TELEMEDICINE UTILIZATION ON THE WELL-BEING OF DIABETIC PATIENTS IN NAIROBI CITY COUNTY, KENYA

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DEDICATION

This work is dedicated to my late parents Grace and Henry Were.

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My heartfelt gratitude goes to God for giving me the willpower to complete this course. I am deeply indebted to my supervisors, Dr. Gutwa Oino and Dr. Daniel Kendagor. Thank you for your support, guidance, and advice and for providing me with constant, constructive supervision and nurturing, as well as your deep understanding, and most importantly patience. I also want to express my gratitude to Kisi University for giving me the opportunity to further my studies, the School of Arts and Social Sciences and all the faculty members as well as all my lecturers who took me through the coursework at the initial stage of my studies. I finally would like to thank and appreciate my family for cheering me on when I was on the verge of despair. Thank you for the encouragement and teasing as well. Your support was unwavering. Lastly I to thank Benter, John, Natallie, Boaz, Daphne and the entire Were family for your overwhelming support and encouragement.

ABSTRACT

This study focused on telemedicine utilization on the well-being of diabetic patients in Nairobi City County, Kenya to determine its impact on diabetic patients. Telemedicine-based care provides remote health and social care to maintain people's autonomy and increase their quality of life. The objectives of the study were to assess the effect of telediagnosis utilization on the well-being of diabetic patients, establish the impact of teletreatment utilization on the well-being of diabetic patients, determine whether teleadvice utilization influences the well-being of diabetic patients and examine the effect of telemonitoring utilization on the well-being of diabetic patients. Nairobi has a doctor-patient ratio of 9.5 per 10,000 inadequate to efficiently deliver quality healthcare to diabetic patients and the population at large. Nairobi County faces severe shortages of essential cadres, skill-mix imbalance among other challenges of which telemedicine can be a remedy. The study was anchored on the Diffusion of Innovation and Self-determination theories. The pilot study was conducted at one of the Penda Health clinic branches. The study used a descriptive research design to gain more insight into diabetes mellitus to attempt to ascertain telemedicine gains in diabetic patients. The target population was 100 men and women. Using Krejcie & Morgan (1970) table of sample determination, the research recruited 71 respondents from Nairobi County, 57 for the survey, 14 key informants, and 2 focus group discussions. Proportionate sampling allowed the researcher to work with 59 respondents. A letter of introduction was sought from the National Commission for Science, Technology and Innovation (NACOSTI) as a permit to conduct the study. Similarly, an introduction letter was obtained from Kisii University to relevant administrative offices to explain the objectives of the study. Recurring patterns from raw information from collected qualitative data were looked at then topics formed, coded, and rearranged according to themes, after which a final report was written. Data analysis for this study also involved data preparation on an excel spreadsheet for quantitative data, which were logged in. Data then was checked for accuracy and then transformed after which descriptive statistics were used to describe the basic features of the data in the study. The results were presented in summary reports and tables. The study established that smartphones were the most popular devices used during telemedicine due to its reliability and that doctor mainly rely on the patient's verbalization during telediagnosis. The study also found out that challenges related to power and internet challenges push patients to opt for face to face visits with their caregivers. The study also established little attention is given on adherence and checks on other conditions and organs related to diabetes by teleadvice programmes. The study also established that though telemonitoring allows respondents to stay better connected to their healthcare providers, some clients are unable to operate their devices during sessions. The study recommends that more information and education on telemedicine as a treatment option is given and training on the use of devices especially among those not techno-savvy. The study concludes that country facilities lack advanced telemedicine facilities and that the high cost of devices is a barrier to telemedicine utilization. Other setbacks of telemedicine usage include unreliable power and internet availability and lack of technology knowledge. For further research, it is recommended that another study can be done to assess the relationship between telemedicine sensitization and the well-being among diabetic patients in other countries.

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ABBREVIATIONS AND ACRONYMS

ATA	American Telemedicine Association
CHMT	Council Health Management Teams
HER	Electronic Health Record
FDTT	Frog Design Telehealth Toolbox
FGD	Focus Group Discussion
FTF	Face to Face
GDM	Gestational Diabetes Mellitus
GHRIS	Government Human Resource Information System
ICT	Information and Communication Technology
IOT	Internet of Things
ITU	International Telecommunication Union
ISDN	Integrated Service Digital Network
JST	Journal of Sensor Technology
KI	Key Informants
KNH	Kenyatta National Hospital
KRA	Kenya Revenue Authority

MMS	Ministry of Medical Services
NAM	National Academy of Medicine
NHS	National Health Service.
NMRC	Naval Medical Research Center
PA	Patient Monitoring
PAHO	Pan American Health Organization
RCD	Remote Care Delivery
RCT	Randomized Control Trials
ROK	Republic of Kenya
SAMHSA	Substance Abuse and Mental Health Service Administration
SCHMT	Sub-County Health Management Teams
SIDM	Society to Improve Diagnosis in Medicine
SMI	Serious Mental Illness
SUD	Serious Mental Illness
T1D	Type I Diabetes
T2D	Type 2 Diabetes
UHC	Universal Health Coverage

WBAN Wireless Body Area Network

WHO World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

In order to advance the health of people and their communities, the World Health Organisation (WHO) defines telemedicine as the provision of health care services where distance is an essential consideration by every healthcare provider (HCP) using technology for communication and information for the exchange of accurate data for the prevention, treatment, and detection of illnesses and injuries, research and assessment, and for the ongoing education of medical professionals (Ghosh, Gupta & Misra, 2020). According to Pradeepa, Rajalakshmi, and Mohan (2019), it is the remote exchange of health-related data or services between patients and physicians via electronic communication technology. Telemedicine is being utilised more and more to enhance clinical results and patient access to care for conditions other than diabetes. Routine medical treatment for chronic illnesses will be provided online, just as the majority of other parts of life have become computerised (Borries, et al. 2019).

According to the findings of WHO 2019 universal healthcare (UHC) report, investing in health is an investment in human capital that takes time to pay off and contributes to the empowerment and protection of everyone. With increased life expectancies, decreased rates of mother and child mortality, and effective campaigns against major illnesses, the globe has achieved significant progress in recent decades in terms of health. This accomplishment is the result of national and international efforts to raise the standard of healthcare and increase its accessibility for all. The Sustainable Development Goals for 2030 place a strong emphasis on ensuring that everyone has access to affordable, high-quality healthcare. 75 nations have passed UHC laws in

response to the 2015 UN Sustainable Development Summit pledges, which included achieving UHC by 2030 Feigl & Ding, (2013). But in order to achieve real UHC, we must not only quantify the increases in the coverage of health services but also comprehend the obstacles for obtaining and the significant gaps that still exist. Access to health care and, eventually, health outcomes are significantly influenced by socioeconomic circumstances (Cotton, 2017).

In addition to facilitating the remote transfer of medical records between patients and medical professionals, telemedicine is utilised to improve patient access to treatment and deliver high-quality remote medical services. For people who live in rural areas or have restricted physical access to healthcare, it is especially pertinent. Hamidreza and Fatemeh (2017) have classified telemedicine into three primary categories: store-and-forward, which involves gathering medical data and forwarding it to a physician or medical professional; remote monitoring; and interactive services. The terms "telehealth," "telecare," and "eHealth" are frequently used interchangeably, however there is a great deal of variety in their definitions and usage. "Common definition(s) as defined by (Eswaran & Dawson, 2022)." is necessary.

The history of telemedicine dates back to the 1800s. The term initially appeared in one of the earliest papers on electrocardiography data transmission over telephone wires in the 20th century (Craig & Patterson, 2005). In the 1960s, commercial telemedicine equipment was utilised to foster partnerships between experts at different health facilities by the military, space technology departments, and private persons in industries like television Currell et al., (2000). Later, the telegraph and telephone were added as means of communication. During the American Civil War, telemedicine was utilised in military settings to order medical supplies, share information among healthcare providers, and report casualties and injuries sustained on the battlefield due

to the high speed of telegraph communication, according to Shirzadfar & Fatmeh (2017).

According to Rasmussen et al. (2018), broadcasts of modern telemedicine to radio consultation centres across Europe started in the Netherlands in the early 1900s. After that, patients on ships at sea and on isolated islands had radio evaluations from medical centres in France, Italy, and Norway between the 1920s and the 1940s. In the United States, radiographic pictures first appeared in the early 1950s. In the United States, the first wave of formal telemedicine initiatives got underway in the late 1950s.A new era of telemedicine emerged from the ashes of previous unsuccessful attempts to establish it, Hamidreza &Fatemeh, (2017). The first practitioner of modern telemedicine was a Dutch physician, Willem Einthoven. The revival of telemedicine in the late 1980s can be attributed to major improvements in technology.

In the United States, 76% of hospitals connect with patients using some form of telemedicine, (Kane & Gillis, 2018). In Europe, the European telemedicine industry is on the rise as a result of the legalization of remote treatment and electronic prescriptions. Online medical appointments, and requests for health information and medical services in Europe is increasing by the day. In Asia, telemedicine has become an important part of medical services. According to a 2021 State Council Information Office of China report, "Internet plus medical and health care" has changed from "option" to "necessity" in many medical institutions.

Until recently, just a small part of Africa was able to realize and push for telemedicine. There are success stories from South Africa, Mali, Sudan, Rwanda, Burkina Faso, and Uganda (Gulube et al, 2001, Corret et al, 1998, Nzeyimana, 2012, Jambusaria, 2013, FMPOS, 2013). Kenya identified telemedicine as one of the strategic areas of

intervention in the Kenyan e-Health strategy presented in the Vision 2030 report. The country launched the first phase of national telemedicine initiative at Kenyatta National Hospital in 2015, with the aim of improving access to better healthcare among the marginalized and rural poor, who were to interact with health experts at the hospital, SciDevNet, (2015). During 2021 COVID-19 pandemic Kenya Medical Practitioners and Dentist Council (KMPDC) began the issuance of licenses to 20 facilities to offer telemedicine. Unfortunately, most of these facilities stopped offering the services post-COVID. Kenya National eHealth Strategy (2011), documents telemedicine as one of the five key strategic areas of intervention that form the pillars of the e-Health Strategy.

Diabetes mellitus is a chronic disease. Journal of Diabetes Science and Technology, (2008) defines diabetes as a metabolic disorder in which there are high levels of sugar in the blood (hyperglycemia). According to Kulkarni (2022), insulin is required for the entrance of glucose into a body cell. The illness is linked to low life quality, morbidity, and death. (2019) Harding et al. Insulin shortage causes blood glucose levels to rise in people with diabetes. Insulin is produced by the pancreas. When the body produces too much insulin or when the insulin's effectiveness is compromised, excess glucose builds up and damages the cells in different organs. The body attempts to create extra glucose (gluconeogenesis) when the cells are unable to use it as efficiently as they should. This causes blood sugar levels to rise even in the absence of food consumption. 2022 saw Kulkarni.

Diabetes has become a public health concern worldwide. It is one of the most common chronic and avoidable illnesses, impacting more than 415 million people worldwide. According to Shukri et al. (2018) and Ogurtsova et al. (2017), it was the cause of almost 5 million fatalities in 2015 and 4 million in 2017, or one death every eight seconds. According to Wang et al. (2019), estimates place it as the seventh most common cause

of mortality in the United States. In terms of the worldwide diabetes epidemic, India is predicted to overtake China in the following years, ranking second behind China (IDF, 2017). It is projected that by 2030, the yearly medical expenses and associated expenditures associated with type 1 and type 2 diabetes within the United States of America would total 622 billion US dollars.

According to Badri & Hamdy (2021), about 85% of diabetes care is carried out by non-endocrinologists whose estimated shortage by 2030 will be between 14,80049,300. Current diabetes guidelines recommend diabetologist or general practitioner consultations at least every 3 months to measure Hemoglobin A1C (HbA1c) (American Diabetes Association, 2020). The ripple effect of the growing number of diabetic patients has led to high costs of treatment and physicians who are overworked leading to reduced doctor-patient interaction time. Technological evolutions of digital health like telemedicine are however promising better healthcare.

Lal (2016), lists 3 types of diabetes. Type 1 diabetes (T1D) is associated with early adulthood, before the age of 40. Treatment includes regular insulin injections, special diet, yoga, and exercise. Type 2 diabetes (T2D) affects approximately 90% of all cases of diabetes worldwide. It gradually gets worse compelling the patient to take insulin. Overweight, obese and whose testosterone levels are low people have a higher risk of developing it. Prevention includes yoga, exercise, a healthy diet, and body weight control. Treatment includes tablets, exercise a special diet, and sometimes insulin injections. Gestational diabetes affects females during pregnancy. Its remedy includes exercise and blood-glucose-controlling medications. Diabetes can often be detected by carrying out a urine or blood test. Its effects include kidney failure, stroke, blurred vision, sores that do not heal, unexplained weight loss, fatigue, and increased thirst.

Understanding healthcare transformation through innovation in digital health is the primary motivation behind this work. This study focuses on the utilization of telemedicine with a view to understanding its utilization effect on the well-being of diabetic patients, with exclusive attention to telemedicine applications in the follow-up of diabetic patients in Nairobi City County. The study is an attempt to examine the relationship between telehealth functionalities and diabetes disease care management in Nairobi City County. People with diabetes represent a vulnerable population who need to be protected from avoidable outpatient clinic visits (Aber, Hochfellner & Mader, 2021). The study assumes that telemedicine solutions serve to reduce outpatient clinic and physician visits.

The present work is designed to contribute to the increasingly important debate on cost-reduction measures in healthcare management. The study advances the argument that digital health interventions are likely attractive tools for delivering virtual healthcare services, and anticipates a correlation between telehealth functionalities and positive health outcomes among diabetic patients. Digital healthcare interventions have the potential to reach diabetic patients who for one reason or another are unable to make in-person medical visits to hospitals or to visit physicians (Ginige & Maeder, 2018).

The multidisciplinary discipline known as development studies, which focuses on understanding the social, political, technical, cultural, and economic dimensions of societal change, especially in developing nations, is where this research is grounded. Conceptually speaking, development is a process of change that is aimed at improving the living standards of the people of a country (Taylor 2014). Improvement in education, health care, clean water, good sanitation, as well as human rights, are all aspects of social development necessary for a country's economic production. To this end, development studies give an understanding of how politics and economics, together

with social and environmental issues, work together to contribute to improving living standards. It can be argued that good health is the cornerstone of economic health in every society.

For the purposes of this work, the study focuses particularly on the technological evolution (change/development) in relation to the healthcare management of diabetic patients. The development of ICTs and digital health care services, for example, is part of the development processes that form part of the interdisciplinary field of development studies. The study pays particular attention to diabetic patients in Nairobi. The total number of people living with diabetes in Kenya, Nairobi included, is unknown Maina *et al., (*2011). A study by Waniru, (2011) however indicates that the prevalence rate in Kibera, is 3.2%.

The provision of quality health care is a human rights obligation squarely pressed upon governments. Development in health care is therefore a key aspect of social development since good health is correlated with the economic production of a country. Economic productivity is affected when the workforce is weak or absent due to ill health. A county's development will be slowed down due to the disease burden. Diabetes affects the economy in ways other than just medical expenses. Diabetes's impacts were expected to cost the US economy $58 billion in lost productivity at work (Polisena et al., 2019). According to Rasmussen, Lauszus, and Loekke (2020), the life expectancy of those with diabetes is between six and eight years lower than that of those without the disease. According to an 18-year research by Dullett et al. (2017), the University of California determined that between 1996 and 2013, telemedicine services saved about 11,000 patients and five million miles of travelling, or nine years of travel time.

Though telemedicine utilization in Kenya is relatively new, it represents a social change with obvious advantages, despite the challenges of adopting it. Kenyans can adopt this innovation and probably realize that they can equally obtain good medical services remotely at reduced cost in the comfort of their homes. As Rogers (2003) observes in his work "Diffusion of Innovations", "Many innovations require a lengthy period of many years from the time when they become available to the time when they are widely adopted. Therefore, a common problem for many individuals and organizations is how to speed up the rate of diffusion of an innovation. Many will also require striving (self-drive) and acceptance by the patients themselves to actualize their potential as demonstrated by Deci & Ryan, (2000) in Self-Determination Theory.

Access to health in Kenya is affected by extraneous factors such as costs, availability of funds, and socioeconomic inequalities and this hinders access to health (Muriithi, 2020). A 2016 study by Omondi on factors influencing service delivery in public hospitals in Nairobi County indicates ICT systems and equipment are not commonly used for service delivery. Equitable telemedicine requires reliable, accessible, and affordable internet and digital literacy (Siefer, 2021). Kenyan Vision 2030 seeks to have Universal Health Care by 2030 for a more prosperous and healthier country. To achieve this, and SDG 3 the current healthcare system must embrace telemedicine technology in order to safeguard the advancement of enhanced patient outcomes, cost, and quality of life, Dinesen et al., (2016). The primary solution to the increased utilization of telemedicine applications will be supported by strong research-based evidence that telehealth applications are both sustainable and scalable (Dinesen et al., 2016).

1.2 Statement of the Problem

Although telemedicine is said to be cost-effective in diabetes related treatment, the benefits emitting from the actual relationship between telemedicine utilization and the health outcomes among diabetes mellitus patients is still scarce. Despite the increase in population, healthcare cost, overstretched social, and educational resources, and shortage of healthcare professionals in Africa, there is inadequate basic infrastructure, human resource gaps, poor quality services, and low trust in health practitioners and medical authorities acting as barriers to achieving UHC, (Ajala, Adetunji & Akande, 2015). Nairobi has a doctor-patient ratio of 9.5 per 10,000 inadequate to efficiently deliver quality healthcare to the population Waruru (2018). The 6th January 2023 Ecitizen report indicates that Nairobi County faces severe shortages of essential cadres, poor working environment, skill-mix imbalance, and frequent strikes by health workers among other challenges. While a vast literature studies the effects of in-person visits on the health outcomes among diabetes patients, less work has been done on understanding the impact of telemedicine intervention on the health outcomes among diabetes patients.

The current systematic review of evidence on the potential for digital technologies to improve access to health and social care for diabetic patients is limited in both scope and quality. Though telemedicine applications have achieved varying levels of success, the shortage of studies documenting the economic benefits and cost-effectiveness of telemedicine applications is a challenge. Attempts to invest in telemedicine have suffered shortcomings in infrastructure and underfunding of programs. The empirical literature is relatively limited because of the scarcity of empirical data relevant to establishing the impact of telemedicine on healthcare outcomes. Diabetic patients may therefore be ignorant of the available means of accessing remote services. Currently, there is shortage of studies on the economic benefits and cost-effectiveness of

telemedicine. Attempts to invest in this innovation have suffered shortcomings in infrastructure and underfunding of programs Craig & Patterson, (2005). This research intends to show how remote diagnosis, treatment, advice, and monitoring impact a diabetic patients and the service providers. The study intends to ultimately expose the patient to available channels to access remote care.

1.3 Justification of Study

Although there are numerous eHealth interventions being piloted in Sub-Sahara-Africa, a 2014 report from a joint survey by WHO and the International Telecommunications Union (ITU) revealed that most of these initiatives are weak platforms that have failed to transition to actual practice. In Kenya, the doctor-patient ratio is 1 doctor to 17,000 patients (Karongo, 2012). This is way below the World Health Organisation recommendation of one doctor for every 1,000 patients Karongo, (2012). The adoption of telemedicine can be instrumental in enabling healthcare providers to reach more patients without incurring transport or relocation costs (Shikuku, 2013). The use of ICT has bridged the gap in the exchange of medical information from one site to another. Demiris, (2003) asserts that aided by high-capacity digital networks, the healthcare sector can be greatly transformed in areas that have adopted the technologies**.**

Patients with diabetes fall into the groups of patients with chronic conditions to obtain the beneficial effects of telemedicine. Telemedicine is useful for the management of patients with T1D and T2D, women with gestational diabetes, and new cases of diabetes. Apart from minimizing the risk of COVID-19 infection, telemedicine offers better glycemic control and reduced diabetes distress. According to PAHO, (2016), telemedicine provides solutions to the challenges posed by socioeconomic changes in

healthcare systems in the 21st century with limited budgets. Its application has achieved varying levels of success.

Several challenges hinder the successful implementation of most e-health systems in Kenya. Literature indicates that telemedicine applications have achieved varying levels of success in a way that FTF cannot. It is the perfect remedy to barriers to easy access to health services as it will solve challenges related to distant health facilities, insufficient diagnostic equipment, inadequate number of skilled staff, poor referral and network, and lack of specialized trained personnel among others. According to Zhang, (2021), people living with diabetes are at considerably higher risk for community-acquired and nosocomial infections. They therefore should be protected from having to needlessly visit medical institutions, but they should still receive adequate care. These factors motivated the researcher to take this study. According to the researcher, specialist digitally knowledge will ease costs in healthcare and make the scarce specialist knowledge more readily available

Undiagnosed diabetes poses a public health concern with costly public health implications. Cases to convince policy-makers, like government, doctors, and even patients to embrace telemedicine have failed according to Craig & Patterson, (2005). Isabalija, (2011) attributes key factors hindering the adoption of telemedicine as limited knowledge and skills, lack of telemedicine policy, and change resistance by hospital staff. Legal considerations are a major obstacle to telemedicine uptake. These include an absence of a legal framework to deliver services in different jurisdictions and countries, and a lack of policies that govern patient privacy and confidentiality vis-à-vis data transfer, storage, and sharing between health professionals and jurisdictions (Swanepoel et al, 2010). This study injects novel insights that aim at understanding the health impact assessment of mobile health technologies among patients with chronic

diseases in Kenya. Study findings are critical to health policy reforms in Kenya, and serve to inform all stakeholders in the healthcare sector; policymakers, healthcare professionals, and patients.

1.4 Objectives of Study

1.4.1 Broad Objectives

To examine the relationship between telemedicine utilization and the well-being of diabetes patients in Nairobi County, Kenya

1.4.2 Specific Objectives

The present study was guided by the following specific objectives:

i. To assess the effect of telediagnosis utilization on the well-being of diabetic patients in Nairobi City County.

ii. To establish the impact of teletreatment utilization on the well-being of diabetic patients in Nairobi City County.

iii. To determine the influence teleadvice utilization has on the well-being of diabetic patients in Nairobi City County.

iv. To examine the effect of telemonitoring utilization on the well-being of diabetic patients in Nairobi City County.

1.4.3 Research Questions

i. How does telediagnosis utilization impact the well-being of diabetic patients in Nairobi City County?

ii. What impact does teletreatment utilization have on the well-being of diabetic

patients in Nairobi City County?

iii. What influence does teleadvice utilization have on the well-being of diabetic patients in Nairobi City County?

iv. What effect does telemonitoring utilization have on the well-being health of diabetic patients in Nairobi City County?

1.5 Assumptions of Study

i. The study assumes that mobile health technology interventions play a critical role in the health outcomes of diabetes patients. The study anticipates that telehealth intervention in blood sugar monitoring is important, and thus guides diabetes patients in achieving glycemic control, and thus improves clinical outcomes.

ii. The study assumes that telehealth intervention in blood pressure monitoring is likely to provide knowledge, which then can be used by diabetes patients to determine their health condition, and thus seek the necessary medical therapy in a timely fashion. The other assumption is that telehealth intervention in weight monitoring is more likely to relay accurate information on the weight of diabetes patients which then can inform the patient about watching his or her weight in order to keep the recommended weight during the chronic illness, and hence be able to achieve glycemic control.

iii. The study also assumes that telehealth intervention in physical exercise is critical in ensuring that diabetes patients receive enough exercise for their glycemic control.

1.6 Significance of Study

The significance of the study is to help raise awareness of the existence of telemedicine services as a better healthcare service for diabetic patients in Nairobi County, where there is scarcity not only of diabetologist but doctors in general. The study is also significant as it looks at innovation as way of improving health especially towards the achievement of UHC but pointing out the factors that act as a barrier towards the achievement of the same.

1.7 Scope and Limitations of the Study

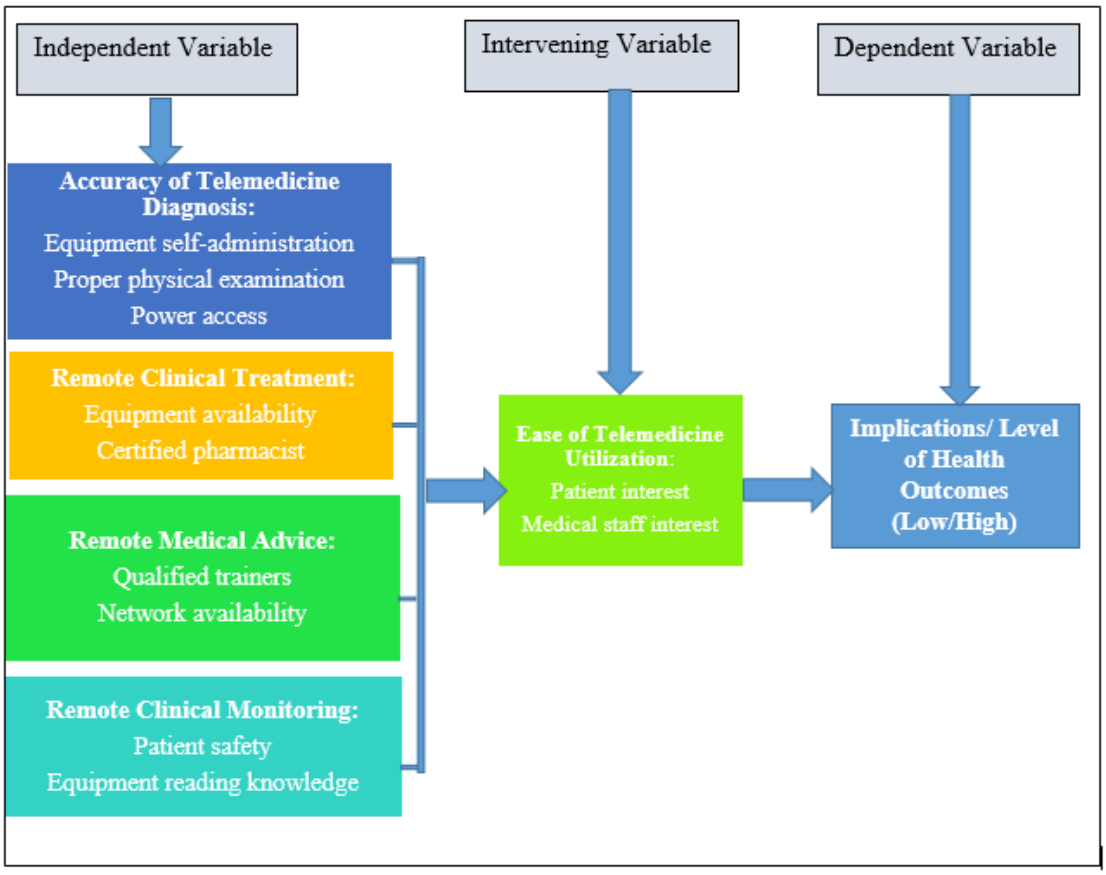
The focus mainly focused on diabetes patients in Nairobi City County. The parameters of the study included blood glucose, diagnosis, treatment, advice and monitoring among the selected diabetes patients within select hospitals in Nairobi. The researcher visited the selected healthcare facilities with a view to obtaining a sampling frame of healthcare professionals and diabetes patients, which the researcher intended to use to obtain the actual list of study respondents (i.e. both healthcare professionals and diabetes patients). The facilities were unwilling to provide the names of their patient. The researcher talked to individual patients without involving the facilities. For key informants, the researcher made appointments with staff availed by the facilities who were able to create time to respond as per schedule of the facilities. Some respondents requested that the tool be sent online. The study participants responded to their respective tools (survey instrument, KI guide and FGD tool) which were then carefully analyzed to obtain results.

The study focused on the relationship between telemedicine intervention and the well-being of diabetes patients in, Nairobi City County. There are, however, important caveats that limited the potency of the study like lack of adequate resources, time, and

finances. The idea of using specific informants in the facilities was not embraced by the selected facilities. The researcher used availed key informants in the facilities. The facilities were unwilling to give the researcher the names or contacts of their patients. The researcher worked with respondents who were willing to participate in the study after being talked to by the researcher or through referrals from other diabetic patients. Generally, telemedicine, and especially the area of diagnosis in diabetes has not been well explored by researchers thus information on the topic was limited even among key informants. During data collection, some facilities contradicted the information they gave, which may lead to bias data. Also, since the research questions mainly touched on individual health conditions, some respondents either evaded some questions or contradicted themselves. This means some indicators will not be effectively measured in the results.

1.8 Conceptual Framework

Figure 1.9 below represents the conceptual framework. It contains the relationships between independent variables and dependent variables. The variables predict that appropriate telehealth interventions lead to glycemic (blood sugar) control among diabetes students.



Source: (Researcher, 2023)

Figure 1.0 Conceptual Framework

Diffusion of Innovation and Self-Determination theories are based on the fundamental humanistic assumption that individuals naturally and actively orient themselves toward growth and self-organization. In other words, people strive to expand and understand themselves by integrating new experiences, cultivating their needs, desires, and interest as well as connecting with others and the outside world. The theories rest on the notion that the individual is involved continuously in a dynamic interaction with the social world, striving for need satisfaction and also responding to the conditions of the environment that either support or thwart needs. As a consequence of this person-environment interplay, people become either engaged, curious, connected, and whole,

or demotivated, ineffective, and detached. A deficient social environment does not control people.

