MOBILE PHONE TEXT MESSAGING STRATEGIES AND PERCEIVED SELF-EFFICACY FOR TREATMENT AMONG PEOPLE LIVING WITH HIV/AIDS IN HOMA BAY COUNTY, KENYA

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Mobile Phone Text Messaging Strategies and Perceived Self-Efficacy for Treatment among People Living with HIV/Aids in Homa Bay County, Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

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DEDICATION

I dedicate this work to the memory of my late dad David Mwangi, who plays a very big role to the person I am today and to my mom Gladys Mwangi whose prayers and encouragement kept me going during the many moments that I almost gave up.

I dedicate this work also to my loving husband Karanja, my beautiful daughters Maria and Teanna and my siblings Patrick, and Dr. Winny Mwaura for the constant encouragement.

You all made it possible.

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ABBREVIATIONS AND ACRONYMS

AIDS   Acquired Immunodeficiency Syndrome

ART   Antiretroviral Therapy

CAK   Communications Authority of Kenya

CASCO   County AIDS and STI Coordinator

CCC   Comprehensive Care Centres

CHAI   Clinton Health Access Initiative

CI   Confidence Interval

DASCO   District AIDS and STI Coordinator

EGPAF   Elizabeth Glaser Pediatric AIDS Foundation

EMR   Electronic Medical Records

GFATM   Global Fund to Fight AIDS, TB and Malaria

GSE   General Self-Efficacy Scale

GSMA   Groupe Spéciale Mobile Association

HIV   Human immunodeficiency virus

ICT   Information Communication and Technology

JITAI   Just-in-time adaptive interventions

KAIS   Kenya AIDS indicator survey

KENPHIA   Kenya Population-based HIV Impact Assessment

KMO	Kaiser-Meyer-Olkin measure
KNBS	Kenya National Bureau of Statistics
mHealth	Mobile Health
MOH	Ministry of Health
NACC	National AIDS Control Council
NASCOP	National AIDS and STI Control Program
NVAM	Nature video application with music
PEPFAR	President's Emergency Plan for AIDS Relief
PLHIV	People living with HIV
PMTCT	Prevention of mother-to-child transmission
RR	Relative Risk
SDS	Shwachman-Diamond syndrome
SMS	Short Messaging Service
SPSS	Statistical Package for Social Sciences
STI	Sexually transmitted infections
T4A	Text for Adherence
TAM	Technology Acceptance Model
TB	Tuberculosis
TRAM	Technology Readiness and Acceptance Theory

TRI	Technology Readiness Index
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
USG	United States Government
VIF	Variance inflation factor
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Adherence: his can be defined as the fact of someone behaving exactly according to the rules, standards, agreements, law or beliefs.

Demographic: These refer to as statistical data about the characteristics of a populations and usually included age, gender, and income of the people within the population.

File review: This is the process of reviewing of files for patients at the facilities.

Green card: This can be defined as the patient documentation card used in the Comprehensive Care Centres in Kenya. It contains enrolment date for care and treatment for PLHIV/AIDS, appointment dates, test results and any other important information about the clients.

Innovations: This can be defined as a new method, idea or a product. It is mostly referred to as creative thoughts, new imaginations in form of device, method or service that may create value or for which customers or users could pay for.

Intervention: This refers to as the action or process of intercession or interceding intentionally becoming involved in a difficult situation in order to improve or prevent it from becoming worse.

Mastery experience: A person's attempt in doing something and are successful or when one manages to master in a certain activity (Hayden, 2019)

mHealth: Mobile Health

Mobile phone text messaging strategies: This refers to aspects related to how the text adherence solution is packaged. As the independent variable mobile phone text messaging strategies (the aspects of the solution) being investigated in this study included i) timing, operationalized in terms of morning, noon and evening ii) frequency operationalized as daily, weekly and monthly and iii) content, operationalized to include language of choice, message type (appointment reminders and wellness check-ins).

Mobile technology: This can be described as the technology used for cellular communication or use of mobile telephony, mobile computing or any other miscellaneous portable electronic devices, systems and networks.

