



Integrating Tele-treatment of Diabetic Patients for Improved Health Outcomes in Nairobi City County, Kenya

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Abstract: Although access to telehealth technology has rapidly expanded in developing countries, its potential benefits in improving healthcare are still underutilized. This study sought to investigate the effect of tele treatment on health outcomes of diabetic patients in Nairobi County, Kenya. The study employed a descriptive design. It used a systematic sampling method to collect the required data. Self-administered questionnaires, which contained items that are, both open and closed-ended were used. The data collected was used to illustrate the effect of telemedicine utilization on the health outcomes of diabetic patients. The study mainly targeted diabetic patients in Nairobi City County. 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. From the study findings, it is concluded that the impact of tele-monitoring on the health outcomes of the diabetic patient can be rated as good as most thought tele-monitoring had positively impacted their lives. The study recommends the need to enhance home monitoring to make patients feel more secure in detecting health problems, the need for training of more endocrinologists and diabetologists to meet the needs of the increasing number of diabetic patients and the need for the government and other stakeholders to have virtual diabetic clinics that defy the boundaries of locations and time.

Keywords: Tele-treatment, Health, Diabetes, Patients, Nairobi City County, Kenya

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1. Introduction

The WHO 2019 Universal Health Care (UHC) report indicates that health is a long-term investment in the human capital needed to fully realize human potential by contributing to the protection and empowerment of all people. Over recent decades, the world has made major health gains with longer life expectancies, lower maternal and child mortality rates, and successful campaigns against major diseases. This achievement stems from the efforts of individual countries and the international community to

improve the quality of health care and to make it accessible to all. The 2030 Sustainable Development Goals emphasize having everyone receive the quality health services they need without financial hardship. Following the commitments agreed to at the United Nations Sustainable Development Summit in 2015, which included attaining UHC by 2030, 75 countries have enacted UHC legislation Feigl & Ding, (2013). However, to attain true UHC, we need to measure the gains in health service coverage and understand the barriers to access and the large gaps that remain. Socioeconomic factors influence access

to health services and ultimately health outcomes (Cotton, 2017).

Although access to telehealth technology has rapidly expanded in developing countries, Donner, (2008) finds that its potential benefits in improving healthcare are still underutilized. Mobile phone messaging applications, including text messaging or short message service (SMS) and multimedia message service, could offer a convenient and cost-effective way to support desirable health behaviors for preventive health care by providing educational and motivational advice, (Donner, 2008). The urgency for improvement of diabetes management means that conventional outpatient care is no longer sufficient. 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, 2018; Lee et al., 2014). Despite this growing body of evidence, telehealth technologies are not being used by healthcare providers to their full potential in the management of T2DM (ADA, 2018a)

Type 2 Diabetes has a significant impact on health within populations, healthcare systems, and individuals. Health professionals are obligated to use the best evidence to improve practice and ensure the best possible outcomes for their patients. A number of systematic reviews, meta-analyses, and randomized controlled trials (RCTs) have provided evidence for the use of telemedicine to improve outcomes in patients with Type 2 Diabetes (Chamany et al., 2015; Faruque et al., 2017; Lee et al., 2017; Polisena et al., 2019; Rasmussen et al., 2020; Stone et al., 2019; Su et al., 2018; Teeter & Kavookijan, 2014; Trief, et al., 2013). Considering the implementation of the Family Physician Evaluation and Singapore Integrated Diabetic Retinopathy Program (SiDRP), Nguyen et al concluded that SiDRP showed better cost-effectiveness value than FP in the context of DR screening program (Rachapelle et al., 2016). In the context of video monitoring, a study by Kitwitee et al. (2017) in Thailand put its cost-effectiveness at 84%. Kitwitee et al. (2017) argue that telemedicine is a promising approach to increasing life and effectiveness of treatment.

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). In Kenya, telemedicine was identified as one of the strategic areas of intervention in the Kenyan e-Health strategy presented in the Vision 2030 report. 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. According to Hamidreza & Fatemeh,

(2017), telemedicine can be broken into three main categories: store-and-forward (acquiring medical data and then transmitting this data to a doctor or medical specialist), remote monitoring, and interactive services. The field of telehealth has been rapidly evolving, and there has been considerable variation in the use and meaning of different telehealth-related terminologies with the common ones being eHealth, telecare, and telehealth used interchangeably. There is a need for “common definition(s) according to (Eswaran & Dawson, 2022).

2. Literature Review

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. It can also involve telemonitoring/screening, sensors, and chatbots for connecting at-risk patients to a doctor and suggestions (Vidal et al., 2020). According to a discussion meeting on Introduction to Improving Telehealth and Virtual Care for Pain Management and Opioid/ Substance Use Disorder by NAM, (2022) and shared from the patient's perspective, one of the biggest advantages of virtual care for patients experiencing pain is avoiding many of the factors associated with in-person visits that can exacerbate chronic pain symptoms, including long car rides, bright lights, and noisy waiting rooms. 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 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).

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).

Nowadays, healthcare utilizes many aspects to educate patients who have chronic illnesses. Telemedicine is only one of those aspects, yet it is one which is at the technological forefront. As diabetes is one of the most common chronic diseases worldwide and thus impacts a great number of people, many of whom are undiagnosed, it seems one of the most promising facets of educating patients as it allows healthcare to meet them in their environment to receive care. Telemedicine is an alternative modality that has in the past proven to be a significant means of delivering care to a growing prevalence of long-term conditions. An analysis of a tele-nursing call management software system at Health Link BC in Canada, which is a self-care/tele-nursing program staffed by registered nurses and other health care professionals and is accessible to the residents by phoning, receives over 350,000 calls every year from residents requesting care and decision-making advice about their healthcare.

