanga district. According to heads of the community (chiefs, headmen) most of the adult males who complete their high school migrate to urban areas in search of work. 36% of the patients consulted were over the age of 65 and 10 % were below the age of 15 years.

At least a third of the referred patients had hypertension. 153patients were referred from the clinic, with 566 having been saved a referral. Referrals were for admission or for a procedure such as abscess drainage, X-ray, ultrasound or a specific blood test not available at the clinic. The aetiology of those referred included HIV related illnesses, trauma, abscesses, fibroids and benign prostate hypertrophy or prostate cancer.

Internet connection in Nyanga district is mostly without challenges but rain and overcast conditions tends to affect the quality of video calls. Power outages also occur during consultation sessions and this is mitigated by use of a generator. There are days when there is no connection at all. Bad connections result in cancellation of consultations. The connections have improved with the installation of the 3G mobile phone backup. 3G backup is used when satellite link or electricity is unavailable. 3G network is not affected by weather but it is 2.5 times as expensive as satellite data transmission. Monthly VSAT data transfer ranges from 5-8 Gigabytes.

In addition to discussions of held with the nurses during each teleconsultation over the last five weeks, one live session was introduced to review and discuss management of cases that would have been presented during the week. These sessions were introduced

as a way of building capacity for the rural health centre nurses. The researcher will interview both the patients and health care workers at the rural health clinics (Nyatate, Nyafaru and Tombo) at the time of data collection.

1.3 Statement of the problem

Initially statistics for Nyatate, Nyafaru and Tombo telemedicine pilot project indicated a high uptake level. However, this trend was out sustained. With time figures began to show a significant loss of uptake despite the pilot project being far from being over. The pilot project is set to close by end of 2020. According to the telemedicine medical records (2014 &2015), for the three rural clinics there is a decrease in the uptake of telemedicine.

The records are as follows:

Table 1.1: Nyatate, Nyafaru & Tombo telemedicine records, (2014 & 2015).

Year 2014	Clinic Consultations	Referrals	Year 2015	Clinic Consultations	Telemedicine Consultations	Referrals
April	588	75	April	441	135	35
May	529	84	May	432	135	35
June	446	75	June	575	175	30
July	405	82	July	449	135	28
August	288	51	August	301	74	15
September	250	45	August	280	65	10

The figures clearly show that telemedicine consultations were constant in the month of April and May. They increased in June then drastically started to fall months and

years following up to date. The clinics see on average over 600 patients a month during the malaria season which is from February to June annually, with decreases outside the malaria season. Telemedicine consultations averaged 201 per month. As shown by Table 1.1 the number of clinic consultation began to also go down as telemedicine uptake went down. The project received donations from Government of Zimbabwe through POTRAZ. The donation was in the form of transportable devices used in telemedicine and internet connections. After that no other support came, so there was no monitoring and evaluation of the project. The reasons for both clinic consultations and telemedicine consultations low uptake are unknown. The communities are clearly not using the clinics as a source of healthcare as evidenced by the low clinic consultations. Hence the need to carry out a research on the causes of the low uptake and if there are any prospects for telemedicine in Zimbabwe.

1.4 Purpose of the study

The research aims to investigate the current situation of telemedicine in Zimbabwe, with particular reference to Nyatate, Nyafaru and Tombo rural clinics in Nyanga district. The principal purpose is to determine scopes and barriers or challenges and prospects of its application within the Ministry of Health. The study will provide a basis for advance studies of telemedicine. The study will help promote implementation of telemedicine in Zimbabwe by looking at the current prospects and challenges. It will provide a basis for advance studies of telemedicine.

1.5 Research objectives

The research objectives were to:

1.5.1 Assess the attitudes of the community towards telemedicine.

1.5.2 Determine the perception of clinical workers in the use of telemedicine in their daily duties.

1.5.3 Assess the levels of access to internet and infrastructure at Nyatate, Nyafaru & Tombo rural clinics.

1.5.4 Recommend ways in which telemedicine can be provided for country wide.

1.6 Research questions

1.6.1 What is the general attitude of members of the community towards telemedicine?

1.6.2 How do clinical workers perceive telemedicine in relation to their daily duties?

1.6.3 Is the internet and infrastructure adequately available in Nyatate, Nyafaru & Tombo rural clinics?

1.56.4 How can telemedicine be provided for country wide?

1.7Assumptions

- There are health services delivery problems in Nyanga district.
- Telemedicine pilot projects launched at Nyatate, Nyafaru and Tombo rural clinics are currently running.

1.8 Significance of the study

Telemedicine ameliorates problems posed by the shortage of medical professionals in rural areas. Once the rural health centre is connected to the district telemedicine centre, the rural health centres will have automatic access to doctors and other medical professionals. These medical professionals include pharmacist who cannot be

stationed at rural health centres. There is inadequate infrastructure in rural hospitals which may render even skilled professionals non useful. This inadequacy limits or compromises diagnostic ability at rural health centre level but, through telemedicine, skilled doctors will be able to offer diagnostic solutions.

There are a large number of patients who require referral for specialist care either for diagnosis, definitive management or review. Currently these patients have to travel long distances in order to access specialists. Telemedicine offers telereferrals which bring convenience and quicker turnaround time. There is a low availability of health experts (if any) in remote health centres (due to unattractive conditions of service, brain drain and low population density). Health experts are made available to rural health centres via video link. There are limited opportunities for training for healthcare professionals in rural centres. The telemedicine platform can be used to deliver continuous medical education through live lectures, discussion and presentations. A significant proportion of patients in remote locations can be successfully managed with some advice and guidance from doctors through electronic delivery of diagnostic and health care services. Therefore, it is important to analyse the prospects and challenges of telemedicine in Nyanga District and propose, if possible, its adoption at the national level.

1.9 Delimitation of the study

The researcher will sample patients who would have come to any of the three rural clinics (Nyatate, Nyafaru, and Tombo) at the time of data collection. The researcher assumes that those who decide to come to the rural health centre are in need of some medical assistance.

1.10 Limitations of the study

The researcher will incur high transport cost travelling from Harare to Nyanga District to collect data. Further cost will be incurred travelling between Nyanga District Hospital and Nyatate, Nyafaru and Tombo rural clinics, for the same purpose. Whilst health professionals are likely to appreciate the objectives of the research, members of the public might be sceptical which might affect the data collection process. Appropriate public relations strategies might need to be employed in order to gain the trust of the community. It is intended therefore to use the existing traditional structures such chiefs and headmen. In addition, there are village health workers who may assist.

1.12 Layout of the research

The remainder of this dissertation is organized as follows. In the next chapter there will be a comprehensive review of published and unpublished work from secondary sources of data in the area of telemedicine. From the literature review in Chapter 2, a conceptual framework will be formulated, from which the research was based. Chapter 3 highlights the methodology that was used in the research. This included the types of data that was collected and the methods used to analyse the data. Chapter 4 presents and analysis the research findings. Lastly, chapter 5 shows the overall conclusion of the research in relation to the research objective, the recommendations and further areas of study.

CHAPTER 2: REVIEW OF RELATED LITERATURE

2.1 Introduction

Telehealth, Tele-care, and Telemedicine are some of the terms used to describe delivery of health care services using information and communication technologies. Telemedicine, which is an aspect of Telehealth, involves providing clinical care, including diagnosis and treatment of illnesses, and patient monitoring and follow up through the use of information and communications technologies (ICT) (Abdelhak et al., 2012). It enables the chronically ill and elderly to live independently in their own homes, thus lowering the cost of nursing home stays (Maestrutti, 2011). Telemedicine has been successful in many countries due to the availability of the necessary technological and computing resources. Most people in the world remain underserved due to acute lack of doctors and specialists; particularly in the developing countries. People that mostly suffer in developing countries are those that live in the remote or rural areas. Most health care providers do not want to work in such areas due to the lack of infrastructure among other factors (Kalam, 2011).

Telemedicine is straightforward, two health professionals discussing a case over the telephone, or via a satellite technology and videoconferencing equipment to conduct a real-time consultation between medical specialists in two different geographical areas. According to Ukaoha (2012), telemedicine can be broken into three main categories namely; store-and-forward, remote monitoring and interactive services.

2.1.1 Store and forward telemedicine.

This is when you store medical data such as medical images and then forward this data to a medical doctor for assessment offline when they are free to do so. Both the doctor and the patient are not required to be there in order for the assessment to happen.

Dermatology (tele-dermatology), radiology, and pathology are common specialties that are conducive to asynchronous telemedicine. A key difference between traditional in-person patient meetings and telemedicine encounters is the omission of an actual physical examination and history (Bhore, 2017). It allows the doctor to rely on a history report. There are very few sustained telemedicine services that have been integrated into routine service in sub-Saharan Africa. Several free international humanitarian store and forward telemedicine services exist and are available to doctors in sub-Saharan Africa but they are not being used. An example is the Swinfen Charitable Trust which offers free store and forward telemedicine services to 153 hospitals and clinics in 50 countries around the world (Mars, 2010).

2.1.2 Remote monitoring telemedicine

This involves self-monitoring and testing. It authorizes medical doctors to monitor a patient remotely using various technological devices. The method is mainly used for managing lifelong illnesses such as diabetes, heart diseases, asthma, etc. With this aid different outcomes can be obtained such as the supply of greater satisfaction to customers and the cost effectiveness of the service (Khandpur, 2017).

2.1.3 Interactive telemedicine

Khandpur (2017) states that interactive telemedicine are services provided in real time between patients and provider. These include phone conversations, online communication and home visit. Sasikala (2018) indicates that many ventures such as history review, physical examination, and psychiatric evaluation and ophthalmology assessments get conveyed in a mode comparable to the traditional face-to-face visits. Doctor interactive telemedicine may be less costly than in-person clinical visit.

2.1.4 Application of telemedicine

Telemedicine can be applied in different departments in the healthcare delivery system. These are namely, telenursing, telepharmacy, telerehabilitation, teletrauma care, telepsychiatry, telepathology and teledematology, among others.

2.1.4.1 Telenursing

It involves the application of telecommunication and information technology to provide nursing services in health care when both the doctor and the patient can't be in the same geographical space. Telenursing reduces the cost of health care and improve coverage of health care in remote and sparsely populated areas. It may also help solve the problem of shortage of nurses by overcoming distance and saving on travel time, and by retaining patients out of the hospital. Telemedicine nurses can provide pre-surgery services with the guidance of a medical doctor. These nurses can also help continue to develop the best practices for specific circumstances as they arise (Poudel & Nissen, 2016).

2.1.4.2 Telepharmacy

It is the delivery of pharmaceutical care through telecommunications to patients in locations where they have no access to a pharmacist. Telepharmacy assistance includes drug therapy monitoring, patient counselling, prior permission and refill support for prescription drugs. Telepharmacy has many recognizable benefits such as the easy access to healthcare services in remote and rural locations, economic benefits, patient satisfaction as a result of medication access and information in rural areas, effective patient counselling, and minimal scarcity of local pharmacist and pharmacy services. Telepharmacy unquestionably is a great concept, but it is sometimes challenging to put into practice. Essential to the adoption of these practices are legal challenges and pitfalls that need to be addressed. The start-up of telepharmacy (hardware, software,

connectivity, and operational cost) involves considerable time, effort, and money. Poudel and Nissen (2016) state that, for rural hospitals with fewer patients, the issue of costs appears to be one of the biggest barriers to telepharmacy services. Moreover, execution and implementation of comprehensive and uniform telepharmacy law is still a challenge. A well-developed system, however, can usher the practice of pharmacy that is beneficial to both the rural communities and the hospitals or retail pharmacies that deliver these services.

The four different types of telepharmacy.

2.1.4.2.1 Inpatient (remote order-entry review)

Inpatient telepharmacy refers to a pharmacist at a remote location performing remote order-entry services for an inpatient pharmacy at a hospital. The remote pharmacist reviews medication orders before the hospital staff administers the drugs to the patient.

It is useful as it benefits hospitals and health systems. Inpatient telepharmacy allows for real-time medication order review and verification. Remote order-entry review in a health system serves as an extension of the in-house pharmacy. With inpatient telepharmacy, remote pharmacists are able to provide 24/7 coverage or fill-in during peak hours to help supplement and strengthen the inpatient pharmacy.

2.1.4.2.2 Remote dispensing (retail/outpatient/discharge)

A remote-dispensing site, or retail community telepharmacy, is a licensed brick-and-mortar pharmacy staffed by a certified pharmacy technician. A pharmacist supervises the technician, reviews prescriptions and performs his or her duties from a remote

location via technology. Imagine a traditional pharmacy, except the pharmacist is located off-site.

According to Schladetzky (2018) telepharmacy is typically used in retail community pharmacy and outpatient/dischargepharmacy settings, telepharmacy gives patients convenient access to a pharmacist and prescription medication no matter geographic location. Remote dispensing allows healthcare organizations to open retail telepharmacy sites in areas where a traditional pharmacy would not be feasible by sharing the cost of a pharmacist across multiple stores. Additionally, telepharmacy works to reduce readmission rates by improving patient adherence, helps improve financial performance and creates a better patient experience all while expanding your geographic footprint.

2.1.4.2.3 IV admixtures

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) defines IV admixture as, "the preparation of pharmaceutical product which requires the measured addition of a medication to a 50 mL or greater bag or bottle of intravenous fluid." Hospital pharmacies can save time and money by implementing telepharmacy in the IV-admixture cleanroom. If a pharmacist can review the IV admixture remotely, they save the time needed to suit up and enter the cleanroom to review the solution. Freeing up pharmacists' time allows them to focus on clinical activities and other revenue-generating tasks (Schladetzky, 2018).

2.1.4.2.4 Remote counselling

Remote-patient counselling equates to pharmacists providing patient counselling via a live-and-interactive video session, or by some means through telecommunications. Remote-patient counselling allows pharmacists to consult and provide a variety of

pharmacy-care services to patients via secure, live-video calls. Beyond being beneficial to retail independents, community, clinic and hospital-based pharmacies, remote counselling also provides opportunities for specialty counselling (diabetics/HIV/AIDS), discharge counselling and various clinical interactions with pharmacists (Schladetzky, 2018).

2.1.4.3 Telerehabilitation

It is the transmission of recovery assistance over telecommunication networks and internet. Khandpur (2017) states that telerehabilitation can give treatment to people who cannot travel to dispensary because the patient has geographical barriers. During treatment, specialist can join in clinical discussions from a distance. Critical areas of telerehabilitation research are demonstrating likeness of assessment and therapy to in-person evaluation and therapy and building new data collection structures to digitize information that a therapist can use during treatment. By using ICT, client access to care can be improved and the reach of clinicians can outspread beyond the physical walls of a traditional healthcare facility, thus increasing continuity of care to persons with disabling conditions. The idea of telemedicine, when telerehabilitation is used to deliver services to clients in their homes or other living environments, empowers and enables individuals to take control of the management of their medical needs and interventions by enabling personalized care, choice and personal control. Brennan et al (2009) indicates that there is a wide variety of assessment and treatments that can be delivered to clients using remote monitoring systems, robotic and virtual reality technologies, and synchronized collaboration with online material.

2.1.4.4 Teletrauma

Is the use of telecommunication to improve competence and success of the transfer of attention in emergency situations. Trauma experts can communicate with personnel during emergency situations through the network using mobile applications. They can provide clinical evaluations and decide if those injured should be evacuated for urgent attention. Remote trauma experts an provide the same quality of clinical assessment and plan of care as injury expert located physically with the patient. Using telemedicine, trauma specialists can relate with personnel on the scene where the injured person is through the internet using mobile devices, to determine the severity of injuries. They then offer clinical evaluations and determine whether those hurt must be evacuated for necessary care. Trauma specialists can offer the same quality of clinical assessment and strategy of care as a trauma specialist located physically with the patient (Disabled World, 2015)

2.1.4.5 Telepsychiatry

It is the use of video conferencing for patients living in underserved areas to access psychiatric services. Services include meeting between the psychiatrists, educational, clinical programs, investigation and evaluation. Most telepsychiatry gets initiated in real time. Real-time telepsychiatry is well established in the developed world. The need for expensive videoconferencing equipment, adequate bandwidth and the ability to converse in the patient's language has limited its uptake in Africa. A pilot project has been reported of telepsychiatry from Somaliland to Somali Diaspora groups in Europe using Skype (Abdi & Elmi, 2011). In South Africa a number of studies have led to a videoconference-based service, with the development of clinical, operational and technical guidelines and an administrative model for telepsychiatry (Chipps et al, 2012).