To improve effective outcomes by disseminating intervention strategies, the theory encourages the application of high technology media and mass media with rapid transmission characteristics to meet the demand of health needs such as diabetes care. Literature in this study shows the relationship between self-administration of telediagnosis equipment by the patients and improved health outcomes. Self-administration of equipment is a challenge among patients (Guevara et al, 2021. The need for specialized training in this is emphasized. More examination of diagnostic accuracy is also required. Developments in machine learning and feature engineering, present new possibilities to improve early diagnosis and treatment outcomes of chronic diabetes patients like the use of virtual diagnostician coaching (Onan, 2019). This means, patient engagement strategies are needed to improve telediagnosis, as stated in objective one of the study.

Since the COVID -19 pandemic, primary care providers have had to rapidly offer their care services through some type of remote access, which includes live video visits, telephone, and web-based applications to improve patient access and outcomes through telehealth services (Robson & Hosseinzadeh, 2021); Kamene and Njeri, (2019) study found that the successful adoption and use of ICT in hospitals contributed positively to the performance of these hospitals. Patients are also happy about initiating their own treatment and doctors happy about their improved work-life balance and quality of life. There is also decreased burden on caregivers and fewer missed appointments. Dealing with certified pharmacist gives patients more confidence to have their prescriptions dispensed remotely. This is done to among other reasons, improve accuracy enhance patient safety, quality of care, and continuity of care for individual patients (ROK,

2017). The client has the right to choose to which pharmacy their prescriptions shall be delivered electronically. Teletreatment will therefore be highly utilized with availability of adequate equipment and certified pharmacist especially during pandemics.

The cornerstone of diabetic management is lifestyle changes which include nutritional counseling, counseling against alcohol and smoking, exercise, stress management, and weight loss. The patients can remotely be taught how to use a glucometer, and advised about the frequency of self-monitoring of blood glucose (SMBG), and the target blood sugar values to be achieved. Studies indicate that remote clinical advice reduces stigma and may increase engagement in the screening process, as well as response accuracy. There is evidence in this study that accessibility problems in poor network coverage areas, limitation to women's limitation of mobile gadgets, and limited sources of information due to the lack of connectivity to other sources are noteworthy problems according to Handel, (2011). Teleadvice utilization will therefore be dependent on training knowledge acquired and network access in the area one is residing.

The deployment of an RPM intervention however requires sufficient monitoring devices, clinical providers and information technology personnel, which necessitate significant upfront investment. A lot of first time patients with new-onset diabetes and acute illness are concerned on the safety of telemedicine use for routine monitoring compared to in-person visits. Most patients using RPMs are usually concerned about their health data, therefore various studies are concerned with data privacy and security, Tian, et al, (2014). Rahim et al, (2016) indicated that most caregivers and families do not have the time or relevant skills to take care of the patients thus putting their lives at risk. This can lower telemonitoring utilization services. However, with the advancements in wearable sensors, communication protocol healthcare systems are bound to be enriched and reshaped soon.

The success or failure of the stated telemedicine services is quite dependent on intervening variables which can either enhance or decrease utilization by reducing the barriers to adoption processes. The variables include understanding both the well-being of the patient and the disease by caregivers which is not only makes people worry less about the body's physical problems but also encourages them to focus more on the psychological, relational and social aspects of the individual that are able to influence one's well-being and/or malaise condition (Migliorini, 2015). Health-care professionals can also motivate the public to accept a new lifestyle modification program to reduce the incidence of diabetes. In the case of this study, diabetic patients can get telemedicine information through daily social networking, they continually interact with others to exchange information, experiences and ideas; thus, frequent interaction leads to the dissemination of new ideas. The autonomous support from healthcare professionals for patients with T2D was found to improve diabetes management thereby improving blood glucose control.

1.9. Definitions of Operational Terms

Comorbidities: This refers to the simultaneous presence of two or more diseases.

Diabetologist: Refers to a person who studies diabetes

Diffusion: This refers to a social process among people in response to innovation learning

Endocrinologist: Specialist in hormonal disorders like diabetes

Glucometer: This is a device measuring the amount of sugar in the blood

HbA1c-Hemoglobin AIc: Refers to a test measure for the amount of blood sugar

(glucose) attached to hemoglobin

Innovation: Modern devices useful to applicants

Macrovascular disease: These refer to diseases affecting large blood vessels

Metatheory: This is a theory devised to analyze a theory.

Morbidity: This refers to suffering from a disease or medical condition.

Remote: From a distance

Telediabetes: Telemedicine intervention in the management of diabetes

Telediabetology: Services that support and guide diabetic management digitally

Telediagnosis: Medical diagnosis made by means of telemedicine.

Teletreatment:Remote care and treatment between patients and healthcare professionals

Teleadvice: Provision of general health information remotely

Telemonitoring: Technology use to provide care and support to patients in their homes

Utilization: Refers to making use of something in an effective way.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews both theoretical and empirical literature on telemedicine utilization and the well-being of diabetic patients in Nairobi County. The study thoroughly reviewed relevant literature on the study topic in relation to the objectives, that is, assess the effect of telediagnosis utilization on the well-being of diabetic patients, establish the impact of teletreatment utilization on the well-being of diabetic patients, determine the influence of teleadvice utilization on the well-being of diabetic patients and examine the effect of telemonitoring utilization on the well-being of diabetic patients in Nairobi. The study also paid particular attention to what prominent scholars have written about the topic, with a view to getting relevant insights for the critical analysis and furthering the debate on the implications of telemedicine on health outcomes.

2.2 Theoretical Review

2.2.1. Diffusion of Innovation Theory

Innovation is an idea or practice perceived as new. It takes place when a new thought, behavior, or thing that is different from the existing one is conceived and actualized Barnett, (1953). The innovation is ideally communicated within a specific period. By sharing information through particular channels, individuals can disseminate innovativeness to their social networks to reach a certain level of consensus. Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1995). DOI was propounded by E. M. Rogers in 1962 as a communication tool to explain how over time, an idea or product gains momentum and spreads through a given population or social system. In

other words, the theory was coined to understand the reason innovations are adopted in society leading to social change. It is a social theory that occurs among people in response to learning about an innovation.

Robinson (2009) states that DOI uses a fundamentally different approach from the majority of existing theories of change in order to clarify how innovations are embraced by a population. It views change as essentially about the development or "reinvention" of goods and behaviours so they become more suitable for the requirements of individuals and communities, rather than concentrating on convincing people to change. It explains the process by which a novel concept or healthy habit proliferates within a group or social structure. Robinson contends that in DOI, the inventions themselves undergo transformation rather than humans. COVID-19 pandemic for example forced people to embrace innovation due to the introduction of isolation and distancing. In this study, except for the first visit, a lot of people opted to talk to their physicians online as opposed to FTC.

The rational conceptions of organisational life that are derived from communication theory, sociology, and economics are the foundation of the DOI tradition. It reportedly aids technology implementers in advancing the dissemination of certain technologies by developing predictive descriptions of the diffusion phenomena. Going back to the theory's original idea, "diffusion of innovation" may be separated into two categories: diffusion and innovation. "Innovation" is defined as contemporary, original ideas or concepts; procedures, goods, services, or equipment that applicants find helpful; or innovative programming that benefits a person or a group. Adopting novelty is just one aspect of innovation; another is changing people's attitudes and behaviours individually or in groups.

An innovation cannot be objectively defined by being new or old depending on the circumstances or by being the creation of a first-use item. Innovation is the subjective acceptance or recognition of something as "new" by people or organisations. The method via which a new idea is spread over a given time frame is known as "diffusion." People may spread innovation within their social networks and achieve a certain degree of agreement by exchanging knowledge through certain routes. According to Rogers, adoption is a complicated psychosocial process, and obstacles to adoption should be taken into account. He claimed that despite evidence showing that environmental factors and healthy habits significantly enhance health, some patients refuse to modify their current unhealthy habits in favour of the recommended lifestyle change. The adoption process is hampered by this resistance to change. Individuals reside in unique environments within social contexts. They communicate with others on a regular basis through social networking, exchanging ideas, experiences, and information; as a result, new ideas spread through frequent engagement (Rogers, 2010).

Because innovation is usually something new being introduced by adopters or potential adopters, the adoption can be voluntary or may require influencing. In voluntary adoption, decisions and speed of diffusion are dependent on influential members of the social system who adopt a decision and then communicate to others who also adopt, according to Rogers (2003). Diffusion and Innovation change societies. The changes manifest in different ways. The dependable variable in diffusion research is adoption time. The theory is a good evidence-based approach to improving health care. Opinion leaders and organizations are examples of main influencers in adoption, and systems' reactions are dependent on their reactions. The response takes place when adoption by different actors takes place by abandoning the old for the new and over time, Greve

(2011). Though the process of adopting new innovations has been studied for over 30 years, this theory is one of the most popular adoption models.

Innovation is linked to certain and quantifiable characteristics according to DOI research (Hai 1998; Premkumar, Ramamurthy, and Nilakanta 1994; Rogers 1995; Tornatzky and Klein 1982). One of the challenges with this kind of description is that it's unclear if the list is exhaustive and includes every characteristic that influences the adopter's behaviour. For instance, technological elegance or style is absent from the lists, despite research in the history of technology showing the opposite (Hughes 1987); Why should all technological innovations be described with the same attributes, such as Electronic Data Interchange (EDI), which is described with the same attributes as a television; What roles do these various characteristics play at different stages of diffusion, such as compatibility, which has different meanings for early adopters and late adopters; and, finally, disregarding the socially constructed character of large technological systems. According to all research, these innovations are complicated, networked, learning-intensive, and socially created (Pinch and Bijker 1987). Innovations should offer advantages over old concepts, such as being more affordable or time-efficient, being compatible with existing knowledge, being simpler, and being simple to test and observe in daily life. Innovations can be successfully disseminated throughout society through interpersonal contact or by using mass news outlets and events to highlight and publicise them. In order to achieve effective disease prevention, DOI theory has been increasingly used to public medical treatment and health in recent decades.

In Australia, the DOI concept was applied to reduce the prevalence of tobacco from 40% in 1983 to 15.9% in 2010, McManus, 2013). Australians were urged to adopt a creative approach to health promotion within the continuity of care paradigm. In Canada, patients, doctors, and nurses reacted well to creative diabetes training, and social mobilisation was

the primary factor in the innovation program's effective spread. The DOI hypothesis places a strong emphasis on using social media and networking sites as means of communication to quickly spread innovations. In addition to standard instructional techniques, health providers should use creative diabetes care tactics that take patients' needs into account.

Ecologically speaking, DOI theory constitutes a macro-level hypothesis that posits the adoption of community-level innovations to modify health-related behaviours within a population. Understanding how a beneficial invention might spread quickly or dissipate is another goal of DOI theory. The invention may spread through scheduled or sporadic broadcast. One example of an organised information promotion programme is the interdisciplinary shared care programmes for individuals with diabetes. For example, families, physicians, nurses, dieticians, including physical therapists are involved in a family-based diabetes preventive plan that integrates healthcare services to guarantee the quality of diabetes treatment (Greenhalgh et al., 2007).

In order to better understand how people apply new concepts—such as improved treatment techniques, illness knowledge, or instructional strategies—into the real world, DOI has been used in a variety of domains. The diffusion of creative ideas theory, as defined by De Civita & Dasgupta (2007), can offer a succinct model for spreading cutting-edge diabetes preventive techniques. The approach has been used in a variety of contexts to study how individuals convert novel concepts—like new medical procedures, illness awareness, or teaching methods—into practical implementations. The DOI theory promotes the use of high-technology media also mass media with quick transmission qualities to satisfy the demand of health requirements, such as diabetes care, and to increase effective results through the dissemination of intervention measures.

This study uses DOI to address a significant problem with the region's shortcomings in adopting new technologies: development experts and practitioners tend to embrace a development rationale that is foreign to African cultural perspectives. When it comes to carrying out development programmes, the culture and thought processes of the indigenous African populations are viewed as dubious or, at most, as having little significance (Brodnig & Schnonberger, 2000). Communication security, privacy, and rules are some of the ways that culture indirectly influences the uptake of telemedicine, according to a 2013 research by Mansouri-Rad et al. Based on the results they obtained, the researchers justify that it is crucial to examine and take into account the culture of healthcare organisations before attempting to introduce telemedicine systems. Patients may become frustrated and lose motivation to keep on self-care monitoring as a result of technological issues, lack of suggestions, and response delays (Marva, 2014). The five phases of the innovation-decision process include knowledge, persuasion, choice, execution, and confirmation, according to Rogers (2003). Usually, these phases happen one after the other in a chronological order. In Figure 1, this procedure is displayed.

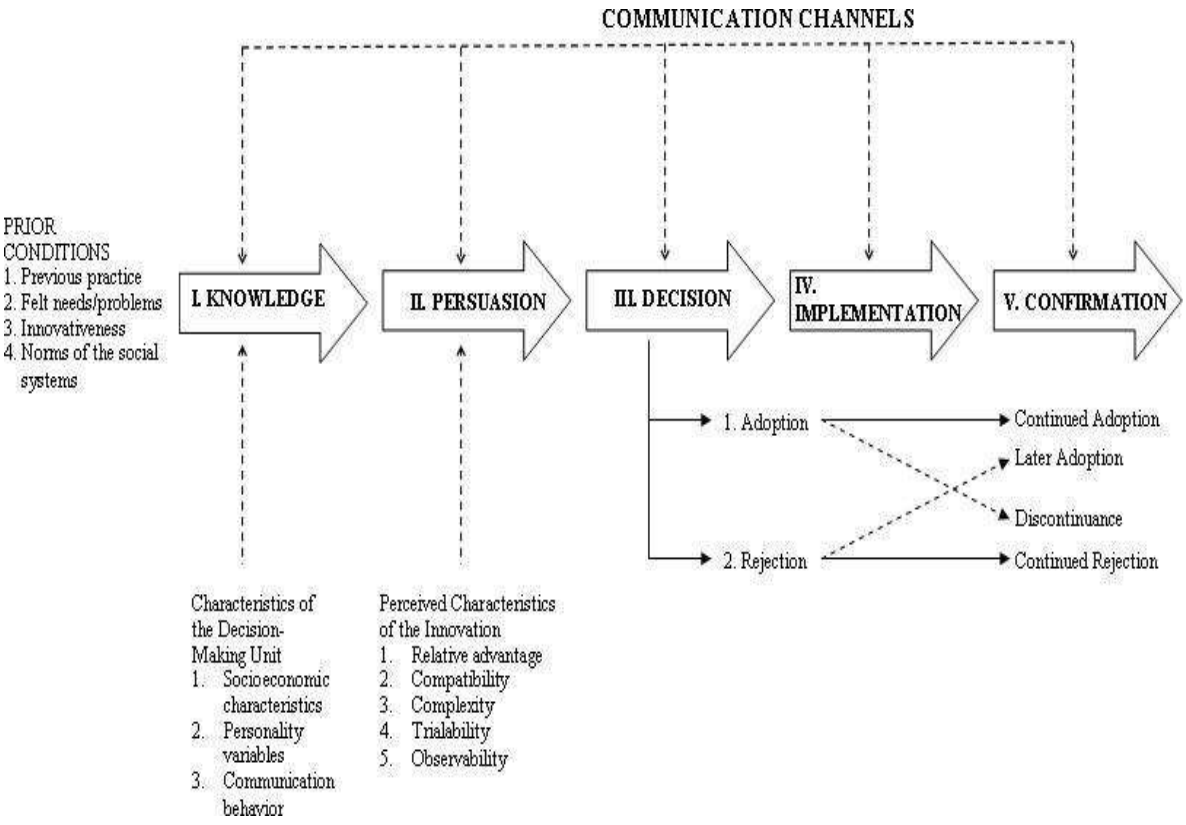


Figure 1.1. Diffusion of Innovation Theory

Since Rogers considers diffusion a complex psychosocial process, it is important that the barriers to adoption processes be considered**.** Rogers contends that despite recommendations for patients to adopt healthier behaviours and environments, some patients continue to engage in harmful routines. The adoption process is hampered by this resistance to change. In this instance, everyday social networking provides diabetes patients with access to telemedicine information. People communicate with each other all the time to share ideas, experiences, and information; as a result, new ideas spread via regular engagement. Adopters who possess self-efficacy are empowered. Self-efficacy is the belief in one's own ability to carry out actions to accomplish personal health objectives, in this case, making an effort to use telemedicine.

The goal of DOI theory is to comprehend how a beneficial invention might spread or diffuse quickly. The invention may spread through scheduled or sporadic broadcast.

According to the study, diabetic individuals can communicate with other patients remotely or via word of mouth. A specific kind of organised information promotion are diabetics. Individuals make decisions more quickly than groups or organisations do. Consequently, we should alter the decision-making process to put society's leaders' opinions first by leveraging their power to affect the rate of innovation in order to raise the acceptance rate. For instance, diabetes educators and public health nurses can influence members of the community to frequently get tested for the disease, control their food consumption, and exercise (advice). As an alternative, medical experts can encourage the general people to embrace a novel programme of lifestyle change aimed at lowering the prevalence of diabetes.

The primary goals of creative strategies are to guarantee not only the dissemination of the invention but also its adoption by the populace in order to have a long-lasting, sustained influence. Early treatment can be guaranteed in cases of asymptomatic hyperglycemia detected early. The effectiveness of communication, user needs understanding, favourable management traits, development efficiency, and marketing performance are the five fundamental elements that determine whether an invention succeeds or fails. Diffusion fails if these market demands are ignored (Braun, 1992). Social mobilisation may gain more importance and exposure through the use of mass news media and current events. Dasgupta and Civita (2007).

DOI generally stresses social marketing techniques and social networking as communication channels to rapidly disseminate an innovation. The main assumptions of the theory are that the population is homogenous and acts rationally. It assumes all individuals in a population are the same, have equal access to information, and make decisions using the same criteria but the reality is that populations are heterogeneous, and the preferences, values, and behaviors of individuals are different. It is easier to

concentrate on institutional measurements and procedures that are involved in establishing the parameters and mandate for the process of diffusion when analysis is conducted from an institutional viewpoint that delineates the boundaries of the diffusion space. Strong institutional shifts can redefine participating organisations, redraw borders, and alter incentives, all of which can have a significant impact on the pace and trajectory of any diffusion process.

According to the DOI hypothesis, adopter characteristics, risk, preference functions, and information that is currently accessible all play a role in adoption choices. However, the study conducted by Damsgaard and Lyytinen in 1997 discovered that corporate strategy, rather than the amount of knowledge accessible about the technology, influences adoption decisions. DOI theory also ignores the fact that cultural and geographical differences can affect adoption. The theory assumes that individuals adopt innovations the same way whereas the reality is that people's adoption behavior is dependent on the innovation question. The assumption that individuals adopt new innovations based on rationale and deliberate decision-making processes has been faulted as adoption behavior is also influenced by emotional and social factors. The fact that younger individuals are assumed to be early adopters has also been criticized as adoption can be influenced by other factors such as education, socioeconomic and cultural background.

The DOI theory combines two additional explanations: the demand-pull and the supply-push theories (King and others 1994; Zmud, 1984). According to these theories, certain characteristics of the innovation lead to diffusion capabilities and acceptance as a rational choice problem among an old and a new technology. Critics disagree, arguing that organisations should alter their market positions and improve internal operations by using technical knowledge to pull diffusion (Bensaou 1996; Porter 1985) and that

adoption is pushed by powerful actors (gatekeepers), such as industry associations, the government, hubs, or industry associations rather than the media or peer networks (Damsgaard and Lyytinen 1997).The theory also focuses on diffusion as a single innovation technology while ideally, it is a complex cultural and technological process.

DOI theory is not able to address cultural norms and economic differences in society as it concentrates more on innovations than socio-cultural differences hence the need for self-determination theory which focuses on human motivation and personality development. Other than being perceived to be outdated and not as radical as the current models of innovation diffusion like CACAO change model Dormant, (2011), the theory does not offer adequate constructs to deal with collective adoption behaviors (including the critical role of standards). It advocates for changing adopters, agents, and organizational structure. The mechanisms driving the diffusion remain constant across time, and the time scales utilised in the hypothesis are often somewhat short. Time periods vary from few months to several years, and the process of diffusion is mostly predictable since, once the key organisational and technical traits are identified, they don't change over time. Furthermore, the decision history from the past is not considered significant.

A succinct model for promoting innovative diabetic therapies may be found in DOI theory (Civita & Dasgupta, 2007). The idea supports the use of high-tech media plus mass media with quick transmission qualities to satisfy the increasing number of health requirements, such as diabetes care, and to promote effective results through the dissemination of intervention tactics. In order to lower the prevalence of diabetes, healthcare providers can also persuade the general people to embrace a novel programme of lifestyle modification. The primary goals of creative strategies are to guarantee not only the dissemination of the invention but also its adoption by the

populace in order to have a long-lasting, sustained influence. This is relevant to the goal of the study, which is to assess and ascertain how telemedicine diagnosis affects diabetes patients' health outcomes.

Good relationships are crucial since the palliative care process is often emotional for both carers and patients. As a result, a deeper comprehension of the conflicts arising from utilising telehealth to support patient-professional interactions throughout palliative care is necessary. According to research, professionals' acceptance of telehealth is crucial for its integration into conventional healthcare delivery methods (Nicholson et al., 2013). As such, they continue to play a crucial role as gatekeepers for the services that can be made accessible to their patients.

Studies indicate that professionals may continue to be less accepting of telemedicine than their patient counterparts. According to Mair et al. (2008), the Normalisation Process Theory (NPT) may theoretically explain this in terms of interactional workability, relational insertion, skill-set workability, as well as contextual integration. Professionals' preexisting unfavourable opinions about telehealth might possibly restrict a service that is provided, preventing patients from sharing their opinions on innovative approaches to service delivery. Professionals' perceived obstacles to telehealth adoption could represent a gap between policymakers and patients in terms of accessing what they see as the answer of their unmet needs.

Though prior study has examined the adoption's practical obstacles and advantages, nothing has been done to examine the underlying psychological causes of people's varying viewpoints. To allow solutions or study to open up the possibilities of telehealth for appropriate populations when applicable, it is necessary to logically explore where

there might be mutual respect and disagreement in the fundamental psychological values and beliefs of stakeholders.

New digital communication channels can also enhance and impact adoption rates of innovations, therefore reducing the time taken to reach the market. Critics want the categories of adopters to be redefined to become more applicable to high-tech industries and relevant to modern markets, the theory should also consider behavior change as opposed to only change in innovation and customer expectations change over time. Robinson, (2009). DOI has also been criticized for failing to understand the critical role of market-making and, institutional structures in shaping the diffusion platform. Critiques want it to learn intensive features of technology, consider all key players in the process, and appreciate the need for varying time scales when seeking to account for what happened and why, among other issues as a way forward. Critiques say the theory analysis leaves a “theoretical” gap between the current mainstream and our field study findings.

By using simplistic metaphors like "forces" and "diffusion rates," it is thought that DOI researchers have compromised accuracy in favour of simplicity and generalizability. As a result, it is thought that DOI researchers should exercise caution when examining the effects of institutional policies as well as regimes, industrial strategies and policies, the significance of the installed base, and the nature and meaning of technology. Similar adoption theories include Technology Acceptance Model (TAM) by Davis, (1985), The Chocolate Model by Dormant, (2011 and the Concerns-Based Adoption Model (CBAM) by Hall, (1979).

The fundamental humanistic premise that people naturally and deliberately orient themselves towards growth and self-organization serves as the foundation for DOI

theory in this work. To put it another way, people work to integrate new experiences, nurture their wants, desires, and interests, and interact with others as well as the outside world in an effort to grow and understand oneself. However, this natural growth tendency should not be assumed, as people can become controlled, fragmented, and alienated if their basic psychological needs for *autonomy*, *competence*, and *relatedness* are undermined by a deficient social environment. The theories are based on the idea that an individual is always engaged in an ever-changing relationship alongside the social world, responding to the environment's conditions that either facilitate or obstruct needs, and this are needs resulting from the perception that others are purposefully undermining one's psychological needs. People either become interested, curious, connected, and whole as a result of all this person-environment interplay, or they become demotivated, ineffectual, and alienated.

2.2.2 Self-Determination Theory

Deci & Ryan introduced the Self-Determination Theory (1985). This comes after Lansisalmi et al. (2006) noted that innovation has grown to be a crucial priority for all healthcare organisations over the past century. According to the notion, people are creatures that are focused on growth and actively engage with their surroundings Deci & Ryan, (2000). SDT emphasises that people's behaviour might vary depending on the social context in which they find themselves. Various circumstances can either promote or hinder self-motivation. Ryan & Deci (2000) define SDT as a metatheory of personality development and human motivation. It is a commonly used theory of wellbeing, motivation, and personality development. SDT differentiates two main types of motivation, according to the idea that “the type or quality of a person’s motivation would be more important than the total amount of motivation for predicting many important outcomes such as psychological health and well-being”

Self-determination theory focuses largely on inner sources of motivation, such as a drive to achieve knowledge or independence, while acknowledging that people are frequently motivated to act by external incentives, such as money, awards, and recognition (extrinsic motivation). According to the hypothesis, compared to regulated motivation (extrinsic), autonomous motivation (intrinsic) typically results in better psychological health and more productive performance. According to the notion, persons can become independent when their demands for autonomy, competence, and connection are met. In this study, the patient who strives to utilize telemedicine becomes familiar with requirements and devices and as they begin to discover the advantages, they develop a paradigm shift i.e. from FTF to telemedicine. It is thought of as a metatheory in the sense that it is made up of several "mini-theories", *cognitive evaluation, organismic integration, causality orientation, basic psychological need, goal content, and relationship motivation* which fuse together to offer a comprehensive understanding of human motivation and functioning including work, (Fernet, 2013), relationships (Guardia & Patrick 2008), education (Reeve & Lee, 2014), religion (Soenens et al. 2012), sports (Pelletier et al. 2001), and even stereotyping and prejudice (Legault et al. 2007).

The concept of fundamental psychological needs is at the core of each mini-theory; in order to thrive and develop, all people require autonomy (the need to feel independent and self-directed), competent (the need to feel successful), and connection (the need to form intimate connections with others). Deci and Ryan (2008) and Ohajunwa & Mji (2018) contend that psychological well-being is predicted in all cultures by desires for relatedness, competence, and autonomy. Feeling capable of influencing one's surroundings and achieving an objective is the essence of competence. The ability to make one's own decisions about what is most beneficial to oneself is referred to as

autonomy.

Deci & Ryan (2000) propose that humans are growth-oriented creatures that actively engage with their surroundings. According to SDT, people have an inbuilt desire to reach their full potential. They work hard to incorporate these novel experiences and arrange them in a way that makes sense and is true to who they are. The innate need to connect with others goes hand in hand with this. When people behave in a volitional as well as self-integrated way, they offer their behaviour direction and purpose Vansteenkiste, (2005). It is also recognised in SDT that people might become inactive and unproductive. Deci and Ryan (2000). It is not implied by the idea that humans are naturally busy creatures that this inclination may be ignored or occurs on its own. On the other hand, SDT argues that people's growth-oriented natures need basic nutrients, which may be obtained from the environment or by developing enough inner resources to support this innate drive.

According to Chambers (1980), experts in development find hard to concede that there is another framework of understanding or rationality to their personal that is complimentary, valid, or occasionally even superior inside the localities where advancement takes place. This is because of the uncomfortable unequal leverage within the scientific knowledge, which drives modern development, and indigenous local expertise of rural people. Therefore, when development practitioners try to replicate the advancements that technology has made possible in rich nations inside the framework of underdeveloped countries, they fail to see the conflict of rationalities (Avgerou, 2000). The contradiction between the rationale for advancement and the local ways of thinking has hindered the acceptance of science-based advances by local communities.

According to Deci & Ryan's (1985) interpretation, the autonomous orientation is the

pinnacle of development and maturity, enabling an individual to self-adjust their behaviour in harmony with their surroundings, attain positive interpersonal relationships, and experience a sense of self-realization. According to SDT, pursuing autonomous objectives will enhance wellbeing as they fulfil fundamental psychological requirements since they are consistent with one's own self, priorities, and beliefs. On the other hand, pursuing regulated objectives will impede well-being as they are unlikely to meet fundamental psychological requirements since they do not fairly represent the values and interests of one's inner self (Gillet et al., 2012). In the end, the person comes up with his own explanations for the actions that others had first suggested to him.

According to SDT, awareness is necessary for the growth of integrated, autonomous functioning. According to Miquelon and Vallerand (2008), having a stronger sense of self-realization in the face of adversity is important for one's health because it makes people more resilient to stressful situations by arming them with enough psychological resources derived from more adaptive coping mechanisms. According to a research by Chae et al. (2001), telecare can reduce the frequency of clinic visits while also increasing patient satisfaction. Despite the fact that the creation of telecare systems for diabetics is mostly accepted by the condition's victims, (Turner, Lennon, 2013). et al. Hanson (2007).