According to Jothydev & Viswanathan, (2023), existing diabetes treatment strategies have not completely been able to prevent disease-related complications. 50–85% of people with diabetes develop one or more complications despite following medication advice. The average glucose remains high in those people with diabetes, raising concerns of these complications affecting the working-age population, since the age of onset of diabetes is now relatively early. The urgency for improvement of diabetes management means that conventional outpatient care is no longer sufficient. Many people are adopting tele-consultation services where patients seek remote advice from qualified doctors or practitioners. The trend increased with the emergence of

COVID 19 which forced many people to turn to remote healthcare.

Support for diabetes self-management education (DSME) should be individualized to the patient and use multiple different methods to reach patients (VA/Army, 2019). DSME practices include “knowledge about diabetes and treatment options, medications, nutrition, exercise, hypoglycemia, monitoring of glucose and HbA1c, psychosocial and behavioral components, risk reduction, foot care, smoking cessation, chronic complications, and sick day management” (VA/Army, 2019, p.21). Despite this growing body of evidence, telehealth technologies are not being used by healthcare providers to their full potential in the management of T2DM (ADA, 2018a)

Telemedicine is increasingly being utilized in the field of diabetology to improve access to healthcare, quality of care, and clinical/psychosocial outcomes in people with diabetes. In patients with diabetes, patient-physician interactions are essential for improving health outcomes and preventing long-term complications. 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, Association AD (2020). Diabetic patients have to understand the importance of self-care and self-management. Patients get to know their therapeutic and behavioral needs, which include proper nutrition and physical exercise, but they also need the diabetologist’s periodic reinforcement.

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.

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, dietitians, 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.

Diffusion of Innovation (DOI) 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). Diffusion of Innovation Theory was propounded by Everret 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. The DOI tradition draws upon rational theories of organizational life adopted from economics, sociology, and communication theory. It develops predictive accounts of the diffusion phenomenon that supposedly helps technology implementers advance the diffusion of selected technologies. Tracing back to the concept of this theory, ‘diffusion of innovation’ can be divided into two parts: innovation and diffusion. ‘Innovation’ refers to modern, novel ideas or thoughts; practices, products, services, or devices useful to applicants; or novel programming advantageous to an individual or group. Innovation not only includes the adoption of novelty but also involves the modification of the attitudes and behavior of individuals or groups.

An innovation is neither objectively identified by whether the new or old depends on the time, nor the invention of something first used. When groups or individuals subjectively accept or recognize something as ‘new,’ this constitutes innovation. ‘Diffusion’ is the process by which an innovation is 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. Rogers considered adoption to be a complex psychosocial process, whose barriers to adoption processes needed to be considered arguing that, even with evidence that healthy habits and environmental conditions majorly improve health, some patients still do not change their existing unhealthy habits to adopt a suggested lifestyle modification. This inability to change is a barrier to the adoption process. People have their own living environment in a social circumstance. 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 (Rogers, (2010).

In this study, Diffusion of Innovation theory is 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 interests as well as connecting with others and the outside world. 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 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, which are needs arising from a perception that one’s psychological needs are being actively undermined by others. Because of this person-environment interplay, people become either engaged, curious, connected, and whole, or demotivated, ineffective, and detached.

3. Methodology

The study was conducted in Nairobi County. 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 Km² and is located between longitudes 36° 45’ East and latitudes 1° 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 1600 to 1850 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. The study employed a descriptive design. It used a systematic sampling method to collect the required data. Self-administered questionnaires, which contained items that are, both open and closed-ended were used. 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 study targeted 57 respondents. This was 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.

The researcher talked to individual diabetic patients who were willing to take part in the study. Snowballing was also used to locate diabetic patients within Nairobi County. Data for this study was analysed quantitatively. Graphical analysis and descriptive statistics form the basis of virtually every form of quantitative analysis. 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.

4. Result and Discussions

4.1 Respondents’ Feelings (Sentiments) on Telemedicine Use for Treatment

The study sought to assess the respondents' feelings on telemedicine use for treatment. Statistical analysis is presented in table 1 below.

Table 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. On how well the respondents were able to hear what the provider was saying during remote treatment. Statistical results are presented in Table 2 below.

Table 2: How Well Respondents Were Able to Hear What the Doctor Was Saying

How well respondents were able to hear what the doctor was prescribing	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 caregivers or medical practitioners. Moreover, the study sought to understand whether patients were to understand doctor's terminologies. Statistical results are provided in Table 3 below.

Table 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, patients are able to understand doctor's terminologies. This also means that patients using telemedicine services are fairly educated to understand medical terminologies.

4.2 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 below.

Table 4: Ability of respondents see or communicate the tele-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.

4.3 Level of Politeness and Caring for the Medicine providers

The study sought to assess how polite and caring the medicine provider(s) was/were. Statistical results are presented in Table 5 below.

Table 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 5 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 6 below.

Table 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. This is also supported by previous study that insinuates that 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, 2018).

5. Conclusion and Recommendations

5.1 Conclusion

The study concluded that the impact of telemonitoring on the health outcomes of the diabetic patient can be rated as good as most thought telemonitoring had positively impacted their lives. They 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.

5.2 Recommendations

The study recommends the need to enhance home monitoring to make patients feel more secure in detecting health problems, the need for training of more endocrinologists and diabetologists to meet the needs of the increasing number of diabetic patients and the need for the government and other stakeholders to have virtual diabetic clinics that defy the boundaries of locations and time.

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