2.1.4.6 Telepathology

It is the study of pathology at a distance. It uses telecommunications technology to transfer data from a distance for diagnosis, education and investigation. The pathologist selects the video images for review and renders examination. Telepathology brings advantages in terms of personnel, operational and quality of service. This brings it to be the solution for problems arise in the today's medical field. However, its disadvantages and challenges have restricted it from being widely used. The main problems are the high cost fee of the software, set-up components and maintenance, high complexity of the system, security issues and inconvenient in slide selection, (Krishnappa, 2013). There are different types of telepathology which are:

2.1.4.6.1 Static Telepathology (or store-and-forward)

Involves the process of pre-selection and digitization of representative image by sender pathologist. Thereafter, these images are transmitted to a remote telepathologist via e-mail or the Internet (Sowter, 1998). One of the benefits of static telepathology is the low building up fees. It is due to no special software is required to view the images and it requires only some basic components for setting up such as microscope, camera and internet (Habeeb et al 2012). However, there are some disadvantages such as the possibility of missing a potential diagnostic importance area with a glass slide, lack of clarity at low power magnification, lack of focus in still images, labour intensive and the sampling errors may occur (Schrader et al, 2008).

2.1.4.6.2 Dynamic Telepathology (or real time)

It involves the transmission of microscopic slide images to recipient in real time via live telecommunication (Kaplan et al, 2002). With the implementation of remote robotic microscope recipients can completely control the magnification and slide.

However, this sophisticated system is expensive and not easy to maintain. It is fitted with charge coupled device (CCD) video camera, high-resolution video monitors, proprietary software and dedicated, high performance hardware (computer). Besides that, it needs a stable and broad-bandwidth telecommunication link between the sender and the recipient.

2.1.4.6.3 Hybrid Telepathology (or virtual)

Hybrid telepathology combined both static and dynamic telepathology system; having the advantages of both systems. Williams et al (2010) states that a series of images are automatically stitched together in software, compressed to a single file form and transmitted once the dynamic telepathology session start. This fastens the consultation process of recipient as less time is required to control the robotic microscope.

2.1.4.7 Teledermatology

It provides dermatology information over a range using audio and visual. Applications include health care administration such as diagnoses, consultation and treatment as well as ongoing study of medication, (Bhore, 2017). The Africa Teledermatology Project has set up a Web based service with educational material available on its site (Kaddu et al, 2009). Two reports of its use in seven and later 17 countries showed an average use of approximately 1 case sent per country per month (Weinberg, 2009). Low use of humanitarian telemedicine services such as the Swinfen Charitable Trust by doctors in Africa has been documented and possible explanations for this, provided (Wootton, 2008).

2.1.4.8 Tele-education

It is long distance education carried out with the use of telecommunication. Tele-education is by far the most successful use of ICT in health in Africa. This is consistent with reports from Canada, Australia and the US where tele-education reduces the sense of isolation experienced by rural doctors (Ricci, 2005). The University of KwaZulu-Natal has been providing continuing medical education by videoconferencing since 2001 with over 40 hours of interactive sessions broadcast per week by 2010. The model was based initially on sharing broadcasts of existing postgraduate seminars. This has expanded into the provision of academic programmes in telemedicine and medical informatics to students in nine African countries, all of whom take the interactive courses from their home country with additional learning materials supplied through a learning management system (Chipps, 2012).

2.1.5 Benefits of telemedicine

Telemedicine has the potential of improving health indices, if infrastructural challenges are addressed. Telemedicine bridges the gap between health care specialists and rural communities. Telemedicine helps doctors in distant and remote areas to avail themselves of timely consultations with specialists without going through long hours of travel across distances (Miller & Derse, 2002).

Telemedicine can be enormously beneficial for people living in remote communities. Patients who stay in remote areas can be seen by a doctor or expert, who can offer an exact and complete check-up, the patient won't have to travel long distance or times like those from conventional hospital or general practitioners' visits (Miller& Derse, 2002).

The introduction of modern communication technology in the health industry has resulted in opportunities for the delivery of better, effective and efficient health services. Even the developed countries are taking steps to establish telemedicine to reduce their health expenses. The United States has a plan to establish telemedicine (EHR) which will save 77 billion dollars annually, coordinate care, measure quality, and reduce medical errors, (Obama Health Policy document, 2008).

Telemedicine is also useful as a communication tool amongst general practitioners and specialists available at remote locations. It can be used as a education instrument, by which skilled medical staff can observe, show and instruct medical staff in remote location. They can provide more effective and faster medical examination techniques (Boulanger et al., 2001).

Telemedicine has been shown to reduce the overall cost of healthcare and increase efficiency through better management of chronic diseases shared health professional recruitment, reduced travel times, and fewer or shorter hospital stays. Several studies have documented increase patient satisfaction of telemedicine for some years now (Mbarika, 2004).

The socioeconomic changes of recent decades are increasingly affecting the age structure of modern societies. The improvement in the quality of life, which materializes in better food and hygiene conditions along with improved efficiency of health policies and health systems, leads to a demographic transition characterized by an increasing number of adults and a decreasing proportion of younger population. This situation poses new challenges because of the higher prevalence of chronic diseases, which, in turn, entail high health care costs that are actually growing in most countries. Even though the influence of lower death rates and longer life expectancy

on health costs is still under study, available evidence seems to indicate that the current model of intensive use of health care resources during the last stage of life is shifting to increased expenditure in prevention and treatment of chronic diseases (Payne, 2007).

According to a study by Ukaoha and Egbokhare (2012) carried out in Nigeria, there are several other benefits derivable from using telemedicine in a developing economy such as Nigeria. These benefits are:

2.1.5.1 Supports health-care delivery in distant remote sites and villages.

Ukaoha and Egbokhare (2012) mention that roads in Nigeria are in a bad state therefore access to patients in remote rural areas becomes a big problem. With telemedicine, doctors can remotely attend to such patients, send health-tips to them, and monitor their medical conditions and access feedback from them.

2.1.5.2 Connect primary care physicians, providers, specialists and patients.

With the help of telemedicine, different categories of health workers could liaise and interact amongst themselves while sharing vital information, current health practices and experiences.

2.1.5.3 Offers improved access to quality healthcare delivery.

Patients in remote locations have equal access to quality medical healthcare as those in the urban areas.

2.1.5.4 Cheap healthcare delivery.

Reducing or containing the cost of healthcare is one of the most important reasons for funding and adopting telehealth technologies. Telemedicine has been shown to reduce

the cost of healthcare and increase efficiency through better management of chronic diseases, shared health professional staffing, reduced travel times, and fewer or shorter hospital stays (Boulanger et al., 2001).

2.1.6 Disadvantages of telemedicine

A study carried out at St George's Hospital, London, UK by Hjelma (2005) shows that telemedicine results in breakdown in the relationship between health professional and patient. A breakdown in the relationship between health professionals brings about issues concerning the quality of health information from both the patient and the medical practitioner. The breakdown is due to a number of reasons which include:

2.1.6.1 Physical and mental factors

Patients suffering from reduced vision or who are hard of hearing are likely to have some difficulty following the information presented in a video consultation. It seems, however, that by displaying questions as text and using sign language, these limitations can be overcome.

2.1.6.2 Depersonalization

During a teleconsultation, the images of both the health-care worker and the patient are projected onto a monitor and all interactions between the two parties are indirect. There is subjective evidence that elderly patients at times do not accept that a physician, appearing on what looks like a TV screen, can see and listen to them properly. In one instance, a resident in an old people's home participating in a trial asked the female research assistant sitting next to her to repeat what was said by the male physician on the monitor, and finally asked the research assistant, 'Why are you talking to me in a man's voice?' (Hjelm et al., 2005)

Telemedicine has been successful in many countries due to necessary technological and computing resources. Most people in the world remain underserved due to acute lack of doctors and specialists; particularly in the developing countries. People that mostly suffer in developed countries are those that live in the remote or rural areas. Most health care providers do not want to work in such areas due to the lack of infrastructure among other factors, (Kalam, 2011).

The introduction of modern communication technology in the health industry has resulted in opportunities for the delivery of better, effective and efficient health services. Even the developed countries are taking steps to establish telemedicine to reduce their health expenses. The United States has a plan to establish telemedicine which will save 77 billion dollars annually, coordinate care, measure quality, and reduce medical errors, (Obama Health Policy document, 2008).

2.2 Conceptual framework

The framework figure 2.1 below describes an approach to optimizing telemedicine system performance. The aim of the framework is to take a look at the factors that may affect the implementation and success of telemedicine in other words, the determinants of telemedicine use. These are:

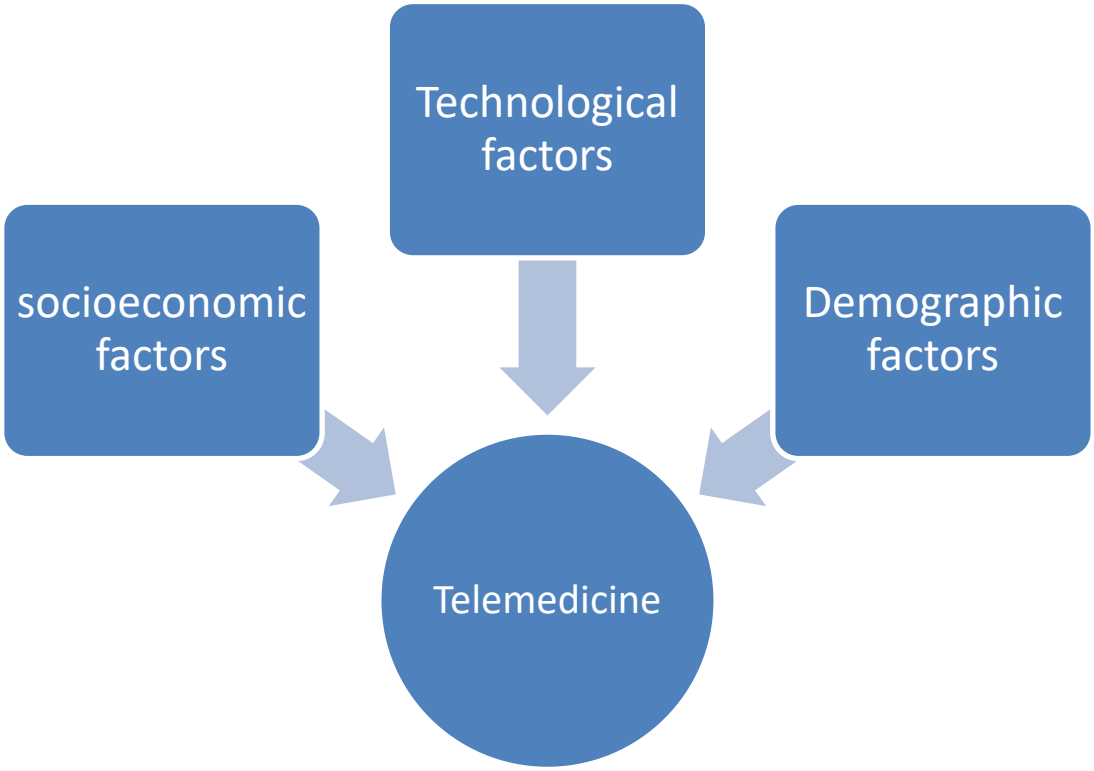


Figure: 2.1 conceptual framework

i) Socioeconomic factors-. Socioeconomic refers to society related economic factors. These factors relate to and influence one another. The socioeconomic factors that determine health include employment, education, and income. There is a direct correlation between level of education, employment and income. Thus, these socioeconomic factors have a direct influence on health. An educated person is likely to be more cautious about their health and have better health practices such as safe sex, balanced diet, avoiding smoking etc.

ii) Technological factors-There are a number of technical factors that affect the use of telemedicine. One of the known factors is the quality of internet connection. Good internet connection is fundamental to the success of telemedicine. Also, medical stuff should be trained. This factor is seen as

one of the most important barriers to telemedicine use because, in general, health professionals are not trained in the use of this technology during medical school. Technical factor is the frequency of technical failures. These technical failures may cause delays in the use of telemedicine, or discourage some telemedicine services users.

iii) Demographic factors-there is need to take note of any demographic variables that correlates with acceptability of communication technologies and telemedicine. These factors include gender, age, race, geographical location etc. the analyses are on whether demographics affect the use of telemedicine. Elderly people are often resistant to the use of technology; most of them may be a bit sceptical about it. Most senior citizens from the rural areas have different opinions on how medical services should be rendered. These opinions may have a positive or negative effect on telemedicine

In order to achieve the telemedicine success there is need to focus on individuals and families, redesign of primary care services and structures, population management, cost control and system integration and execution.

2.2.1 Socioeconomic factors

Mars and Erasmus (2012) state that poor countries have small budgets and even smaller health budgets. The governments of 20 African countries budget less than US$20 (about R160) per capita per annum for health. This amount includes the costs of ICT for health purposes. Thirty-one African countries have fewer than 10 doctors per 100 000 people. In comparison with European countries; Germany has 240 doctors

for every 100 000 people, Italy has 370 and Norway has 380. Telemedicine is seen as a solution to the shortage of doctors in Africa.

However, Mars and Erasmus (2012) acknowledge that it is often forgotten that telemedicine adds additional steps to the normal work flow of already overburdened doctors and nurses at both the sending and receiving sites. In support, Mars (2013), states that there are still major barriers to its ability to reach the people. While much has been written about the potential benefits of telemedicine in Africa, uptake has been limited. There are many obstacles not least of which are the shortage of doctors and the unfortunate reality that most telemedicine activities add extra steps into the routine clinical workflow, adding burden to already overworked doctors and nurses. According to Mars (2010) hospitals and clinics in 13 African countries have used the service. Data from 2007 show that only seven of 206 cases referred that year were from six African countries and of the six doctors who referred cases, only one was a local national.8 Why is use of a free service low? Possible reasons for this are: cost, lack of infrastructure or access to infrastructure, ignorance, workload, lack of training, issues of remuneration and legislative and policy barriers.

Some of the barriers include:

2.1.2.1 Infrastructure barrier

According to a paper by Kalam (2011), information infrastructures includes a balanced practical match surrounded by schedules of work practice, technology, and large range of organizational as well as technical property. It is set for a wide diversity of consumers and consumer groups, and made to work in a determined way with a consulted order concerned with it. All of these features are really relevant to

telemedicine arrangement, where telemedicine is being used for a large number of consumer groups.

Health care information infrastructures have several types of information that are interrelated as well as overlapping. The same information may be transmitted in different ways, for example, a digital X-ray image can be transmitted through a multi-media conferencing system or attached through an email. Moreover, one organizational unit may communicate with several units of that organization for outside of that organization in different purpose. These interconnecting properties make the systems having multi-level applications and turn the systems into infrastructure (Hanseth & Monteiro, 2002).

Norris (2002), states that digital communication gives healthcare information that is more accurate, more complete and better quality that lead to better access and affordable health care. Discharge letters are similarly available without delay. Different countries are promoting a subsidized scheme for low-income families to help them gain home access to the internet. The internet could be used for health promotion with web sites targeting both children and parents. Good access to the information is concerned more with the individual who would want to pull information from the internet or other sources to answer specific questions. A preferred approach is therefore to set up a smaller number of resource sites and make this available for users through telemedical links. In case of teleradiology, clear cost savings have been identified. It has been around long enough for practitioners to create marketable services and optimize the operation procedures. Therefore, for strengthening the system of health care, any health care institution can adapt the new approaches of health care technologies. Inadequate broadband structures are a significant factor in

the sustainable implementation of telemedicine. Due to lack of proper broadband services in rural and remote areas telemedicine remains out of reach in many areas.