New genetic testing along with digital information are two innovative elements that are revolutionising health care and creating opportunities for more innovation and process improvement (Omachonu & Einspruch, 2010). These modifications are intended to improve life expectancy, quality of life, and access to diagnosis and treatment choices, as well as the efficacy and economy of medical services (Varkey et al., 2008). According to Lansisalmi et al. (2006), innovations in healthcare organisations are

increasingly focused on patient interaction and new technology. They also include relatively novel services and methods of operation. Innovation is a multifaceted and intricate process involving several major players, including patients and clinicians, each with specific and purposeful needs, wants, including expectations. A high-performing system of healthcare is widely understood to be largely dependent on patient participation (Osborn & Squires, 2012). According to Coulter (2012), engagement initiatives enhance patient health and save healthcare costs by lowering the chances of inadequate adherence, failed care coordination, medical mistakes, needless ER visits, and hospital stays.

A vital source of energy for managing not only the challenges of daily living but also life-threatening stressful situations is one's self-perception of health, which is defined through an upbeat attitude towards oneself, a sense of self-control, as well as an optimistic outlook on the future (Vazquez et al., 2009). Patients have a significant influence on their own medical treatment. Numerous studies have shown the importance of paying attention to patients' happiness and well-being throughout the treatment connection (Rania et al., 2015, 2018). For suitable therapies or management options, patients and physicians must collaborate.

The link between health and new technology is becoming more predictable, but this also means that people must accept that there will always be some risk (Battistuzzi et al. 2019). Improved accessibility towards health-related information (e.g., genetic testing, medical websites, electronic documentation that contains patients' medical histories, magnetic resonance imaging, and social media tools) can raise awareness of the possible risks to one's health and well-being associated with personal decisions in addition to elevating one's sense of competence. Self Determination Theory may play a significant

role in bolstering these novel patient-centered procedures as well as the patient-provider interaction.

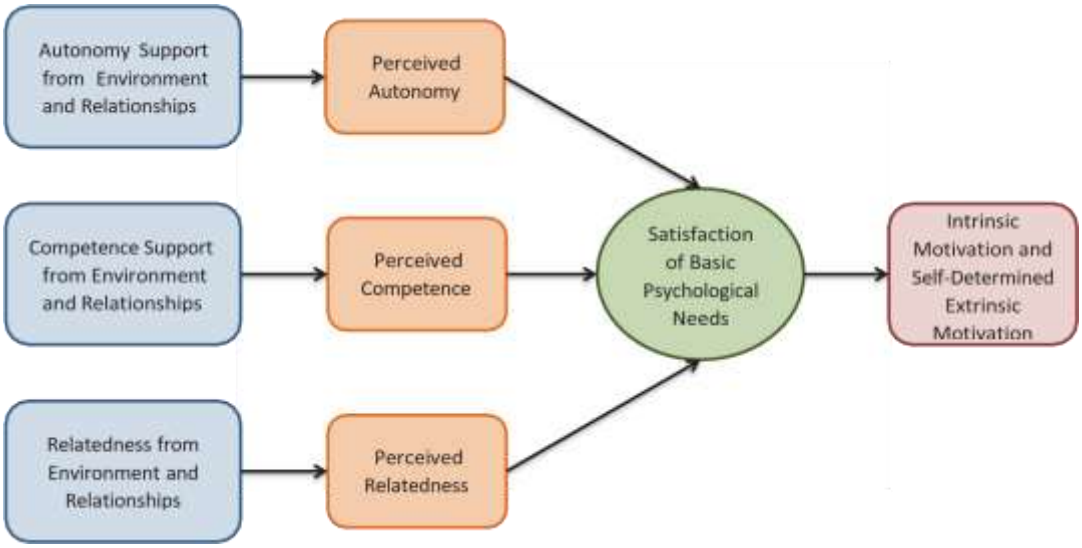


Figure 2.1: The Role of Need Satisfaction in Motivation According to Self-Determination Theory.

The degree of comprehensiveness as well as testability of SDT theory is what makes it successful. SDT presents extremely specific, dynamic, provable, and well-defined hypotheses that relate to needs and motives in a variety of contexts, including clinics, families, teams, organisations, schools, and cultures. It offers thorough explanations of the ways in which social and cultural factors affect the formation of personality, global motivational orientation, and behavioural reactions in specific contexts and activities. SDT was employed as a peace goal during World War 1. The hypothesis has been used in a number of contexts, such as relationships, parenting, education, physical activity, and development. The validity of the theory has been supported by a number of empirical contributions since it was proposed recently in the field of occupational health psychology (Gagné & Deci, 2005; Scheldon, Turban, Brown, Barrick, & Judge, 2003).

SDT has been criticized for assuming that needs are gained through a learning process rather than from outcomes of human heredity Sheldon & Schuler, (2011). Murphy-Berman and Berman (2003) have questioned the theory's cross-cultural applicability, viewing relatedness, autonomy, and competence as organismic requirements that cut beyond cultural and developmental boundaries. They contend that different cultures place different values on having a sense of autonomy. They contend that psychological well-being was linked to meeting each demand. The inquiry if autonomy constitutes a common psychological need lies at the heart of this criticism. They contend that different cultures place different values on having a sense of autonomy. According to basic needs theory, all three needs can be satisfied in settings that encourage an individual's autonomy.

According to Leversern et al. (2012), there is disagreement about whether needs are internal or external. However, the theory mainly emphasises internal sources of motivation, such as the need for autonomy or knowledge (intrinsic motivation), and autonomy as a motivator (intrinsic) tends to result in better psychological health. The basic needs hypothesis, on the other hand, contends that all three needs may be met in settings that respect an individual's autonomy. Thus, all the factors in the fundamental requirement theory should be evaluated in future study as possible predictors and consequences of the other factors.

The researcher contends that illnesses and impairments are putting more and more pressure on the economy and public resources, making them a global concern. Thus, it's important to maintain and encourage healthy lives. In order to comprehend the patient's condition as well as the illness, one must not only be concerned with the physical issues pertaining to the body but also with the psychological, relational, along with social

facets of the person that can impact one's state of well-being and/or malaise (Migliorini, 2015).

The theory of self-determination is a theory regarding motivation that takes into account how our incentives for participating in certain behaviours are determined by the satisfaction of psychological needs. It views motivation as the mental energy that propels individuals towards a certain objective and highlights the impact of social circumstances on behaviour and motivation. According to the notion, relatedness, competence, and autonomy are the three basic psychological requirements. The urge for self-determination and volitionality in one's choices and actions is associated with autonomy. Relatedness stands for the desire to feel supported as well as accepted in one's surroundings, and competence refers to a desire to feel that one can influence the results of one's actions.

According to SDT, meeting psychological needs is linked to better psychological wellbeing, greater persistence, and a higher probability of engaging in a behaviour (Deci & Ryan, 2000). Conversely, failing to meet psychological needs or actively thwarting them can leave one feeling less motivated to engage in activities and with less psychological wellbeing overall. Thus, using SDT in the context of telehealth deployment offers a fresh way to think about how patient and professional accounts of the advantages and disadvantages of telehealth could indicate whether or not underlying psychological needs are being met. By identifying these, future implementation tactics may be better informed and give insight into the underlying psychological hurdles as well as facilitators to telehealth deployment.

According to a 2021 study by Keenan et al. using the lens of the theory of self-determination, the acceptability of telehealth use in palliative care provision by

healthcare professionals and patients may differ or converge. However, both groups believed that telehealth facilitated an environment that supported autonomy, with professionals viewing it from an additional condition-centered perspective along with patients from a more comprehensive life-centered perspective. Professionals and patients, on the other hand, showed differing opinions on telehealth's capacity to foster an atmosphere that meets people's demands for relatedness and competence.

In contrast to other telehealth services like conference calls or messaging reminder services, which allow patients to self-manage their medical condition and symptoms through feedback from telemonitoring systems, professional views on telehealth frequently focus on telemonitoring systems. Consequently, this would augment patient autonomy by facilitating a better comprehension of their ailments and the necessity of self-management strategies. According to patient views, telemedicine supports an atmosphere that values autonomy and gives patients the confidence to engage more deeply with medical providers. This supported the definition of an autonomy-supported surroundings provided by Reeve et al. (2002), which includes settings that minimise external controls, offer opportunities for participation as well as choice, and acknowledge the negative emotions that come with taking on challenging tasks. Being in familiar terrain gives one more courage to seek assistance and raise questions that would not be feasible during an FTF appointment.

In terms of competency, healthcare providers and patients believe that younger patients are more suited to utilise telehealth since they have more time to acquire the necessary skills. The age of the professional was seen to be a possible obstacle to the effective integration of telehealth into the provision of palliative care. The Unified Model of the Utilisation and Acceptance of Technology (UTAUT), developed by Venkatesh et al. (2003), is an additional theory that bolsters this conclusion. It implies that a decision to

embrace technology is aided by past technological experience. According to Radhakrishnan et al. (2012), a growing number of senior heart failure patients are discontinuing their usage of telehealth in their medical care programme because they are becoming more anxious about using the technology. Given that patients are not accustomed to utilising technology, their age may consequently be seen by experts as a barrier to its use in palliative care.

In terms of relatedness, experts voiced worries that the remote character of telehealth, lack of human contact, and lack of closeness would hinder the growth of trustworthy connections and reduce their capacity to comprehend the emotional requirements of their patients. Elderly patients were also believed to be at a disadvantage from the absence of human contact since carers were concerned that patients would view telehealth services as impersonal. According to Whitten et al. (2009), several professionals had a negative perception of telehealth in a palliative care context where the purpose is to soothe patients and families. Telehealth was perceived as impersonal and missing in the human touch. Demiris et al. (2006) examined the effects on the relationship among patients and professionals, noting that the lack of human touch, distant care, and other nonverbal communication methods may also have an impact on the development of clinical understanding and interpersonal relationships. Demiris & associates (2006). Similar thoughts are expressed by Ludwig (2003), who highlights the value of human contact and claims that a "caring touch" may help individuals connect and overcome boundaries, show care and interest, lessen pain and anxiety, and forge a link. Ludwig, the third. A research by Hui et al., (2022) on the factors influencing telehealth continuity intention also confirms these findings. According to a multi-perspective framework, continuation intention is highly positively impacted by attitude, perceived behavioural control, considered utility, as well as perceived autonomy

support all together. The findings also demonstrated that attitude is greatly improved when viewed independence support, perceived usefulness, and perceived simplicity of use are combined.

According to SDT, psychological needs have an impact on behavioural regulation. For this reason, it's critical to comprehend the various ways in which patients and professionals discuss need satisfaction in order to gain a clear understanding of the psychological underpinnings of the barriers that prevent regular utilisation of telehealth (Deci & Ryan, 1985). The reason telehealth has not been used more frequently in the delivery of healthcare, despite research indicating it can create an atmosphere of encouragement for patients, may be due to the differences between patient alongside professional perspectives on its ability to create an environment that meets fundamental psychological needs.

According to SDT, people will experiment in accordance with how much they feel in control of their behaviour and will orient to the surroundings based on knowledge about the beginning and regulation of behaviour. The idea of autonomous self-regulation is central to SDT, and medicine ought to be guided by the ethical principle of autonomy. This relates to this study as the effect of telemedicine treatment on health outcomes of diabetic patients and the relationship between telemedicine advice and health outcomes will be dependent on the information they are given, their determination to utilize telemedicine, and their autonomy so that they are self-driven.

A study by Migliorini, Cardinali & Nadia, (2019) found that autonomy support, perceived competence, and autonomous motivation which are core elements in SDT, were determinants of diabetes self-management and well-being. The autonomous support from healthcare professionals for patients with T2D was found to improve

diabetes management thereby improving blood glucose control. The study findings also indicated that SDT is valued as a conceptual framework to study motivational processes and helps patients adopt and maintain new health behaviors.

2.3 Empirical Review

2.3.1 Effect of telediagnosis utilization on the well-being of diabetic patients in Nairobi City County.

Accurately recording provider-patient interactions during clinical visits is becoming more and more important as government policies continue to emphasise patient engagement in the treatment of their condition. Telediagnosis is the process of using software, sensors, and communication devices to monitor, analyze, and diagnose. Smith, Hunte, Graber, (2020), define telediagnosis as the co-production of an accurate and timely explanation of the patient's health problem through remote interactions and transmitted data, and a clear explanation to the patient through these interactions. It can also be said to be a medical diagnosis made by means of telemedicine. Patient-centered models of care focusing on patient autonomy, informed consent, and empowerment have gained a high level of policy support (John Stewart, & Harris et al. 2021). According to Keinfenheim et al 2015, a great deal can be learned from a simple conversation and review of medical records online.

Collaboration is necessary for a good diagnosis, although the makeup of the team will vary depending on the patient's demands. The patient, his or her family, and any medical personnel engaged in the patient's treatment should ideally be included (Henriksen and Brady, 2013; McDonald, Bryce, and Graber, 2013; Babiker et al., 2014; Graedon and Graedon, 2014). Teams might consist of individuals with varying backgrounds, levels of expertise, and physical locations. They can also be complicated in nature. It is

possible for certain team members to be absent from the medical facility due to conferences, workshops, and training. A healthcare institution might not be able to hire every kind of healthcare worker, thus it could be essential to consult with specialists at other facilities. This is also not always cost-effective. The group must communicate. The team members must have the same understanding of the patient's health status, medical records, and other pertinent details needed for diagnosis. Physicians, nurses, medical professionals, radiologists, technicians, laboratory scientists, chemists, patient guides, social workers, therapists, dietitians, medical professionals, and biomedical technologists are examples of this type of healthcare professional.

Obtaining, reviewing, analysing, and interpreting data is all part of the diagnosis process. It also entails reducing the range of potential diagnoses and accurately identifying the patient's health issue. In clinical practise, it serves as the conventional foundation for decision-making (Croft et al., 2015). For instance, in image-oriented professions like radiology and ophthalmology, where diagnostic choices are frequently made by trained technicians after reviewing photos or images, real-time telemedicine is a viable tactic for enhancing access for patients to care as well as care delivery (Dasgupta, 2008). Conventional approaches to managing chronic diseases rely on rule engines using score estimations to identify diabetes risk; however, machine learning techniques are more efficacious in identifying patient health issues. The Bruen team (2017).

The application of virtual diagnostician training is one of the new opportunities that recent advancements in machine learning as well as feature engineering bring to enhance the early detection and therapy results of patients with chronic diabetes (Onan, 2019). One of a clinician's key competencies in telehealth engagements is excellent communication. Research indicates that physicians ought to utilise comparable

communication techniques during virtual health visits as they would in-person patient encounters (Pappas et al., 2019). These abilities include motivational interviewing, attentive and in-depth listening, and crucial nonverbal cues like maintaining eye contact. Developing presence and engagement with patients over clinic visits is already a challenge for many doctors (Kesavadev et al., 2015).

Establishing a presence at telediagnosis visits necessitates that medical professionals learn new techniques in order to build rapport, gain patients' confidence, and prevent the remote meeting from becoming impersonal. For its physicians who are new to virtual interactions, several healthcare organisations have created orientation training, and there are numerous publications accessible with pointers and recommendations on how to maximise "website manner," Kvedar J, (2020). whereas a few of the skills required for an efficient in-person visit are also required for an effective telehealth visit, there are some additional skills that are necessary, such as how to get ready for the come across, what to put on, how to adjust the background and lighting, how to summarise what happened, and the necessity of outlining and verifying the patient's understanding of the next steps. et al., Zulman DM (2020).

Some of the devices used for telediagnosis include tele-ultrasound, a robotic system based on ultrasound. It captures and stores images as audio texts, Pickers's remote diagnostic tool for CT scanners also known as "Expert" that enables step-by-step diagnostic routines, and teleradiology that interprets medical images that are far from physical location. Examples of devices that are used for diagnosis in developed countries include interfacing biomedical diagnostic devices with the Internet of Things (IoT) which enhances Telediagnosis by allowing electrodes to convert the heart signal to an electrical signal known as Electrocardiogram (ECG). The ECG signal is sampled and processed using a microcontroller. An Internet of Things (IoT) device called a Wi-

Fi shield is interfaced with the ECG signal by means of a microcontroller. The ECG signals are released into the internet for additional analysis by the IoT shield. On the other hand, ThingSpeak is a web-based platform that gathers the signal and uses the internet to map it in real time. By using the ThingSpeak platform, anybody may access the patient's vital signs from anywhere in the world. The medical records are only accessible by the network administrator along with other authorised workers, and the Wi-Fi shield is impervious to external attacks. Telediagnosis can be enabled by providing healthcare team members with the necessary patient information. additional vital signs, additional biomedical equipment, and more patients may all be added to the system. It has been determined that deploying this technology inside African hospitals by African engineers is both practical and cost-effective. It would enhance the healthcare delivery system in Africa.

On the other hand, systems for decision-support (DSS) play a significant part in the lives of both patients and physicians. They not only assist medical professionals with diagnosis and treatment, but they also enhance remote healthcare, which has an impact on patients' quality of life. Dhonde and Dhanashri (2017). Its primary foundation is knowledge. The semantic web is an effective way to share and express knowledge in order to increase its knowledge. One of the foundations of the semantic web is ontology. It is defined as “an adapted technology for knowledge representation” It acts like a dictionary for a specific domain that defines objects, properties, and the relationship between these objects, El-Sappagh et al, (2015). Diabetes.uk released a basic online tool during the COVID-19 epidemic in England to predict one's risk of acquiring diabetes. This online tool calculates a person's probability of developing diabetes by asking them to provide particular risk indicators for the disease's development. A quick hotline contact may be made to arrange for rapid entry to the NHS Diabetes Control Programme

in the event that the tool indicates an elevated risk. Furthermore, guidelines for attaining a health-conscious way of living and suitable recipe collections may be promptly obtained on the website.

Kenya now has BYON8, a digital diagnostic application, originally founded in Sweden and introduced by a doctor, Murad in 2021 operating according to Safaricom online, (16/11/ 2022). It has over 40,000 active users. The application transforms a patient's data into diagnosis propositions. The gadget has a symptom checker that provides a list of possible causes of ailment. This is followed by online interaction with the doctor who then gives prescription and treatment. The application also books appointments with licensed doctors, allows chats and video calls with the doctor, and keeps track of the patient's health information, lab reports, and healthcare visits among other things (monitoring). To use it, one needs to download the BYON 8 app, register, and even subscribe then pay using Mpesa.

Both in-person and telediagnosis exams follow similar phases in the diagnostic procedure. Telediagnosis does, however, provide special problems for both patients and doctors, as well as chances for process improvement. In addition to specific training, telediagnosis necessitates patients to have exceptional communication skills and a new language in which to express their symptoms. The Centre for Healthcare Research and Quality, or in short, 2020 states that telemedicine specialists are aware of the difficulties in listening to and seeing certain body areas. They do, however, contend that if a patient is willing and a skilled clinician is present, every other component of the examination may be completed properly. Like in-person encounters, the quality and efficacy of telehealth encounters can be influenced by the relationship between clinicians and patients and the degree of patient engagement (Pappas, et al., 2019). Providers claim

that a telediagnosis visit may be just as successful as a physical visit with the right planning (Kvedar, 2020).

Studies indicate that in cases when the patient and the physician do not have a prior relationship, video visits are the preferred method as they offer a more relaxed environment for the clinician to establish their presence and facilitate productive patient engagement (Kvedar, 2020). Physicians may feel more at ease doing phone consultations with their long-term patients. Patient engagement and participation in telediagnosis has been ignored over time, and there needs to be ways of involving them. Martinez, et al. (2020). Health disparities already present may be made worse by telediagnosis services that just concentrate on access problems and neglect how members of disadvantaged communities interpret and absorb the information presented. Parker and others (2020). It is yet unknown if telediagnosis is effective for acute diseases. The fast evolution of telehealth technologies and capabilities is a problem for formal controlled trials. It will be necessary for future research to be extremely focused, iterative, along with adaptive to the particulars of remote care. Van and others (2020).

Existing research regarding diagnostic accuracy in telemedicine has focused primarily on teledermatology or specific clinical contexts (e.g., stroke identification) according to Solenski, 2018, Trettel, 2018 & Bashur, 2017. Telediagnosis is unprecedented, creating more unknowns on diagnostic impact, quality, and safety as indicated by Willis, (2021) & Smith, (2020). Published evidence regarding the effectiveness of telediagnosis is fairly limited and mixed, (Shigekawa, Totten & Mold, 2018). A 2021 survey by (SIDM) on the diagnosis experience of patients and clinicians, reported by McConnochie, 2015, shows high patient satisfaction but at a cost. In contrast, some cases identified through the primary-care telemedicine programme resulted in mortality and morbidity that might had been mitigated by an initial in-person visit, according to a 2020 Mayo Clinic

study titled Assessment of Clinician Diagnostic Concordance alongside Video Telemedicine in the Integrated Multispecialty Practise. Ohta et al. (2017) did note, however, that telemedicine can offer diagnostic concordance on par with or better than in-person practise.

Beyond the infrastructure to enable it, telediagnosis requires specialized training. More examination of diagnostic accuracy is required. Self-administration of equipment is a challenge among patients (Guevara et al., 2021). Telediagnosis experts believe that other than a few exceptions, every other element of the examination can be performed successfully with a trained clinician and a willing patient with skills such as deep and reflective listening, motivational interviewing, and critical nonverbal communication attributes, such as eye contact. There however have been cases of missed diagnoses and misdiagnoses, which are thought to have stemmed from the inability for a proper physical examination, as well as privacy concerns, including the regulated devices, Health Insurance Portability and Accountability Act (HIPAA) security standards, and the need for patients to have access to a private, secure place to conduct their telehealth visits, Hollander, (2022). Also, most laboratory tests and imaging require a separate in-person visit, something that may discourage their completion and follow-up. Since physical examination is not possible remotely, some physicians give referrals out of fear of misdiagnosis. One benefit of telediagnosis is that it can facilitate the prompt gathering of many professionals (peers, consultants from different disciplines, or additional medical professionals) to participate in the process of clinical reasoning in the case of difficult diagnostic circumstances.

Almost every part of the personally visit can be handled successfully, with a few exceptions. Devices used at home can improve the capacity to gather tangible data. Insofar as additional family members may participate and the therapist can get a feel of

the home setting, a remote history collection may be preferable to an office-based one. Video visits provide an opportunity to engage patients and families giving the provider not only the chance to have a glimpse into the environment the patient is living in but also a chance for family members' participation as well when necessary. This can enhance communication and understanding. On the other hand, clinicians may not visualize the tympanic membrane or the retina or listen to heart or lung sounds as they would during physical visits. Also, incidental findings that might have been detected in an office-based visit may be missed. Patients may however experience challenges due to lack of internet access or video-chat tools.

It might be difficult to establish rapport and presence over the phone and on video. Experts in telehealth argue that replacing the significance of "touch" in building trust within the therapeutic connection might be challenging. Other than that, there are no translation services or standardised language and norms, therefore gathering the patient history from non-English speakers might be challenging. Additional difficulties arise from the possibility that telehealth programmes are not designed to let patients enter their health information ahead of time; virtual visits also prevent patients from fully interacting with the diagnostic team and the dietitian or social worker, which makes them less likely to drop by and say hello. Compared to a physical visit, there are less possibilities to be exposed to consumer educational resources or health screenings. If the diagnostic group is not interacting as much as they would in person, there's also a chance that communication will decrease. Safety may be reduced by missed physical findings, lack of presence, and decreased participation of onsite specialist team members. In case of violence and abuse, it may be difficult to have a discussion with the specialists as the patient may require a private location.

The influence of patient involvement and engagement in telediagnosis, above patient pleasure, has received little attention, despite its significance for diagnostic safety (Harrison et al., 1999). Studies to assess patient involvement tactics and enhance telediagnosis are required. However, other doctors believe that not having a hands-on assessment might cause them to order more tests and inappropriate referrals, which could raise healthcare expenses (Goldberg et al., 2020). Physicians who observed a rise in specialist referrals frequently attributed this to worries about incorrect diagnoses since telemedicine did not allow for in-person exams. Therefore, according to Pappas & Seale (2009), telediagnosis services that just concentrate on access problems and disregard how members of disadvantaged communities interpret and process the information presented might worsen already-existing health inequities.

In addition to the physical examination's apparent limitations, tele-diagnosis significantly changes a number of other crucial aspects of the diagnostic process, most notably access, engagement, and teamwork. Research on whether or whether these individual variations have a positive or negative impact on diagnosis will be necessary. Kvedar (2020) notes that many providers, however, believe that a tele-diagnosis visit resembles a house call. The final yardstick for evaluating the efficacy of telediagnosis will be whether or whether it enhances the value, safety, and quality of diagnostic for both people and communities, regardless of the effects of these many components. Numerous global and micro factors might influence these results. It is important to assess these concerns via a formal sociotechnical lens in order to take into consideration the contextual variables influencing the results of individual diagnostic consultations.

After the COVID-19 pandemic, telehealth will probably still be in use, thus it is necessary to optimise the use of telediagnosis in order to meet the current rapid expansion and establish new research objectives. Measurement of telemedicine's

diagnosis accuracy was noted as a significant research gap in a recent comprehensive study on the current state of telehealth by Graber & Schrandt (2022). Increased family involvement, better access, and a greater understanding of the patient's home environment can all contribute to increased safety. On the other hand, absenteeism, missing physical findings, and low engagement from onsite team members (pharmacists, nurses, and others) can all compromise safety. Investing in the necessary technology for this aim can prevent misdiagnosis because an accurate diagnosis is the first step towards the proper therapy.

2.3.2 The Impact of Teletreatment Utilization on the Well-being of Diabetic Patients in Nairobi City Counnty.

Teletreatment is the care and treatment delivered remotely between patients and healthcare professionals. Teletreatment includes online videoconferencing, text messages phone calls for consultations in different forms, assessment, diagnosis and prescription. Additionally, telemonitoring/screening, sensors, including chatbots may be used to connect at-risk individuals with medical professionals and recommendations (Vidal et al., 2020). The patient's perspective during a discussion meeting on "Introduction to Improving Telehealth as well as Virtual Care for Pain Management and Opioid/Substance Use Disorder" by NAM, (2022) revealed that avoiding many of the factors associated with in-person visits—such as long car rides, bright lights, and noisy waiting rooms—can be one of the biggest benefits of virtual care for patients experiencing pain. Digital health interventions are likely attractive tools for delivering virtual healthcare services and have the potential to reach diabetic patients who for one reason or another are unable to make in-person medical visits to a hospital or to visit physicians (Ginige & Maeder 2018). Additionally, Sanders, (2020) highlighted that given the limited number of specialty pain care providers, telehealth has helped increase

access to care for many. COVID-19 shocked the healthcare system. Its unexpected effects led to significant adaptations of health systems in providing healthcare services.

The increased use of telemedicine to sustain continuity in healthcare delivery, disrupted by epidemic control measures such as lockdowns, stay-at-home orders, or social distance, is one of the adjustment mechanisms resulting from COVID-19 (Sime, et al. 2022). According to The Economist journal (2015), a plethora of health-related smartphone applications (apps) have been made possible by the advancement of mobile technology. These applications seek to improve patients' ability to manage their chronic illnesses on their own, facilitate communication between patients and healthcare providers, boost treatment compliance, and lower treatment costs. There are several smartphone applications for managing diabetes, and the majority of them focus on rewards for taking medications as prescribed, changing one's lifestyle, and managing diabetes on one's own.

The COVID-19 pandemic has created many new challenges, including access to health care for the treatment of chronic diseases, such as diabetes (Robson & Hosseinzadeh, 2021). Since the pandemic, primary care providers had to rapidly offer their care services through some type of remote access, which includes live video visits, telephone, and web-based applications to improve patient access and outcomes through telehealth services (Robson & Hosseinzadeh, 2021). According to CarePay, (2020), providers had seen a significant drop in revenues as well as the number of inpatient and outpatient services during the pandemic. Safaricom reported approximately 40% of the general public keeping away from health facilities thus affecting businesses. Gaty, (2020), Head of Communications and PR at M.P. Shah reports that COVID-19 compelled M. P. Shah to defer or cancel elective procedures and close down non-emergency services. This forced them to implement digital health solutions to be able

to continue giving services. The pandemic exacerbated issues regarding access to healthcare. In response, remote medical services were recognized as an essential adjustment mechanism to maintain the continuity of healthcare provision according to GCA, (2017).

The benefits of videoconferencing and medicine utilisation in remote care delivery, or RCD, are seen across the hospital system. RCD decreases healthcare costs by eliminating or drastically lowering expensive hospital stays, ER visits, doctor visits, and re-hospitalizations. According to Athanasia (2022), a global study conducted during the COVID-19 lockdown confirmed the role that telemedicine plays in the management of those diagnosed with T1D. Approximately thirty percent of individuals stated that the pandemic had adversely affected their healthcare due to cancelled in-person appointments, while two-thirds received remote care via telephone and seventy-two percent via video calls. According to Scot et al. (2021), of the patients who utilised telemedicine, 86% thought that remote appointments were helpful, and 75% intended to use them in the future. Reduced stress on carers, fewer absences from appointments, and the capacity to promptly handle any concerns that may occur in between in-person visits without needing to visit the ER or urgent care facility were among the other advantages mentioned.