Non-adherence: Lack of adherence, failure to adhere to certain guideline

Open Data Kit: This is a free and open-source software that enables people to collect data fast, offline, accurately and in large scale and is supported by a large community of users and developers (ODK, 2020).

Opportunistic infections: These are infections that occur often and are severe with people suffering low or weakened immune system like people living with HIV and with reduced viral loads. Examples are pneumonia, tuberculosis, etc.

Perceived self-efficacy: This refers to individual's beliefs in their ability to influence events that affect their lives, which becomes the foundation of their motivation, emotional well-being and their accomplishments (Bandura, 1994). This refers to the outcome among participants in the text for adherence solution. As the dependent variable, perceived self-efficacy was measured on a scale of no change, decreased or increased.

SDS Patients: These are patients with Shwachman-Diamond syndrome

Self-efficacy: These are the beliefs that influence how an individual feels, thinks, act and motivate oneself and the perceptions of being able to accomplish a specific task (Zulkosky, 2009).

UNAIDS targets: Targets aimed at ending the HIV/AIDS epidemic by 2030 by achieving 95 per cent diagnosed among all people living with HIV, 95 per cent on antiretroviral therapy among those diagnosed and 95 percent of those on treatment should be virally suppressed. These are targets that have been taken up by many countries globally (Dimitrov, Moore, Donnell, & Boily, 2020).**Verbal experience:** This is where verbal and social persuasion is used to influence self-efficacy (Hayden, 2019)

Vicarious experience: This is when individuals observes the successes and failures of others who are similar to themselves (Hayden, 2019).

ABSTRACT

The field of mobile phone technology has grown widely in Kenya and globally. The increased adoption of mobile technology in Kenya and globally continues to provide opportunities to experience evidence based mobile health benefits through increased access and provision of efficient services that would lead to better health outcomes. Although the field of mHealth is rapidly making significant advances that impact people's daily lives throughout the world, there is no significant progress in terms of research aimed at evaluating the effect of patient based mHealth solutions. The broad objective of this study was to examine the effect of mobile phone text messaging strategies on perceived self-efficacy for treatment among people living with HIV (PLHIV) in Homa Bay County. Specifically, the study examined 1.) the effect of timing of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County; 2.) the effect of frequency of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County; 3.) the effect of the type of message on perceived self-efficacy for treatment among PLHIV in Homa Bay County; 4.) the effect of language of choice of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County; and assessed the moderating effect of demographic characteristics in relation to mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV in Homa Bay County. Both theoretical and empirical literature reviewed suggested that there were a myriad factors that influence how mobile health solutions could affect self-efficacy among beneficiaries. This study used a quasi-experimental design. It comprised a sample of 543 (247 test group and 296 control group). The participants were systematically sampled from three facilities in Homa Bay County that were implementing the Text for Adherence (T4A) communication system. Data was analyzed using descriptive and inferential statistics. Qualitative data was analyzed under themes. Inferential statistics using correlations and linear regression models indicate that within the test group, the mobile phone text messaging strategies including language and frequency of messages were not statistically significant determinants of the levels of self-efficacy among participants. Nonetheless, participants who received messages on a monthly basis had demonstrated high levels of self-efficacy. However, timing of the messages and the type of messages had significant effects on the level of self-efficacy. In particular, appointment messages and wellness messages which were directly related to adherence had high levels of self-efficacy compared to those who were receiving general informative messages. All the socio-demographic characteristics studied did not have significant effect on the levels of self-efficacy. In conclusion, comparison of the levels of self-efficacy between participants in the test group and those in the control group revealed significant differences, with participants in the test group exhibiting high levels of self-efficacy. This implies that text messaging as a whole has potential of improving self-efficacy regardless of the strategies employed. This study recommends that 1.) timing 2.) frequency of messages 3.) type of messages and 4.) language, being key communication messaging strategies, should be employed in mobile communication interventions.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The field of mobile phone technology has grown widely in Kenya and globally. There is sufficient evidence that mHealth innovations have impacted treatment and adherence and subsequently improved patient outcomes (Deglise, Suggs, & Odermatt, 2012) (Sharma & Agarwal, 2012). Text for Adherence (T4A) system was developed to leverage on previous proven successes while trying to address existing gaps to improve adherence to care and treatment of people living with HIV/AIDS (PLHIV). The T4A system is an integrated mobile technology platform that uses text messaging to communicate with patients and increase awareness on HIV/AIDS, tuberculosis (TB), prevention of mother-to-child transmission (PMTCT) and other chronic health conditions. Mobile technologies and innovations are progressively scaling up in health facilities in areas of communication, public health practice, data collection, monitoring of patients, providing education and sensitization to patients and to enhancing adherence to communicable and life style disease management (WHO, 2011). The T4A is designed to send automated appointment reminders and follow up messages to patients that fail to go for the appointments. The text messages are linked to the facility or health center that the client or patients are receiving care and treatment. In cases where a child is the patient, the parent or guardian would need to consent to receive the text messages on their behalf. The design has timed check-in text messages, some that are one-way and others two-way whose responses may require a health care worker's intervention. The system was designed to support patients' engagement in their own care and treatment and to integrate with other information systems such as existing electronic medical records (EMRs). However, it can also work as a standalone especially in facilities without proper information communication technology (ICT) infrastructure.