Telemedicine requires information and communication infrastructure, the ability to use that infrastructure, a relatively stable supply of electricity and people to maintain and support the infrastructure. Internet penetration in Africa is half that of Asia and the Pacific and is the lowest of any developing world region. In poor communities, people are mostly computer illiterate and few of the over 2000 African languages are available on the Web. Telecommunication costs in Africa, when expressed as a percentage of per capita, monthly, gross national product are very high and 14 of the 20 most expensive countries are in Africa (Mars, 2013). In rural areas, where telemedicine is needed the most by the poorest of the poor, it is least likely to be provided because of inadequate infrastructure and high connectivity costs. In addition, there is limited awareness of telemedicine by healthcare workers and the patient community, and lack of government will.

Lack of broadband remains an obstacle to synchronous telemedicine in Africa. In part this is due to the low fixed telephone line penetration which limits the use of Asymmetric Digital Subscriber Lines (ADSL). Per capita bandwidth is very low. In 2008, Africa had 12 Gbps of international bandwidth which is less than a third of that of India. New undersea fibre optic cables coming on line on the East coast of Africa and new cables planned for the West coast offer promise and are expected to increase bandwidth and reduce costs. Currently there is a large disparity in bandwidth per capita in sub-Saharan Africa with landlocked countries still dependent on expensive satellite access (International Telecommunications Union, 2009).

The main aspects on the infrastructure side cover the pure ICT technological infrastructure as well as any other generic infrastructure such as power supply, water supply. In fact, generic infrastructures that can limit the results of the projects refer to: poor-quality electricity supplies e.g., the average electric power consumption in Sub-Saharan Africa is 124 KWh per capita per year, only a tenth of what found elsewhere in the developing world, and barely enough to power one 100-W light bulb per person for three hours a day (The World Bank, 2014); poor-quality water supplies; poor-quality telephone services; isolation and lack of continuing medical education (CME) for health care staff; and poor supervision of health care staff (Wootton, 2008). In rural regions of developing countries, communication media mainly include voice and text (typically, via e-mail messages), while rural regions of developed countries feature very different and more powerful communication media (Martìnez, 2004).

According to Combie (2007) in most rural areas the required ICT infrastructure can be below minimal acceptable levels, thus impairing any type of connection with remote centres and facilities. Lack of ICT infrastructure is one of the most evident causes of failure in telemedicine systems. Even the most well-designed telemedicine system may result in a low-quality system if the connectivity with the remote health care centre(s) is poor. On the other side, amid quality system fed by a very good connectivity may produce high quality results.

2.1.2.2 High Maintenance and support cost

In order for the telemedicine equipment to run smoothly there is need for routine maintenance. Maintenance problems such as software upgrade, parts replacement and equipment failures may come at a high cost which may be unsustainable at the

beginning of the project. Kalam (2011) indicates that prototyping and piloting give the impression a more reasonable way to go. For the duration of piloting, there is sufficient time for consumers to change or improvement their technological border to lodge the new technology being initiated. Apprehensions and challenges can be concentrated on early during the implementation process. Any kind of fault can be identified and set before an organizational wide deployment new protocols can be made. The benefit of this approach is that equally organizational issues and technical issues are given cognition and concentrate on early in the implementation process. Basic requirements for the hardware cover a wide variety of aspects such as power consumption and, possibly, power generation, air conditioning, and number of involved workstations. While most of these requirements are not critical for telemedicine projects in developed countries, the same requirements can be critical in rural locations, and even in some urban locations, of developing countries.

According to Combi (2007), low budgets are affecting all the projects of developing countries. Maintenance costs for keeping the system alive after the original experimentation and enthusiasm are even higher in developing countries if compared to the similar costs in developed countries. In order to achieve a good final result, some initial funds could be devoted to continuing the use of the system. Such considerations are confirmed by our organization and by the survey based on it. Indeed, there is no evidence that the designed and implemented systems have been used after the end of the projects, even for those with significant economic efforts and high requirements.

Basic software requirements have to consider both the main location, typically the big hospital running as the server of the telemedicine service, and the remote locations, typically the rural locations and/or the developing countries running as clients of the telemedicine service. It has been noted that major limiting requirements come from

the client side (Combie, 2016). A distension was made to see if the telemedicine service in the client side involves one unique remote workstation, e.g., one PC, or more remote workstations, e.g., one PC and other biomedical instrumentation such a bio-signal recorder or an imaging device. Moreover, some local workstations in the client side can be locally connected through a local area network (LAN): consequently the remote server type and architecture (open vs. proprietary), the operating system (typically, Linux or Windows), the provided services (printer spool, document sharing, proxy, firewall, security and user log-in and authentication), and the number of deployed workstations must be considered (Combi, 2016). Other minor issues concerning the software requirements must be considered, such as scalability and customizability. Moreover, if a limited budget is available, the difference between commercial software and public domain/freeware/shareware becomes extremely relevant.

2.1.2.3 Staffing and training

According to Norris (2002), education and training are key elements but considerable overheads in a flourishing telemedicine application. Both start-up and ongoing requirements must be considered as the system develops and new staff is taken on board. The training requirement covers the setting up and use of the equipment, the teleconsultation process, and the production of suitable documentation for these tasks and for recording the consultation procedures and outcomes. Sometimes low quality or tentative quality of health information can be appeared at the web pages that are highly detrimental to the patients. Moreover, procedure development is one of the most important and most time-consuming aspects of the introduction of a telemedicine application. For seamless and sustainable implementation of the telemedicine project,

well qualified stuff is required. Competency, capability and capacity play an important role in the success of any telemedicine initiative (Teleradiology solutions, 2017).

The University Hospital of Geneva, Switzerland, started a project initially involved Mali in 2001, and then was extended to include Morocco, Tunisia, Cameroon, Madagascar, Ivory Coast, Niger, Burkina Faso and Djibouti (Bagayoko, 2006). The main original goal of the project was remote education for physicians in Occidental Africa, receiving education from Geneva, Switzerland. The project has then been enriched to cover remote consulting for pathologist, neurosurgeons, and oncologists. Education was extended, too, so that remote education could take place also among African countries as well as from Africa back to Europe for African and tropical diseases. The project is based on an open source platform for remote consulting, namely iPath developed at the University of Basel, Switzerland (Geissbuhler, 2007).

According to Combi (2007), locally organized courses may significantly increase the overall acceptance of the telemedicine system, thus increasing the overall results. Beyond user-friendly interface, training of personnel is a fundamental step in having the proposed technology accepted, especially when no direct interaction between local and remote physicians is available. While it is reasonably expected that any physician in a developed country is familiar with using a PC, such a requisite cannot be given for sure in a developing country.

Nazviya and Kodukula, (2011) recommend the enforcement of capacity building and trainings programs in the telemedicine field to address the shortage of trained personnel in the health sector. Training of Trainees (TOTs) can be conducted once an initial batch of employees is trained.

Mars and Erasmus (2012) state that not only is there a shortage of doctors to treat patients, there is also a shortage of doctors to teach and train new doctors and specialists. It is not uncommon for medical schools, and indeed countries, to have no specialists in some disciplines. E-learning in the health sector has been one of the most successful uses of telemedicine in Africa to date. Some of the examples include the following the Resau en Afrique Francophone pour la Telemedicine Project, based at the Hopitaux Univesitaires de Geneve, which involves 15 West African countries, the African Medical and Research Foundation (AMREF) project to raise the qualifications of 40 000 nurses in Kenya and the video-conference postgraduate training programme of the University of KwaZulu-Natal in South Africa.

The rapid spread and adoption of telemedicine may create more modern technology related challenges. If remained unsolved, these challenges may become an obstacle in the way telemedicine can be utilized. Problems related to telemedicine may range from technical limiting barriers to ethical and confidentiality concerns. Technical limitations can be overcome by advancement in technology. However, ethical and legal concerns remain an obstacle needs attention. In order for a physician to conduct a successful session remotely with a patient and reach an accurate diagnosis, he/she needs sufficient medical information and history about the patient. Whether such information is conveyed to the physician correctly is a concern; also, whether the information is transferred securely is another critical concern. Patient confidentiality and consent must be taken into account when dealing with telecommunication technology. The storage of patients' personal information and access to it should be known, documented, and approved (Atac, 2013).

2.1.2.4 Human and cultural factors

These include; user acceptance of technology by patients and health workers, motivation, and training. The beginning of new technologies and methods of working always lead to some disruption and concern about the short-and long-term consequences. The US Western Governors' Association Telemedicine Action Report lists several reasons for resisting change, including: fear that telemedicine will augment the workload; be short of agreed standards. Additionally, sometimes impersonal technology may be created. The problems are most likely to occur with technophobic patients (or healthcare workers). Their occurrence is therefore greatest with elderly patients whose lack of self-reliance fuels their confusion. Careful preparation and equipment maintenance will diminish most difficulties (Norris, 2002). Combi (2007) states that introducing some techniques which strongly differ from the local practices or that may result as offending according to the local habits or religion must be absolutely avoided or the project will fail even before its start.

Evidence published in international literature on the difficulties of introducing technologies such as telemedicine (and eHealth in general) in health care organizations (Greenhalgh, 2004). All this points to internal resistance to changes in work processes and organizational transformations (May, 2007). International literature has also described economic factors as a barrier, and studies in the United States point to the lack of reimbursement models for telemedicine as a key factor (Grigsby, 2002).

A study conducted by Lewin Group in 2000 showed that "User acceptance by the healthcare workers" was the second biggest challenge after the availability of appropriate technology to the successful implementation of Telemedicine. Apart from the absence of physical examination, patients and physicians resist adopting telemedicine services due to lack of faith in diagnosis. Despite the growing acceptance of telemedicine, there are sections of patients who prefer seeing their doctors in person.

It becomes very important to focus and select the right services which can deliver value.

In support, Combi (2007) states that a significant amount of effort should be devoted to overtake the entrance barriers every new project has to face when entering the application domain. This is particularly evident and must be properly managed in the health care sector. General practitioners as well as specialized physicians are used to maintaining their traditional investigation and diagnostic methods, rather that experimenting with new ones even if supported by the most recent technological discoveries.

However, Combie (2007) acknowledges that personal resistance and opposition to using a computer system is nowadays a completely obsolete problem in developed countries, as young generations are getting more and more connected to the internet. On the other side, some resistance may persist in mid-to-low profile personnel in developing countries, thus affecting in a negative manner the real adoption of telemedicine systems. It would be clear to all the personnel involved in the telemedicine project that asking for a remote consultation does not mean lack of skill, incompetence, or inadequacy in managing the patient. Confronting one‘s opinion with someone‘s else helps to better analyze and diagnose the patient‘s disease no matter if in a developed or developing country.

Stakeholders need to be made aware of standardised project management practices and empowered so that it can be utilised in telemedicine projects as well as other projects within the health sector. This will contribute to overall improvements in planning, managing, organising, sustaining and monitoring of telemedicine activities (Nazviya & Kodukula, 2011). It is recommended to have a quantitative study on the perspective

of general public so that more factors relating to perception of public is uncovered and any issues are addressed in the planning of telemedicine projects (Nazviya & Kodukula, 2011).

The Triple Aim (2012) is a framework developed by the Institute for Healthcare Improvement (an independent non-profit organization based in Cambridge, Massachusetts), that describes an approach to optimizing health system performance. The aim of the framework is to develop three dimensions, referred to as the "Triple Aim". The dimensions are as follows:

a. improving the patient experience of care (including quality and satisfaction);

b. improving the health of populations; and

c. reducing the per capita cost of health care.

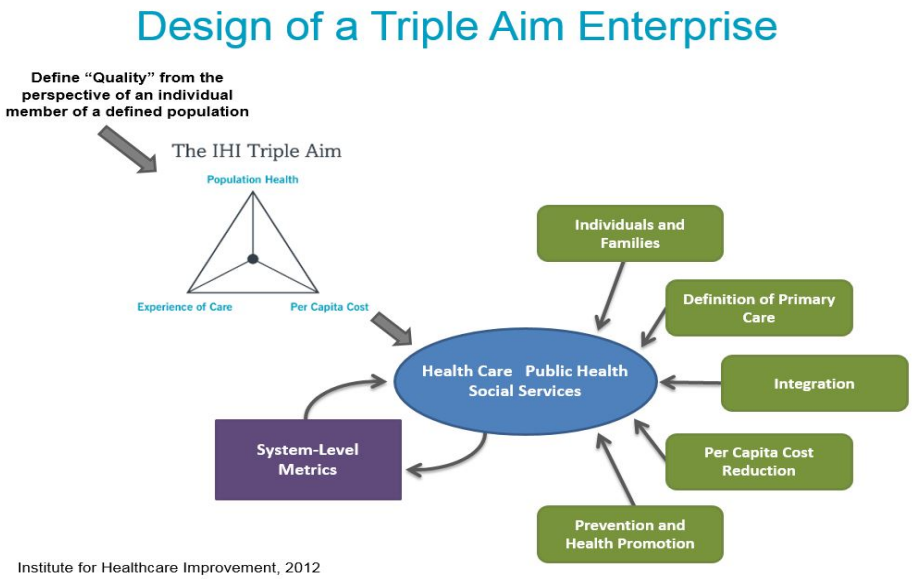


Figure 2.2: Triple aim

In recent years the United States, Australia, England, New Zealand, Northern Ireland, Scotland, Singapore, Sweden, and several jurisdictions in Canada have adopted the Triple Aim as a framework for health care reform. Adoption of the Triple Aim requires decision makers to balance each of the three aims, recognizing that improvement in one area may have negative trade-offs on the others, and thus careful policy development is required. The success of the Triple Aim is dependent on identifying a specific population of concern, recognizing policy constraints, and having an entity that has the authority to assume the responsibility for the goals of the Triple Aim for the identified population, (Berwick et al., 2008).

In order to achieve the Triple Aim there is need to focus on individuals and families, redesign of primary care services and structures, population management, cost control and system integration and execution. Triple Aim is the ultimate destination for high performing hospitals and health care systems of the future. Institute of Healthcare Improvements (IHI) recommends a change process that includes: identification of target populations; definition of system aims and measures; development of a portfolio of project work that is adequately strong to move system level results; and rapid testing and scale up that is changed to fit local needs and conditions. It important to harness a range of community determinants of health, empower individuals and families; to significantly extend the role and impact of primary care and other community-based services; and to assure a seamless journey through the whole system of care throughout a person's life. Therefore, the key to delivering the Triple Aim is the formation of a system integrator whose role is to coordinate and direct the resources allocated to a population group with the aim of optimising performance against the three aims.

McCarthy and Klein (2010) indicate that without balanced attention to these three overarching aims, health care organizations may increase quality at the expense of

cost, or vice versa. Alternatively, they may decrease cost while creating a dissatisfying experience for patients. Many problems that health care systems face can be linked to one or more of these objectives. Problems like supply-driven care, preventable readmissions, and overbuilding may represent a failure on all three counts.

While easy to understand, the Triple Aim is a challenge to implement. Various forces and traditions have encouraged physicians and hospitals to focus on acute and specialized care over primary and preventive care and to think narrowly about care for particular conditions or episodes of care for individual patients, without considering the health of a population. To achieve the Triple Aim, health care organizations must broaden their focus to organize care to meet the needs of a defined population. Payers, especially those with little direct influence on health outcomes and patient satisfaction, find they must forge new kinds of partnerships with providers. Success requires a willingness to take on new roles and a commitment to honest self-appraisal—otherwise it is easy for health care organizations to continue to work on objectives that play to their existing strengths and neglect those that do not.

2.2.2 Technological Factors

The impact of the telemedicine system on everyday practice is absolutely relevant and must not be neglected. The results of the entire project strongly depend on the acceptance of the application and of the telemedical service, too. As for the acceptance, user interface obviously is one of the most important issues: however, local languages especially in developing countries must be suitably adopted, as the use of the local language may be the only way for a proper interaction with the local users. Furthermore, training of personnel on how to use the system is another fundamental issue to achieve a pretty good technology acceptance: in fact, the difficulties

encountered at the very early interaction with the system may discourage further use of the system itself (Combi, 2007).