Particularly for use with paediatric patients, patients with cognitive impairments, and patients with inadequate adherence to medication, smart pens have been created. These insulin pen devices wirelessly provide the data to mobile applications that interface with them, automatically recording the quantity and timing of insulin delivery. The user may keep track of previously supplied insulin dosages and administration timings with the use of smart pens, which offer a more dependable and clear image of dosing behaviours. Smart & Klonoff (2018). Collected data can also be transferred to digital glucose diaries

and delivered to healthcare professionals, thus supporting diabetes telecare. Smart pens are however still only rarely used in clinical practice due to their costs, lack of coverage by insurance companies, and availability issues, Adilfsson et al. (2020). Prescription management can be done using electronic automatic pill dispensers. Some dispensers include video chats that enable patients to discuss their prescriptions with their doctors or pharmacist. The specialist involved can track usage and prevent missed doses or overdoses using the devices.

According to the CarePay 2020 report, patients like remote care because technology allows them to take control of their own care and understand their rights. In a similar vein, a 2013 poll of patients in nine nations who were 65 years of age or older revealed that more than three-quarters of the participants preferred to schedule and manage their appointments online and that more than three-quarters believed that online availability of medical information was crucial. Kunonga, Bower, Hanratty, and Hall, 2021. Due to a better work-life balance, doctors expressed more satisfaction with telemedicine. In a comprehensive analysis published in 2014, Teeter and Kavookijan showed that, more generally, telephone-based motivational interviews for medication adherence resulted in increased adherence to medications in five of the nine included trials. Physicians who had families in particular reported that the advent of telehealth had enhanced their standard of life since it allowed them to be more active in their families' lives. However, some senior doctors bemoaned the lack of face-to-face interaction with patients and colleagues, saying it negatively affected their morale. Others bemoaned the cost of web-enabled gadgets to elderly patients.

According to a 2019 journal article by Kamene & Njeri on the impact of technology uptake on level 5 hospitals' performance in Kenya, the majority of these hospitals use mobile phones and computers to provide services. It also demonstrated that nearly all of

level five facilities are unable to give medication online and have no access to patients' medical information online. Nonetheless, the majority of patients may be reached via the phone in rural parts of the nation. Additionally, Kamene and Njeri's 2019 study discovered that the effective implementation and usage of ICT within medical facilities improved these facilities' performance. On the use of telemedicine in the 5 hospitals, only 16.7% used telemedicine in their facilities while 83.3 did not**.** Integrating mobile into the customer journey made it possible to improve services and waiting times at healthcare facilities. From the findings of CarePay, (2020) study, the demand for an online marketplace for healthcare providers is being driven by a wider trend of Kenyans preferring to 'pull' (as opposed to receiving 'push') information prior to purchase. This supported by (King and others 1994; Zmud 1984) in DOI theory where specific features of the innovation lead to diffusion functionality and adoption as a rational choice problem between an old and a new technology though adopters will trust recommendations from other users, particularly in their network Mwirigi (2020).

The process of electronically preparing a prescription and sending it to a licenced healthcare professional (a pharmacist or pharmaceutical technologist) so they may distribute medication to a patient is known as "digital prescriptions," or "e-prescriptions." Among other goals, this is carried out to increase precision, improve patient safety, treatment quality, and continuity of care for specific patients (ROK, 2017). The patient is entitled to select the pharmacy to whom their electronic prescription orders will be sent. Usually, a competent, registered, and licenced pharmacist or pharmaceutical scientist working in a recognised facility will do this using a registered pharmacy or chemist. According to ROK (2017), this guideline stipulates that the patient retains the right to modify or cancel their designated pharmacy. The patient has to physically pick up the medication at the designated outlet after the prescription is electronically issued.

In the case of the Veterans Affairs Medical Centre in the United States, where 30% of the total prescriptions issued belong to diabetic patients and oral diabetes drugs alone result in yearly pharmacy expenses exceeding $103 million, is an excellent example of how e-prescription works (Gervera & Graves, 2015). More than 50,000 beneficiaries receiving care at Air Force medical facilities in the United States Air Force have diabetes; the bulk of these beneficiaries are not on active service (Sauerwein & True, 2016). According to the United States Department of Veterans Affairs/United States Army Medical Command Office of Evidence-Based Practise [VA/Army], 2019 data, the total prevalence of diabetes in the Military Health System is 13%, which is comparable to national diabetes trends.

According to Kronberg et al. (2021), research has proven that telemedicine for physical health is convenient for patients of all ages as long as the equipment used is accessed by relevant authorities. Broader and accelerated usage of RCD as a standard of care for many more conditions and use cases will go a long way toward benefiting patients and other care recipients, as well as reducing costs across the healthcare ecosystem as a whole. As patients' needs continue to grow, wider adoption of RCD will enable individuals to more readily receive high-quality, affordable, and accessible care (GCA, 2017). Kenya hopes to attain UHC so that all receive quality services without financial hardship. UHC is not only a requirement in SGD 3 but is in Kenya's Vision 2030 blueprint and was one of the Big 4 commitments of the Jubilee government under President Uhuru Kenyatta. The Kenyan e-Health strategy seeks to set in motion the process of closing current gaps by harnessing ICT for improved healthcare delivery in addition to other ongoing efforts, (ROK, 2017). However, the fact that some facilities admit to there being chances of providing wrong medication during telemedicine should be seriously looked into because it can be tragic.

2.3.3 The influence of teleadvice utilization on the well-being of diabetic patients in Nairobi City County.

Mobile technology has been embraced globally, allowing both low and middle-income earners to set up health call centers with the idea of facilitating patients and public access to health information with the objective of offering services such as health advice through strategies such as phone calls using their trained personnel. The demand for electronic health information exchange from one health care professional to another is growing along with efforts to improve the quality, safety, and efficiency of health care delivery. Teleadvice refers to the provision of general health information remotely. The information can include opinion or guidance, usually with no intention to diagnose or treat a patient. Appropriate use, new payment approaches that stress care coordination, and financial incentives are all driving the interest and demand for health information exchange (ROK 2017).

In order to educate people with chronic conditions, healthcare nowadays makes use of a variety of methods. Even though telemedicine is just one of those components, it is at the cutting edge of technology. Diabetes appears to be one of the most exciting aspects of patient education because it allows healthcare providers to meet patients where they live and provide care. Diabetes constitutes one of the most prevalent chronic diseases in the world, affecting a large number of individuals, many of whom go untreated. An other technique that has shown promise in the past for treating the increasing number of long-term illnesses is telemedicine. An examination of a tele-nursing call handling software package at HealthLink BC in Canada reveals that the programme, which combines tele-nursing and self-care, is manned by registered nurses as well as other medical professionals and is available to residents via phone. Each year, the programme gets over

350,000 calls from residents seeking assistance and guidance in making healthcare decisions.

Jothydev & Viswanathan (2023) state that the diabetic treatment plans now in use have not been able to fully avert problems associated with the condition. Despite taking their medications as prescribed, 50–85% of diabetics experience one or more problems. Since the average age at which diabetes onset occurs is now quite early, there is fear that the working-age population may be affected by these consequences as long as diabetes patients' average blood glucose levels stay high. Conventional outpatient treatment is insufficient given the pressing need to enhance diabetes control. A growing number of individuals are using teleconsultation services, in which clients ask licenced medical professionals for guidance over the internet. With the advent of COVID 19, which compelled many people to seek out remote treatment, the tendency grew.

Diabetes education on self-management (DSME) should be provided with patient-specific support, utilising a variety of outreach strategies (VA/Army, 2019). Knowledge of diabetes and treatment options, drugs, diet, exercise, hypoglycemia, monitoring of glucose as well as HbA1c, psychosocial and behavioural components, risk reduction, foot care, quitting smoking, chronic complications, and sick day management are all included in DSME practises (VA/Army, 2019, p. 21). Despite the increasing amount of evidence, healthcare practitioners are not fully using telehealth technology in the management of type 2 diabetes (T2DM) (ADA, 2018a).

In the discipline of diabetology, telemedicine is being used more and more to enhance clinical and psychosocial results, healthcare quality, and patient access for those with diabetes. Patient-physician interactions are critical to enhancing health outcomes and averting long-term problems in patients with diabetes. Patients with hectic schedules find

frequent clinic sessions to be bothersome, and those who live in rural locations, have little financial resources, are old, or have impairments may find it more difficult (Association AD, 2020). Patients with diabetes must recognise the value of self-management and self-care. Patients learn about their dietary and exercise requirements as well as their therapeutic and behavioural needs, but they also require regular encouragement from the diabetologist.

The ADA (2022) suggests that a successful approach to the management of diabetes is to reduce or prevent the risks of developing associated comorbidities and improve patient outcomes. The Diabetes Prevention Program (DPP) consists of an intensive lifestyle behavior change program that includes a decrease in overall body weight and an increase in physical activity of at least 150 minutes per week (ADA, 2022; CDC, 2018; IDPH, 2021). A patient-centered approach, through the use of a telehealth platform, to improve the progression of hyperglycemia, reduction in associated comorbidities, and decrease in body weight can be achieved in primary care offices (ADA, 2022; CDC, 2022; IDPH, 2021; So & Chung, 2018). Primary care providers can provide education in self-management to patients who are diagnosed with T2DM.

Since self-management is still the key to managing type 2 diabetes, all of the examined studies (Kempf et al., 2017; Nicolucci et al., 2015; Niemczewski et al., 2015; Warren et al., 2019) offer some sort of Diabetes Self-Management Education (DSME). Numerous reviewed research showed that regular education and assistance is essential for helping type 2 diabetic patients achieve and maintain glycemic control. As an alternative to routine in-person outpatient visits, telemedicine treatments can be utilised to give T2DM patients organised diabetic education and support in the outpatient context. The feedback loop is another component that has shown to be essential to the research' effectiveness. It has been established that this feedback loop keeps patients and respective telehealth

providers in contact and offers the assistance required for effective T2DM management. (Research papers: Cho et al., 2017; Rasmussen et al., 2016; Wang et al., 2017; Niemczewski et al., 2013; Greenwood et al., 2015; Lim et al., 2016).

In many rural areas, where healthcare access is limited, the primary care provider can use the telemedicine platform to further educate and promote better disease management and decrease the rate of hospitalizations and complications associated with uncontrolled diabetes mellitus type 2 (So & Chung, 2018). Live video and audio telehealth visits have also proven their effectiveness in lifestyle or behavioral modifications, by ways of providing nutritional support, enhancing compliance, and empowering patients to better understand their disease (Eberle & Stichling, 2021). Adults with diabetes are given the information and abilities needed for diabetic self-care through DSMES (ADA, 2018a). Short-term process metrics including knowledge, HbA1c, cholesterol screening, self-monitoring abilities, and food behaviours have all improved with DSMES (Strawbridge, Lloyd, Meadows, and Howell, 2019).

Diabetes self-management is a continuous learning process, which also benefits patients' psychosocial aspects and emotional well-being. The ultimate aim of chronic disease management systems is to assure that patients receive the "appropriate care at the appropriate time and place in the most appropriate manner. Telediabetes actualizes this as it incorporates crucial components of patient-centered care because it concentrates on the unique health needs of the patients and involves them in their own care. The corollary idea of the medical home aims to coordinate the patient's services and referrals throughout a continuum of care. These two ideas are frequently combined to describe a cutting-edge model of care coordination and delivery that meets a patient's full range of healthcare needs. This model is known as the patient-centered medical home.

The idea of shared decision-making has been promoted since the 1970s as the ideal model for patients' decision-making when presented with a consequential range of options for their care. Wayne et al., (2015) described health coaching in primary care as one of the significant benefits of patients. Further evidence of teleadvice efficacy comes from a prospective, parallel-group, randomized controlled trial involving Asian Indian men with impaired glucose tolerance. Conducted at 10 sites, the study assessed whether mobile phone messaging that encouraged lifestyle change could reduce incident type 2 diabetes. This study reported that the cumulative incidence of type 2 diabetes was lower in the intervention group who received mobile phone messages (18%) than in controls (27%). Investigators concluded that mobile phone messaging is an effective and acceptable method to deliver advice and support toward lifestyle modification to prevent type 2 diabetes, in men at high risk.

In a systematic review regarding the effectiveness of telehealth on diabetes care, McLean, Sheikh, Cresswell, Mukherjee, Hemmi, and Paglari (2013), found that many studies showed no differences in outcomes between telehealth care and usual care. Their televisits enabled their disease to be managed, stimulating their adherence to therapies, routine blood glucose monitoring, healthy eating habits, and exercise. The influence of an effective provider-patient relationship in promoting emotional well-being and treatment adherence is well established and the quality of the provider-patient relationship has been shown to predict a range of health outcomes in people with diabetes. A patient-centered relationship is associated with better diabetes self-care, greater adherence to treatment and psychosocial outcomes, and lower levels of stress because it nurtures patients' perceptions of their ability to self-manage their condition.

An effective provider-patient relationship relies on good communications from the provider, and the patients' involvement in decision-making processes regarding their

treatment, making sure they understand the benefits and importance of therapy. In the review by McLean et al. (2013) regarding the effectiveness of telehealth on diabetes care, open-ended questions clearly demonstrated the strong impact of the provider-patient relationship when patients assessed their satisfaction with their televisit. Most of them seemed satisfied with the service (regardless of their glycemic control), and the empathic exchange they had with their provider, even via remote means. This would suggest that telemedicine can have an intrinsic value, whatever the disease involved, that stems from the provider-patient relationship, which concerns not only the clinical care aspect of a medical visit but also the patient's bio-psycho-social sphere.

Dorthea Orem's Self Care Deficit Theory is a self-care model that focuses on the patient's ability to perform self-care to maintain life, health, and well-being with the nurse assisting that process through performing, leading, supporting, teaching, and manipulating an environment to enhance individual development (Shah, 2015). Orem believed that people have a natural ability for self-care and defines self-care deficit as those individuals whose self-care needs outweigh their ability to provide the needed self-care levels (Simmons, 2009). Orem's theoretical framework is rooted in Maslow's Hierarchy of Needs. The framework believes patients should be sufficiently responsible to take care of themselves.

The main goal of self-care is to regulate the effective factors on growth and the patient's performance in relation to life, health, and well-being (Shah, 2020). Orem incorporates the nurse as an agent of change who teaches the patient how to solve problems and make decisions through support and nursing care that impact the quality of life within chronic disease (Borji, Otaghi, & Kazembeigi, 2019). According to Borji et al., (2019), Orem's Self Care Model is noted to be one of the most complete self-care theories that provide clinical guidelines for change in self-care as a major factor in healthcare changes and is crucial for the control of DM. The fundamentals of this principle are designed to address

individuals taking responsibility for their health and the health of others (Borji, Otaghi, & Kazembeigi, 2019).

In diabetes, telemedicine has been proven to have phenomenal benefits in preventing long-term complications by ensuring adherence to medications and lifestyle advice. The use of televisits has been well-studied in populations with limited access to specialized clinicians, registered dietitians, and diabetes educators. Telemedicine programs with visits that match usual care models for diabetes treatment have already demonstrated success in helping patients maintain or improve their health (Lee et al., 2017). In a diabetes center in Kerala, telemedicine in diabetes care, termed Diabetes Tele Management System (DTMS), is a simple and cost-effective tool, practiced since 1997. DTMS consists of a multi-disciplinary team of physicians, nurses, dieticians, diabetes educators, pharmacists, and psychologists, who with the help of customized software and a user-friendly interface titrate the dosages of medications and provide advice on diet, and lifestyle, among other things to all enrolled and willing patients irrespective of the distance from the hospital.

According to Agha et al, (2009), many healthcare organizations have developed orientation training for their clinicians' virtual encounters. mHealth creates a platform that allows care providers to deliver psychological, educational, and medical support to patients. Patients benefit from the engagement and the motivation they get from the service providers, offering few opportunities for researching treatment to treat their conditions. Publications with tips and advice are widely available to guide. While some of the skills needed for a successful telemedicine visit are similar to those needed for an effective in-person visit, additional skills include how to prepare for the encounter, what to wear, how to adjust the lighting and background, how to summarize the visit, and the need to outline and confirm patient's understanding of next steps. Smith et al. (2021), say

clinicians will be required to adopt additional skills to effectively develop relationships, engender patients' trust, and avoid depersonalization of the remote encounter. Agha et al. (2009) and Harrison et al. (1999), observe clinicians may be more comfortable with telephone visits for their established patients.

According to Kuria (2020), mobile platforms, like M-TIBA are a powerful tool for educating potential customers about a provider's presence in the neighborhood. They help providers structure more efficient pre- and post-treatment communications by providing a vehicle for improving the quality and safety of patient care by reducing medication and medical errors, stimulating consumer education and patients' involvement in their own health care, increasing efficiency by eliminating unnecessary paperwork, providing caregivers with clinical decision support tools for more effective care and treatment, eliminating redundant or unnecessary testing and improving public health reporting and monitoring (ROK, 2017).

Virtual training sessions via telephone or video calls have been introduced in clinical practice, enabling remote training on specific diabetes-related aspects such as handling of technical devices, dietary advice, or behavioral recommendations. In the case of new-onset T1D, most of the education has been done remotely by certified diabetes care and education specialists. The majority of mobile applications used for diabetes management are designed for various platforms, providers, and devices. They integrate insulin documentation tools, give information on carbohydrate counting, and provide automated feedback on users' glucose patterns. Video visit platforms allow the provider to coach patients and encourage active involvement in their care (Lee et al., 2018). Improvements in patients' ability to self-manage their behavior can be a crucial factor in the prognosis and risk reduction in the development of diabetes-related complications (Storch et al., 2019). A decrease in the HgbA1c marker has been tied to improved self-management of

diabetes (Storch et al., 2019). Regardless of the limitations of the studies conducted, these mobile tools have positively affected outcomes, improving HbAlc levels, reducing the frequency of hypoglycemic events, and increasing the quality of life in type 1 and type 2 diabetes, Kaur et al, (2015).

Several telemedical programs have been conducted, including diabetes prevention programs and randomized controlled trials. The methods used include regular phone and video calls, virtual education sessions, remote exercise, and dietary coaching, as well as virtual physical exercise sessions. During the COVID-19 pandemic, for example, a virtual COVID Inpatient (VCIP) program was an innovative model designed to deliver in-patient-level care at the patient's own home virtually. The main advantage of this program was treating patients in their homes eliminating the mental stress of hospitalization and at minimal costs thus decreasing the burden on local hospitals and making beds available for much sicker patients. This reduced the cost of hospitalization by far, Kesavadev et al. (2021).

A recent meta-analysis including 17 studies lasting between 3 and 12 months that employed telemedical lifestyle modification measures revealed modest reductions in HbA1 and it was suggested that automated mobile transmission or a real-time feedback modality strengthened the efficacy of these interventions, Michaud et al., (2020). Web-based psychoeducational interventions have also helped adults with both type 1 and type 2 diabetes to cope with depression and emotional distress, Nobis et al, (2015). In the pediatric setting, the use of frequent video consultations as an adjunct to regular care was found to lower the burden of disease and improve treatment satisfaction in patients with limited evidence of improved glycemic control, and has shown promising levels of acceptance among diabetes professionals, Frielitz et al, (2020). A hotline number allows the patient to proactively contact the treating center in the event of emergencies or device

problems, or for other diabetes-related inquiries. Video calls might also be suitable for FTF appointments with selected patients who need to see the face of the healthcare professional for a therapy guide.

According to Giani et al. (2021), telemedicine appears to be a mode of consultation for diabetes education of patients during hospitalization with great satisfaction from patients and healthcare providers. Clients who experience anxiety about leaving their homes to access treatment benefit from services delivered via telehealth according to Bouchard, (2014). In emergencies (e.g., clients experiencing panic disorder or agoraphobia) are instructed to call emergency response systems which automatically provide emergency dispatchers with the location of the client, rather than the client needing to provide their address to the dispatcher while the providers remain connected via telephone or video. To reduce geographic distances and communication barriers between providers and patients, remote connection of multiple providers with a client, promoting provider collaboration, and the exchange of health information is provided, by Dixon, et al., (2008).

When it comes to nutritional information, diabetes patients need to maintain a balance between the quantity of food they eat, their physical activity, and insulin medication in order to manage their blood glucose levels. Usually, People with diabetes are placed on rigid diets and advised on a list of dos and don’ts about eating by practitioners or sometimes advised by friends or family from whom at times, the advice may be misleading. It is difficult for diabetes patients to get food that is totally safe. As mentioned by Bunma, (2014), it is worth noting that poor diet and physical inactivity are the key factors in developing chronic diseases in humans, Bunma, (2014)

Advancement in ICT has brought essential health-related information for diabetes

patients. Mobile devices on the other hand provide different applications in the field of health that improve communication between health practitioners and patients, Rahman et al, (2012). It provides feedback on individual eating habits, which may enable people with diabetes to better manage their condition, Leader, (2012). Previous research has developed tools that can support dietary management for Type 1 and Type 2 diabetes patients. Findings suggest that greater growth is required for mobile dietary and nutritional support in diabetes patients. Mobile applications that support healthy eating habits require applications for managing blood glucose, physical activity, and medication data Bunma, (2014).

In some developed countries commercial applications that rely heavily on manual data analysis and labor-intensive user interaction have been recently created. An example is MyFoodPhone by Sprint, Diet Fitness Diary by Verizon, and Sensei. A new application idea called BIG-GLUCON-HERO meant to reduce hospitalization and support independent lifestyle in Adult Diabetics is also being worked on. The application will be used to reduce hospitalization and support independent lifestyles in Adult Diabetics. However, telephone discussions are usually limited to education and counseling because there are no visual cues for the provider/telenurse. Some patients encounter technical challenges managing the devices while others find the devices unaffordable. It is therefore necessary to ensure a user-centered adoption and socio-technical design to ensure usability, perceived usefulness, and, adoption of the technology, Arsand et al, (2008). Chomutare, et al, (2011) propose a methodology for automatic food recognition, based on the bag-of-features (BoF) model as a first step toward the development of a portable application and providing dietary advice to diabetic patients through automatic carbohydrate counting. More patient education is also required initially for the use of the equipment. Teleadvice therefore provides many possibilities for diabetes care such as

creating awareness among urban and rural populations about the risk factors and prevention of diabetes, facilitating patient monitoring, remote diabetic retinopathy screening, and diabetes prevention at the primary, secondary, and tertiary levels Pradeepa et al, (2019).

To attain multiple goals of therapy in a single patient, continuing education, motivation, empowerment, and advice on healthy food habits, physical activity, and accurate use of monitoring and injection devices are required, (Lee et al. 2017). Studies indicate that remote clinical advice reduces stigma and may increase engagement in the screening process, as well as response accuracy. Additionally, these measures lead to cost reduction (Cornelius et al. 2012). Medical apps remind patients of medication intake, monitor the side effects of the drug, and update the physicians through texts or emails are some of the contributions of these apps in the patient recovery process. According to (Talbott, 2022), virtual care has also enabled greater access to adjunct support services, such as counseling, where patients can more easily fit appointments into their schedules. Accessibility problems in poor network coverage areas, limitation to women's limitation of mobile gadgets, and limited sources of information due to the lack of connectivity to other sources are noteworthy problems according to Handel, (2011).

Goldberg et al. (2020) interviewed together with 48 physicians on the perspective of telehealth for older adults during the COVID-19 pandemic, reported that in some instances, telehealth enabled physicians to prevent clinical decomposition and recommend patients seek necessary in-person medical care when patients had been otherwise unconcerned. The physicians further indicated that without telehealth, patients would have completely forgone visits during the pandemic, with potentially devastating consequences on individuals' health. MOH, (2017), contributing to health standard requirements states that there is a need to understand the audience that will use the

proposed service by finding out, whether individuals in the target population currently own mobile phones or share phones with others, whether the level of mobile phone ownership is influenced by gender, the type of phones that members of the target population use (basic, feature phones or smartphones), who pays for the phone and airtime.

A 2020 Future Health Journal on establishing a remote clinical advice service during the COVID-19 pandemic conducted by Samuel et al., (2020) at North Bristol NHS Trust in England set up a virtual advice service called 'Ask the Medical Reg' to provide senior medical support to inpatient and community teams for general medical and COVID-19-related queries. GPs were the most frequent service users, representing 47.5% of all requests for clinical advice. This remote advice service was successfully used to support community teams with general medical and COVID-19-related queries and for vulnerable clinicians unable to participate in frontline work during the pandemic in England, Samuel et al. (2020). Other benefits include admission avoidance, reducing pressure on acute hospital services, and reducing the risk of nosocomial infection, infections that patients acquire while admitted to a healthcare facility.

A study to reduce the Cost of Diabetes care with Telemedicine by Jothydev & Viswanathan (2023) says numerous smartphone applications exist with the aim of improving patients' glycemic control and control of other parameters through diabetes education. Coaching mySugr is a diabetes management app that helps to record blood glucose data, along with meals, exercise, and medicines. It provides daily, weekly, and monthly reports that can be shared directly with the doctor. It also provides help calculating insulin doses, and the new coaching features turn it into a full-service learning and support program. mySugr Coach helps to connect with a diabetes educator who can offer support, tips, and help through the app, via email or text message. Even in the

absence of a doctor, there is a virtual live educator to help assist patients with diabetes 24/7. Patients feel comfortable and it is convenient to interact with a user-friendly popular app. Moattari, Hashemi & Dabbaghmanesh (2019) conducted a randomized clinical trial comparing tele-education versus usual care on A1c among 48 insulin-dependent patients in Iran. 24 participants in the experimental group received an electronic education program for twelve weeks including consultation service, quick answers to patients' questions, contact with the healthcare team, and education materials.

Remote clinical advice can be used in therapies such as prolonged exposure therapy, cognitive processing, cognitive behavioral, behavioral activation, among others. A study by CarePay, (2020) on the influence of mobile phones on Kenya's healthcare sector indicates that over 90% would like to receive more healthcare services on COVID-19 and general health information through their mobile phones. The cornerstone of diabetic management is lifestyle changes which include nutritional counseling, counseling against alcohol and smoking, exercise, stress management, and weight loss. The patients can remotely be taught how to use a glucometer, and advised about the frequency of self-monitoring of blood glucose (SMBG), and the target blood sugar values to be achieved. The testing should be at various times of the day that is pre and post-all meals. Those on insulin should be taught how and where to inject.

Diabetes education using telemedicine is feasible, acceptable, and effective in the management of most patients with diabetes, especially during pandemics like COVID-19. The improvements in the access and quality of healthcare after mHealth implementation will yield an improvement in the general health of the target population, (Juma et al. 2012). Some mHealth applications will be designed in a way that they will offer constant reminders to patients on how and when to take their medication. However, Kenya lacks ICT policies and related regulations. The 2005-2010 Kenya National Health

Sector Strategic Plan (NHSSP 11) did not address any issue in regard to e-health but it only casually addressed ICT in general (Boore et al. 2017). With more emphasis on the right diet during teleadvice sessions, the prevalence rate of diabetes is likely to decrease since the key to diabetes prevention is diet.

2.3.4 The effect of telemonitoring utilization on the well-being of diabetic patients in Nairobi City County.

It is continually becoming difficult to treat chronic diseases that are becoming widespread by the day and whose treatment and monitoring require frequent hospital visits, burdening both hospitals and patients. These diseases require special home care to fulfill patients' needs or administer therapy programs. A UNECE 2021 brief states that, the 21st Century is characterized by rapidly expanding digitalization, such as telemonitoring, which is the use of technology to provide care and support to patients in their homes. The COVID-19 pandemic prompted the rapid implementation of new and existing digital technologies to facilitate access to health and care services during physical distancing. It has also highlighted unequal access to digital technologies across and within populations.

A growing body of evidence supports the use of innovative technologies such as telehealth in the monitoring and management of patients with diabetes over a distance and as frequently as necessary (Burchard & Sadarangani, 2014; Lee et al., 2018). Chronic disease management expects patients to assume substantial responsibility for managing their own health and healthcare while being monitored and guided actively by clinical providers through telephony, videoconferencing, or other electronic devices on a routine basis. The typical telediabetes system provides patients with electronic tools to measure blood glucose levels, report this information to a care coordination

clinic, staffed by nurses and/or dietitians, and receive guidance on proper steps to control their glucose levels, thus enhancing their health and well-being.

For at least a decade, the World Health Organization has encouraged member states to become leaders in serving citizens online, using digital technology to improve health and social care services (Kunonga, Hall, Hanratty, & Bower, 2021). The digital platforms have been the link to engage in social isolation and health consultations. Namakula et al. (2012) argue that the health sector is among the sectors that have inarguably benefited from this technology. Health information systems have become sophisticated thus improving surveillance and real-time monitoring. Also, the changes have eradicated the necessity of paper health surveys in monitoring health outcomes in addition to monitoring the use of health services. State regular medical monitoring, psychological therapies, phone calls from/to loved ones, and healthcare personnel as examples of healthcare online services (Aprahamian & Cesari, 2020).

The treatment and care of patients with diabetes and its comorbidities require careful and regular monitoring. Remote patient monitoring (RPM) also known as self-monitoring/testing, is the foremost of these advancements. According to the Science Direct journal, (2019), telemonitoring is the transmission of symptom scores and physiological data to care providers via automated electronic means, web-based or phone-based data entry. Telemonitoring is primarily used for managing chronic diseases or specific conditions, such as heart disease, diabetes mellitus, or asthma. It enables medical professionals to monitor a patient remotely using various technological devices by collecting the patient's vital signs using invasive and noninvasive techniques, then sending them to physicians and allows physicians to monitor several patients in parallel according to Zhanwei & Yongjian, 2021).