According to the Communications Authority of Kenya Quarterly Report (CAK, 2020) by September 2020, the mobile phone penetrations were at 125.8%, rising from 119.9% during the previous quarter. The number of mobile subscriptions grew

from 57.0 million to 59.8 million subscriptions that were reported in the previous quarter (CAK, 2020) The Mobile Economy 2019 reported that there was a 71% subscription penetration rate globally with a 45% penetration rate in the Sub-Saharan Africa. The report also noted that the use of mobile technology has played a big role in driving improvements in both productivity and efficiency in workers and firms having different types of mobile innovations creating impact on productivity in the global economy. Mobile phone text messages allow health care workers in health facilities and firms to communicate more efficiently and thus reduce unproductive travel time (GSMA, 2019).

Adoption of mobile technology opens up prospects for increased access and supply of services, resulting in better health outcomes. Because mobile phone communication via text messaging is relatively inexpensive, accessible, and real-time, it has been viewed as a potentially powerful tool for influencing behavior (Cole-Lewis & Kershaw, 2010). The authors conducted a systematic evaluation of nine research and found evidence to support mobile phone text messaging as a strategy for behavior modification in eight of them (Cole-Lewis & Kershaw, 2010).

According to UNAIDS reports from the global HIV statistics, there were 36.9 million PLHIV and from these, 21.7 million had access to antiretroviral therapy in 2017. In addition, there were 1.8 million new HIV infections in 2017. Since the beginning of the epidemic, 77.3 million people have been infected out of which 35.4 million deaths have been registered from illnesses related to AIDS (UNAIDS, 2018b). In Kenya, there are 1.5 million PLHIV of which 75% are on treatment. On average, 53,000 new infections and 28,000 deaths annually are attributed to AIDS-related illnesses (UNAIDS, 2018a). These numbers offer reason to reach as many people on treatment as possible so as to reduce the number of deaths.

In 2003, World Health Organization (WHO) reported poor adherence to treatment of chronic diseases as being a worldwide problem of striking magnitude and provided examples like asthma, diabetes and uncontrolled blood pressure. WHO has defined adherence as the extent to which a person's behavior – taking medication, following a diet, and/or executing lifestyle changes, correspond with agreed recommendations

from a health care provider (WHO, 2003). Prevention and effective management of chronic illness can only be done by use of medications. Despite this vital importance and known benefit, non-adherence to appropriate medication use still remains a challenge for both patients and health care providers. When patients continuously miss to adhere to essential medications, the results are poor clinical outcomes, increase in mortality rates, and increase in the cost of care, low workforce productivity and decrease in overall public health. The consequences of medication non-adherence can be very costly due to poor clinical outcomes and unnecessary health care costs (Bosworth, H. B.; Granger, B. B.; Mendys, P.; Brindis, R.; Burkholder, R.; Czajkowski, S. M.; Daniel, J. G.; Ekman, I.; Ho, M.; Johnson, M.; Kimmel, S. E.; Z., Liu. L.; Musaus, J.; Shrank, W. H.; Buono, E. W.; Weiss, K.; B., Granger. C., 2011)