Recent advances in information and biomedicine technology have significantly increased the technical feasibility, clinical viability and economic affordability of telemedicine-assisted service collaboration and delivery. The ultimate success of telemedicine in an adopting organization requires the organization's proper addressing both technological and managerial challenges. Based on Tornatzky and Fleischer's framework 1990 shown in figure 2a model was developed and empirically evaluated in order for healthcare organizations' adoption of telemedicine technology. A survey study was used; it involved public healthcare organizations in Hong Kong. Results from the exploratory study suggested that the research model exhibited reasonable significance and classification accuracy and that collective attitude of medical staff and perceived service risks were the two most significant factors in organizational adoption of telemedicine technology. (Paul Jen-Hwa Hu et al., 2000).

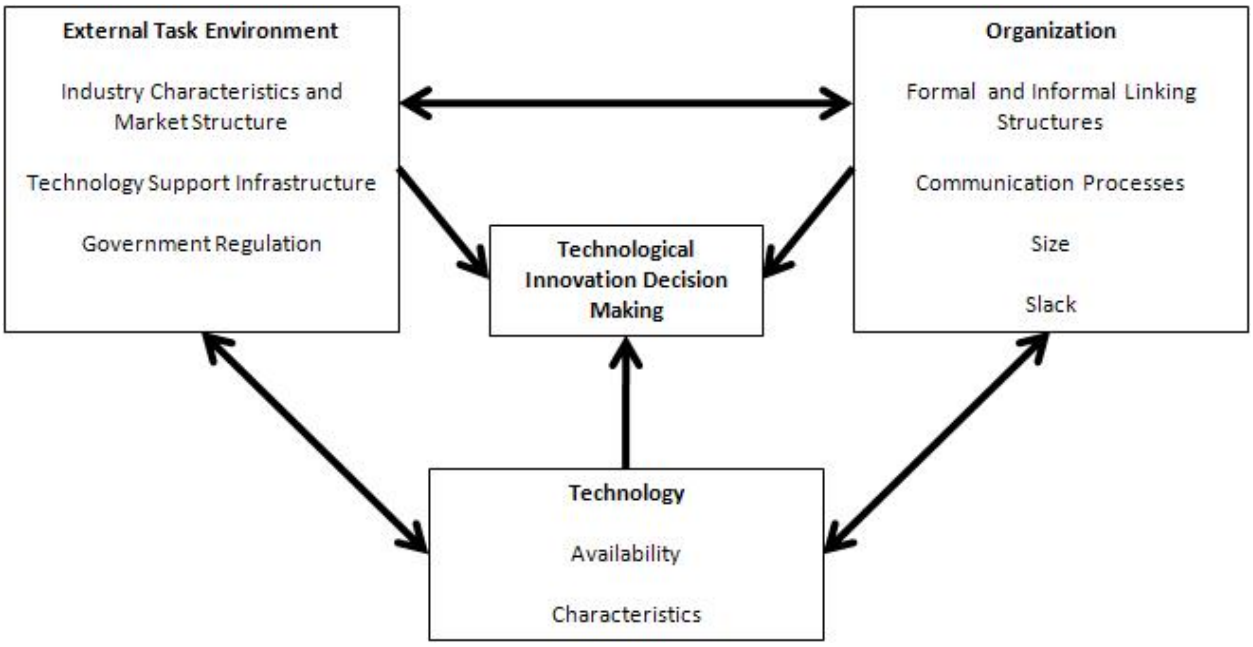
The technology-organization-environment (TOE) framework was created by Tornatzky and Fleisher (1990). It describes factors that influence technology adoption and its likelihood. TOE describes the process by which a firm adopts and implements technological innovations are influenced by the technological context, the organizational context, and the environmental context. When the TEO framework is applied to certain processes or scenarios, it helps to establish the way the organisation sees the need for technology, searches and adopts the new technology.

The technological context includes the internal and external technologies that are relevant to the firm for certain services to be provided. Technologies may include both equipment as well as processes.

The organizational context refers to the characteristics and resources of the firm, how well the organisations are able to implement the new technology. This also includes the firm's size, degree of centralization, degree of formalization, managerial structure, human resources, amount of slack resources, and linkages among employees.

The environmental context includes the size and structure of the industry, the firm's competitors, the macroeconomic context, and the regulatory environment (Tornatzky & Fleisher, 1990). These three elements present "both constraints and opportunities for technological innovation". Thus, these three elements influence the way a firm sees the need for, searches for, and adopts new technology.

Figure 2.3: Tornatzky& Fleisher, 1990.



This framework conceptually describes organisational innovation adaptation and at the same time, provides a necessary foundation upon which relevant adaptation factors can be identified within the context.

According to Kalam, (2011) the design and usability of telemedicine is important. The objective of any implementation group in initiating telemedicine should go beyond changing the way the organization does things, improving competency, etc. It should seek out to develop a practical and an acceptable telemedicine system. The design of the telemedicine should be given much concentration as the concerns for a successful implementation. User should be implicated during the design period, and their contribution and concerns taken into account. In designing a usable and acceptable telemedicine system, the requirements of the organization should be evaluated. For most organizations it is often difficult to differentiate between a need's appraisal and a desire list; and wishes lie along a range of deployment and feasibility (Walker, 2005). In this design of telemedicine service, the needs of the society should be carefully balanced. The usability of a technology is the solution to its acceptability by users. When introducing a telemedicine system, user interfaces should be as user responsive as possible.

According to Shrader (2015), telemedicine 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 Sustainable Development Goals (SDG) 2015 of ensuring healthy lives and promoting healthy lives for all at all ages by giving more individuals access to quality care. The most powerful attributes of telemedicine include its widespread access of care, convenience, and reduction in medical spending. The Government of Zimbabwe in 2018 allocated US$694, 5 million or 8.3% of the budget to the Ministry of Health and Child Care. According to UNICEF Zimbabwe 2018, the allocation was grossly inadequate to fund the critical needs in the sector as it does not meet the 15% Abuja declaration target. In order to manage the high cost of healthcare such as those being

incurred by Zimbabwe, the United States uses telemedicine. The effects of telemedicine technology are helping to relieve the burden of high cost of healthcare for patients, medical staff, and government medical funding programs. One factor attributing to lower cost is the elimination of travel. Doctors are no longer required to travel long distances to render medical care or specialized surgeries. Equally patients do not have to travel such long distances to receive medical attention. Many correctional facilities are utilizing telemedicine for the mere fact that it reduces medical travel expenses.

Physician remuneration has long been identified as a barrier to the adoption of telemedicine. A number of provincial health ministries have made changes to their fee schedules to allow for remuneration and/or to incentivize telemedicine services. Since 2008 physicians providing telemedicine services have been able to bill the Ontario Health Insurance Plan (OHIP) directly. In an attempt to provide an incentive to offer telemedicine services physician is paid $15 to $35 more than a face-to-face consultation (Edwards, 2009).

2.2.3 Geographical Factors

In May 2016 a longitudinal study was carried out on a telehealth project on healthcare professional recruitment and retention in remote areas in Mali. There were no noticeable changes in perceptions related to telehealth influence on recruitment and retention. Only access to information and communication technology significantly differed between T1 (one year after first survey) and T2(second data collection) according the Wilcoxon rank test ($p = 0.001$). Perceived influence of telehealth on recruitment and retention was mostly explained by attitude towards telehealth, perceived effect on recruitment and retention and barriers to recruitment and retention.

Mbemba et al., (2016) states that telehealth was perceived as having a positive influence but mostly indirect influence on healthcare professional recruitment and retention. According to their results there were no major changes after 1 year of telehealth use.

Telemedicine uses ICTs to overcome geographical barriers, which then increases access to health care services. This is mostly beneficial for rural and underserved societies in developing countries. These are the groups that traditionally suffer from lack of access to health care. According to the American Telemedicine Association, correctional facilities annually spend nearly $302 million to transport prisoners to physicians' offices. In 2013, 543,000 transports were avoided, saving the government $210 million. Fewer travel expenses and reducing the number of emergency room visits helps to minimize medical costs. 80% of the United States nation's costs are attributed to the chronically ill, (New England healthcare institute, 2010). These patients often inhabit the emergency rooms which come at a great cost. Specifically, tele-consultation, telemonitoring, and tele-surgey have reduced the occupation rate in emergency rooms by lessening the number of patients that need to be transported from one hospital to another. This reduction has saved $537 million in medical transport, (New England healthcare institute, 2010).

According to Geissbuhler et al., (2003) telemedicine tools have an important role to play in the improvement of the quality and efficiency of health systems in developing countries, as they offer new channels for communication and collaboration, and enable the dematerialization of several processes that are usually hindered by deficient physical infrastructures. They also expose some risks, and in particular the exchange of inappropriate or inadequate information and the potential aggravation of the local digital divide between the cities and the rural areas. These risks must be examined

when designing telemedicine projects and can probably be mitigated by the development of South-South communication channels, the use of satellite-based technologies to incorporate remote areas in the process and by fostering a culture and skills for local medical contents management**.**

Graham (2003), states that an e-mail link with the facility to send high-resolution digital images is a cheap and uncomplicated telemedicine method. The Swinfen Charitable Trust helped establish such a link in Patan Hospital Kathmandu, Nepal in March 2000. For a period exceeding 12 months using this link, 42 telemedicine referrals were sent to specialists throughout the world. Referrals were: 36% respiratory medicine; 21% neurology, 21% dermatology; 14% cardiology; 5% nephrology; and 3% radiology. 28 had digital pictures attached, of which 96% were of high enough quality on which specialists were able to comment. 39 replies were received. The average time for a specialist reply was 2 days, and 45% were answered within 24 hours. All replies were judged by independent assessors to be helpful or very helpful for diagnosis, management and education. The assessors decided that in 50% of cases the advice if acted upon would have shortened hospital stay. This pilot study has shown that a low-cost telemedicine link is technically feasible and can be of significant benefit for diagnosis, management and education in a developing world setting.

Telemedicine consist of a great prospective for modernizing the delivery of health services, serving equitable to remote areas and permitting primary care physicians to refer patients to the specialists. However, before its regular application information infrastructure (as whole; Technological and non-technological) should be reorganized. A lot of effort will have to be put in the restructuring and reorganization of workflows to effectively implement a successful telemedicine system. Of course, should be considered its accuracy and cost-effectiveness, reliability needs to be verified through

evaluation. Though, Information infrastructures in Bangladesh are still weak but some of the initiatives both public and private sectors are enthusiastic (Kalam, 2011).

2.2.4 Telemedicine in Africa

The experiences reported in the failed implementation of the first Ethiopian telemedicine project and the reasons for the failure of the National Telemedicine Project in South Africa are similar and enlightening (Gulube & Wynchank, 2002). These include lack of a change management plan, no business model, limited buy-in from practitioners, high staff turnover, limited e-readiness, problems with connectivity and transmission of large files, inappropriate software and devolution of project management to health authorities which had not budgeted for ongoing telemedicine services and their management (Shiferaw & Zolfo, 2007). In South Africa the Health Professions Council of South Africa has recently stopped a nurse to doctor telephone-based telemedicine service, and at the same time condemned aspects of telemedicine as unethical (Scheepers, 2011). Apart from a prior doctor patient relationship, a "hands on" physical examination is required, which cannot be performed in a telemedicine consultation (Bateman,2011). This is an example of the teething problems that telemedicine practitioners face in countries where there is a lack of understanding of telemedicine and perhaps a fear that those who do not adopt telemedicine will lose patients to those who do. Again, pragmatic solutions are required (Mars, 2007). The approach of "if you put it in place, they will use it" highlights the lack of understanding of the human, management and cultural factors that need to be resolved for successful change management and technology adoption.

With a population of some 725 million inhabitants, the Sub-Saharan Africa (Meso, 2009) region is severely affected by HIV/AIDS (some 70% of the 40 million

worldwide people suffering from this disease live in the SSA), and by malaria (killing more than 1 million children every year). The physician-to-population ratio ranges from 1:5,000 to 1:30,000, while in developed countries the typical ratio is 1:300 (Meso, 2009). All of these conditions suggest that telemedicine can substantially improve the quality of health-care. The main projects over the last decade in the SSA include: transmission of biomedical images among the four major hospitals in Senegal; schedule consultations and referrals in Ethiopia; share scientific literature about cholera epidemic infections in Zambia; provide local physicians in Ghana with education on malaria from hospitals in London, UK and Geneva, Switzerland; provide patients in Congo with a remote assistance on diagnosis, treatment, and follow up by physicians of the Luigi Sacco Hospital in Milano, Italy; and, exchanging medical records and images between two major hospitals in Mozambique by a direct microwave terrestrial link set up by ITU (International Telecommunication Union, 1998).

According to Wotton (2001) major difficulties encountered refer to poor national ICT policies (e.g., some nations including Burundi and Ethiopia have extremely low public expenditure on health care, in the range between 0.6% and 1.5% of the GDP and in some cases include high tax policies on already very expensive medical instrumentation), very limited ICT infrastructure (despite the number of mobile subscribers has been observed to grow up at a rate of 82% a year), implementation factors (e.g., obtaining top management support locally, and training local trainers for sustainable long-term support), and cultural differences among the users involved in the projects (e.g., Cameroon has a population of 14 million with 279 distinct languages).

Major difficulties encountered by the projects in Egypt include the technical, financial, and human resources aspect (Hussein, 2012). Other encountered difficulties include the resistance to change, the unclear business model for telemedicine (i.e. which services could be provided, who will pay and how much will be paid), the unavailability of an efficient infrastructure for telemedicine (high bandwidth and the special equipment) in the rural areas, and the unavailability of regulatory bodies for accrediting telemedicine e-health systems and health care organization, and for issuing best practices and guidelines.

In Burundi the telemedicine project, funded by the Veneto Region and by the University of Verona, considers requirement collection and analysis, design, implementation, and deployment of a prototype aimed at providing local physicians of the Hospital of Ngozi, Burundi, with expert second opinions from their colleagues in the University of Verona, Italy, on interpreting ECG signals, ultrasound and X-ray images. First experiments were done mainly focusing on tele-consulting for paediatric cardiology (Combi, 2015). The project identified as fundamental requirement the involvement of local users as many as possible. In order to avoid the major pitfalls, the project provided the local users with the proper skills before deploying the system, and then performing a continuous follow up of the system and of its usage in the everyday practice. For this reason, the project trained 20 nurses on how to better use the ECG machine, and 5 physicians on how to use the ultrasound system for performing echocardiography examinations. Although the project focused on cardiovascular diseases, the proposed system has been used also to ask for a second opinion about cases of cancer, pneumonia, and laryngomalacia.

Wamala (2013) states that observations indicate dearth efforts and commitment to optimize use of the tools in the majority of the countries south of the Sahara. Sub-

Saharan Africa has been left almost behind the rest of the world in terms of development going through decades of economic exploitation by especially the west through its natural and human resources. These factors, ethnic conflicts and endless wars have continued to ruin sub-Saharan Africa's socio-economic development. Telemedicine in Africa though has not attracted enough political support; it is potentially a very useful conduit of health-care given the fact that the continent is resource limited and still enduring the effects of scarce human resource especially in health.

It is generally observed that most telemedicine projects are successful as long as the financial support is visible, and this typically occurs at project onset time: after the implementation, most projects reduce fund availability and, consequently, projects decline as time goes by. This aspect is even more enhanced and evident if the training personnel abandons the trained personnel after some time, letting the trained personnel to continue the project on their own. A good evaluation of the project and of its success is the lifespan of the project (Moodley, 2014). It is therefore important to monitor and evaluate telemedicine projects.

Combie et al (2016) indicates that very few projects in developed country feature a follow-up study aimed at evaluating the real advantages and usefulness of every project. Too many success factors must be considered and suitably weighted to achieve a success/failure evaluation of the project. Very few projects reports describe the real economic effort spent in deploying the project itself: such data, which are generally expressed as percentage of the GDP.

A telemedicine study carried out by Geissbuhler (2003) on telemedicine in West Africa indicates that there are three kind of problems that result in the failure of telemedicine.

These are; stability of basic infrastructure and in particular of the electric power supply; the limitation of the international bandwidth, which, is often misused, in particular by e-mail accounts hosted out of the country; and the unavailability of reliable connectivity beyond large cities. The study also notes that collaboration between the stakeholders of telemedicine applications must be organized, in order to guarantee the reliability, security, safety and timeliness for exchanging sensitive information, in particular when the communication is not synchronous. Computer-supported collaborative work environments have been developed. For example, the iPath project (Oberholzer et al., 2003) developed by the Institute of Pathology in Basel, organizes "virtual medical communities", which replicate organizational models of institutions in distributed collaboration networks, including clearly identified responsible experts and on-call schedules. These new forms of collaboration over distances, across institutions, and sometimes across national borders also raise legal, ethical and economical questions.