Telemonitoring services can provide comparable health outcomes to traditional in-person patient encounters, supply greater satisfaction to patients, and may be cost-effective. Rahim, A. et al, (2016) indicated that most caregivers and families do not have the time or relevant skills to take care of the patients thus putting their lives at risk. Developing e-health systems (e.g., remote patient monitoring (RPM), electronic health record (EHR) systems, mobile health (m-health), telemedicine, e-visits, and e-consultations) for monitoring, diagnosis, prediction, and treatment is becoming increasingly necessary. The systems also reduce healthcare costs and allow patients to perform their daily activities as physicians monitor them as stated by Zhanwei & Yongjian (2015). With the advancements in wearable sensors, communication protocol healthcare systems are bound to be enriched and reshaped soon.

Remote patient monitoring (RPM) technologies enable patients to be evaluated outside of a typical clinical visit, in their home, or in their community. RPM programs collect data using symptom surveys, wearable sensors, and other medical devices and send this information to a healthcare practitioner to facilitate clinical assessment and decision-making. Telemonitoring is used to help manage veterans with chronic illnesses, such as diabetes and depression. In the last decade, many studies have demonstrated the utility of RPM in improving the outcomes of patients with chronic health conditions (Vegesna, 2017). The Care Coordination/Home telehealth program in the United States for example yielded high satisfaction from patients using telemonitoring and produced a 19% reduction in the number of hospital visits as compared with their usual care (Darkins et al. 2008).

Meta-analyses have found that monitoring blood glucose at home and sending measurements to the provider for clinical feedback yield significant improvements in glycaemic control, Kitsiou et al., (2017). During the past year, several hospital systems

around the world have developed and implemented RPM platforms in response to the pandemic. Many of these programs have focused on monitoring patients with COVID-19 after hospital discharge. Throughout the COVID-19 pandemic, the capacity of hospitals has been severely strained, and RPM programs provide a mechanism to reduce this strain. RPM platforms enable physicians to discharge patients early and monitor them remotely after leaving the hospital, freeing up inpatient beds. Since the virus is highly transmissible, monitoring patients remotely can reduce the number of follow-up hospital visits needed, decreasing its spread.

Beyond following up with patients after hospital discharge, RPM has also been employed to monitor symptomatic patients prior to admission. A patient Monitoring System (PMS) is the repeated or continuous observations or measurements of the patient, his physiological functions, and the function of the life support equipment, for the purpose of guiding management decisions, including when to make therapeutic interventions, and assessment of those interventions (Brown and Carr, 1981; Zubair, 2010; Zubair and Eneh, 2018). RPMs are intended to continuously capture many clinical data from patients and allow physicians to be continuously monitored using various internal and external sensors. RPMs provide patient assurance, increase patient awareness and responsibility, and provide low-cost solutions by decreasing the cost of hospitalization and admissions. Regular measurement of the patient's vital signs such as heart rate and rhythm, respiratory rate, blood pressure, blood oxygen saturation, and many other parameters have become part of the health care procedures.

When accurate and immediate decision-making is crucial for effective patient care, electronic monitors are frequently used to collect and display physiological data. Increasingly, such data are collected using non-invasive sensors from less seriously ill patients in a hospital's medical-surgical units, labor and delivery suites, nursing homes,

or patients' own homes to detect unexpected life-threatening conditions or to record routine but required data efficiently. Some of the devices used for telemonitoring include blood pressure devices, blue tooth-enabled scales, digital thermometers, blood glucose meters, and pulse oximeters. Today, many health monitoring projects and applications have been initiated that use different architectures. Health monitoring systems are heterogeneous and have been developed for various diseases and disabilities.

Today, nurses are increasingly being asked to use advanced information and communication technologies (ICTs) in the practice and delivery of care. Telenursing, the use of "technology to deliver nursing care and conduct nursing practice" has brought great benefits to both providers and patients (Schlachta & Sparks 1998). Telenurses and other health care professionals are continually struggling to increase the safety of their patients, increase the quality of health care, and decrease adverse events. Nurses engaged in telenursing practice continue to assess, plan, intervene, and evaluate the outcomes of nursing care, using technologies such as the Internet, computers, telephones, digital assessment tools, and telemonitoring equipment.

Telemedicine has had an impact on health care utilization rates for acute care services (such as decreasing visits to the Emergency Department). Further, patients who live in rural areas or in medically underserved areas may not be receiving the expert care that is needed (Wei, Valentino, Bell, et al, 2006 & McConnochie, Conners, Brayer, et al., 2006). Telehealth technology offers increased productivity for nurses by decreasing travel time to remote areas, thereby increasing the average daily census (Frey, Harmonosky, Dansky, 2005). Audio and video technology can facilitate remote home health monitoring between patients and caregivers, (Lamothe, Fortin, Labbe, et al. 2006). Often, peripheral devices placed in patients' homes such as thermometers,

sphygmomanometers, and stethoscopes are connected to the telehealth equipment so telenurses can monitor clinical signs remotely. Because there is no FTF contact, telenurses face the challenges of having to build a picture of the patient by constructing a mental model of the caller a process known as “visualization work (Edwards, 1998).

Patient Monitoring has always been occupying a very important position in the field of medical devices owing to the importance of continuously monitoring the vital physiological signs of a patient. The continuous improvement of technologies not only helps us to transmit the vital physiological signs to the medical personnel but also simplifies the measurement and as a result raises the monitoring efficiency of patients. In the past, the dominant products manufactured by medical device manufacturers were mainly those for single-parameter measurement. When monitoring blood sugar, it is important to measure other factors besides the glucose level such as blood pressure, body temperature, consciousness level, respiratory rate, etc. to avoid diabetes complications.

It is now possible to support data collection solutions such as monitoring diseases and conducting health surveys through mobile devices which are connected to remote sensors fixed in homesteads which allow the transmission of sensitive data to specialists offering health services. This connection highly benefits individuals seeking check-ups as they don't have to visit health centers to access desired services. The sensor technology utilized in mobile patient monitoring is expensive, making it less common in developing countries. Another challenge is the fact that only a limited number of patients have the chance to access different services associated with this technology. This is because not all individuals have gadgets that connect to diagnostic sensors. Significant enough about mobile patient monitoring is the fact that it allows the consistent monitoring of patients’ recovery progress using mobile devices or computers.

Telemonitoring leads to a reduction in hospital admissions as indicated by Queiros and colleagues (2021) as well as (Kunonga, Hall, Hanratty, and Bower, 2021), Peters & Garg, (2020). Italian study of 40 patients (36 with T2D and 4 with T1D) demonstrated the feasibility and efficacy of telemedicine via intermittently scanned Continuous Glucose Monitoring CGM at the time of the COVID-19 outbreak. The results of the study showed a significant reduction of HbA_{1c} at 3-month follow-up during the lockdown period Luzi, (2021). Patients who attended a telemedicine visit during the lockdown period had a significant improvement in average glucose, glycemic management indicator, time in range, and time above range without significant changes in time below range, number of daily scans, or hypoglycemic events. In contrast, there were no significant changes in any of the CGM metrics during the lockdown in those who did not attend telemedicine visits, Alharth et al. (2021). However, from the study, most of the patients preferred to use telemedicine in a hybrid manner, Schiller et al, (2012).

Quinn et al, (2011), have studied mobile-based health applications and improvements in glycemic control. A study conducted in 2008, among 28 patients with type 2 diabetes, showed that the intervention group, which received cell phone-based software, achieved statistically significant improvements in HbA_{1c} compared to the patients in the control group. Malasinghe et al. (2019) surveyed the most recent glucose monitoring methods and reported that closed-loop systems where the feedback mechanism provided immediate intervention to patients were the most effective in diabetes control and management.

Nowadays, a multi-parameter patient monitor is commonly used. It can transmit vital signs like ECG, blood pressure, and respiration rate. The design and construction of an electrocardiograph (ECG) are presented on the CDSS service provider's side. It

provides comprehensive and complicated decision support based on the patient's entire historical data and keeps giving updates periodically, (Zubair and Eneh, 2018). It has two layers. The first layer helps patients with advice and recommendations based on the patient profile, resolves the human-computer interaction issues, and provides a simple and user-friendly version. It is also friendly, does not require experience in dealing with computers or smart apps, and runs in an offline mode. In case the system detects abnormal signs, it will fire the alarm and send an alarm message to the network CDSS system utilizing the semantics of ontology and fuzzy logic to optimize the resulting decisions. It supports the prediction of the patient's future conditions and suggests preventive actions by mining the temporal data collected when the healthcare personnel are contacted. It acts as a virtual doctor.

In 2018, the Technology Assisted Case Management 2 (TACM2) program was established at the Medical University of South Carolina with the goal of improving chronic disease management for a diverse patient population, spanning across the state, (NLM, 2020). The TACM2 program is an implementation program based on the success of the pilot study, TACM-DM, which demonstrated significant reductions in HbA1c and blood pressure at 6 months through the use of remote glucose and blood pressure monitoring with nurse case management oversight among patients randomized to the TACM intervention compared to controls. The TACM2 program aims to improve health outcomes for low-income and rural patients in the state of South Carolina using this proven technology.

Most people with diabetes can make use of CGM systems. These systems provide glucose values from the interstitial fluid. Through the real-time transfer of glucose values to a reader or smartphone or by deriving glucose data from scans (intermittently scanned glucose monitoring), the frequency of capillary glucose measurements can be

substantially reduced. The use of these systems has also significantly improved glycemic control, treatment adherence, and quality of life, Polonsky et al. (2017). CGM sensors provide the current glucose concentration and its rate of change for improving the determination of exogenous insulin administration and the prediction of forthcoming adverse events, such as hypo-hyperglycemia. Nowadays, smartphones (iPhone, Android phones) act as receivers either through a cloud or a Bluetooth interface. Software on a smartphone interprets the incoming sensor data, along with other data from a personal health **r**ecord, and detects various patterns.

The increased burden of diabetes has prompted increasing efforts to develop mobile technologies for monitoring blood glucose among individuals with diabetes. During the past decade, much progress has been made in utilizing technology to monitor blood glucose levels. Glycemic control in individuals with diabetes can be measured by various means, including laboratory-based glucose monitoring, HbA_{1c}, self-monitoring of blood glucose (SMBG), and continuous glucose monitoring system, using ambulatory glucose profiles for data interpretation and analysis. SMBG is a valuable tool for decision-making for both patients and clinicians, Garg, (2017). Regular SMBG has been shown to improve HbA_{1c} and reduce the fear of both h**y**perglycemia and hypoglycemia in individuals with type 1 and type 2 diabetes, (Harashima, 2015). A wide range of blood glucose meters are available that are portable, inexpensive, accurate, and reliable. One of the barriers to frequent and regular SMBG is patients' inability to make decisions based on the results. However, this issue could be addressed by the use of telemedicine technology. The increasing use of smartphones and the availability of mobile applications for the management of diabetes presents a possible method to transmit the SMBG test results to a healthcare provider electronically through emails, SMS, or Internet portals.

The Structured Testing Program (STeP) study evaluated how a structured patient/physician SMBG intervention influenced the timing, frequency, and effectiveness of primary care physicians' treatment changes among 483 poorly controlled, insulin-naive type 2 diabetes patients over a year, (Polonsky, 2011). On assessing the impact of structured SMBG on physician treatment modification recommendations (TMRs), it was reported that patients who received at least one TMR demonstrated a greater reduction in HbA_{1c} (-1.2%) than the active control group (-0.8%). The STeP study investigators concluded that collaborative use of structured SMBG data leads to earlier, more frequent, and more effective TMRs.

Ismail, et al., 2020 explain how the Internet of Things (IoT) uses a Wireless Body Area Network (WBAN), a wireless sensor network that connects wearable devices, called sensors, on a patient's body, to the network, allowing remote monitoring for the patient's vital signs, **v**iews shared by Naslund, J. A et al, (2015). WBAN can be used to monitor diabetes, heart diseases, asthma, and cancer detection among other illne**ss**es, (JST, 2011). Diabetes Monitoring System records physical activity patient's blood glucose level, food intake, and blood pressure, Rghioui, et al., (2020). Mobile PMs for chronic patients need continuous and long-term monitoring. Liu, et al, 2011) state that the system aims to decrease the need for hospital visits as well as nursing. Liu, Liu & Y. Human (2017), argue that with the growing spread of the coronavirus (COVID-19), robots now participate in various applications including a telemedicine robot that helps doctors monitor the physiological parameters of large-scale patients remotely.

An initiative called RESET which stands for "Reward Efficiency, Set Priorities" was started at Joint Base Elmendorf- Richardson (JBER) in Alaska in late 2020, and involved offering limited telephonic follow-up visits to patients instead of face-to-face clinic appointments. In general, these visits were used for simple acute conditions or

follow-ups where a physical exam was not needed. These virtual visits have generally not been used for more complex issues such as diabetes follow-up, and no specific program exists to guide provider-driven diabetes telemedicine practice. RESET was sidelined with the transition to Defense Health Agency (DHA) management in late 2019.

A security schema called elliptic curve cryptography (ECC) has been developed to Identify data skin and consumers, register to confirm the identification step, create a secret channel, and verify the communication between skin and consumer ultimately enhancing the reliability of the system. There also other devices and applications with specific functionalities that are making a difference in patient health care and safety as related to health outcomes. Glucoboy and Digiscope are two examples of these new technologies. The former is a diabetic tool in a video game cartridge format. The cartridge is inserted into Nintendo's Game Boy and has been shown to help children with the management of type 1 diabetes mellitus (Slater (Slater SG, 2005). The Digiscope is a telehealth technology that allows for screening of diabetic retinopathy in a primary care physician's office rather than under the specialized care of an ophthalmologist (Zimmer& Zeimer., 2006). Other devices that help to monitor patients are bluetooth enabled scale, smartwatches, digital stethoscope, and pulse oximeters among others. These telehealth technologies have been shown to be practical alternatives to traditional care.

The use of telemedicine as an alternative follow-up tool during the COVID-19 pandemic was confirmed in a study in Turkey, where telemedicine proved to be useful in achieving optimum glycemic control in pediatric patients with new-onset T1D. However, their preference for telemedicine visits instead of in-person appointments in the future was significantly lower, showing the patients' need for in-person contact

Scott et al. (2022). In gestational diabetes (GDM) perinatal and postnatal outcomes (for the mother and infant) were reduced by telemedicine interventions, Xie et al., (2020). The above was confirmed in a study in Austria using an integrated digital care program during the COVID-19 pandemic in 2020 in 27 GDM patients who showed significantly improved glycemic control (Moazen et al., 2021).

The COVID-19 pandemic revealed the need for more use of telemedicine for the monitoring of patients with either T1D or T2D. It is noteworthy that in the USA, the proportion of telemedicine visits before the pandemic was < 1%, rising to an average of 95.2% in April 2020, Lee et al. (2018). Zoom was the most popular video platform used. Overall, 83.3% of healthcare providers reported being satisfied with the use of telemedicine (Giani et al. 2021).

Concerns arose from the fact that older age was negatively related to willingness to continue telemedicine visits. Another concern was on the safety of telemedicine use for routine monitoring of a patient with diabetes, as a first visit for patients with new-onset diabetes and acute illness compared to in-person visits. Since a substantial proportion of patients still show a preference for in-person diabetes care, a personalized approach is still needed.

Telemedicine is an easy way to follow up with patients with T1D since most of them, mainly the younger ones, are able to generate and send to their healthcare provider their glucose profile reports allowing remote monitoring and consultation (Sangave et al., 2019). Due to their improved accuracy and acceptance as well as relatively liberal reimbursement criteria in many counties, most people with diabetes and complex insulin therapies can make use of continuous glucose monitoring (CGM) systems that report real-time glucose from sensors that measure glucose in the interstitial fluid.

Through the real-time transfer of glucose values to a reader or smartphone, the frequency of capillary glucose measurements can be substantially reduced. These systems use significantly improve glycemic control, treatment adherence, and quality of life (Rodbard, 2017).

CGM system recorders can also be used to document insulin injections, meal intake, or other events such as sports or illness. Users can assess their current glycemic control and adjust their therapy if needed. CGM reports can quickly be delivered to the treating physician (via email or directly via the platform with the user's permission) and then discussed during a telephone call between healthcare professionals and the person with diabetes. The efficacy and safety of managing glucose control via remote CGM manufacturers discourage their use in hospitals.

COVID-19 has illustrated that we need to expand the reach of the health system beyond the hospital and clinic setting. RPM technologies provide an avenue to do exactly that. The deployment of an RPM intervention however requires sufficient monitoring devices, clinical providers, and information technology personnel, which necessitate significant upfront investment. Most patients using RPMs are usually concerned about their health data, in terms of loss and privacy. Various studies are also concerned with data privacy and security (Tian et al., 2014). Providers need to ensure they have custom healthcare software solutions. Experts recommend cloud-based storage as opposed to web-interface-based applications. The question that begs is whether the government is ready and willing to invest in monitoring devices and data privacy which would enhance clients' confidence and trust during telemonitoring visits.

2.4 Summary of literature

The literature made bold attempts to explore the relationship between the variables under the study and the empirical results they are likely to produce. It examined the relationship between telehealth functionalities and diabetes disease care management in Nairobi County. Two theoretical frameworks were used to identify the gaps in the literature that need to be filled in order to expand the boundary of telemedicine knowledge. The literature highlights the challenges of treating diabetes mellitus and other diseases that are becoming widespread by the day and whose treatment and monitoring require frequent hospital visits, burdening both hospitals and patients**.** The literature advances arguments that digital health interventions are likely attractive tools for delivering virtual healthcare services and have the potential to reach diabetic patients who for one reason or another are unable to make in-person medical visits to the hospital or to visit physicians (Ginige and Maeder, 2018). As part of epidemic control measures, Sime et al., (2022) stress the need for adjustment mechanisms including the more frequent use of telemedicine to maintain continuity in healthcare provision. Telemonitoring for example allows physicians to monitor several patients in parallel according to Zhanwei & Yongjian, (2021). Other than remote clinical services telemedicine reduces stigma and increases engagement in the screening process, as well as response accuracy. Additionally, these measures lead to cost reduction (Cornelius et al. 2012). However, accessibility problems in poor network coverage areas, applications' limitation to women's limitation of mobile gadgets, and limited sources of information due to the lack of connectivity to other sources are noteworthy problems according to (Handel, 2011).

2.5 Knowledge Gaps

The current systematic review of evidence on the potential for digital technologies to improve access to health and social care for diabetic patients is limited in both scope and quality. Though telemedicine applications have achieved varying levels of success, there's a shortage of studies documenting the economic benefits and cost-effectiveness of their applications especially less developed countries like Kenya. Government, health system managers, and doctors have not prioritized telemedicine services among its population. Relevant data to establish the impact of mobile health technologies on healthcare outcomes is also scarce and more training and awareness is necessary.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents research paradigm, research design, study area, population of the study, target population, sampling procedures and sample size, methods of data collection, research instruments, data analysis and ethical considerations.

3.2 Research Paradigm

A research paradigm helps to articulate established theories, research design choice, data collection and analysis methods and research finding interpretations Mertens, (2005). It plays a role in research expectations. This study was based on pragmatic paradigm since solves practical problems taking place in the real world, (Creswell & Clark, 2011). It focuses on what and how with regard to research problem and no philosophical loyalty to any alternative paradigm. It is also concerned with multiple perception of a single reality as (Krauss, 2000). The paradigm observes empirical domain and thus allows for theoretical reasoning and experimentation, making it appropriate for this study since responses emanating from real life experiences will allow the researcher to interact with the research without bias.

3.3 Research Design

A research design is a procedure for collecting, analyzing, interpreting, and reporting data in research studies (Creswell & Clark, 2007). Research design provides the glue that holds various elements in a research project together. The design is used to structure the research, to show how all of the major parts of the research work together to address the central hypothesis of interest (Trochim, Donnelly, and Arora, 2016). The study

employed a descriptive design. It used a systematic sampling method to collect the required data. For a topic like telemedicine which little is known about in the region, descriptive design is likely to give the right trends of the current telemedicine utilization. Self-administered questionnaires, which contained items that are, both open and closed-ended were used. There were two FGDs. The data collected was used to illustrate the effect of telemedicine utilization on the health outcomes of diabetic patients.

3.4 Study Area

After the promulgation of the 2010 constitution of Kenya which divided Kenya into 47 counties, Nairobi formerly referred to as a province became county number 47. Like all the other 46 counties, it is led by a governor and his deputy who together with MCAs form the county government. According to the Nairobi City Annual Development Plan (CADP 2022/2023) which was published in 2021, Nairobi County borders Kiambu County to the North and West, Kajiado to the South, and Machakos to the East. The county has a total area of 696.1 Km^2 and is located between longitudes 36^o 45' East and latitudes 1^o 18' South. It lies at an altitude of 1,798 meters above sea level. The County is divided into seventeen sub-counties and a total of eighty-five wards, (CADP 2022/2023). Nairobi's 2020 population is now estimated at 4,397,073. Females dominate the population having 2,204,376 in number, males are 2,192,452 while intersex are 245. The city is the location of one of the largest slums in the world, and approximately 22% of the city's residents live in poverty. It was projected that by 2022 total population would be about 5 million persons. Nairobi occupies an area of about 700 km2 at the south-eastern end of Kenya's agricultural heartland. At 1 600 to 1 850 m above sea level. It enjoys tolerable temperatures year-round (CBS 2001, Mitullah

2003). The western part of the city is the highest, with a rugged topography, while the eastern side is lower and generally flat. The Nairobi, Ngong, and Mathare rivers traverse numerous neighborhoods and the indigenous Karura forest still spreads over parts of northern Nairobi.

The study mainly targeted diabetic patients in Nairobi City County. Nairobi was chosen because of several important factors. It is the Capital City of Kenya and is the primary economic hub of Kenya's economy. It has a high number of population with a good source of income relative to individuals in the rural economy. It also has several salient medical facilities clustered together, which makes for short-distance traveling and faster access as compared to other medical facilities in other urban locations across Kenya. Moreover, the use of mobile devices to access health information is relatively widespread compared to other urban centers in Kenya. Nairobi is also considered to have better medical facilities and a better health information technology (HIT) infrastructure compared to other medical facilities across the country. To effectively and efficiently address many of the health needs of individuals, there is a need to invest in the delivery of healthcare services using telehealth technologies.

3.5 Study Population

The study included the population of diabetic patients in Nairobi County who utilize health facilities in Nairobi County. The total number targeted were individuals aged between 31-70 years. This is because diabetes risk, especially type 2 increases with age. Older people develop insulin resistance with age due to decreased muscle mass, overweight, and reduced physical activities amongst the older population.

3.6 Target Population

The study participants represent diabetic users of telemedicine**,** diagnosis treatment, information or advice, or follow-ups and the healthcare providers/professionals who provide these services. Targeted participants were required to at least have access to a mobile phone. The target population was 100 men and women composed of 4 diabetic patients from each facility, 28 health specialized personnel (two specialized were targeted from each facility), and 2 FGDs composed of 6 members each. Using Krejcie & Morgan (1970) table of sample determination, the research recruited 71 respondents from Nairobi City County, 59 for the survey, 14 key informants from the targeted health facilities, and 2 focus group discussions, one from a private hospital and another from a public hospital. This was in order to establish whether public hospitals offer equally competitive services like private, as such the average citizen in need of telemedicine does not miss out on the services. Proportionate sampling allowed the researcher to work with 59 respondents. The unit of analysis were patients with Diabetes Mellitus utilizing telemedicine.

3.7 Sampling Techniques and Sample Size

The study population involved all individuals who live within Nairobi City County. The researcher initially devised a method of obtaining a sampling frame, the list from which the researcher would be able to draw the sample. For purposes of this study, the researcher used purposive sampling method to select hospitals offering telemedicine services after which she physically visited all the hospitals included in the study to obtain a list of health professionals in charge of providing diabetic care and a list of diabetic patients who have ever visited the named hospitals to seek or receive medical treatment. This did not materialize prompting the researcher to randomly select diabetic

patients who were willing to take part in the study. Snowballing was also used to locate diabetic patients within Nairob**i** County out of which 59 were sampled through survey interviews. Majority lived far from the facilities they visited for treatment. 5 key informants from 5 facilities out of the 14 targeted were purposively sampled as the rest had either stopped offering telemedicine after COVID-19 or were unwilling to undertake the study.

3.8 Data Collection Methods

This was used to seek permission from relevant facilities to undertake the study. Data was collected from selected respondents (participants) through semi-structured instruments (questionnaires), key informant guides, and focus group interviews. The researcher identified salient medical facilities within Nairobi, which indicated that they offer telemedicine on their websites, the majority of which were private. The researcher having obtained a research approval letter from NACOSTI, approached all the aforementioned hospitals and talked with relevant hospital administrators, healthcare professionals, and staff members and random diabetic patients for specific interviews. Data from the 2 FGD was collected from participants during scheduled meetings.

3.8.1 Key Informants

5 key informants, one from each facility was subjected to the key interview guide. The informants responded to questions regarding the telemedicine services offered by the facilities, those not offered, what age group frequents the facility, how their telemedicine services operate, and challenges encountered in the course of delivering the services. The researcher probed to ensure rich detailed data. The key informants that responded from these facilities are the wellness coordinator, Home-based care coordinator, patient assistant, coordinator, pharmacist, and diabetes educator.

3.8.2 Telemedicine Questionnaire

The researcher approached individual patients identified in diabetic clinics and requested them to take part in the survey. Some survey respondents were identified through referrals by those already interviewed or by individuals known to the researcher. A total of 57 respondents participated in the survey questions regarding their demographic profile and telemedicine satisfaction levels which included devices used, the period telemedicine has been utilized, experiences with providers, and challenges faced. Participants who wanted to respond using other means like email, orally, or by telephone were allowed to.

3.8.3 Focus Group Discussions

Two focus group discussions composed of 6 individuals each were conducted, one composed of diabetic patients from public hospitals and the second from private hospitals. Focus groups enable deeper consideration of complex issues than many other survey methods (Trochim et al. 2016). It allows for in-depth discussions of discussion topics (Trochim et al. 2016). The groups would mainly be used to get feedback regarding telemedicine utilization and health outcomes in Nairobi. The researcher ensured there were representations from both genders. A focus group discussion guide was used to engage the groups. Patients were allowed ample time to respond guided by the timelines. Participants were given time to exhaustively express themselves on their experience with diabetes, special needs, challenges faced when seeking health services, experiences with telemedicine, and improvements they would like to see in telemedicine. The researcher, who was also the facilitator gave equal opportunities for responses to questions and allowed time for brainstorming on ways of improving remote access to health. She keenly listened and observed the body language to pick up the non-verbal cues.

3.9 Pilot Study

The pilot study was conducted at one of the Penda Health clinic branches in Nairobi CBD as the facilities scheduled for the same in three different counties out of Nairobi, specifically Nakuru, Machakos and Kiambu cited lack of preparedness despite their willingness in prior conversations. Penda has been in existent since 2012 and has over 20 branches in Nairobi County.

3.9.1 Validity

Validity is the stability of measurements over a variety of conditions that obtain results. A study that is conducted by different researchers under the same conditions yields the same results. Middleton (2019) defines validity as the extent to which the results really measure what they are supposed to measure (Accuracy). The results should correspond to established theories. This study used criterion validity as it is used to measure how well one measure predicts an outcome for another measure and can be used to make predictions about future outcomes. During proposal presentation the panel members gave their expertise judgement and suggested areas of improvement which was done on the instruments to improve validity.

3.9.2 Reliability

Drost (2011) defines reliability as the extent to which measurements are repeatable when different people perform the measurement on different occasions, under different conditions, supposedly with alternative instruments that measure the construct or skill, in other words, the degree to which the constructed measure is consistent or dependable (Consistency). In this research, Criterion Predictive Validity was used because it is accurate, precise, and reliable. Pre-testing was done during the pilot study to estimate

on required time during the actual exercise. Issues arising from the instruments were streamlined and reliability determined.

3.10 Data Analysis

In this research study qualitative and quantitative data came from three different sources at different times: survey returns, key informants and coded focus group interview data. As soon as survey data was received, it was scrutinized and screened for accuracy. This provided the opportunity for the researcher to ask pertinent questions: Are the responses legible/readable? Are all important questions answered? Are the responses complete? Data analysis for this study involved data preparation on an excel spreadsheet for quantitative data, which was then logged in. The next step involved checking the data for accuracy and then transforming the data. Descriptive statistics was then used to describe the basic features of the data in the study. This is because they provide meaningful summaries about the sample so that potential patterns might emerge from the data. Graphical analysis and descriptive statistics form the basis of virtually every form of quantitative analysis.