2.3 Relevance of the conceptual framework.

As determined by Berg (2001) the implementation of comprehensive information systems or telemedicine services in health care practices has proved to be a path ridden with many types of risks, dangers and complexities. As he stated, to implement a health care information system is a process of mutual transformation; the organization and the technology transform each other during the implementation processes is a balancing act between initiating organizational change and taking information system as a change agent, without attempting to pre-specify and control the process (Berg 2001). Balancing socioeconomic, technological and demographic factors is the basis for a successful telemedicine system. Analyzing these factors will provide a internal view of Nyatate, Nyafaru and Tombo telemedicine pilot projects.

2.4 Summary

Telemedicine has been practiced successfully in many countries with the help of necessary technological and human resources. However, past attempts to implement telemedicine in Africa were not successful for various reasons. Accordingly, the information derived from the literature review identifies the critical success factors for implementing telemedicine mostly in a developing country. These critical success factors include increasing public awareness and acceptance, availability of technological infrastructure, availability of sustainable financial support, adequately trained personnel and proper communication between all stakeholders. It is clear that if these critical factors are addressed telemedicine can be implemented smoothly without fail.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In order to fully answer the research questions both qualitative and quantitative data was used in order to ensure quality of results. The research made use of both primary and secondary data in order to analyse the prospects and challenges of telemedicine at Nyatate, Nyafaru and Tombo rural clinics in Nyanga District, Zimbabwe. The core of the study was to analyse the relationship between telemedicine and health services; taking a special look at the prospects and challenges of telemedicine in Zimbabwe. Qualitative data was used to analyse the correlation between telemedicine and the quality of health care. Quantitative data was then used to assess the prospects and challenges of telemedicine in in the rural clinics under study. This chapter will give an outline of the methods, the type of data that was collected and the data analysis methods that were used. Finally, the researcher will justify the methods used in the research by evaluating their effectiveness.

3.2 The research design

A cross sectional study was conducted from the three telemedicine pilot projects (Nyatate, Nyafaru & Tombo) in Nyanga district. According to Hemed (2015) a cross sectional study measures simultaneously the exposure and health outcome in a given population and in a given geographical area at a certain time. The researcher interviewed both healthcare workers and patients. The patients interviewed were those who were at any of the three rural clinics (Nyatate, Nyafaru & Tombo) at the time of data collection. In this research a patient was any person receiving or registered to receive medical treatment.

This research was done in the form of a descriptive research design. This design allowed for the collection of a large amount of data from the study population of Nyatate, Nyafaru and Tombo rural clinics in Nyanga district. It was a non-experimental research with the purpose of describing characteristics of a phenomenon. The design is appropriate as it helped describe what is happening right now in the telemedicine pilot project. The design was also able to bring out the prospects and challenges of telemedicine in Zimbabwe focusing on the rural clinics under study. Both qualitative and quantitative data was collected. Regression, percentiles and correlation analysis tools were used to analyse the relationship between telemedicine and health care delivery. An effective way to assess and evaluate health care is the critical assessment, through rigorous processes, of an aspect of healthcare in order to determine whether it fulfils its objectives. Telemedicine may be assessed in terms of its effectiveness, efficiency, acceptability and equity. Effectiveness relates to the improvements in health care arising from the use of telemedicine whilst efficiency relates to the cost of telemedicine compared to the output or benefits obtained. In the implementation of an innovative system such as telemedicine it is of vital importance that the new system be embraced by both the medical profession and the community. The degree of acceptability depends on a number of social dynamics in a particular community. These may include medical, psychological, historical and ethical factors. Telemedicine has the capacity to provide fair distribution of health care among individuals or groups despite differences in geographical location. This way equity or fairness in the distribution of health care is achieved.

3.3 Population and sampling

A population is a large collection of individuals or objects that is the main focus of a scientific query. Research population is generally a large collection of individuals or objects that is the main focus of a scientific query. It is for the benefit of the population that researches are done. According to Bryman and Bell (2003) a population is a well-defined or set of people, services, elements, events, group of things that are being investigated. The individuals or objects usually have similar characteristics. The study population for this research is Nyatate, Nyafaru and Tombo rural clinics in Nyanga district. According to ZIMSTAT, (2012) Nyatate, Nyafaru and Tombo rural area has a population of 4100.

3.3.1 Sample

Data collection and analyses was done within 3 months. Due to inadequate time the researcher used random sampling. Random sampling is a sampling technique in which each sample has an equal probability of being chosen. This sampling technique is meant to remove bias as each member of the subset carries an equal chance of being selected as part of the sampling process. Participants were given numbers, and then randomly picked to fill in the questionnaires. The formula below was used to calculate the sample size:

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

N = population size • e = Margin of error (percentage in decimal form) • z = z-score

P= sample proportion

Margin of error= 10%

Z score=1.28

Confidence level= 85%

A sample size of 52 (fifty-two) was obtained.

3.4 Data collection instruments

In order to collect adequate data for the research, interviews and questionnaires were used.

3.4.1 Interviews

Gosh (2002), defines interview as a verbal means to gather information face to face. A set of interview questions were formulated. These questions were asked in the language in which the interviewee was comfortable with. According to Manyika dialect, (2015) people in Nyanga district can read and write both Shona and English. Therefore, the interviews were carried out in both Shona and English.

3.4.2 Questionnaire

McLeod (2018) defines a questionnaire as a research instrument consisting of a series of questions for the purpose of gathering information from respondents. The researcher used two questionnaires, one for the rural health workers and Nyanga District Hospital clinical workers, and the other for the selected patients and members of the community. The questionnaires had both open and close ended questions. This enabled the researcher to get quality information and also be able to control the amount of information received.

3.4.3 Validity of instruments

Validity refers to the degree to which any measurement approach or instrument succeeds in describing or quantifying what it is designed to measure (Colson et al., 2016). Validity is the extent to which any measuring instrument measures what it is intended to measure (Thatcher, 2010). The research used the following types of validity in the questionnaire.

• Face validity- This is concerned with whether at face value, the questions appear to be measuring the construct. The researcher is going to consult some experts to evaluate the questions.

• Content validity

Content validity regards the representativeness or sampling adequacy of the content of a measuring instrument. The researcher will ensure that each research question is going to be represented in the questionnaire.

• Criterion validity- Criterion validity is used to demonstrate the accuracy of a measure or procedure by comparing it with another measure or procedure which has been demonstrated to be valid. To this regard, the researcher is going to use the questionnaire in a variety of situations in order to see how predictive it will be.

• Concurrent validity- Concurrent validity is a measure of how well a particular test correlates with a previously validated measure. Concurrent validity is concerned with whether results of a new questionnaire are consistent with results of established measures.

3.5 Data collection procedures

Information for the research was collected from the Nyatate, Nyafaru and Tombo rural health centre's clinical workers (such as doctors, nurses, nurse aids etc) and; community members and patients from each community. Data was collected using a variety of data collection methods such as self-administered pencil and paper questionnaires, face to face interviews and observation. Secondary was collected from telemedicine records at the selected rural health clinics (Nyatate, Nyafaru and Tombo) and Nyanga district hospital.

3.6 Analysis and organization of data

IBM SPSS Statistics was used to analyse data. Descriptive statistics was used to present data in the form of charts and diagrams for qualitative data. This information has been presented in the following ways:

3.6.1 Textual method in which the reader will understand the information through reading the data.

3.6.2 Tabular Method which provide the reader with precise, systematic and orderly presentation of the data in rows and columns.

3.6.3 Semi-tabular Method which will be a mixture of both textual and tabular methods.

3.6.4 Graphical Methods which will present the data using charts and diagrams allowing the researcher to visually present the data.

3.7 Ethical consideration

Permission was sought from Africa University Research Ethics Committee (AUREC) before the study commenced. The participants voluntarily participated in the study. The researcher put all six aspects of ethics into consideration. These are:

3.7.1 Autonomy- that is to respect the rights of participants; to be self-governing within their social and cultural framework.

3.7.2 No coercion or duress is going to be used in the study. In addition, the respondents will have absolute freedom of choice of whether to continue with the research or not.

3.7.3 Nonmaleficence- In the consent form the researcher is going to ensure the respondents that they are not going to get any harm because of participating in the research. The researcher will strongly emphasise that the information that is going to be obtained is going to be used for academic purposes only.

3.7.4 Confidentiality and anonymity- Confidentiality will be maintained throughout the study. The researcher is going to have a nondisclosure of confidential information agreement with the participants. In addition, real names will not be used in the study so as to protect the identity of participants.

3.7.5 Permission - The researcher is going to ask for permission before conducting the research from the relevant authorities and respondents who are going to participate in the study. The respondents will be asked to sign a consent form before taking part in the study as an indication that they are agreeing to participate.

3.7.6 Fidelity- to be faithful that is to keep promises and honour the trust placed in the researcher by the participants.

3.8 Summary

A cross sectional study was carried out from telemedicine pilot projects in Nyatate, Nyafaru and Tombo rural clinics in Nyanga district. The study interviewed patients at the three-telemedicine pilot project health centres (Nyatate, Nyafaru & Tombo) at the time of data collection. Questionnaires and interviews were used to collect data. The researcher delivered the questionnaires in person. The information will be used to determine the prospects and challenges of telemedicine in Zimbabwe.

Descriptive research design was used in this research. This design allowed the collection large amounts of data from the study population. The research design was appropriate as it described what was happening in the telemedicine pilot projects at time of data collection. A sample size of 52 was obtained from the research population of 4100. Random sampling was used in order to give each member of the population an equal chance of being selected. Patients that were at any of the rural clinics(Nyatate, Nyafaru& Tombo) during the time of data collection were assigned numbers, these numbers were then picked randomly from a hat to determine thee 52 participants.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

The chapter before focuses on the methods used in the research, the source of data and how the data was analysed. This chapter's attention is on the analysis of data that was collected. A statistical analysis software called IBM SPSS was used to analyse the data. The researcher intended to collect data from a sample size of 52. There were 50 responses representing a response rate of 96%.

4.2 Data presentation and analysis

4.2.1 Participants characteristics

The majority of the participants were female and they contributed 71.1%. The age group with the highest participants was the 20-30 years, with a contribution of 61,5%.

Table 4.1: Participants Demographics

Variable	Number (%) N=52
Gender	
Male	15(28.8)
Female	37(71.1)
Age group	
20-30	32(61.5)
31-40	10(19.2)
41-50	7(13.5)
50+	3(5.7)
Participants	

Patients	42(80.7)
Healthcare workers	10(19.3)

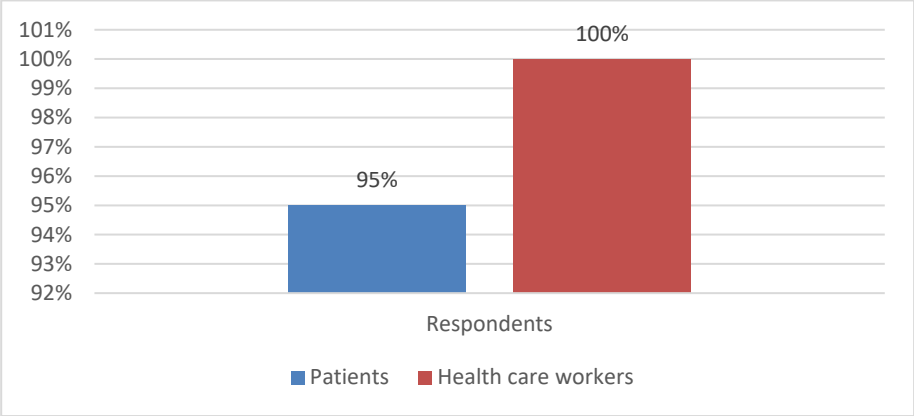
4.2.2 Response rate

Table 4.2: Response rate

Category	**Questionnaires sent**	**Response**	**Response rate**
Patients	42	40	95%
Health care workers	10	10	100%
Total	**52**	**50**	**96%**

Out of the sample size of 52 questionnaires distributed, only 50 questionnaires where responded to. One questionnaire was incomplete and the other one was spoiled. The response rate was 96% from which the above satisfactory conclusions were made. The information shown in the table is also shown in the graph below:

Figue:4.1 Response rate



4.2.3 Level of awareness

Category	Level of awareness	Awareness rate
Patients	34	81%
Healthcare workers	10	100%
Total	44	85%

Table 4.3: Level of awareness

Out of the 42 patients interviewed only 34(81%) had some level of telemedicine awareness. This level of awareness was achieved through intensive awareness campaigns that were carried out in 2015. The awareness campaigns where carried out in a systematic way. The first port of call were the health centre committees established in each area whose composition included nurses and village health workers. After presentations and demonstrations on the subject, comments and recommendations from the health committees were received and incorporated into the system. After the health committee awareness program, the Zimbabwe Telemedicine Network (ZTN) then met with the local leadership consisting of all chiefs and headmen in the area.

After a series of meetings at which demonstrations on telemedicine were conducted the local leaders were then empowered to pass this knowledge to the rest of the community. Telemedicine was highly accepted in the community because it was introduced by their local leaders. The result of this intervention by the local leadership was that the level of acceptance of this technology by the community was enhanced. Once the community became aware of the concept of telemedicine requests to consult medical doctors via telemedicine became frequent. Telemedicine became so popular that in many cases patients were making unnecessary requests to consult with doctors.

All the 10 health care workers interviewed in the research were aware of telemedicine as a mode of providing health care services. The high level of awareness of telemedicine amongst healthcare workers was achieved through training programs conducted with health care workers from the selected rural health clinics (Nyatate, Nyafaru & Tombo). Telemedicine pilot project clinics were chosen on the basis of their geographical location, accessibility and the size of the population that they serve. Nyafaru and Nyatate clinic were chosen because they are relatively inaccessible by road due to the unfavourable terrain. and Tombo clinic was chosen because it serves a large population.

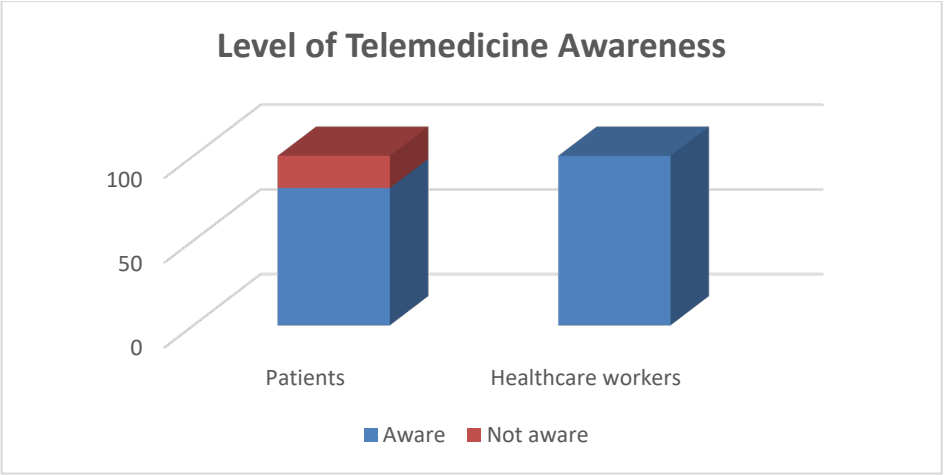


Figure 4.2: Level of telemedicine awareness.

4.2.4 Attitudes of members of Nyatate, Nyafaru and Tombo communities towards telemedicine use.

According to Kalam, (2011) the design and usability of telemedicine is important. The objective of any implementation group in initiating telemedicine should go beyond changing the way the organization does things, improving competency. It should seek out to develop a practical and an acceptable telemedicine system. The design of the telemedicine system should be given much attention as success in implementation will depend on suitability of the design. The willingness to use telemedicine at the three rural clinics under study is depended on a number of socioeconomic, technological and demographic factors. The willingness to use telemedicine also varied with the group of participants.