Regression analysis was used to show the relationship between telemedicine utilization and the outcomes. The study accomplished its statistical analysis by using the standard statistical program SPSS, and by running simple descriptive analyses to obtain reports on data status and final results. For key informants and focus groups, a qualitative method of data analysis is composed of understanding the interviews, understanding the raw information, looking at recurring patterns and forming topics, and then rearranging them according to themes that explain emerging patterns from collected data. The researcher used recurring patterns to form topics. The data was presented along emerging themes. Verbal quotations were used to echo informants' voices

3.11 Ethical Considerations

A letter of introduction was sought from the National Commission for Science, Technology and Innovation (NACOSTI) as a permit to conduct the study. Similarly, an introduction letter was obtained from Kisii University addressed to the Ministry of Health, respondents, and other relevant administrative offices to explain the objectives of the study and channels through which the results of the study would be shared. The researcher sought informed consent from respondents and assured them of confidentiality, anonymity, and the need to give information voluntarily. Pseudo-names were used both for respondents and facilities. The researcher explained to the respondents that other than the study being for academic purposes, the results would help them make more informed decisions in relation to remote access to health and help the government, Ministry of Health, and other relevant stakeholders make policies that may improve telemedicine services in the country. The results of the study will be published and shared for consumption by diabetic patients, physicians, caregivers, and the larger scientific community.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of this chapter is to lay out the findings of the study and come up with discussions based on the findings. Information from diabetic patients on their experience or perception of telemedicine utilization, the benefits and concerns as well as the improvements they would want made will be provided. Details from hospitals or facilities offering telemedicine, used as key informants will also be availed with the view of them stating the services they offer and the reasons why. They will provide information on the services that are popular or unpopular those that are unavailable. They will also give their views on the improvements they would like made to enhance telemedicine services. Two focus groups, one from patients who attend private hospitals and another from patients who visit public ones will present a comparison of perceptions of telemedicine.

Online research on facilities providing telemedicine services came up with 14 facilities. The researcher however found out that only 5 facilities representing 42.9% of the targeted facilities offer the very basic forms of telemedicine. Of the 14 facilities, 2 were reluctant to hold an interview. The remaining 50% of the facilities were either not aware the services existed or gave numerous appointments with the researcher that did not materialize. The facilities that responded to the study tool are given pseudo names F1, F2, F3, F4, and F5. There were 2 FGD groups each composed of 6 members. Group 1 was composed of patients who visit private facilities who, in these findings will be referred to as (PR) while Group 2 was totally dependent on government or public facilities (PU). The findings are based on responses from the two groups.

The study presented the results based on the following specific objectives:

i. To assess the impact of telemedicine diagnosis on health outcomes of diabetic patients in Nairobi County.

ii. To assess the effect of telemedicine treatment on health outcomes of diabetic patients in Nairobi County.

iii. To analyze the relationship between telemedicine advice and health outcomes among diabetic patients in Nairobi City County.

iv. To examine the impact of telemedicine monitoring on health outcomes of diabetic patients in Nairobi County.

4.2 Demographic Characteristics

4.2.1 Frequency Distribution of Gender Characteristics

The study sought to determine the gender characteristics of the respondents in relation to their ages under the study. The results are presented in Table 4.2.1 as shown.

Table 4.2.1 Gender of Respondents

Gender of Respondent		Age			Percent	Total
		31 -40	41-50	51-70		
Gender of respondents	Male	3	7	17	47.4	27
	Female	9	10	11	52.6	30
Total		12	17	28		57

Source (Researcher 2023).

The study showed that the majority 17 (51-70 years) were male respondents followed by 11 females, between 31 to 40, 3 males and 9 females, while of ages 41 to 50 there were 7 males and 10 females. Therefore, the majority of the respondents were female, 30 representing (52.6%) of the 57 respondents. The fact that the deviation was not high implied that the respondents were generally distributed among the genders under study.

4.2.2 Marital Status

The study sought to determine the marital status of the respondents under this study and the results are shown in table 4.2.2 below.

Table 4.2.2 Marital Status

		Current marital status					Total
		Married	Divorced	Separated	Widowed	Never married	
Gender of respondents	Male	12	6	2	1	6	27
	Female	17	3	4	2	4	30
Total		29	9	6	3	10	57

Source (Researcher 2023).

The results showed that 12 males and 17 females were married, followed by 6 males and 3 females who were divorced, 2 males and 4 females were separated, 6 males and 4 females never married and finally, 1 male and 2 females were windowed. From the results, it was noted that the majority of the respondents were married.

4.2.3 Highest Level of Education

The study sought to determine the highest level of education of the respondents under this study and the results are shown in table 4.2.3 below.

Table 4.2.3 Highest level of education

		Highest level of education					Total
		None	Primary	Secondary	Diploma	Degree	
Gender of respondents	Male	3	0	11	10	3	27
	Female	1	8	4	9	8	30
Total		4	8	15	19	11	57

Source (Researcher 2023).

The study showed that 11 males and 4 females have secondary level of education, 10 males and 9 females have diploma, 3 males and 8 females have degree qualification, 8 female have primary education. However, 3 males and 1 female have never gone to school. From the results, it can be depicted that the majority of the respondents had some level of education and could understand the concept of telemedicine utilization and health outcomes.

4.2.4 How Often Respondents Use Telemedicine Services

The study sought to determine how often the respondents use telemedicine services. The results are shown in Table 4.2.4 below.

Table 4.2.4 Frequency of Telemedicine Services Use by Respondents

Frequency of telemedicine services use	Frequency	Percent
Occasionally	5	8.8
Often	8	14.0
Many times	11	19.3
Most always	19	33.3
Never	14	24.6
Total	57	100.0

The results showed that those using the services most always were 19 (33.3%), 14 (24.6%) of the respondents never sought telemedicine services, 11 (19.3) of the respondents sought the services many times and 8 (14.0%) of the respondent often while 5 (8.8%) of the respondent sought the services occasionally.

4.2.5 Device Used for Telemedicine

The study also sought to determine the type of device the respondents used for telemedicine. Statistical analysis is presented as shown in table 4.2.5 below.

Table 4.2.5 Device Used for Telemedicine

Device used for telemedicine	Frequency	Percent
Smart Phone	27	47.4
Telephone	15	26.3
Videoconferencing	7	12.3
All of the above	8	14.0
Total	**57**	**100.0**

Source: (Researcher, 2023)

From the results, 27 (47.4%) of the respondents use Smart Phone, 15 (26.3%) use Telephone, 8 (14.0%) of the respondents use the telephone, smartphone and videoconferencing while 7 (12.3%) of the respondents use Videoconferencing. The study indicated that the majority of the respondents use smartphones.

4.2.6 Reason for Choice of the Telemedicine Device

The study at the same time sought to assess the reasons for the choice of the device in telemedicine diagnosis on health outcomes of diabetic patients in Nairobi County. The results are presented in table 4.2.6 below.

Table 4.2.6 Reason for Choice of Device

Reason for choice of device	Frequency	Percent
Easy to use	13	22.8
Affordable	11	19.3
Convenient	14	24.6
Portable	4	7.0
Recommended by the practitioner	1	1.8
Visibility	9	15.8
Safety	5	8.8
Total	57	100.0

Source: (Researcher, 2023)

The results show that 14 (24.6%) of the respondents chose a device for convenience, 11 (19.3%) of the respondents said it was affordable, 13 (22.8%) of the respondents said it was easy to use, 9 (15.8%) of the respondents said it was because of its visibility, 5 (8.8%) of the respondents said it was because of safety, 4 (7.0 %) said the device of choice was portable and 1 (1.8%) of the respondents said the practitioner recommended it. The study showed that the smartphone was highly used for telemedicine services. This study concurs with a study by Umair (2020), which observed that mobile devices and smart gargets, particularly smartphones were highly used for telemedicine services.

4.2.7 Indication of How Long the Respondents Have Used the Devices

Moreover, the study sought to assess how long the respondents had used the telemedicine device for diagnosis. Statistical results are presented in Table 4.2.7 below.

Table 4.2.7 Duration devices have been used.

Duration of Use	Frequency	Percent
Less than 1-year	5	8.8
1- 3 years	13	22.8
3 -5 years	11	19.3
5 - 10 years	19	33.3
10 years and above	9	15.8
Total	57	100.0

Source: (Researcher, 2023)

The result indicated that 19 (33.3%) of the respondents had used the device for between 5 - 10 years, 13 (22.8%) of the respondents said 1- 3 years, 11 (19.3%) of the respondents said 3 -5 years, 9 (15.8%) of the respondents said 10 years and above, and 5 (8.8 %) said it was less than 1-year. The study revealed that the majority, (33.3%) of the respondents had used telemedicine devices for the longest period (5 to 10 years). This implies that there are some diabetic patients who have been using telemedicine services for the last 5 to 10 years thanks to smartphone technology. The rest of stakeholders should take note of this and encourage the use of smartphone devices for mhealth services in Kenya.

4.2.8 When the Device is to be Used

At the same time, the study sought to assess on what occasions the respondents applied the devices. The results are presented in Table 4.2.8 below.

Table 4.2.8 When the Device is Used

When the device is used	Frequency	Percent
When I need to consult the doctor	15	26.3
For appointments	14	24.6
When caregivers are monitoring my progress	17	29.8
When I need clinical advice	11	19.3
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 17 (29.8%) of the respondents indicated they use the devices when caregivers are monitoring their progress 15 (26.3%) of the respondents indicated it is when they need to consult the doctor, 14 (24.6%) of the respondents indicated they use them for appointments, while 11 (19.3%) of the respondents indicated they use them when in need of need clinical advice.

4.3. Telediagnosis and Health Outcomes

The first objective was to assess the impact of telediagnosis on health outcomes of diabetic patients through experiences with caregivers. The results are presented below.

4.3.1 Reception from Caregivers During Telediagnosis

The study sought to find out the reception from caregivers on the use of remote diagnostic and treatment. The results are presented in table 4.3.1 below.

Table 4.3.1 Reception from Caregivers During Telediagnosis

	Frequency	Percent
Below average	11	19.3
Fair	12	21.1
Good	5	8.8
very good	25	43.9
Excellent	4	7.0
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 25 (43.9%) of the respondents indicated it was very good, 11 (19.3%) of the respondents indicated it was below average, 12 (21.1%) of the respondents indicated it was fair, 5 (8.8%) of the respondents indicated it was good, while 4 (7.0%) of the respondents indicated it was excellent. This means mobile device connectivity for telediagnosis in Nairobi is reliable and should be encouraged for purposes of mhealth services. Also, given the reliability of the connectivity with mhealth devices, it can be said that telemedicine services tend to save time and resources that would have otherwise been used in making physical visits to healthcare facilities.

4.3.2 Ascertaining How Patients Engaged with Doctors

The study also sought to assess how easy it was to talk with the doctor i.e. rapport during remote diagnosis. Statistical results are presented in Table 4.3.2 below.

Table 4.3.2 The Level of Ease When Engaging with the Doctor

Level of ease when engaging with the doctor	Frequency	Percent
Fair	3	5.3
Good	9	15.8
very good	32	56.1
Excellent	13	22.8
Total	57	100.0

Source: (Researcher, 2023)

The study showed that majority of the respondents, 32 (56.1%) indicated that rapport was very good, 13 (22.8%) of the respondents indicated it was excellent, 9 (15.8%) of the respondents indicated it was good, while 3 (5.3%) of the respondents indicated it was fair indicating majority of the respondents had a good relationship with their doctors/providers. This study therefore concurs with a study by Bhaskar, Nurtazina, Mittoo, Banach, and Weissert (2021), which observes that mobile devices for telemedicine became prominent during Covid-19 as patients could easily engage with their healthcare providers for consultations and medical prescriptions.

4.3.3 Reliability of the Device Used

The study sought to assess the reliability of the device used during remote telediagnosis. The results are presented in Table 4.3.3 below.

Table 4.3.3 Reliability of the Device Used

Reliability of the device used	Frequency	Percent
Fair	5	8.8
Good	10	17.5
very good	25	43.9
Excellent	17	29.8
Total	57	100.0

Source (Researcher 2023).

Statistical results show that 25 (43.9%) of the respondents indicated their devices reliability was very good, 17 (29.8%) of the respondents indicated it was excellent, 10 (17.5%) of them thought it was good, while 5 (8.8%) of the respondents indicated it was fair.

Responses from the key informants indicated each facility had a unique way of ensuring patients receive the correct remote diagnosis ranging from patients sending prior brief reports, asking specific questions related to the symptoms, and asking for lab reviews among other measures. As narrated by a key informant:

"Patients are required to have a physical visit in addition to the remote one," said the F1 informant."

This indicates that telediagnosis is still not fully trusted necessitating the physical visit. At F2, the client is required to remotely send a brief report on his/her signs /symptoms before they are booked for a consultation. In the event that the doctor is uncomfortable making a diagnosis or needs to examine the patient, then we ask the client to come to

the facility. According to the F3 informant, doctors ask the client a series of target questions to determine the symptoms during a video consultation while at F5, the doctor must inquire from the patient if they have done a lab review such as Home-Based Medical Care (HBMC), Lipid profile and the like shortcomings singled out were the possibility of data breaches raised by the Fl informant and the inability to source vital signs, according to F2 informant, where a diagnosis is only based on the client's verbalization raised by the F2 informant.

"When we receive calls, we try to ask specific questions relating to how the patients are feeling based on their symptoms," reported the D5 informant.

"It is not possible to source vital signs remotely, since diagnosis is only based on the client's verbalization. Non-verbal communication may not be well interpreted at times," the informant explained,

This view supported by the 2020 Agency for Healthcare Research and Quality brief where examples of the challenging vital signs include the heat and lungs. This according to Schiller et al, (2012) could be reason most of the patients preferred to use telemedicine in a hybrid manner. In the FGD groups, both PR and PU group members had their specific group discussions. The patients from both groups had varying and similar experiences with diabetes. They were not aware at the initial stages of their ailments that they were experiencing symptoms of diabetes until they went for check-ups, with some going for remote consultations with their doctors who suspected diabetes. All had FTF diagnoses the first time as they believed physical visit would allow the care giver to better diagnose them by picking what would not be otherwise identified remotely, like skin rash. This resonates with SDT which talks of social and,

cultural forces impacting personality and motivational orientation, as well as behavioral responses within particular domains and tasks.

"*I realized I had a problem when I started urinating frequently but I didn't know the cause. I booked an appointment and later went to the hospital and on being checked up, I was found to be having diabetes. This shocked me as I never imagined I would suffer anything like this*", said PR2 who has had diabetes for over 10 years.

PR2 indicates she had a physical visit for first time diagnosis. As (Kesavadev et al., 2015) says, care givers and patients struggle with fostering presence and connection with patients during remote clinic visits and this could be a driving force towards first time physical visits. She however confirmed that she had adjusted to the new diet and lifestyle. These same symptoms were shared by PR1.

"I realized I was losing weight though I never felt any pain in my body. I went to the hospital and on being checked, my sugar level was 30.! The normal level is usually between 4-6," said the 66-year-old man.

PR2 from group 2 who has some of the check-up devices reiterated her concerns over their high cost and lack of usage know-how.

"*Devices for checkups or diagnosis are quite expensive and complicated to use. Minus advice on how to apply them, one may just feel the need for a proper physical diagnosis which cannot happen remotely yet in our country. An incorrect diagnosis can lead to a wrong prescription. Sometimes when you want to engage the doctor, he or she may be unavailable online*," she concluded.

PR1, while agreeing with her sentiments said there is little or no education or advice on how to use telediagnosis devices so more information is needed especially among the

elderly. He said frequent power failures also affect internet access and that at times the internet connection is unstable. In SDT, Self-motivation could be fostered or inhibited by different situations. From the responses, the situation inhabiting telediagnosis is the high prices of devices, technical challenges surrounding the way to use the devices and power failures which also affect internet access. PR6 however felt that even though telediagnosis may be looking attractive, there was a need for physical examination once in a while.

"*From my experience, some side effects need a physical examination. I used to have a skin infection that was related to my diabetic condition, this might not be well captured remotely. If a physical examination is done, the doctor will prescribe the correct drugs, so physical presence is good*," said PR6

She added that at one time when she went for her appointment, her doctor noticed by looking at her that her blood level was low. When a test was done, it confirmed her fears, it was 7 as opposed to 12, which was the normal level. These findings differ with a study conducted by Tachakra, Lynch, Newson, Stinson, Sivakumar, Hayes, and Bak (2000), which argues that telemedicine diagnosis is as good as face to face diagnosis. This further cements the argument by

4.4 Teletreatment on Health Outcomes of Diabetic Patients

The second objective sought to assess the effect of telemedicine treatment on the health outcomes of diabetic patients in Nairobi County. The results are presented below;

4.4.1 Respondents' Feelings (Sentiments) on Telemedicine Use for Treatment

The study at the same time sought to assess the respondents' feelings on telemedicine use for treatment. Statistical analysis is presented in table 4.4.1 below.

Table 4.4.1 Feelings on Telemedicine Use for Treatment

Feelings on telemedicine use for treatment	Frequency	Percent
Below average	6	10.5
Fair	9	15.8
Good	7	12.3
Very good	27	47.4
Excellent	8	14.0
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 27 (47.4%) of the respondents indicated they felt very good, 9 (15.8%) of the respondents had a fair feeling, 8 (14.0%) of the respondents indicated the feeling was excellent, 7 (12.3%) of the respondents indicated it was good, while 6 (10.5%) of the respondents rated it at below average. This clearly indicates that diabetic patients generally feel better when they seek treatment through telemedicine services.

4.4.2 How Well the Respondents Were Able to Hear What the Provider was Prescribing

The study sought to assess how well the respondents were able to hear what the provider was saying during remote treatment. Statistical results are presented in Table 4.4.2 below.

Table 4.4.2 How Well Respondents Were Able to Hear What the Doctor Was Saying

How well respondents were able to hear what the doctor was saying	Frequency	Percent
Below average	7	12.3
Fair	18	31.6
Good	13	22.8
Very good	9	15.8
Excellent	10	17.5
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 18 (31.6%) of the respondents indicated audibility was fair, 13 (22.8%) of the respondents indicated it was good 9 (15.8%) of the respondents indicated it was very good, 10 (17.5%) of the respondents indicated it was excellent while 7 (12.3%) of the respondents indicated it was below average. This shows that patients are able to use their mobile devices to effectively communicate with their care givers or medical practitioners.

4.4.3. The Extent of understanding the provider's terminologies

Moreover, the study sought to understand whether patients were to understand doctor's terminologies. Statistical results are as provided in Table 4.4.3 below.

Table 4.4.3 The extent of understanding the provider's terminologies

The extent of understanding the provider's terminologies	Frequency	Percent
Fair	4	7.0
Good	11	19.3
Very good	32	56.1
Excellent	10	17.5
Total	57	100.0

Source: (Researcher, 2023)

The results indicated that 32 (56.1%) of the respondents indicated the understanding was very good, 11 (19.3%) indicated it was good, 10 (17.5%) of the respondents rated it as excellent, while 4 (7.0%) of the respondents thought it was fair. From this analysis, it is clear that patients are able to understand doctor's terminologies. This also means that patients using telemedicine services are fairly educated to understand medical terminologies.

4.4.4 Ability to Communicate the Image on the Screen Effectively

The study sought to assess how well the respondents were able to effectively see or communicate the image on the screen during remote treatment. Statistical results are presented in Table 4.4.4 below.

Table 4.4.4 How well respondents were able to effectively see or communicate the image on the screen.

Ability to Communicate the Image on the Screen Effectively	Frequency	Percent
Below average	2	3.5
Fair	5	8.8
Good	14	24.6
Very good	29	50.9
Excellent	7	12.3
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 29 (50.9%) of the respondents rated their ability to effectively see and communicate screen images as very good, 14 (24.6 %) said it was good, 7 (12.3%) excellent, 5 8.8%) fair, while 2 (3.5%) of the respondents indicated it was below average.

4.4.5 Level of politeness and caring the medicine providers

The study sought to assess how polite and caring the medicine provider(s) was/were. Statistical results are presented in Table 4.4.5 below.

Table 4.4.5 How polite and caring the medicine provider(s) was/were

How polite and caring the Medicine provider(s) was/were	Frequency	Percent
Fair	2	3.5
Good	9	15.8
Very good	33	57.9
Excellent	13	22.8
Total	57	100.0

Source (Researcher, 2023)

From Table 4.16 above, it is evident that 33(57.9%) of the respondents indicated the medicine providers' politeness and care was very good, 13(22.8%) of the respondents indicated it was excellent, 9 (15.8%) of thought it was good, and 2(3.5%) of them thought it was fair. The study sought to assess the overall feelings of respondents about talking with a doctor remotely. The results are presented in Table 4.4.6 below.

Table 4.4.6 Overall feeling about talking with a doctor remotely.

Overall feeling about talking with a doctor remotely	Frequency	Percent
Below average	5	8.8
Fair	4	7.0
Good	16	28.1
very good	26	45.6
Excellent	6	10.5
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 26 (45.6%) of the respondents indicated the feeling was very good, 16 (28.1%) of the respondents indicated it was good, 6 (10.5%) said it was excellent, 5 (8.8%) below average, and 4 (7.0%) thought it was fair.

4.4.7 Choice of treatment between telemedicine and FTF

The study sought to assess which treatment the respondents would prefer between telemedicine and FTF. The results are presented in Table 4.4.7 below.

Table 4.4.7 The choice between telemedicine and FTF

	Frequency	Percent
Telemedicine service	18	31.6
Face to Face	39	68.4
Total	57	100.0

Source (Researcher, 2023).

The study showed that 39 (68.4%) of the respondents indicated they preferred Face to Face while 18 (31.6%) of the respondents indicated they prefer telemedicine. This clearly indicates that many diabetic patients seem to prefer face to face visit to the healthcare facilities as opposed to remote telemedicine services.

The study also sought to assess reasons for the making the choice between telemedicine and face to face response. The results are presented in Table 4.4.8 below.

Table 4.4.8 Reason of choices made between telemedicine and FTF

Reason choices made between telemedicine and FTF	Frequency	Percent
Affordability	15	26.3
Privacy	5	8.8
Ailment	6	10.5
Power absence	13	22.8
Internet challenges	7	12.3
Cannot use technology	6	10.5
No internet	1	1.8
Distance	4	7.0
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 15 (26.3%) of the respondents indicated it was because of its affordability, 13 (22.8%) indicated it was because of power absence, 7 (12.3%) of the respondents indicated internet challenges, 6 (10.5%) indicated they could not use technology, 6 (10.5%) of the respondents indicated it was due to ailment 5 (8.8%) of the respondents sighted privacy, 4 (7.0%) of the respondents indicated it was because of distance and 1 (1.8%) of the respondents indicated it was due to lack of internet.

4.4.9 Feeling after calling the healthcare provider and being taken care of

The study sought to assess how the patient felt after calling the healthcare provider and being attended to (listened to and guided on what to do). The results are presented in Table 4.4.9.

Table 4.4.9 Feeling after calling the healthcare provider

Feeling after calling the healthcare provider	Frequency	Percent
My health problem reduced	20	35.1
My health problem remained the same	22	38.6
My health problem worsened	15	26.3
Total	57	100.0

Source (Researcher, 2023).

The study showed that 22 (38.6%) of the respondents indicated their health problems remained the same, 20 (35.1%) indicated their health problems reduced and 15 (26.3%) of the respondents indicated their health problem worsened. In terms of the feeling after calling the healthcare, a majority of respondents seem to be dissatisfied with how they feel about their health problem after calling the healthcare provider.

4.4.10 Challenges faced by respondents when trying to access remote treatment

The study sought to assess the challenges the patients face when trying to access telemedicine treatment. The results are presented in Table 4.4.10 below.

Table 4.4.10 Challenges faced when trying to access telemedicine treatment

The challenges faced when trying to access telemedicine treatment	Frequency	Percent
Poor internet connection	14	24.6
Screen frozen	10	17.5
Unable to hear	11	19.3
No challenge	17	29.8
Others (please explain)	5	8.8
Total	57	100.0

Source (Researcher, 2023).

The study showed that 17 (29.8%) of the respondents indicated they do not encounter any challenge, 14 (24.6%) sighted poor internet connection, 11 (19.3%) of the respondents indicated they were unable to hear, 10 (17.5%) of the respondents indicated screens freezing and 5 (8.8%) of the respondents indicated they had other challenges such as lack of data or power.

4.4.11 Comparison between telehealth clinical treatment received and FTF

The study sought to assess whether the telehealth clinical treatment received was as good as face-to-face. The results presented in Table 4.4.11 show the responses.

Table 4.4.11 The telehealth clinical treatment I received was as good as face-to-face

Telehealth clinical treatment I received was as good as face-to-face	Frequency	Percent
Strongly disagree	9	15.8
Disagree	12	21.1
Agree	25	43.9
Strongly agree	11	19.3
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 25 (43.9%) of the respondents agreed the clinical treatment was as good as FTF, 12 (21.1%) of the respondents disagreed, 11 (19.3%) of the respondents strongly agreed and 9 (15.8%) of the respondents strongly disagreed.

4.4.12 Status of respondents' physical health before and after using telemedicine

The study sought to compare the status of respondents' physical health before and after using telemedicine. The results presented in Table 4.4.12 show the responses.

Table 4.4.12 Status of physical health before and after using telemedicine

Status of physical health before and after using telemedicine	Frequency	Percent
Much better	11	19.3
Slightly better	4	7.0
No change	6	10.5
Slightly worse	29	50.9
Much worse	7	12.3
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 29 (50.9%) of the respondents indicated their health got slightly worse, 11 (19.3%) of the respondents indicated it got much better, 7 (12.3%) of the respondents indicated they got much worse, 6 (10.5%) of the respondents indicated there was no change, while 4 (7.0%) of the respondents indicated they got slightly better.

4.4.13 Rating of overall satisfaction with telemedicine as a way of healthcare provision

The study sought to rate the degree of satisfaction with telemedicine as a way of treatment. The results presented in Table 4.4.13 show the level of satisfaction.

Table 4.4.13 Overall satisfaction with telemedicine

Overall satisfaction with telemedicine	Frequency	Percent
Very poor	5	8.8
Poor	17	29.8
Neither good nor poor	7	12.3
Good	24	42.1
Very good	4	7.0
Total	57	100.0

Source: (Researcher, 2023)

The results showed that 24 (42.1%) of the respondents indicated it was good, 17 (29.8%) of the respondents rated it as poor, 7 (12.3%) of the respondents indicated it was neither good nor poor, 5 (8.8%) of the respondents said it was very poor and 4(7.0%) of the respondents indicated it was very good. Experience after visiting targeted facilities for key informant interviews showed that majority of the facilities seemed not very familiar with the many different types of telemedicine services. Their responses were based on what the facilities offered and what they had either heard of or read about. The top 5 treatment services sought through telemedicine in the facilities are telemonitoring and teleconsultation which 83% of the facilities said they offer. This was followed by medication or pharmacy delivery at 66% then mobile lab at 50%, mobile prescription or adjustment taking 33%, and home-based physiotherapy, radiology inquiries, and health education, which took 16% each.

Results from the key informants indicated that 66% of the facilities offer real-time interactive services (doctor consults assesses, diagnoses, and prescribes). None of the

facilities have store and forward (collect clinical information then send to specialist) but a number said they offer other services like physiotherapy and lab on wheels (collect lab samples from home). The reasons given for the absence of the services included technological issues, absence of equipment or devices, or for some facilities, they had no idea why. All the facilities said they do not have telepsychiatry, teleophthalmology, telerehabilitation, teledermatology, or telepathology. telenursing and telescreens.

"Our list of services includes virtual consultation, physiotherapy on wheels (physiotherapy is offered at your home, lab on wheels (urine, blood, and stool samples collected and shared from the comfort of your home), pharmacy on wheels (delivers medicine at your doorstep)," said the informant from F2. *"We do not offer screening and ultrasound,"* said the informant from F5…*"Ophthalmology consultation and pediatric consultation are not available at our facility*," said the F2 informant.

The informant from F3 seemed to have a contradicting response as the same services they indicated they offer appeared in the list of those not being offered raising eyebrows as to whether the information was authentic. Informant F5 said Acute-related consultation is not offered. Only the F2 informant gave a comprehensive explanation regarding the lack of availability of some telemedicine services. Their explanation was that ophthalmology cases often require physical examination which cannot be done remotely. As for the pediatric age group, she said that kids tend to change condition really fast and parents may not give comprehensive reports on the child's state hence they are advised to go to the hospital for a physical examination. F3 informant stated that the services were unavailable due to technological issues. The informant from D5 said it was not practically possible to have the services at their facility but was not ready to give further explanation. The remaining facilities did not respond to the question. F1

informant explained that the reason they do not have some services was because their program was a pilot so, giving a direct response to the question would be speculative.

The different facilities have different ways of handling prescriptions remotely. These include billing remotely and delivering to the patient through delivery services as is the case of F1. At F2, clients forward their prescriptions via WhatsApp or email, and some send them to the pharmacy for billing. The patient makes payment through Mpesa, and the medicine is packed and delivered to the patient's home after which the pharmacist calls the client for an explanation of the same. F3 has prescriptions uploaded on their platform. They only process and deliver valid prescriptions or those from their doctors. F4 on the other hand encourages their patients to book appointments through their Health Care System after which the doctor calls and talks to the patient for confirmation before delivery. At D5, patients call and ask for specific medicines. The facility sometimes delivers via courier services or advice accordingly remotely. Providing the wrong medication is sometimes bound to happen at times.

On how the facilities deal with exclusion e.g. the elderly who are not techno-savvy during treatment, all the facilities indicated that the age group that most frequently seeks telemedicine services in their facilities is the middle-aged group. To help those not techno-savvy, options other than video conferencing are used as options such as text messages and phone calls. All facilities also indicated that they use dependents, mostly relatives, caregivers, or next of kin to assist and guide their clients. In the FGDs opinions touching on tele-treatment varied from groups 1 and 2. Majority said they do not use teletreament. A number gave a brief of how they get treatment. PR5 stated that limited insurance coverage forces her to use additional cash from her pocket to buy drugs.

Sometimes essential medicines prescribed for the condition are missing. Sometimes I am told my doctor is on leave so I am referred to a different doctor who does not know my history and at times even changes drugs. Occasionally, essential medicines prescribed for the condition are missing" she added. PR2 and PR6 also supported the sentiments on the missing of prescribed drugs or their usual doctors missing forcing them to start afresh with a new doctor. PR6 added that her insurance cover decides on the doctor she sees. The fact that clients may miss appointments with their preferred doctors alludes to what Smith et al. (2021) says contributes to depersonalization which he advises clinicians to avoid as it brings about trust issues between clinicians and patients, views supported by Pappas, et al., (2019). According to DOI theory delays in responses, lack of feedback, and technical problems Like those experienced by the above respondents can all lead to frustration and reduce motivation for patients to continue self-care monitoring (Marva, 2014)

"*I had 2 doctors but one passed on. When my doctor is not there, I have to wait till he comes back as per the rules of my cover. I thank God I have never had an emergency*," she expounded.

All participants of group 2 members who have not used telemedicine said that lack of prescribed drugs was a common thing and most of the time they were either forced to buy them from their pockets or referred to different facilities.

"Some people turn to divine interventions when things get very tough," added PU3, a 55-year-old mother of 5.

PR1 complained that drugs are expensive in hospital pharmacists, diabetic specialists few in number, and that those infected are many so at times one takes a long time before

being attended to. PR3 had issues with the status of the health facilities saying they are not well equipped to deal with diabetic patients.

"Occasionally the queues are long though everyone is attended to in the end. If the government took telehealth seriously, these scenarios would be evaded" he said

It is due to challenges like PR3's who seems to be unhappy with the long duration of time he takes at the facilities that (Ginige & Maeder 2018) sees the potential of teletreatment reaching diabetic patients to avoid in-person medical visits to a hospital. All Group 2 members thought health services are poor in public facilities. This would therefore mean that the supply-push and the demand-pull theories propagated by DOI theory where specific features of the innovation lead to diffusion functionality and adoption as a rational choice problem between an old and a new technology. In this case, traditional FTF seems to frustrating most of them and push them towards teletreatment which saves time and cost and therefore having a pull-effect. Association AD (2020) also indicates that Frequent traveling to clinic appointments is inconvenient for patients with busy schedules and particularly burdensome for patients living in rural areas, those with low financial backgrounds, the elderly, and people with disabilities.

"There are usually very long queues and very few doctors attending to patients. 'I was told specialists in the field were few," said PU2.

The two FGDs gave different experiences on how they treat diabetic-related health issues. Some respondents said they consult their doctors either remotely or physically, reach out to family members, visit hospitals to see diabetes patient specialists, or just take medication as per earlier instructions.

"*I have never had serious diabetic-related issues since my case was arrested before it had escalated and I was put on insulin immediately as the sugar levels were very high, but in case of any related challenges, I call my doctor for the next steps, sometimes she prescribes new drugs and sends the prescription by WhatsApp, sometimes the remedy is just about the dos and don'ts*," PR3 said.

One member from group 2 said she goes to the hospital as she is not very comfortable talking to the doctor remotely. 66% of members from the same group said in most cases they either experience low or high sugar levels. If it is not serious they just keenly watch their diets and continue with their usual medication but if serious their doctors advise accordingly. In most cases, the sugar levels normally stabilize.

"*I occasionally have been forced to go to a nearby clinic to buy emergency drugs when what I had been given in my last hospital visit was over and I couldn't take leave from work. If I was made aware of how this teletreatment works, maybe I would not have found myself in such a position*," said PU2 who has had diabetes for more than 2 years.

Relating to concerns regarding teletreatment for diabetic patients' responses included complaints over the lack of access to power, internet connection, or digital devices that are meant to allow remote treatment or communication to work seamlessly but do not.

"Developing countries like Kenya still lack appropriate or advanced medical equipment that helps in remote treatment," said PR4.

Some members also felt that doctors may become lazy and totally depend on consultation with each other instead of striving to learn more for example through research. A number of Group 2 had unique concerns surrounding technology use.

"It is said technology use spreads cancer, I think there is some truth in it but if there isn't, then we need to be assured that all is well," said PU5.

PU5 argument got 83% support from the group. They gave examples of what they hear about the side effects of gadgets like microwaves which according to them spread cancer. This negative attitude towards telemedicine acts as a barrier to adoption. DOI being a social theory that occurs among people in response to learning about an innovation, argues that other than adoption, of novelty there is need for modification of the attitudes and behavior of these group members. This will help them have a paradigm shift.

"Diabetic patients also suffer from high blood pressure among other health challenges, imagine another ailment on top of that because of using this telemedicine!" PU6 exclaimed.

"*From the little we now know about telemedicine, I think it requires that we talk to our doctors either by phone or video yet some of us have challenges of power access,"* PU1 stated.

The members said that though making calls and sending text messages may be affordable, buying bundles to go online for services like videoconferencing is very expensive and could be a challenge unless data freely provided. They also agreed that little is known about telemedicine in the country and that the public needs lots of education and information on telemedicine so that they are aware of its benefits, and make informed decisions. According to DOI theory, by sharing information through particular channels, individuals can disseminate innovativeness to their social networks to reach a certain level of consensus.

Both FGD groups shared their fears of going to the hospital during the COVID-19 period and said they used different means to manage themselves. Members of group 1 complained of challenges such as doctors' unavailability during that time, and change of the usual doctors and clinics among other things.

"*Most doctors were focusing on COVID-19 patients. Our conditions were not a priority. I consulted my doctor online and when this became a challenge at some point, I looked for an alternative doctor*," said PR4

"*I was scared given those with underlying conditions like diabetes were said to be more vulnerable to COVID-19. I could not visit family or allow visitors to come to my place due to my vulnerability*," stated PR1

The above insecurities can be kept at bay is according to (Storch et al., 2019), improvements in patients' ability to self-manage their behavior can be enhanced as it can reduce risks in the development of diabetes-related complications. PR5 however, said she honored her appointments strictly by wearing a mask. The special clinic she used to visit for her appointments was closed because some nurses were affected so she had to go to the general patient attendance area of the hospital as opposed to seeing her specialist as was the routine before COVID.

"I feared going to the hospital because I thought I would get infected by COVID," said PR2

PR3 shared with group members how his diabetic condition was discovered during the COVID-19 period.

"*My condition was discovered when COVID-19 first hit the country and was at its peak. I was turned away from most hospitals due to a lack of space or beds for admission.*

COVID patients had overwhelmed the facilities, it was a terrible experience for me given my condition was also not good and at that point, we did not know it was diabetes yet,"

He however said if there was adequate information on telemedicine in the country then, admissions would have been less. Most members said that some doctors were not working during the pandemic. On calling, one would be told the doctor was not available. These sentiments indicate that telehealth services which would have been an option at this time, were not in use. So & Chung, (2018) encourage the use teletreatment platformsfor better disease management and decreasing the rate of hospitalizations and complications associated with uncontrolled diabetes during such pandemics and where healthcare access is limited.

"*My doctor being elderly kept away from the clinic fearing he would get infected. He also advised me to avoid going to work because other than being diabetic, I was anemic. Our communication was strictly by phone where he would prescribe drugs then I go and buy*," said PR6.

Among the group 2 members, only 33% of the members had access to their usual drugs which they bought from chemists around them. 66 % had challenges accessing their drugs as all hospitals were congested by COVID-19 patients.

"Our cases were not considered serious as COVID-19 patients were given priority in all hospitals," said PU5

He added that he hates thinking about that period as at one point he almost lost his life. A relative who knew a doctor specialist in diabetes came through for him. PU6 who says diabetes runs in the family said that the fact that her mother and an older sibling

also had diabetes forced them to check each other out. *"We ensured all of us had sufficient drugs at any given time,"* she said.

Both FGD groups expressed their fears of a lack of preparedness by the facilities to treat not only diabetic patients but also other vulnerable groups, especially during pandemics like COVID-19. They shared suggestions that would improve the well-being of not only diabetic patients but all in need of healthcare. They ranged from, the need for more trained specialists in diabetes, training in ICT, more information on telemedicine, and expansion of telemedicine services to rural areas among others. In the case of this study, diabetic patients can get telemedicine information through daily social networking. They continually interact with others to exchange information, experiences, and ideas; thus, frequent interaction leads to the dissemination of new ideas, so that they are empowered through self-efficacy. PR6 suggested that remote treatment like telemedicine could be a remedy during pandemics like COVID-19 and that E-commerce services for medication should be given priority or more attention as they came through for most patients during this period. She thought remote communication proved to be very helpful, especially with family and doctors during COVID-19. PR2 suggested that insurance should be more comprehensive to allow for coverage for pandemics such as COVID-19. From the past COVID-19 experience, this was not the case.

"*The country lacks enough specialists in diabetes. Generally, the country needs more experts in the medical field so that patients are not left in limbo like the case was during COVID-19*," PR2 added

PR1 said he learned that one can lose life easily due to ignorance, confusion, or late attention to a medical condition. He argued that more education on how patients should handle themselves during pandemics is not sufficient and needs to be enhanced using

all channels including local radio stations. PR3 in his contribution said that the country has not given enough information on remote health access.

"If telemedicine was working well, most people would have been able to access services from home. The government must enhance telemedicine services," said PU4

PR6, on the other hand, suggested that people with chronic conditions like diabetes should have special areas designated for their treatment during pandemics so that they do not suffer neglect as it happened during COVID-19 period. She also thought there was a need for more training of personnel in the area of diabetes. Few doctors understand the disease. The suggestion for a mobile clinic by one member of group 2 was overwhelmingly embraced by group members.

"Government needs to introduce mobile clinics during such pandemic to alleviate people's suffering," said PU1.

Regarding cost implications of treating diabetes remotely, there was 83% consensus in group 1 that telemedicine is convenient, cheaper, and time-saving: *"When you save on time, you save on money too,"* said PR5

"*I do not have to drive to hospital so I save on fuel. I can call my doctor from the comfort of my house so the chances of losing my job are reduced. Employers don't like people who ask for leave even if it means going to see a doctor*," said PU4.

CarePay 2020 study supports sentiments by PR5 by stating that customers appreciate remote treatment due to the fact that they understand their entitlements and can initiate their own treatment. PR1 said that other than telemedicine saving time, energy, and fuel or transport, it was less tedious because one could call anytime as the doctor was always reachable. According to PR4 and PR6, one can call even during odd hours and there is

privacy during doctor/ patient interaction. These positive attributes indicate DOI supply-push and the demand-pull theories applies.

Group 2 was divided with 50% saying it was less expensive and convenient while another 50% believed FTF was most effective and ultimately cheaper because a physical check-up ensures one is thoroughly diagnosed.

"Talking to a doctor online may turn out to be more expensive in the long run should the diagnosis be wrong," said PU3.

When asked about which treatment method they preferred between telemedicine and FTF, the overall choice was FTF. Though 66% of group 1 preferred telemedicine over FTF, they suggested that occasionally one needed to physically see the doctor. Other members had reasons for not fully supporting telemedicine.

"*I like physical rapport-creating moments with my doctor. The doctor can also capture non-verbal communication raw, something that may not be easy to notice remotely. In case doctors notice anything of concern, tests can be done immediately*," said PR2.

Showing the patients' need for in-person contact is not uncommon according to Scott et al. (2022) because as Pappas, et al., (2019) argues, the clinician-patient relationship and the level of patient involvement can influence the effectiveness and quality of the telehealth encounter Pappas, et al., (2019). PR1 said that though he supports telemedicine, at the beginning of treatment, he would prefer FTF but progressively transit to telemedicine because of its convenience in terms of time and energy. PR6 said that telemedicine was good but occasionally one needed to physically see the doctor. She reminded them of the case she had narrated earlier where she went to see her doctor who discovered she was anemic with just a glance at her. Only 17 % of the respondents

from group 2 said they were pro-remote treatment. 83% of group 2 members still prefer FTF over telemedicine because they think the online conversation is not private. They lamented the inconveniences that remote treatment is likely to cause them, like the high cost of bundles and internet to manage the disease. A number suggested the government subsidizes drugs for "hustlers," (common man). They said they try to adhere to the doctors' instructions but occasionally find themselves defaulting due to financial challenges. They also think that by practicing FTC, they will be keeping lifestyle diseases like cancer at bay. The majority however said with enough training and information they may consider telemedicine.

4.4.14 Relationship between Teleadvice and Health Outcomes among Diabetic Patients

The study sought to analyze the relationship between teleadvice and health outcomes among diabetic patients in Nairobi City County. The started by inquiring whether respondents had technical difficulties when trying to access medical advice. The results are presented in Table 4.4.14.

Table 4.4.14 Technical difficulties when trying to access medical advice

Technical difficulties when trying to access medical advice	Frequency	Percent
YES	39	68.4
NO	18	31.6
Total	57	100.0

Source (Researcher, 2023).

The results showed that 39 (68.4%) of the respondents indicated they had difficulties while 18 (31.6%) of the respondents did not.

4.4.15 Types of difficulties experienced in 4.4.14

The study sought to assess the kind of difficulties experienced in 4.4.14. Statistical results are presented in Table 4.4.15 below.

Table 4.4.15 Categories of difficulties experienced during remote medical advice

Categories of difficulties experienced during remote medical advice	Frequency	Percent
Poor internet connection	20	35.1
Screen frozen	12	21.1
Unable to hear	3	5.3
No challenge	15	26.3
Others (please explain)	7	12.3
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 20 (35.1%) of the respondents indicated they had poor internet connections, 15 (26.3%) of the respondents indicated they experienced no challenge, 12 (21.1%) of the respondents indicated they experienced frozen screens 7 (12.3%) of the respondents said they had other difficulties such as provider changing advice several times for the same thing or change of provider who comes with different ideas. 3 (5.3%) of the respondents indicated they were unable to hear the advice from the provider.

4.4.16 How well respondents understood the healthcare provider's advice

The study sought to assess how well respondents understood the healthcare provider's advice. The results presented in Table 4.4.16 show their level of understanding.

Table 4.4.16 How well respondents understood the healthcare provider's advice

How well respondents understood the healthcare provider's advice	Frequency	Percent
Not very well	13	22.8
Not at all	4	7.0
Well	5	8.8
very well	35	61.4
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 35 (61.4%) of the respondents indicated they understood the provider very well, 13 (22.8%) of the respondents indicated the understanding was not very well, 5 (8.8%) of the respondents indicated they understood the provider well and 4 (7.0%) of the respondents indicated they never understood the provider at all.

4.4.17 How easy it was for respondents to consult their healthcare provider

The study sought to assess how easy it was for respondents to consult their healthcare providers. The results presented in Table 4.4.17 show the level of ease.

Table 4.4.17 Level of ease when consulting healthcare providers

	Frequency	Percent
Very easy	16	28.1
Easy	6	10.5
Difficult	1	1.8
Very difficult	34	59.6
Total	57	100.0

Source: (Researcher, 2023).

The study showed that 34 (59.6%) of the respondents indicated it was very difficult to consult their healthcare providers, 16 (28.1%) of the respondents say it was very easy, 6 (10.5%) of them said it was easy, and 1 (1.8%) of the respondents indicated it was difficult.

4.4.18 Overall feelings of respondents' consulting with their healthcare providers

The study sought to analyze the overall feelings of respondents' consultation with their healthcare providers. Table 4.4.18 below shows the results.

Table 4.4.18 Overall feelings of respondents' consultation with their healthcare provider

Overall feelings of respondents' consultation with their healthcare provider	Frequency	Percent
Very happy	23	40.4
Happy	16	28.1
Not happy	18	31.6
Total	57	100.0

Source (Researcher, 2023).

The study showed that 23 (40.4 %) of the respondents indicated they were very happy consulting 18 (31.6%) of the respondents indicated they were not happy and 16 (28.1%) of the respondents indicated they were happy. Responses from key informants and FGDs regarding teleadvice indicated that even though advice given remotely is convenient, all facilities and some patients narrated challenges that come with it ranging from misdiagnosis, ensuring patient compliance, and inability to source vital organs among other difficulties.

Shortcomings of remote medical advice included inequitable access to the internet which was raised by 83% of the key informants. According to the informants, non-verbal communication may not be well interpreted remotely. F3 informant said patient compliance challenges arise when applying remote advice, sentiments shared by the informant from F4 who claimed that at times patients are busy and unreachable making it difficult to monitor their progress. D5 informant said misdiagnosis and providing the wrong medication are sometimes bound to happen. On how the facilities intend to deal with remote medical advice shortcomings. F1 informant said the facility allows patients to use text messages or make phone calls to establish facts.

"We allow patients to use text messages/phone calls. The facility also ensures data security to avoid breaches."

The F2 informant said remedies to the shortcomings have never been discussed officially. F3 encourages both patient and provider to ensure the transmission is private and secure while F4 has created automated SMS so that they can reach patients however busy they may be. The approach of F5 was different saying they create enough time for the client during remote interactions so that nothing is left out.

"We take time to listen to the client's past history and also ensure we paraphrase whatever our clients say, especially when it comes to symptoms so that we are sure we get it right," the informant said.

Responding to questions regarding the kind of remote advice diabetic patients get or expect to on their special needs, the FGD respondents while appreciating that they have benefitted from some remote advice, stated that there is a need for more information in areas like proper or correct diet, exercise, and adherence to medication and red flags to watch out for other than just management which happens to be more stressed on in most apps and forums.

"*Though medication is expensive, advice on why one must take it as instructed by the doctor is important just like exercising which we are told is paramount, even if it means just walking around your compound*," said PR6.

"*Advice on the need for other organs of the body to be checked regularly should also be emphasized as diabetes comes with other conditions like high blood pressure, weight loss, poor eyesight, and kidney problems among other health concerns*," added PR1

Some respondents argued that sometimes diabetes related ailments are ignored yet some are life threatening and therefore advice along those lines were equally important. These views are supported by Wayne et al., (2015) who described health coaching in primary care as one of the significant benefits of patients. The PR focus groups and a few members of PU group agreed that the apps on diabetes recommend small quantities of food, though regularly so that they can monitor their sugar levels. They also recommend that the diet should be low in carbohydrates but rich in protein and that sugars must be avoided. Raw salt should also be avoided, which means one cannot add salt to food already served on plates. Water should be taken in plenty. PR3 said he listens to a lot

of advice especially on diet remotely with the help of his wife who ensures he strictly adheres to what his doctor recommends. The inconveniences caused on occasions when one has to travel or during functions were emphasized. This is because one needs a special diet and this might inconvenience people hosting you.

"There are times you are at a function and you find that the meals provided are not those recommended for you, it's upon you to decline to take what is not right for your health," said PR3.

PR3 sentiments were supported by the other members of both groups saying in most cases they carry both food and medication from home to work or during "safaris." PR6 said she calls her doctor for advice whenever she is unsure of any food presented before her that she is unfamiliar with.

"*I manage my condition well. Sometimes I can even do without medicine, especially on days I do not eat at night,"* she concluded.

The members said that specialized doctors in diabetes are very few compared to the number of patients with the condition. Those in rural areas are the most affected and occasionally have to be referred to other facilities, views supported by (Ginige & Maeder 2018) in support of telemedicine. This echoes SDT's argument that unpleasant unequal leverage between the scientific knowledge (which drives modern development) and indigenous local knowledge of rural people, development experts generates parallel system of knowledge or rationality.

4.5 Telemonitoring and the Health Outcomes of Diabetic Patients.

The fourth objective sought to examine the impact of telemonitoring on the health outcomes of diabetic patients in Nairobi County. The results were presented as shown.

4.5.1 Responsiveness of remote monitoring healthcare staff to respondents' questions and concerns

The study sought to assess if remote monitoring healthcare staff were responsive to questions and concerns of diabetic patients. The results presented in Table 4.5.1 show the responses.

Table 4.5.1 Remote monitoring healthcare staff responsive to questions and concern

Remote monitoring healthcare staff responsive to questions and concerns	Frequency	Percent
Not at all	6	10.5
Moderately	6	10.5
Quite a bit	33	57.9
Extremely	12	21.1
Total	57	100.0

Source (Researcher, 2023).

The study showed that 33 (57.9%) of the respondents rated the responsiveness as quite a bit, 12 (21.1%) of the respondents indicated the staff was extremely responsive, 6 (10.5%) of the respondents indicated they were moderately responsive and 6 (10.5%) of the respondents indicated they were not responsive at all.

4.5.2 Whether home monitoring makes respondents feel more secure

On the question of whether home monitoring makes respondents feel more secure in detecting health problems, the study sought to examine whether home monitoring makes the respondents feel more secure in detecting health problems. The results presented in Table 4.5.2 show the different responses.

Table 4.5.2 Whether home monitoring makes respondents feel more secure in detecting health problems

Whether Home monitoring makes respondents feel more secure in detecting health problems	Frequency	Percent
Not at all	6	10.5
A little bit	2	3.5
Moderately	1	1.8
Quite a bit	36	63.2
Extremely	12	21.1
Total	57	100.0

Source (Researcher,2023).

The study showed that 36 (63.2%) of the respondents indicated it does quite a bit, 12 (21.1%) of the respondents indicated it extremely makes them feel more secure 6 (10.5%) of the respondents indicated it does not at all, 2 (3.5%) of the respondents indicated it does a little bit and 1(1.8%) of the respondents indicated they moderately felt secure.

4.5.3 Whether remote monitoring allows residents to stay better connected to their healthcare providers

On the question of whether remote monitoring allows respondents to stay better connected to their healthcare providers, the results presented in Table 4.5.3 show the level of connection.

Table 4.5.3 Whether remote monitoring allows respondents to stay better connected to their healthcare providers.

Whether remote monitoring allows respondents to stay better connected to their healthcare providers	Frequency	Percent
Not at all	10	17.5
A little bit	6	10.5
Moderately	16	28.1
Quite a bit	19	33.3
Extremely	6	10.5
Total	57	100.0

Source: (Researcher, 2023)

The study showed that 19 (33.3%) of the respondents indicated it does quite a bit, 16 (28.1 %) of the respondents indicated it does moderately, 10 (17.5%) of the respondents indicated it does not at all, 6 (10.5%) of the respondents indicated it does a little bit and 6 (10.5%) of the respondents it extremely connects them.

4.5.4 Satisfaction level with the amount of information respondents receive from remote monitoring

The study sought to determine the satisfaction level of respondents with the amount of information received from remote monitoring. The results presented in Table 4.5.4 show the level of satisfaction.

Table 4.5.4 Satisfaction level with the amount of information respondents receive from remote monitoring

	Frequency	Percent
Not at all	9	15.8
A little bit	20	35.1
Moderately	6	10.5
Quite a bit	15	26.3
Extremely	7	12.3
Total	57	100.0

Source: (Researcher, 2023)

The results showed that 20 (35.1%) of the respondents indicated they were a little bit satisfied, 15 (26.3%) of the respondents rated the satisfaction level as quite a bit, 9 (15.8%) of the respondents indicated they were not satisfied at all, 7 (12.3%) of the respondents indicated they were extremely satisfied and 6 (10.5%) of the respondents indicated they were moderately satisfied. When it comes to the effectiveness of the facilities' remote monitoring system, responses from the key informants varied. F1 indicated that telemedicine is still in the pilot phase and the systems and processes are still being set up for a more seamless journey, telemonitoring services were therefore not fully effective. They however partners with another facility to monitor patients.

"We partner with Curalie Health to monitor chronic care patients," said the F1 informant.

The system has not been much embraced yet according to the F2 informant who added that most patients prefer FTF. The F3 informant said their monitoring system was effective while the one from F4 said theirs is excellent in all their 63 facilities and save

patients' time. D5 informant rated their facility as fairly effective. Answering the question of challenges experienced when monitoring patients, network issues were indicated as a common problem in all the facilities. Challenges with technology for patients who are not techno-savvy are a concern at F1 but according to the informant they always have ready remedies in terms of options like generators that automatically start when there is a power failure.

"*Occasionally, systems are down and network issues are common but remedies are there in terms of backup power solutions such as an automated generator. We also work with data backup companies*," said F1 informant.

F2 informant said most clients do not have vitals sign machines which are limiting the process of patient assessment.

"Also, some clients have trouble operating their phones or laptops during sessions," she added.

According to the F3 informant, the identification of data skin remotely is tedious. F4 informant on the other hand complained of patients shifting from one hospital to another and others changing prescriptions and communicating late.

"There is a lack of consistency because it is not our core business. We only provide services based on real-time inquiry," informant D5 said.

Members from both focus groups suggested there should be better access to reliable internet and power all over including in rural areas, more ICT education especially among the aged, more information on telemedicine, training of more personnel on remote health access avenues, and the use of different equipment. These sentiments show that respondents are clearly lack the knowhow of the use of the devices, something

that most likely affects the monitoring process. According to a study by Guevara et al., (2021), self-administration of equipment is a challenge among patients. Here respondents are showing interest in autonomy-supportive environment that encourages patients to feel empowered to interact more fully with healthcare professionals as presented in SDT. Such environments are inclusive of opportunities for participation and choice, acknowledgment of negative feelings associated with engagement in difficult tasks, and external controls that are minimized. A number of respondents said they are unable to do video consultations. Most group two members suggested the creation of awareness on the existence of tele-monitoring services or general remote health access.

"*Going by the COVID-19 experience, monitoring patients at such times can enhance confidence among patients. The thought of another pandemic coming and finding this country unprepared for remote service delivery can be disastrous*," said PR6.

(Lee et al., 2018) agrees with this as according to him Video visit platforms allow the provider to coach patients and encourage active involvement in their care. Both groups agreed there was a need to expand telemedicine facilities to other health centers, especially public hospitals.

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CHAPTER FIVE

DSICUSSION

From the foregoing discussion, it is evident that an understanding of healthcare transformation through innovation in digital health is paramount. This study's findings indicate that the majority of the respondents were female, representing (52.6%) of the respondents. Whereas the study anticipated a high likely correlation between telehealth functionalities and positive health outcomes among diabetic patients in Nairobi, what stood out is that implementing new technologies, whether digital or not, should not be based on promise or hope, but on evidence and realism. Clinicians and patients may want to consider several other factors as they discuss preventive interventions for pre-diabetes. In addition to preventing progression to diabetes, lifestyle interventions have a beneficial effect on weight, blood pressure, and lipid levels. The researcher argues there is need to leverage Telemedicine in health facilities to improve health outcomes of patients in the country and beyond.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATION

6.1. Introduction

This chapter consists of a summary of findings, conclusions, and recommendations. The summary will be compared to what exists in the literature review. The recommendations will be made from the findings and from views shared by the survey respondents, informants, and FGD participants. Some findings in the research show insincerity among some facilities purporting to offer telemedicine meaning there is a commercialization aspect on the part of the facilities. The study aimed to bring out health outcomes of telemedicine utilization among diabetic patients in Nairobi County and answers the following questions:

i. How does telemedicine diagnosis impact the health of diabetic patients in Nairobi County?
ii. What effect does telemedicine treatment have on diabetic patients in Nairobi County?
iii. What is the relationship between telemedicine advice and health outcomes among diabetic patients in Nairobi County?
iv. What impact does telemedicine monitoring have on the health outcomes of diabetic patients in Nairobi County?

6.2. Summary of the findings

The first objective sought to assess the impact of telediagnosis on the health outcomes of diabetic patients in Nairobi County. The results indicate that 27 (47.4%) of the respondents use Smart Phone, 15 (26.3%) of the respondents use Telephones, 8 (14.0%)

of the respondents use all three, the telephone, smartphones as well as video conferencing, 7 (12.3%) of the respondents use Videoconferencing only. The study indicates that the majority of the respondents use smartphones.

The study sought to assess the reasons for the choice of the device in telemedicine diagnosis on

health outcomes of diabetic patients in Nairobi County. The results showed that 14 (24.6%) of the respondents said it was convenient to use, 11 (19.3%) of the respondents said it was affordable, 13 (22.8%) of the respondents said it was easy to use, 9 (15.8%) of the respondents said it was because of its visibility, 5 (8.8%) of the respondents said it was for Safety, 4 (7.0 %) of the respondents said it was portable and 1(1.8%) of the respondents said it was recommended by the practitioner. The study showed that the smartphone was highly used for telemedicine services.

The study sought to assess how long the respondents have used the device in telemedicine diagnosis on health outcomes of diabetic patients in Nairobi County. The result indicated that 19 (33.3%) of the respondents said 5 - 10 years, 13 (22.8%) of the respondents said 1- 3 years, 11 (19.3%) of the respondents said 3 -5 years, 9 (15.8%) of the respondents said 10 years and above, 5 (8.8 %) of the respondents said less than 1-year. The study revealed that the majority, 33.3%) of the respondents had used the devices for between 5 to 10 years implying patients are progressively embracing telehealth services.

The study sought to assess when the respondents applied the telemedicine devices when sorting diagnosis services. The study showed that 17 (29.8%) of the respondents indicated usage when their caregivers are monitoring their progress, 15 (26.3%) of the respondents indicated usage when they need to consult the doctor, 14 (24.6%) of the

respondents indicated they use the devices for appointments, 11 (19.3%) of the respondents use them when they need clinical advice.