It has been noted that the acceptance of telemedicine systems requires both the patient and the health professionals to be involved. In Nyanga district both the health care workers and the patients were familiar with face-to-face encounters. However, resistance to utilize telemedicine services was prevented by the

awareness campaigns that were carried out through-out the district. According to Nyatate, Nyafaru and Tombo telemedicine records (2019) by June the 30th forty-seven patients and fifty-nine patients had been seen at Tombo and Nyafaru respectively. More than 50% of the patients seen at both clinics via telemedicine have hypertension. Nearly half of the patients seen at both clinics are above 65years of age. A total of 18(64% of target) telemedicine sessions have been held at Tombo and 20(77% of target) have been done at Nyafaru. Even though the project is facing a number of challenges such as load shedding of electricity, it has demonstrated positive impact in its ability to make doctors available to hitherto hard to reach areas, thus improving management of non-communicable diseases like hypertension and also delivering continuous medical education for rural health centre nurses. The attitude of community members towards the use of telemedicine was either positive or negative. This was dependent on a number of reasons which include:

Table 4.2.4 Community attitudes towards telemedicine

Reasons	Number (%) N=42
Increased access	38(90,4)
Improved quality of care	35(83.3)
Convenience	32(76)
Economic savings	42(100)

4.2.4.1 Increased access.

Telemedicine has drastically increased rural patient access to medical doctors at the district hospital. 90.4% of the patient participants are willing to use telemedicine because it has increased the level of access to medical doctors at the district hospital. The healthcare system in Zimbabwe is structured in such a way that the rural health centre(clinic) is the first port of call for all patients. Primary care nurses run the rural health centres. They are mostly under skilled and are limited in terms of scope of practice. If a patient requires further management which cannot be offered at the clinic, they are then referred to the next level of care which is a district hospital where doctors are stationed. If they cannot be fully managed at a district hospital the patient is referred to a provincial or tertiary hospital where specialists are stationed. The introduction of telemedicine has increased their access as the doctor can now attend to both rural and urban patients without having to travel long distances.

However, 9.6% of the participants indicated that the level of access brought about by telemedicine has been affected by a number of reasons which include the unavailability of doctors to answer the telemedicine calls at any given time, the unavailability of electricity due to long hours of load shedding, poor quality internet supply (which affects the imaging) and the inadequate supply of medication at the clinic pharmacies.

9.6% of the participants state that they have used telemedicine facilities more than once and, in those times, they were forced to travel to the district hospital in order to get access to the prescribed medication. The Ministry of Health and Child care has categorised health care centres into different groups. These groups are the ones

that determine the level of drugs that a health centre stocks. The health centres order their drugs through the Zimbabwe Assisted Pull System (ZAPS). It is responsible for consolidating management of four existing health commodity distribution systems for the primary health care facility level: Delivery Team Topping Up (DTTU); Zimbabwe Informed Push/Primary Health Care Package (ZIP/PHCP); Zimbabwe ARV Distribution System (ZADS); and Essential Medicines Pull System (EMPS). Rural health centres are in class C and therefore cannot order certain drugs such as Ibrufen, diclofenac etc because they are stronger drugs. The clinics are limited to drugs such as paracetamols and other drugs that are less strong. Patients are thus forced to travel long distances in order to access the prescribed medication.

4.2.4.2 Improved quality of care,

Telemedicine has enhanced the quality of care for patients. 83.3% of participants indicate that telemedicine improved the quality of care they received and thus are willing to use it. Patients can now get access to the doctor from a distance at very low cost as and when they require. In the past patients were forced to default medications or go for long periods without a diagnosis and then eventually present themselves to the doctor with complications. Telemedicine is mostly used in situations where the healthcare worker on duty has little or no access to expert help; it is able to offer remote doctors access to otherwise unavailable specialist opinions, providing guarantee to both doctors and patients (Benzion & Helveston, 2007). Telemedicine networks in developing countries could also offer secondary benefits. Telecommunication technologies, such as those used in telemedicine initiatives, have shown to be effective tools for connecting remote sites (Telehealth in the Pacific, 2000). By opening up new channels of communication telemedicine

links rural and remote sites with health-care professionals around the world, overcoming geographical barriers in a bid to reverse ‘brain drain’. This can lead to increased communication between health service facilities, and facilitate cross-site and inter-country collaboration and networking (Geissbuhler, 2003). Such associations can support health-care providers in remote locations through distance learning and training.

However, 16.7% of the participants indicate that the quality of care they expected from using telemedicine was not received. Some patients say that their telemedicine consultations had to be cancelled due to various challenges that included bad weather that affected the internet connectivity, electricity faults and load shedding, technical problems such as failure to log into the system by healthcare workers, etc. Patients with telemedicine consultations that were cancelled where forced to travel to Nyanga District hospital for face to face consultation with the doctor. Also some indicated that they are more comfortable with seeing the doctor face- to-face in order to feel the good quality healthcare.

4.2.4.3 Convenience

Patients that are critically ill but can be managed through telemedicine do not have to travel long distances in order to see the doctor. 76% of the participants indicate convenience as a motivator for them using telemedicine. Patients are attend quickly thereby enhancing timeous intervention. Heinzelmann et al., (2005) and Latifi (2009) states that telemedicine programmes directly and indirectly decrease the number of referrals to off-site facilities and reduce the need for patient transfers. Furthermore, telemedicine programmes have the potential to encourage rural

practitioners to remain in rural practice through expansion of professional support and opportunities for continuing professional development.

However, 24% of the participants state that despite telemedicine showing potential of being convenient as opposed to travelling to the district hospital, a number of challenges have defeated that purpose. The shortages of medical staff, electricity shortages, and supplies among other reasons, have thus affected the level of convenience that telemedicine provides. Patients are having to rely on the old referral system of travelling long distances to see the doctor.

4.2.4.4 Economic savings

A 100% level of willingness to use telemedicine as a result of economic savings was recorded. Economic challenges in Zimbabwe have resulted in shortages of fuel which in turn results in transport shortages. This has resulted in some routes being only serviced once per day by a public vehicle and usually the charge is exorbitant. The transport costs have significantly gone up in recent years. Often times the patient has to be accompanied by a caregiver which adds to the cost. In the rain season, the roads become bad and rivers are impassable due to floods and in some cases, bridges are swept away. Care at a distance via telemedicine in less-economical in developing countries thus benefits both patients and the health care workers by reducing the distance travelled for specialist care and the related expenses, time, and stress (Kifle et al., 2006). Additionally, connecting multiple remote sites via telemedicine has proved to be a cost-effective way of delivering health care to these communities. Using telemedicine is cost effective as opposed to the alternative of constructing facilities and hiring health care workers (Sozen et al., 2003). The participants indicate that if all the issues affecting the

telemedicine program are attended to, the health sector will achieve greater economic savings in fuel savings and ambulance maintenance savings among others.

4.2.5 Perception of healthcare workers in the use of telemedicine in their daily work.

80% (8) of healthcare workers are willing to use telemedicine in delivering health services. Only 20% (2) of the health care worker participants indicated lack of enthusiasm in general use of

the technology.

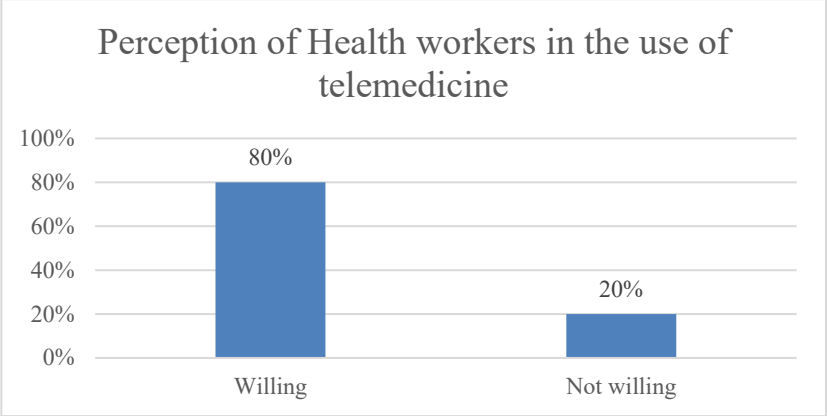


Figure 4.3 Level of perception of healthcare workers in the use telemedicine in their daily duties.

The way the healthcare works perceived telemedicine use in their daily work was dependent of a number of reasons. These reasons were:

Table:4.3 Healthcare workers' perception of telemedicine use.

Reason	Number (%) N=10
Computer Literacy	8(80)
Opportunity to learn	10(100)
Work load	2(20)
Incentives	2(20)

4.2.5.1 Computer literacy

Thara et al, (2008) states that health-care professionals have reported a "fear of the unknown" with regard to handling computers, an anxiety that telemedicine will lead to job loss, an anxiety that the initially high investment required is not viable, or a concern that the bedside presence of consulting physicians in local hospitals will decline. 80% of the health care workers who participated in the study have some level of computer literacy and are thus willing to use telemedicine as they perceive it as a good technology that can improve their daily duties. In Zimbabwe, general nursing studies do not include an information technology course. Telemedicine is highly dependent on computer literacy. 80% of the participants who are willing and are using telemedicine have some level of computer literacy. Initially the healthcare workers went through a five-day training program. The training program was focused on the use of transportable examination station in figure 4.4. However, the program did not include basic computer training. As a result, some healthcare workers were not keen to use the technology as they lacked the skills to do so. 20% of the participants

confessed to having cancelled some telemedicine consultations due to their technical inability to use the system.

It has been noted that healthcare workers fear that the integration of new communication technologies into telemedicine systems may alter existing work practices, challenge physician referral methods, or interrupt workflow (Kifle, 2006). However, Sood &Bhatia (2005) state that there is need to design systems that enhance rather than dislodge current work practices and effectively communicating them to practitioners presents a challenge and an opportunity to ensure appropriate and meaningful uptake of telemedicine systems within low-income settings. According to Mars (2013) people in rural areas are mostly computer illiterate. He also indicates few of the over 2000 African languages are available on the Web. Mobile phone penetration is reported to be 64%, a figure which is skewed because penetration is calculated on the number of subscriptions, that is the number of SIM cards in circulation and not the number of people using mobile phones for delivery of medical education.

Figure 4.4 Transportable examination station. Nyanga district hospital (2020).

4.2.5.2 Opportunity to learn

Health care workers at Nyatate, Nyafaru and Tombo rural clinics perceive the use of telemedicine as an opportunity to learn. The study findings showed a 100% willingness to use telemedicine due to the prospect to learn more. They refer to it as an on the job training which allows them to continuously improve their skills and knowledge. Telemedicine provides opportunities for learning and professional development by allowing the provision and distribution of general information and the remote training of health-care professionals (Wootton,2001). Telemedicine creates a university without borders that fosters academic growth and independence because the local participating nurses have direct access to doctors at the district hospital. It is important to note that such partnerships provide mutual benefits for both the nurse at the rural clinic and the doctor at the district hospital. Brauchli (2005) states that the knowledge sharing that occurs as a result of inter-site collaboration may be formal or informal and has shown to aid health-care professionals in overcoming the professional isolation that they often face in remote areas. This then helps to improve their skills and the services they offer to patients.

4.2.5.3 Work load

80% of the healthcare workers indicated that telemedicine increased their daily work load. 20% of the participants are willing to use telemedicine despite the increased work load. The rural health clinics (Nyatate, Nyafaru &Tombo) are short staffed and overwhelmed with patients. On average each clinic has two health workers and serves about 20 patients per day. One of the reasons why these three clinics were chosen for telemedicine was because of the high number of patient volumes they receive per day. Rural health centres charge $10rtgs per consultation. This consultation fee includes the

medication that the patient then gets after being consulted by a health care worker. Therefore, patients prefer being attended to at the clinic instead of going to the district hospital where they are charged for both the consultation and pharmacy drugs. Traveling to the district hospital is more expensive to patients thus they prefer going to the clinic. Using telemedicine adds on to the work that the healthcare workers have already. 80% of the participants feel telemedicine activities add extra steps into the routine clinical workflow, adding burden to already overworked doctors and nurses.

4.2.5.4 Incentives

There are a number of programs that are run at the clinic and are incentivised. Some of the programs are Voluntary Medical Male Circumcision (VMMC), TB program etc. Unfortunately, the telemedicine program is not incentivised and this has affected the use of telemedicine by healthcare workers. Due to lack of incentives, only 20% of the participants are willing to use telemedicine. According to Codagnone et al., (2014)., Haluza and Jungwirth (2014),studies have shown that doctors overemphasize potential barriers over benefits, with limited financial incentives and resources, inter-operability, and regulatory frameworks on confidentiality and privacy being perceived as the main obstacles of telemedicine use.

Due to lack of incentives 80% of the healthcare workers who participated in the research indicated that they were demotivated to use telemedicine because it did not offer any financial incentives. Financial incentive is another form of direct compensation. The existence of incentives that provide pay based on work performance will enhance employee motivation in an effort to achieve the goals set (Novianty& Evita, 2018).

4.2.6 Availability of internet and infrastructure at Nyatate, Nyafaru and Tombo rural clinics.

Rohleder (2016) indicated that the rising public acceptance and distribution of consumer-oriented technologies in healthcare provision nowadays requires at least basic ICT with internet access. Just like most developing countries; Zimbabwe continues to face electricity shortages. This is due to a number of reasons which include shortage of foreign currency to import electricity from neighbouring countries and global warming which has shortened the rain season and affected the water reservoirs making it hard to generate hydro-electricity. The rural health workers in Nyanga district are unable to use telemedicine consistently due to non-availability of electricity on account of load shedding.

Some of the telemedicine centres experienced poor quality network. X-ray images were blurred and it affected the general provision of the health care service the patients would have come for. In support Mars (2013) indicates that telemedicine requires information and communication infrastructure, the ability to use that infrastructure, a relatively stable supply of electricity and people to maintain and support the infrastructure. Currently only 6.7% of households in Africa have internet access at home, 16.3% of people use the internet, and fixed broadband penetration is 0.3%, (International telecommunication union, 2019). Africa's telecommunication infrastructure is poor, in part due to the continent's long history of civil unrest and war which set economies and infrastructure back by up to seven years for each year of unrest (Collier, 2007).

At the most fundamental level, the instability of electric power supplies and widespread unavailability of internet connectivity beyond large cities has significantly

affected the smooth running of telemedicine (Geissbuhler, 2003). Unreliable connectivity, computer viruses, and limited bandwidth continue to present challenges when and where internet access is available. With regards to internet connectivity; internet congestion can lead to delayed imaging; poor image resolution may limit the efficacy of remote diagnosis (Stutchfield, 2007). Slow bandwidth can prohibit the use of real-time videoconferencing. Even when basic infrastructure is in place, widespread interoperability standards for software are lacking and equipment or computer system failure remains an ever-present possibility (Kifle, 2006).

Some healthcare workers at the rural health clinics under study indicated that they are failing to log into the telemedicine system due to some technical problems. Also, equipment maintenance and training costs of local staff can be challenging for countries like Zimbabwe with limited funding for the operation and maintenance of telemedicine initiatives (Martinez, 2005).

4.2.7 Telemedicine use in Zimbabwe

Telemedicine in Zimbabwe as been limited to the pilot projects in Manicaland province. The technology is not integrated in the overall health delivery system. Due to the growing need of more health practitioners, telemedicine can be used to overcome the barrier of distance and shortages of healthcare workers.

4.3 Discussion and Interpretation

The majority of the participants are willing to use telemedicine as a health delivery method. The members of the community have a positive attitude towards telemedicine. They indicate that the pilot project is being affected by a number of issues such as

shortage of healthcare workers, lack of electricity backup supply, unavailability of medication at the rural clinics. Healthcare workers however, indicated that these problems can be addressed by employing more healthcare workers, back-up generator for all the telemedicine pilot centres and upgrading all rural clinics so they can store all kinds of medical drugs that patients may need. A significant number of participants believe telemedicine can improve access, enhance quality and reduce overall cost of health in the long-run.

Summary

Telemedicine has the capacity to improve the health services delivery system in Zimbabwe. There is a high level of awareness of telemedicine in Nyanga district. There is a mixture of both positive and negative attitude towards the use of telemedicine by the community. Members of the community indicated a number of reasons that determined their use of telemedicine. These reasons were; increased access, increased quality of care, convenience and economic savings. Also, healthcare workers had different perceptions of telemedicine use in their daily work as a mode of health care delivery. These perceptions varied with a number of reasons which included computer literacy, opportunity to learn, incentives and work-load.

Despite its successes the telemedicine project is facing a number of challenges such internet and infrastructure shortages. Some of the clinics are facing poor internet connections which in turn affects the quality of images that are being transmitted between health centres. The telemedicine pilot projects are mostly reliant on ZESA as a source of electricity. Due to load shedding there is no electricity at these centres most of the time

CHAPTER 5 DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses the results that were obtained in chapter 4. Recommendations to various stakeholders will also be discussed. These different stakeholders include medical doctors, nurses, health services administrators and Ministry of Health and Child Care. Furthermore, this chapter looks at other areas of study which can be researched in the future in order to come up with better strategies with respect to the use of telemedicine country wide.

5.2 Discussion

In terms of level of awareness patients had an 81% level of awareness and healthcare workers had 100% level of awareness. It is clear that there is need for more awareness campaigns in the community to increase the level of awareness for the patients. This is important because technology is being integrated in all sectors of the health delivery system.

The majority of participants are willing to use telemedicine. In Zimbabwe information communication technologies and internet technologies have increasingly found use in the day to day life of citizens in such areas as E-commerce and E-learning. The connect a school - connect a community program has resulted in the availability of internet in rural communities. Despite the knowledge that deployment of telemedicine can result in improved access to healthcare the use of ICTs in healthcare has been limited to voice and text applications with the Ministry of Health recently introducing an m-Health reporting system for all its 1200 clinics. About two thirds of the Zimbabwean population resides in rural communities and only a few doctors are located in the rural areas at mission hospitals. The majority of doctors reside in urban areas. The use of

telemedicine applications such as teleconsultation via video conferencing on the internet can therefore potentially result in several benefits such as increased access, improved quality of care, convenience, economic savings on transport and better delivery of medical education. The introduction of the Telemedicine service in Nyanga is therefore a game changer in this regard and could possibly result in greater access to healthcare and eventually universal health coverage.

The program has had a positive impact on both health care workers and patients. They are generally satisfied. The service has brought relief to many patients. Health care workers note that they have been learning a lot and are now able to manage patients by interacting with the doctors via telemedicine. The knowledge so gained enables the health care worker to better manage the patients when they return to the clinic for review.

However, the program has faced a number of challenges for both health care workers and patients. The biggest challenge has been the lack of human resources. Medical doctors that serve as consultants are located at the district hospital. They are very few. These doctors are overwhelmed as they have to serve patients at the district hospital and also attend to telemedicine patients at the same time. Also, the nurses at the rural health centres are overwhelmed. Their main purpose is to provide primary care services such as maternity care and deliveries, dealing with malnutrition, tuberculosis, chronic illness etc but instead they have been overburdened with more work through telemedicine. Despite telemedicine being a learning opportunity for health care workers, it also increases the work load on already overwhelmed employees.

Also, unavailability of electricity is a major problem at all the clinics (Nyatate, Nyafaru & Tombo). This has resulted in long waiting times for patients as some sessions have

had to be delayed or even cancelled. It has been noted that internet has also been a challenge in some clinics such as Nyatate. There is also need for quicker responses from the helpdesk as some of the technical issues are taking too long to resolve. Some tests, such as full blood count and malaria slides, are not available at the clinics. This therefore means patients have to wait for days before they receive their test results from Nyanga district laboratory.

There is also need to merge telemedicine services with the already existing health services. That way these services can be integrated and in turn help in the adoption of telemedicine in Zimbabwe.

5.3 Conclusions

The findings obtained in the study show that there are prospects for the use of telemedicine in Zimbabwe. The patients that where assisted were generally satisfied with the service. Telemedicine has generally improved access to health care. It has improved the quality of care and reduced the cost of health care. However, the unavailability of medicines at clinic level for conditions like hypertension and diabetes also impacts negatively on the success of the telemedicine project. Firstly, there could be potential delays in patients accessing their required medicines. This may lead to medical complications. Secondly and conversely, patients may have to travel to the district hospital to buy the medication. As a result, potential savings in transport money are lost.

Clearly healthcare workers are willing to use telemedicine as a way to improve the health delivery system in Zimbabwe. Health Care workers are over burdened by the use of telemedicine. To add on to the increased work load; they are also not

incentivised for using telemedicine. More work needs to be done to increase the level of computer literacy among health care workers.

There is no adequate internet and telemedicine infrastructure at Nyatate, Nyafaru and Tombo rural clinics. There is constant internet disruptions and power shortages thus disrupting telemedicine use.

Telemedicine medical records are not standardised through-out the three rural health clinics under study. It is difficult to compare their data due to the different ways in which they are recorded. Furthermore, the telemedicine medical records are not forwarded anywhere for compilation. The telerecords are just pilling up at the rural health clinics.

5.4 Implications

5.4.1 The main reasons why patients are willing to use telemedicine include convenience, economic savings and better access to medical services. These advantages can be used to motivate service providers to fix current problems affecting the telemedicine project.

5.4.2 The perception of health care workers on the use of telemedicine in their daily work will have a huge impact on the acceptance of telemedicine in Zimbabwe.

5.4.3 The use of ICTs in healthcare has been limited to voice and text applications. The Ministry of Health recently introducing an m-Health reporting system for all its 1200 clinics country wide. Thus, the use of telemedicine will greatly advance the MoHCC's program in that regard and improve internet and telemedicine infrastructure.

5.4.4 The level of willingness to use telemedicine means regulators and MoHCC can easily adopt telemedicine into its systems

5.5 Recommendations

5.5.1 There should be constant supply of essential medicines and supplies at clinic level to ensure the smooth delivery of health services to patients. More medical stuff should be employed so that teleconsultations are not cancelled on the account of stuff shortages.

5.5.2 The program must be backed by availability of more doctors to provide services as telemedicine consultants. Nyanga district only has 3 doctors; the workload at the district hospital is already huge and telemedicine adds on to the workload. There is need to integrate telemedicine in the daily work routine of health workers. Incentives for health workers using telemedicine service should be made available in order to motivate the employee and enhance the success of the program.

5.5.3 There should be power backup at all clinics (Nyatate, Nyafaru &Tombo) so as to ensure the smooth running of the telemedicine program. Internet and telemedicine infrastructure should be made available in order to allow smooth running of the projects.

5.5.4 There should be a standard way of maintaining telemedicine records. These records should be incorporated into the Ministry of Health and Child Care health system.

5.6 Suggestions for further research

5.6.1 In the future there is need to carry out studies on the prospects and challenges of telemedicine on a provincial or even national level.

5.6.2 Further research can also be done on the impact of telemedicine on the health care system in Zimbabwe, in particular the correlation between the health delivery system and telemedicine.

Reference List

Abdelhak, M., Grostick, S., & Hanken, M. (2012). Health information: management of a strategic resource. St. Louis, MO: Elsevier Saunders.

Abdi, Y., Elmi, J. (2011). Internet based telepsychiatry: a pilot case in Somaliland. *Medical journal* 2(7),145-150.

Bateman, C. (2011). Cutting-edge telemedicine venture freezes as official bodies frown. *South Africa Medical Journal* 101(3),368-372.

Bagayoko, C., Muller, H., Geissbuhler, A. (2006). Assessment of Internet-based tele-medicine in Africa (the RAFT project). *Computer Medical Imaging Graph journal 30(6):* 407-416

Berwick., Donald, W., Nolan, T., & Whittington, J. (2008). The Triple Aim: Care, Health, and Cost. *Health Affairs,* p. 759-769.

Berg, M. (2001). "Implementing inforamtion systems in health care organiztions: myths and challenges. *International Journal of Medical Informatics*, 64(2), 143-156.

Bryman, M., & Bell, E. (2007). Planning a research project and formulating research quotations. *Oxford University press*.

Boulanger, B., Kearney, P., Ochoa, J., Tsuei, B., & Sands, F. (2001). 'Telemedicine: a solution to the follow-up of rural trauma patients?' *Journal of the American College of Surgeons,* 192(4), 447-452.

Bhore, P. (2017). Telemedicine: A Medical Virtualization Technology

Benzion, I., & Helveston, E. (2007). Use of telemedicine to assist ophthalmologists in developing countries for the diagnosis and management of four categories of ophthalmic pathology. *Clinical Ophthalmology journal*, 1(4),489–495.

Brauchli, K. (2005). A telemedicine platform to support health providers in low resource settings. *Journal on Information Technology in Healthcare,* 3(4),227–235.

Carlo, C. (2007). Telemedicine for Developing Countries.

Chipps, J., Ramlall, S., & Mars, M. (2012). Practice guidelines for videoconference-based telepsychiatry in South Africa. *South Africa Journal Psychiatry,* 15(3), 271-282.

Combi, C. Pozzani, G., & Pozzi, G. (2015). Design, development, deployment of a telemedicine system in a developing country: Dealing with organizational and social issues. *Computer Society journal* 545-554.

Collier P. (2007). *The Bottom Billion,* Oxford University.

Codagnone, C., & Lupiañez-Villanueva F (2014). Benchmarking Deployment of eHealth among General Practitioners final report. Luxembourg: *European Commission*.

Geissbuhler, A. Ousmane, L. Lovis, C. & L'Haire, J. (2003). Telemedicine in Western Africa: lessons learned from a pilot project in Mali. *Perspectives and recommendations research.*

Graham, E., Zimmerman, M., Vassallo, D., Patterson,V. Swinfen, P., Swinfen, R., &Wootton, R.(2003).Telemedicine-the way ahead for medicine in the developing world.

Gulube, S., Wynchank, S. (2002). The national telemedicine system in South Africa. An overview and progress report, 92, p. 513.

Grigsby, W. (2002). Telehealth: an assessment of growth and distribution. *Rural Health journal*, 18(2), 58.

Hamed,,M. (2015).Training Course in Sexual and Reproductive Health. *Research Geneva.*

Haluza, D. & Jungwirth, D. (2016). ICT and the future of healthcare: aspects of pervasive health monitoring. *Inform Health Soc Care*, 22(1),11.

Heinzelmann, P., Jacques, G., & Kvedar J. (2005). Telemedicine by email in remote Cambodia. *Journal of Telemedicine and Telecar,* 11(2),44–47.

Hussein, R., & Khalifa, A. (2012). Telemedicine in Egypt: SWOT analysis and future trends. *GMS Medizinische Informatik, Biometrie und Epidemiologie journal, 8(1),* 1-16.

Hjelma, N. (2005). Benefits and drawbacks of telemedicine. *Telemedicine and Telecare*, 11,2.

Kalam, A. (2011). Current Situation and Future Opportunity of Telemedicine in Bangladesh. *Telemedicine and E-health academic research.*

Kaddu, S., Soyer, H., & Gabler, G. (2009). The Africa Teledermatology Project: preliminary experience with a Sub-Saharan teledermatology and e-learning program. *Journal of dermatology, 61(5)*, 155-157.

Khandpur, R. (2017). *Telemedicine, technology and applications* (2nd ed.) India: PHI learning private limited.

Kristen, S. (2015). The Impact of Telemedicine: Bridging the Gaps in Healthcare Delivery. *Health delivery study.*

Kifle, M., Mbarika, V., & Datta, P. (2006). Telemedicine in sub-Saharan Africa: The case of teleophthalmology and eye care in Ethiopia. *Journal of the American Society for Information Science & Technology,* 57(10),1383–1393.

Lewin Group. (2000). Assessment of approaches to evaluating telemedicine. *Health research.*

Latifi, R. (2009). Initiate-build-operate-transfer. A strategy for establishing sustainable telemedicine programs in developing countries: *Initial lessons from the Balkans. Telemedicine and e-Health Journal*, 15(14), 956.

Mars, M., & Erasmus, L. (2012). Telemedicine can lower health care costs in Institute for health improvement, p. 32-33. *Health Affairs.*

Mars, M. (2007). Telemedicine in KwaZulu-Natal: from failure to cautious optimism. *Journal for Telemed &Telecare,*13(8), 57-59.

Maestrutti, M. (2010). New Technologies and Emerging Spaces of Care. *Farnham-Burlington: Ashgate..*

Manyika dialects, 2015.

Moodley, D., Pillay, A., & Seebregts, C. (2014). Researching and developing open architectures for national health information systems in developing African countries. *FHIES of Lecture Notes in Computer Science (7151).*

Mariyam, N., & Subrahmanyam, K. (2011). Evaluation of Critical Success Factors for Telemedicine Implementation. Health research.

Martìnez, A., Villarroel, V., Seoane, J., Pozo, F. (2004). A study of a rural telemedicine system in the Amazon region of Peru. *Journal for Telemedicine & Telecare, 10(2)*, 219-225.

Mbarika, V. (2004). 'Is Telemedicine the Panacea for Sub-Saharan Africa's Medical Nightmare?'*Communications of the ACM*, 47(7),21.

Muvoti, M. (2013). An analysis of the Diffusion and Adoption of Technologies and Innovations in the Public Healthcare Sector in Zimbabwe. *Research in information technology.*

Mbemba, G., Bagayoko, C., Gagnon, M., Hamelin-Brabant, L., & Simonyan, D. (2016). The influence of a telehealth project on healthcare professional recruitment and retention in remote areas in Mali*: A longitudinal study*.

Martinez, A. (2005). Analysis of information and communication needs in rural primary health care in developing countries. *IEEE Transactions on Information Technology in Biomedicine*, 9(1),66–72.

Miller, T., & Derse, A. (2002). 'Between Strangers: the practice of medicine online'*, Health Affairs*, 21(4), 168-179.

Meso, P., Mbarika, V., & Sood, S. An overview of potential factors for effective telemedicine transfer to Sub-Saharan Africa. *IEEE Trans Information Technology Biomed,*13(5),734-739.

Norris, A. (2002). Essentials of Telemedicine and Telecare. *John wiley & sons Ltd.*

Ole, H. (2002). From systems and tools to networks and infrastructures, from design to cultivation. *Communication systems research*. Retrieved from http://heim.ifi.uio.no/~oleha/Publications/ib_ISR_3rd_resubm2.html.

Jen-Hwa Hu, P., Patrick, Y., Chau., Olivia, R., & Liu Sheng. (2000). Investigation of Factors Affecting Healthcare Organizations. *Adoption of Telemedicine Technology journal*.

Peters-Scheepers, B. (2011). HPCSA condemns unethical telemedicine practice. Retrievedfromhttp://www.hpcsa.co.za/downloads/press_releases/current/hpcsa_condemns_unethic l_ telemedicine_practice.pdf.

Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ). (2012).

Payne, G., Laporte, A., Deber, R., & Coyte, P. (2007). Counting backward to health care's future: using time-to death modeling to identify changes in end-of-life morbidity and the impact of aging on health care expenditures. Milbank. *Health journal,* 2(13), 57.

Ricci, M., Caputo, M., & Callas, P. (2005). The use of telemedicine for delivering continuing medical education in rural communities. *Telemedicine Journal for E-Health,* 11(5),124-129.

Rina, N., & Evita, S. (2018). Financial Incentives: *The Impact on Employee Motivation. Research Article*,17(6).

Sasikala, K., Indhira, V., Chandrasekaran, M. (2018). Performance prediction of interactive telemedicine. Retrived from https://doi.org/10.1016/j.imu.2018.03.003Get rights and content

Sood, S., & Bhatia, J. (2005) Development of telemedicine technology in India: ''Sanjeevani'' – an integrated telemedicine application. *Journal of Postgraduate Medicine*, 51(4),308–311.

Sozen, C., Kisa, A., & Kavuncubasi, S. (2003). Can rural telemedicine help to solve the health care access problems in Turkey? 47.*Clinical Research and Regulatory Affairs,*20(1),117–126.

Shiferaw, F., & Zolfo, M. (2012). The role of information communication technology (ICT) towards universal health coverage: the first steps of a telemedicine project in Ethiopia. *Global Health research study.* p. 5-13.

Stutchfield, B., Jagilly, R., & Tulloh, B. (2007). Second opinions in remote surgical practice using email and digital photography. *ANZ Journal of Surgery*, 77(11), 1009–1012.