Facilities use different means to ensure they give the correct diagnosis as failure to do this can lead to the wrong prescription. A good number of diabetic patients have never heard of telediagnosis. The patients prefer to have a FTF diagnosis prior to knowing the nature of their health challenge. Hindrances to telediagnosis use include the high cost of the devices, lack of advice on how to operate them, lack of internet, and frequent power outages. Most diabetic patients believe telediagnosis may not be as effective as it may fail to pick up some infections like skin infections, something a doctor would easily be curious about during a physical visit.

The second objective sought to assess the effect of tele-treatment on the health outcomes of diabetic patients in Nairobi County. The study showed that 27 (47.4%) of the respondents indicated they found the treatment very good, 9 (15.8%) of the respondents indicated it was fair, 8 (14.0%) of the respondents found it excellent, 7 (12.3%) of the respondents indicated it was good, while 6 (10.5%) of the respondents indicated it was below average.

The study sought to assess the reception of caregivers on the use of remote diagnosis and treatment in Nairobi County. The study showed that 25 (43.9%) of the respondents indicated the reception was very good, 11 (19.3%) of the respondents indicated it was below average, 12 (21.1%) of the respondents thought it was fair, 5 (8.8%) of the respondents indicated it was good, and 4 (7.0%) of the respondents indicated it was excellent.

The study sought to assess how well the respondents were able to hear what the doctor/ provider was saying during remote diagnostic and treatment. The study showed that 18

(31.6%) of the respondents indicated it was fair, 13 (22.8%) of the respondents indicated it was good 9 (15.8%) of the respondents indicated it was very good, 10 (17.5%) of the respondents indicated audibility was excellent, and 7 (12.3%) of the respondents indicated it was below average.

The study sought to assess how easy it was to talk with the doctor that is creating rapport during remote diagnosis and treatment of diabetic patients in Nairobi County.

The results indicated that 32 (56.1%) of the respondents indicated Very good, 11(19.3%) of the respondents indicated Good, 10 (17.5%) of the respondents indicated Excellent, 4 (7.0%) of the respondents indicated Fair. The study sought to assess how well the respondents were able to see effectively or communicate the image on the screen during remote diagnostic and treatment of diabetic patients in Nairobi County. The study showed that 29 (50.9%) of the respondents indicated the sight and communication were very good, 14 (24.6 %) of the respondents indicated it was good 7 (12.3%) of the respondents thought it was excellent, 5 (8.8%) of the respondents indicated it was fair, 2 (3.5%) of the respondents indicated it was below average. The study sought to assess the reliability of the device used for remote diagnostic and treatment of diabetic patients in Nairobi County.

The results showed that 25 (43.9%) of the respondents indicated reliability was very good, 17 (29.8%) of the respondents indicated it was excellent, 10 (17.5%) of the respondents indicated it was good, while 5 (8.8%) of the respondents indicated it was fair. The study sought to assess how polite and caring the medicine provider(s) was/were during remote diagnostic and treatment of diabetic patients in Nairobi County. The results showed that 33 (57.9%) of the respondents indicated it was very good, 13

(22.8%) of the respondents indicated it was excellent, 9 (15.8%) of the respondents indicated it was good, and 2 (3.5%) of the respondents indicated it was fair.

The study sought to determine what the overall feeling was about talking with a doctor remotely. The study showed that 26 (45.6%) of the respondents indicated the feeling was very good, 16 (28.1%) of the respondents indicated it was good, 6 (10.5%) of the respondents indicated it was excellent, 5 (8.8%) of the respondents indicated it was below average, and 4 (7.0%) of the respondents indicated it was fair.

The study sought to assess which treatment the respondents preferred between telemedicine and FTF. The study showed that 39 (68.4%) of the respondents indicated they preferred FTF while 18 (31.6%) of the respondents indicated telemedicine would be their choice. The study sought to assess reasons for the choices between telemedicine and FTF. The study showed that 15 (26.3%) of the respondents indicated it was because of affordability, 13 (22.8%) of the respondents cited power absence determined their choice, 7 (12.3%) of the respondents indicated it was because of internet challenges, 6 (10.5%) indicated they could not use technology, 6 (10.5%) of the respondents sighted ailment 5 (8.8%) of the respondents indicated because of privacy, 4 (7.0%) of the respondents indicated distance and 1 (1.8%) of the respondents indicated lack of internet determined their choice. The study sought to find out how the patients felt after calling the healthcare provider. The results indicated that some health problems remained the same, 20 (35.1%) of the respondents indicated their health problems reduced and 15 (26.3%) of the respondents indicated their health problems worsened.

The study sought to assess the challenges diabetic patients face when trying to access telemedicine treatment. The results presented showed that 17 (29.8%) of the respondents had no challenge, 11 (19.3%) of the respondents were unable to hear, 14

(24.6%) of the respondents reported experiencing poor internet connection, 10 (17.5%) of the respondents indicated their screens froze and 5 (8.8%) of the respondents indicated they experienced other challenges.

The study sought to assess if the telehealth clinical treatment patients received was as good as FTF. The results presented showed that 25 (43.9%) of the respondents agreed it was, 12 (21.1%) of the respondents disagreed, 11 (19.3%) of the respondents strongly agreed and 9 (15.8%) of the respondents strongly disagreed. The study sought to compare patients' physical health before and after telemedicine use. 29 (50.9%) of the respondents indicated they got slightly worse, 11 (19.3%) of the respondents indicated they got much better, 7 (12.3%) of the respondents indicated they got much worse, 6 (10.5%) of the respondents indicated there was no change, 4 (7.0%) of the respondents indicated they got slightly better. The study rated the overall satisfaction with telemedicine of diabetic patients. The results showed that 24 (42.1%) of the respondents indicated the satisfaction level was good, 17 (29.8%) of the respondents indicated it was poor, 7 (12.3%) of the respondents indicated it was neither good nor poor, 5 (8.8%) of the respondents indicated it was very poor and 4 (7.0%) of the respondents rated the satisfaction level as very good.

There was a general feeling from patients that insurance covers limit their telemedicine use as they dictate which hospital and doctor one should work with. At the same time, moat insurance covers are not comprehensive. A number of respondents consult their doctors remotely on the steps to take when their sugar levels rise. Whereas some patients have no idea how teletreatment works, others lack the digital devices needed to communicate remotely. Some patients believe diseases like cancer are spread by technological devices and imagine using them would add to their health challenges. The respondents think adequate information on teletreatment is lacking yet it can be a

remedy for pandemics like COVID-19. The need for ICT training is necessary, especially among the aged. There is a need for the expansion of telemedicine services to rural areas. The common man knows little about telemedicine going by the results from public hospital FGD members. 83% of patients attending private hospitals think teletreatment is cheaper, convenient, and time-saving. The government needs to enhance both services and awareness. A few patients feel other than there being chances of misdiagnosis with teletreatment, the security of their personal information is not guaranteed.

The third objective sought to establish the relationship between teleadvice and health outcomes among diabetic patients in Nairobi. The study sought to find out if respondents had technical difficulties when trying to access medical advice. 39 (68.4%) of the respondents said "YES" while 18 (31.6%) of the respondents indicated "NO". The study asked the respondents to indicate the technical challenges experienced showed that 20 (35.1%) of the respondents indicated poor internet connection, 15 (26.3%) of the respondents indicated they had no challenge, 12 (21.1%) of the respondents cited screen freezing, 7 (12.3%) of the respondents indicated other difficulties like power outages and 3(5.3%) of the respondents indicated they were unable to hear. The study sought to assess how well patients understood the healthcare providers' advice. The results showed that 35 (61.4%) of the respondents indicated they understood the health providers' advice very well, 13 (22.8%) of the respondents indicated the understanding was not very well, 5 (8.8%) of the respondents indicated well they well understood and 4 (7.0%) of the respondents indicated they never understood at all.

The study sought to assess how easy it was for the patients to consult healthcare providers. The results presented show that 34 (59.6%) of the respondents indicated that

it was very difficult, 16 (28.1%) of the respondents indicated it was very easy, 6 (10.5%) of the respondents indicated it was easy, while 1(1.8%) of the respondents indicated it was difficult. The study sought to determine the overall feeling of patients consulting with their healthcare providers. The results presented show that 23 (40.4 %) of the respondents indicated they were very happy 18 (31.6%) of the respondents were not happy and 16 (28.1%) of the respondents indicated were happy. Though most apps give information on the quantities of food diabetic patients should take and the need to avoid sugars, more information especially on exercise and adherence is needed.

The fourth objective sought to examine the impact of telemonitoring on the health outcomes of diabetic patients in Nairobi County. The results presented showed that 33 (57.9%) of the respondents indicated telemonitoring has quite a bit of impact, 12 (21.1%) of the respondents indicated the impact was extreme, 6 (10.5%) of the respondents thought it was moderate and 6 (10.5%) of the respondents indicated there was no impact at all. The study sought to examine if home monitoring makes the patients feel more secure in detecting health problems. The results show that 36 (63.2%) of the respondents indicated they felt secure quite a bit, 12 (21.1%) of the respondents indicated they felt extremely secure 6 (10.5%) of the respondents indicated not secure at all, 2 (3.5%) of the respondents indicated they felt a little bit secure and 1 (1.8%) of the respondents indicated the security feeling was moderate.

The study sought to examine if remote monitoring allows patients to stay better connected to their healthcare providers. The results show that 19 (33.3%) of the respondents indicated they felt connected quite a bit, 16 (28.1 %) of the respondents indicated the level of connection was moderate, 10 (17.5%) of the respondents indicated they were not connected at all, 6 (10.5%) of the respondents indicated they were a little bit connected and 6 (10.5%) of the respondents said they were extremely connected.

The study sought to determine the satisfaction level of patients with the amount of information received from remote monitoring. The results show that 20 (35.1%) of the respondents indicated they were a little bit satisfied, 15 (26.3%) of the respondents rated the satisfaction level as quite a bit, 9 (15.8%) of the respondents indicated no satisfaction at all, 7 (12.3%) of the respondents indicated extremely satisfaction and 6 (10.5%) of the respondents indicated they were moderately satisfied. The results of this study indicate that the most sought-after form of telemedicine among diabetic patients is telemonitoring. There is a general feeling from respondents that though COVID-19 should have acted as a wake-up call to the government in terms of preparedness in case of another pandemic, there is still inadequate awareness of existing remote services such as telemonitoring. The services should be expanded to public hospitals.

6.3 Conclusions of the Study

The motivation behind this study is to have an understanding of healthcare transformation through innovation in digital health. The study came up with the conclusion that though it is easy to consult a healthcare provider remotely when the need arises, it can be difficult to consult the same healthcare provider or any other during pandemics. This study was guided by the following objectives: Regarding relationship to objective 1, Smartphones were found to be the most popular devices used for telediagnosis among diabetic patients in Nairobi City County. The choice of the devices patients used during diagnosis was determined by how convenient and affordable they were, power and internet availability, lack of technology knowledge, ailment, privacy, and distance. In relation to objective 2, teletreatment was found to be having setbacks such as power absence (22%), internet challenges (12.3%) and lack of technology knowhow (10.5%). Relating to objective 3, major challenges facing

teleadvice are internet connection, (35.1%), frozen screens (21.1%) and other challenges like provider's inaudibility (12.3%). The results also indicated that more information especially on exercise and adherence is needed. Regarding objective 4, telemonitoring was found to be the most utilized telemedicine service among respondents and has positively impacted their lives. Respondents found home monitoring more secure in detecting health problems and allowed them to stay better connected to their providers. The majority were also satisfied with the information they received through remote monitoring though some felt the information received was not adequate. Generally, the country facilities lack advanced telemedicine facilities and telemedicine awareness level is low.

6.4 Recommendation of the Study

Based on the findings from the first objective;

Facilities should invest more on telediagnosis devices so that they are able to pick vital organs instead of relying on the client's verbalization. This will. This will require training of more endocrinologists and diabetologists to meet the needs of the increasing number of diabetic patients and accurate diagnosis.

(ii) There is a need for the introduction and improvement of telemedicine services in all facilities, especially public hospitals to allow health equity to prevail in order to achieve UHC as well as more information and education on teletreatment to evade speculation by some patients that telemedicine can cause diseases like cancer.Improvement of telemedicine services in all facilities, especially public hospitals to allow health equity to prevail in order to achieve UHC.

(iii) Diabetic educators should put more emphasis on adherence advice and checks on other conditions and organs of the body that come with diabetes like diabetes mellitus patient's foot care and exercise behaviors. The telehome care model could also become an important healthcare policy for the government in the future.

(iv) There is a need to enhance home monitoring to make patients feel more secure in detecting health problems.

6.5 Further Research

i. Another study can be done to assess the relationship between telemedicine sensitization and health outcomes among diabetic patients in other countries.

ii. There is a need for more research on the evaluation of telehealth interventions that serve as a substitute for traditional face-to-face consultation in primary healthcare settings.

iii. Clear guidelines on issues to do with telehealth reimbursement and limits as to where patients can receive telehealth need to be further researched.

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LIST OF APPENDICES

APPENDIX I: INTRODUCTION LETTER

Dear respondent,

My name is Wilkister Were, a Ph.D Development Study student at Kisii University. I need your help in conducting a survey of your own experience with telemedicine utilization within Nairobi City County. This survey asks about you and your health. Your participation in this survey is voluntary. The information you provide will be useful in helping me to evaluate the implications of telemedicine services on health outcomes. Please take the time to complete this questionnaire. Your answers are very important for research. If you are unable to complete this survey, a family member or "proxy" can fill out the survey about you. All responses will be treated confidentially and will in no way be traceable to individual respondents once the survey process has been concluded.

Do you agree to participate in this research?

a. Yes
b. No

Thank you for your assistance.

Sincerely,

Wilkister Were.

APPENDIX II: TELEMEDICINE UTILIZATION AND HEALTH OUTCOMES SURVEY

BACKGROUND: GENERAL INFORMATION

1. Name----------Optional

2. Gender---------- (a) Male (b) Female

3. Age----------

   (a) 31-50 years

   (b) 51-70 years

4. What is your current marital status? Are you: put a tick where it applies.

   a) Married

   (c) Divorced

   (d) Separated

   (e) Widowed

   (f) Never married

5. What is the highest level of education you have achieved?

   (a) None

   (b) Primary

   (c) Secondary

   (d) Diploma

   (e) Degree and above

6. How often do you use telemedicine services when sick?

(a) Occasionally

(b) Often

(c) Many times

(d) Almost always

(e) Never

PART A: TELEMEDICINE PATIENT SATISFACTION SURVEY

If you utilize telemedicine services proceed to no 7-26 below

7. Name the device (s) you use?

(a) Smart Phone

(b) Telephone

(c) Videoconferencing

(d) All the above

8. Give reasons for your choice of device(s)

(a) Easy to use

(b) Affordable

(c) Convenient

(d) Portable

(e) Recommended by the practitioner

(f) Visibility

(g) Safety

(h)

9. For how long have you used the device (s) you chose from 1 above?

(a) Less than one year

(b) 1-3 years

(c) 3-5 years

(d) 5-10 years

(e) 10 years and above

10. When do you apply the device(s)

(a) When I need to consult the doctor

(b) For appointments

(c) When caregivers are monitoring my progress

(d) When I need clinical advice

(e) 10 years and above

PART B: REMOTE DIAGNOSIS & TREATMENT (11-17)

11. Your experience with healthcare providers. Please answer the questions below. Your answers will help relevant authorities to make improvements.

Please select the appropriate response below

	Excellent	Very Good	Good	Fair	Below Average
What is your feeling on telemedicine use for treatment?	5	4	3	2	1
How was the reception from caregivers?	5	4	3	2	1
How well were you able to hear what the doctor/ provider was saying?	5	4	3	2	1

How easy was it to talk with the doctor ie rapport?	5	4	3	2	1
To what extent did you understand the doctor's/ provider's terminologies?	5	4	3	2	1
How well were you able to see effectively or communicate the image on the screen?	5	4	3	2	1
How reliable was the device you used	5	4	3	4	1
How polite and caring was/were the Medicine provider(s)?	5	4	3	2	1
Your overall feeling about talking with a doctor in this way	5	4	3	2	1

12. Which treatment would you rather use?

(a.) Telemedicine

(b.) Face to Face

Reason for the above choice	Tick accordingly
Affordability	
Privacy	
Ailment	
Power absence	
Internet challenges	

Cannot use technology	
No internet	
Distance	

13. How did you feel after calling the healthcare provider and being taken care of?

a. My health problem reduced
b. My health problem remained the same
c. My health problem worsened

14. What are the challenges you face when trying to access telemedicine treatment?

a. Poor internet connection
b. Screen frozen
c. Unable to hear
d. No challenge
e. Others (please explain)

15. The telehealth clinical treatment I received was as good as face-to-face

a. Strongly disagree
b. Disagree
c. Agree
d. Strongly agree

16. Compared to before you started using telemedicine, how would you rate your physical health in general now?

a. Much better

b. Slightly better

c. No change

d. Slightly worse

e. Much worse

17. On a scale of 1 to 5, where 1 = very good and 5 = very poor, how would you rate your overall satisfaction with telemedicine as a way of health care provision.?

a. Very good

b. Good

c. Neither good nor poor

d. Poor

e. Very poor

PART C: REMOTE MEDICAL ADVICE (18-22)

18. Have you had technical difficulties when trying to access medical advice?

Yes No

19. If yes from question 12 above, please tick all that apply:

a. Poor internet connection

b. Screen frozen

c. Unable to hear

d. Other (please explain)

20. How well did you understand the healthcare provider's advice?

a. Very well

b. Well,

c. Not very well

d. Not at all

21. How easy was it to consult your healthcare provider?

a. Very easy

b. Easy

c. Difficult

d. Very difficult

22. What is your overall feeling about consulting with your healthcare provider?

a. Very happy

b. Happy

c. Not happy

PART D: REMOTE MONITORING (23-26)

23. Remote monitoring healthcare staff are responsive to my questions and concerns.

a. Not at all

b. A little bit

c. Moderately

d. Quite a bit

e. Extremely

24. Doing home monitoring makes me feel more secure in detecting health problems.

a. Not at all

b. A little bit

c. Moderately

d. Quite a bit

e. Extremely

25. Remote monitoring allows me to stay better connected to my healthcare providers.

a. Not at all

b. A little bit

c. Moderately

d. Quite a bit

e. Extremely

26. I am satisfied with the amount of information I receive from remote monitoring.

a. Not at all

b. A little bit

c. Moderately

d. Quite a bit

e. Extremely

END OF SURVEY

THANK YOU

APPENDIX III: KEY INFORMANTS INTERVIEW GUIDE (CLINICAL OFFICERS)

Date of interview-

Name of facility-

Name of interviewer-

Respondent Initial –

Gender of respondent-

1. What is your position in the facility? ----------

2. Which telemedicine services does your facility provide?

(a) Store and forward

(b) Telemonitoring

(c) Real-time interactive services

(d) Others (specify)

3. What are Top 5 services sought through telemedicine?

(i). ----------

(ii)----------

(iii)----------

(iv)----------

(v)----------

4. What telemedicine services does your facility not offer?

(i) ----------

(ii)----------

(iii)----------

(iv)----------

(v)----------

(b) Which telemedicine services not available?

-

-

(c How do you handle prescriptions remotely??

----

5. a) Which age group most frequently seeks telemedicine services in your facility (Young, middle-aged, elderly).

----

b). Give reasons for your response in (5a) above

--

6. How do you ensure your patients receive the correct remote diagnosis in your facility?

7.(a) How would you rate effectiveness of your facility's remote monitoring system?

(b) What are some of the challenges you experience when monitoring patients from your facility?

8.What are the shortcomings of remote medical advice?

---

9. How does the facility intend to deal with the shortcomings?

---

10. How does your facility deal with exclusion e.g. the elderly who are not techno-savvy?

APPENDIX IV: FOCUS GROUP DISCUSSION GUIDE (PATIENTS)

Guiding Questions:

1. Describe your experience with diabetes.
2. How do you handle diabetic-related health issues when they arise?
3. What challenges do you experience when seeking services from health facilities?
4. How did COVID -19 affect your access to healthcare?
5. What lessons have you learnt from COVID-19 in relation to access to health services?
6. State special needs for diabetic patients
7. What are your concerns regarding telemedicine for diabetic patients?
8. What are the cost implications of treating diabetes remotely?
9. Which do you prefer between FTF and telemedicine? Expound
10. What improvement would you like to see in telemedicine use in Kenya?

APPENDIX V: RESEARCH LETTER

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OFFICE OF THE REGISTRAR RESEARCH AND EXTENSION

REF: KSU/R&E/ 03/5/ 647 **DATES:** 29th June, 2023

The Head, Research Coordination
National Council for Science, Technology and Innovation
(NACOSTI) Utalii House, 8th Floor, Uhuru Highway
P. O. Box 30623– 00100
NAIROBI - KENYA.

Dear Sir/Madam

RE: WILKISTER ANYANGO WERE DAS/60600/15

The above mentioned is a student of Kisii University currently pursuing a Degree of Doctor of Philosophy in Development Studies. The topic of her research is, **"Telemedicine utilization and health outcomes of Diabetic patients in Nairobi City County, Kenya".**

We are kindly requesting for assistance in acquiring a research permit to enable her carry out the research.

Thank you.

Dr. Evans K. Okemwa, PhD
Ag. Registrar, Research and Extension

Cc: DVC (ASA)
Registrar (ASA)
Director SPGS

APPENDIX VI: NACOSTI PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **816139**

Date of Issue: **17/July/2023**

RESEARCH LICENSE

This is to Certify that Ms.. Wilkister Anyango Were of Kisii University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: Telemedicine Utilization and Health Outcomes of Diabetic Patients in Nairobi County for the period ending : 17/July/2024.

License No: **NACOSTI/P/23/27615**

816139

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY &
INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013 (Rev. 2014)
Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

The National Commission for Science, Technology and Innovation, hereafter referred to as the Commission, was the established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

CONDITIONS OF THE RESEARCH LICENSE

1. The License is granted subject to provisions of the Constitution of Kenya, the Science, Technology and Innovation Act, and other relevant laws, policies and regulations. Accordingly, the licensee shall adhere to such procedures, standards, code of ethics and guidelines as may be prescribed by regulations made under the Act, or prescribed by provisions of International treaties of which Kenya is a signatory to
2. The research and its related activities as well as outcomes shall be beneficial to the country and shall not in any way;
    i. Endanger national security
    ii. Adversely affect the lives of Kenyans
    iii. Be in contravention of Kenya's international obligations including Biological Weapons Convention (BWC), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Chemical, Biological, Radiological and Nuclear (CBRN).
    iv. Result in exploitation of intellectual property rights of communities in Kenya
    v. Adversely affect the environment
    vi. Adversely affect the rights of communities
    vii. Endanger public safety and national cohesion
    viii. Plagiarize someone else's work
3. The License is valid for the proposed research, location and specified period.
4. The license any rights thereunder are non-transferable
5. The Commission reserves the right to cancel the research at any time during the research period if in the opinion of the Commission the research is not implemented in conformity with the provisions of the Act or any other written law.
6. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research.
7. Excavation, filming, movement, and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
8. The License does not give authority to transfer research materials.
9. The Commission may monitor and evaluate the licensed research project for the purpose of assessing and evaluating compliance with the conditions of the License.
10. The Licensee shall submit one hard copy, and upload a soft copy of their final report (thesis) onto a platform designated by the Commission within one year of completion of the research.
11. The Commission reserves the right to modify the conditions of the License including cancellation without prior notice.
12. Research, findings and information regarding research systems shall be stored or disseminated, utilized or applied in such a manner as may be prescribed by the Commission from time to time.
13. The Licensee shall disclose to the Commission, the relevant Institutional Scientific and Ethical Review Committee, and the relevant national agencies any inventions and discoveries that are of National strategic importance.
14. The Commission shall have powers to acquire from any person the right in, or to, any scientific innovation, invention or patent of strategic importance to the country.
15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

National Commission for Science, Technology and Innovation(NACOSTI),
Off Waiyaki Way, Upper Kabete,
P. O. Box 30623 - 00100 Nairobi, KENYA
Telephone: 020 4007000, 0713788787, 0735404245
E-mail: dg@nacosti.go.ke
Website: www.nacosti.go.ke

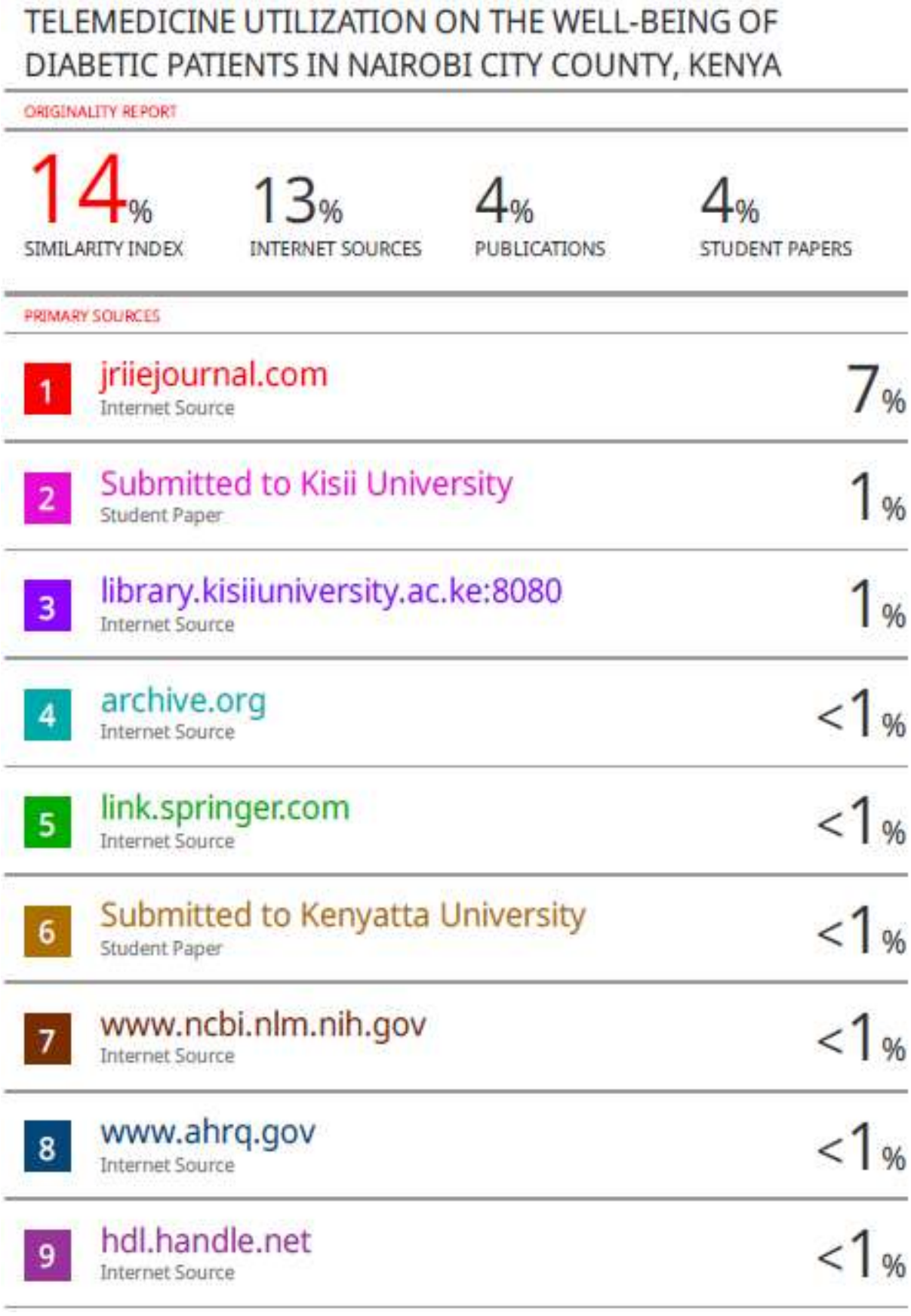
APPENDIX VII: SAMPLE SIZE DETERMINATION TABLE

Pop (N)	Sample	Pop (N)	Sample	Pop (N)	Sample
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10 000	370
150	108	750	254	15 000	375
160	113	800	260	20 000	377
170	118	850	265	30 000	379
180	123	900	269	40 000	380
190	127	950	274	50 000	381
200	132	1000	278	75 000	382
210	136	1100	285	100 000	384

APPENDIX VIII: MAP OF NAIROBI, KENYA

Source: Nairobi City County Integrated Development Plan 2018

APPENDIX IX: PLAGIARISM REPORT



TELEMEDICINE UTILIZATION ON THE WELL-BEING OF DIABETIC PATIENTS IN NAIROBI CITY COUNTY, KENYA

ORIGINALITY REPORT

14%	13%	4%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	jriiejournal.com Internet Source	7%
2	Submitted to Kisii University Student Paper	1%
3	library.kisiiuniversity.ac.ke:8080 Internet Source	1%
4	archive.org Internet Source	<1%
5	link.springer.com Internet Source	<1%
6	Submitted to Kenyatta University Student Paper	<1%
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