Thar, R., John, S., & Rao, K. (2008) Telepsychiatry in Chennai, India: *The SCARF experience. Behavioral Sciences & the Law*, 26(3),315–322.

Teleradiology solutions. (2017). Telemedicine challenges in Africa. *Health research.*

Tornatzky, L., & Fleischer, M. (1990). The process of technological innovation. *Lexington Books, Lexington, Massachusetts.*

Tsokota, T. (2013). ICT and the turning-around of the Zimbabwean Economy. *Academic research in ICT.*

UNICEF. (2013).National HIV Care and Treatment Strategic Plan.(2013-2017). Retrieved from https://www.unicef.org/esaro/UNICEF-Zimbabwe-2018-Health-Budget-Brief.pdf

Ukaoha, K. & Egbokhare, F. (2012). Prospects and challenges of telemedicine in Nigeria. *Academic research.*

Walker, E. (2005). Health Informatics. *London, Springer*.

Wamala, D. (2013). A meta-analysis of telemedicine success in Africa. *Health research study.*

Weinberg, J., Kaddu, S., & Gabler G. (2009). The African Teledermatology Project: providing access to dermatologic care and education in sub-Saharan Africa. *Pan Africa Medical research, 3*(16).

Wootton, R. (2008). Telemedicine support for the developing world. *Journal for Telemedicine & Telecare1*, 4(1), 109-114.

International Telecommunications Union. Information society statistical profiles. (2009). Retrieved from: http://www.itu.int/dms_pub/itu-d/opb/ind/DIND-RPM.AF-2009-PDF-E.pdf. Geneva

The World Bank. Fact sheet: Infrastructure in sub-Saharan Africa. (2014). Retrieved from: http://go.worldbank.org/SWDECPM5S0

Zimbabwe Demographic and Health Survey (ZDHS). (2015). Key Indicators. *Health survey.*

Zimbabwe's E Health strategy, (2012-2017). MoHCC. *Ministry of health and Child Care.*

APPENDICIES

Appendix 1: Approval letter from institution

Reference:

Nyanga District Hospital

P. Bag 2003

Nyanga

Telephone: 0298 – 316/317/532

13/6/2019

The Supervisor
Africa University

Dear Sir/Madam

RE: Authority for Tanyaradzwa Wimbikai Mugavazi Reg#182510 to conduct Telemedicine Research

I am in receipt of your application to conduct a research on the telemedicine project. I am pleased to advise you that authority has been granted for you to proceed and probe this pertinent subject.

Kindly note that in line with our Ministry Guidelines you will be expected to present your findings to our district health executive before you present them elsewhere.

My office will be available to provide support and guidance as you carry out your research. I wish you well

Yours Sincerely

Dr A.T Mulema
Acting DMO-MBChB-UZ

Appendix 2: Research participant consent form

My name is Wimbikai Tanyaradzwa Mugavazi. I am an Executive Masters in Business Administration student from AU. I am carrying out a study on the prospects and challenges of telemedicine in Zimbabwe. The case study will be focused on Nyanga district. I am kindly asking you to participate in this study by answering YES/NO or filling in answers.

What you should know about the study:

Purpose of the study:

The purpose of the study is to establish the prospects and challenges of telemedicine. Reason is to find ways to solve problems faced in Zimbabwe in terms of health services delivery. By introducing telemedicine the health services budget is reduced significantly in the long run, health services delivery is increased geographically; however a number of challenges are likely to be faced. It is therefore important to carry out the research in order to establish if there is a future for telemedicine in Zimbabwe. You are one of 52 participants selected for this research. I have chosen you to participant in the study because you reside in the geographical area (Nyanga district) of my study, you use Nyatate, Nyafaru or Tombo clinic as your health facility plus you are affected by the health services delivery system in Nyanga district.

Procedures and duration

If you decide to participate you will be asked to fill in a written questionnaire or answer oral questions. It is expected that this will take about 2 minutes to complete either of the two.

Risks and discomforts

If you decide to participate you will choose the language you are comfortable conversing in as questions will be in the language you are comfortable in.

Benefits and/or compensation

There won't be any benefits or compensation for all participants. The results of the study will be used to improve the health services delivery system. So eventually the study will benefit the whole country as it is a basis for the introduction of telemedicine country wide.

Confidentiality

Names and any other identification will not be asked for in the questionnaires or interview. All the information obtained from the participant will be used primary for this research only.

Voluntary participation

Participation in this study is voluntary. If participant decides not to participate in this study, their decision will not affect their future relationship with any of the rural clinics (Nyatate, Nyafaru, Tombo) or Nyanga district hospital. If you chose to participate, you are free to withdraw your consent and to discontinue participation without penalty.

Offer to answer questions

Before you sign this form, please ask any questions on any aspect of this study that is unclear to you. You may take as much time as necessary to think it over.

Authorization

If you have decided to participate in this study please sign this form in the space provided below as an indication that you have read and understood the information provided above and have agreed to participate.

---------- ----------

Name of Research Participant (please print) Date

Signature of Research Participant or legally authorized representative

If you have any questions concerning this study or consent form beyond those answered by the researcher including questions about the research, your rights as a research participant, or if you feel that you have been treated unfairly and would like to talk to someone other than the researcher, please feel free to contact the Africa University Research Ethics Committee on telephone (020) 60075 or 60026 extension 1156 email aurec@africau.edu

Name of Researcher: Wimbikai Tanyaradzwa Mugavazi

Appendix 3: Tsvakurudzo Fomu yeMvumo yeMubvumirano

Zita rangu ndinonzi Wimbikai Tanyaradzwa Mugavazi ndiri mudzidzi wepaAfrica University ndichiita zvidzidzo zve Masters of Business Administration. Ndikuita wongororo nestvakiridzo yechirongwa chitsva chakatangwa munyika yedu yeZimbabwe cheTelemedicine. Telemedicine kurapwa nachiremba arikure muchishandisa masai sai kana dande mutande (internet) sezvo murikungoona kuti zvinhu zvava kufambirana nenguva.

Chirongwa ichi chichirerutsa bazi rezveutano kunyangwe nemari inoshandiswa ipapo ichange irishoma kunyangwe zvazvo pachiita matambudziko atinosangana nawo ndosaka ndati tidzoke kuvanhu sezvo murimi muchange muchizoshanda nazvo.Imi muri vamwe vevanhu vakasarudzwa kutiudzawo mufungo wenyu imi vanhu ve Nyatate, Nyafaru kana Tombo Clinic sezvo murimi munosangana nematambudziko akati wandei muno muNyanga District.

Kana mada kuva muchikamu chechirongwa chino tine mapepa ekunyora mhinduro yezvakabvunzwa ipapo,hazvitore hazvo nguva yakareba.Sunungukai kupindura nerurimi rwamunoda hapana hapo muripo watinokupai kuda kungonzwawo pfungwa dzenyu .Mukufamba kwenguva vagary vemuno ndimi muchazoitirwa zvakanaka nechirongwa ichi, saka ngatichishandisai mukana iwoyu.Chirongwa ichi chiri kune avo vanonzwa kuda kuva muchikamu chetsvakiridzo newongororo,kana ukanzwa usina kusununguka kupindura mibvunzo hazvikukanganise hukama hwako nechipatara chenyu che Nyatate.

Musati matanga kupindura mibvunzo sunungukai kubvunza zvamungada kuziva .Munogona kupindura nemucherechedzo wekuzadzisa zvakabvunzwa pabhepa ,urimucherechedzo wekunzwisisa.

---------- ----------

Zita Zuva

Kana iwe uine mibvunzo pamusoro pekudzidza uku kana fomu yemvumo kupfuura iyo

yapindurwa nemuongorori unosanganisisra mibvunzo pamusoro pekutsvakurudza, kodzero dzako sechirongwa chekutsvakurudza, kana iwe uchinzwa kuti wakatorwa zvisina kunaka uye unoda kutaura kune mumwe munhu kunze kweuyo muongorori, tapota

ivai makasununguka kutaura ku Africa University Research Ethics Committee parunhare

rwedu rwunoti (020) 60075 kana 60026 extension 1156 email aurec@africau.edu

Zita remutsvakurudzi ----------

Appendix 4: Patient Questionnaire English

INSTRUCTIONS

Please read carefully and tick or cross the appropriate choice for each statement.

1. Please indicate your gender.

Male [ ] Female [ ]

2. Please indicate your age range.

20-30 years 31-40 years 41-50 years Over 50 years

3. Do you understand what telemedicine is?

Yes [ ] No [ ]

4. Have you ever used telemedicine services?

Yes [ ] No [ ]

IF YES TO Q4

5. Were you satisfied with the telemedicine service?

Yes [ ] No [ ]

IF NO TO Q4

6. Are you willing to use telemedicine services?

Yes [ ] No [ ]

IF YES TO Q6

7. Please explain why?

IF NO TO Q6

8. Please explain why?

---

9. Do you think telemedicine can help your community? Explain.

THANK YOU FOR YOUR VALUABLE TIME

END OF QUESTIONNAIRE

Appendix 5: Mibvunzo yevarapwi

Verengai mibvunzo mugonzwisisa,moisa chinyoro pamhinduro dzenyu.

1. Murume [ ] Mukadzi [ ]

2. Zera

20-30 years 31-40 years 41-50 Years Over 50 Years

3. Munoziva here nezve Telemedicine?

Hongu [ ] Kwete [ ]

4. Makamboshandisa here Telemedicine?

Hongu [ ] Kwete [ ]

Kanamhinduro iri hongupa Q4

5. Makabatsirikana here?

Hongu [ ] kwete[ ]

Kana mhinduro iri kwete paQ4

6. Mungade here kushandisa Telemedicine?

Hongu [ ] Kwete [ ]

Kana mhinduro iri hongu pa mubvunzo wechishanu

7. Makabatsirikana zvakadini?

---

8. Kana mhinduro iri kwete pamubvunzo wechishanu mungatipawo zvikonzero?

---

9. Munofunga here kuti chirongwa ichi chichabatsira munharaunda yenyu?

Hongu [ ] Kwete [ ]

10. Kana mhinduro iri hongu pamubvunzo wepfumbamwe mungatipewo zvikonzero nekudakwei murikufunga kuti chirongwa ichi chingabatsira munharaunda ?

---

11. Kana mhinduro iri kwete pamubvunzo wepfumbamwe mungatipewo zvikonzero murikufunga kuti chirongwa ichi hachingabatsire munharaunda yenyu?

MAGUMO

TINOKUTENDAI NENGUVA YAMATIPA.

Appendix 6: Health care workers' Questionnaire

Please read carefully and tick or cross the appropriate choice for each statement.

1. Gender? Male [ ] Female [ ]

2. Please indicate your age range.

20-30 years 31-40 years 41-50 years Over 50 years

3. What is your profession?

Doctor [ ] Nurse [ ] Other (specify) ----------

---

4. Have you ever used telemedicine to help patients?

Yes [ ] No [ ]

IF YES TO Q4

5. Was it successful?

Yes [ ] No [ ]

IF NO TO Q4

6. Explain why?

IF YES TO Q5

7. Explain how it was successful?

IF NO TO Q5

8. Explain why?

END OF QUESTIONNAIRE

THANK YOU

Appendix 7: Mibvunzo yevanhu vanoona nezveutano.

Verengai mugonzwisisa zvinotevera,mugoisa mucherechedzo wechinyoro panezvakabvunzwa.

1. Murume [ ] Mukadzi [ ]

2. Zera?

20-30 Years 31-40 Years 41-50 Years Over 50 Years

3. Munoita basa rei?

Doctor [ ] Nurse [ ] ----------

4. Makamboshandisa here Telemedicine kurapa varwere?

Hongu [ ] Kwete.[ ]

5. Kana muchiti hongu kumubvunzo wechina, Telemedicine yakabatsira here?

Hongu [ ] Kwete [ ]

6. Kana muchiti kwete kumubvunzo wechina mungatipewo zvikonzero nekudakwei musina kumboshandisa Telemedicine kurapa varwere?

---

7. Kana muchiti hongu kumubvunzo yechishanu, mungatiudzewo here kuti yakabatsira sei?

---

8. Kana muchiti kwete ku mubvunzo wechishanu mungatipewo zvikonzero nei Telemedicine isina kubatsira?

MAGUMO

TATENDA

Appendix 8: Interview guide

INTERVIEW GUIDE FOR HEALTHCARE WORKERS

1. What are your views with regards to telemedicine as a way to deliver health services?

2. How do you think telemedicine should be implemented country wide?

Appendix 9: AUREC approval letter

AFRICA UNIVERSITY
(A United Methodist-Related Institution)
INVESTING IN AFRICA'S FUTURE

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60073/60026/61611 Fax: (+263 20) 61785 website: www.africau.edu

Ref: AU1315/19

15 January, 2020

Wimbikai T Mugavazi
C/O CBPLG
Africa University
Box 1320
Mutare

RE: **PROSPECTS AND CHALLENGES OF TELEMEDICINE IN ZIMBABWE: A CASE STUDY OF NYANGA DISTRICT**

Thank you for the above titled proposal that you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

AFRICA UNIVERSITY
RESEARCH ETHICS COMMITTEE (AUREC)
15 JAN 2020
APPROVED
P.O. BOX 1320, MUTARE, ZIMBABWE

The approval is based on the following.

a) Research proposal
b) Questionnaires
c) Informed consent form

- **APPROVAL NUMBER** AUREC1315/19

This number should be used on all correspondences, consent forms, and appropriate documents.

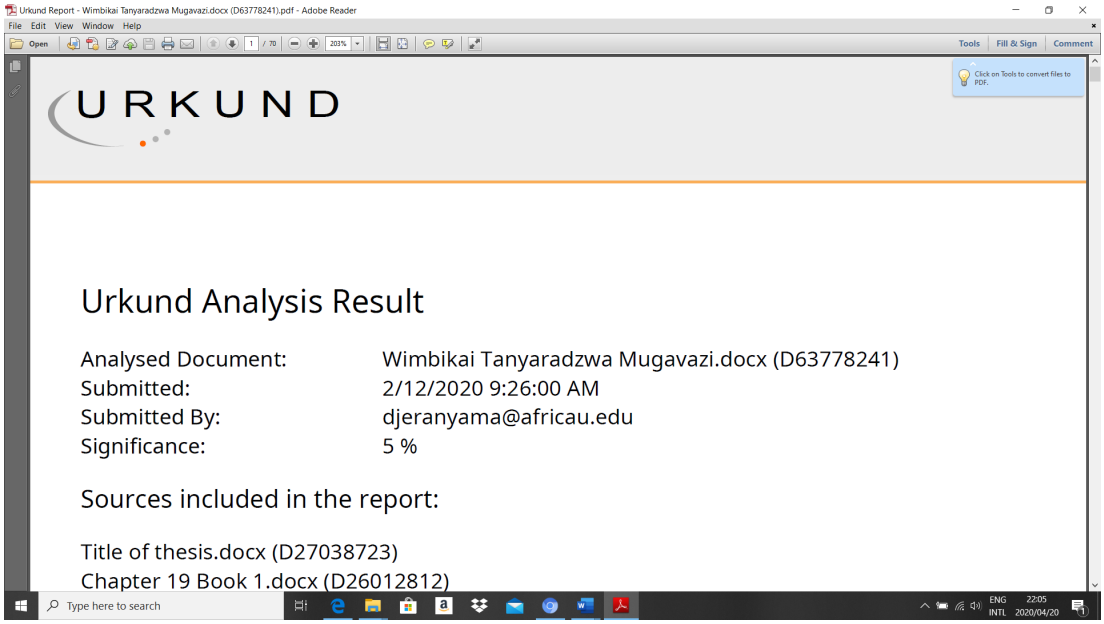
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** January 15, 2020
- **EXPIRATION DATE** January 15, 2021
- **TYPE OF MEETING** Expedited

After the expiration date this research may only continue upon renewal. For purposes of renewal, a progress report on a standard AUREC form should be submitted a month before expiration date.

- **SERIOUS ADVERSE EVENTS** All serious problems having to do with subject safety must be reported to AUREC within 3 working days on standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

Yours Faithfully

MARY CHINZOU – A/AUREC ADMINISTRATOR
FOR CHAIRPERSON, AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE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