Adherence has also been defined as compliance and often is the preferred word by many health care providers. It suggests that patients are complying with doctors' orders without being bound by therapeutic alliance or contract between the physician and the patient (Osterberg & Blaschke, 2005). Medication adherence can be an important treatment regimen that contributes towards the long-term health outcomes. Medication non-adherence is a global public health concern that creates barrier to achieving optimal health and thus causing treatment failure and complications (Badawy, SM; Barrera, L; Sinno, MG; Kaviany, S; O'Dwyer, LC; Kuhns, LM, 2017). With most chronic conditions, successful treatment requires self-management and mobile health interventions would therefore be very useful in making sure that patients are constantly reminded to do what they need to do to remain healthy and at the right time.

Text messaging strategies have been utilized all around the world to promote appointment and medication adherence. In a systematic review conducted by Badawy et al., (2017), text messaging and mobile phone system interventions were used to improve medication adherence among adolescents with chronic health conditions, demonstrating promising feasibility and acceptability and thus supporting the efficacy of these interventions. The authors of the review recommended better understanding of barriers to medication adherence. This would guide future

development of content for text messages that would help in improving adherence and ultimately better health outcomes. Medication adherence is an important factor to successful treatment and contributes to long-term outcomes (Badawy, SM; Barrera, L; Sinno, MG; Kaviany, S; O'Dwyer, LC; Kuhns, LM, 2017). Additionally, content of the message can have positive or negative impact if it is not clearly understood by the recipient. There has been growing evidence base for mHealth interventions in low-and middle-income countries in improving adherence to appointments, treatment, data gathering and developing education and support networks for health care workers but the quality and quantity of the evidence is still limited in many respects (Hall, Fottrell, Wilkinson, & Byass, 2014). This could be due to limited full scale projects that would enable more efficient quasi-experimental studies that would strengthen the evidence base (Hall, Fottrell, Wilkinson, & Byass, 2014).

Bandura (2012) describes the human functioning as being a product of the interplay of intrapersonal influences. Individuals engage in this behaviour and environmental forces that affect them negatively (Bandura, Albert, 2012). When behaviour change communication systems are developed, the goal is to improve on self-efficacy of the users. In changing behaviour to improve health outcomes, the concept of self-efficacy is thought to be central. Thus, it is important to consider how mobile based solutions impact on self-efficacy during the design and implementation of mobile systems (Egbert & Omosun, 2017). We however cannot ignore Bandura (2012) where he revisits self-efficacy. He addresses discordance between efficacy beliefs and action that are caused by faulty assessment of performance and ambiguity about the performance undertaking. The results of misjudgment and situational constraints can be distorting (Bandura, Albert, 2012) and are likely to influence one's self-efficacy.

In Kenya, like many low and middle income countries there is a huge deficit of health care workers as compared to the number of patients each health care worker manages. In addition to that, there are chronic strikes within the public health sector leaving most hospitals with little or no clinical care (Irimu, G.; Ogero, M,; Mbevi, G.; Kariuki, C.; Gathara, D.; Akech, S.; Barasa, E.; Tsofa, B.; English, M., 2018).

From December 2016 to March 2017, there was a nationwide doctors' strike affecting the Kenyan public health sector that lasted 100 days. Shortly after, in 2017, nurses went on a nationwide strike that lasted 150 days (Irimu, G.; Ogero, M,; Mbevi, G.; Kariuki, C.; Gathara, D.; Akech, S.; Barasa, E.; Tsofa, B.; English, M., 2018). With the constant unavailability of clinical care in the public sector, people were left to seek care in the private hospitals of which most cannot afford. The most affected population is the poor.

According to the Kenya National Bureau of Statistics report (2018), the National Integrated Household Budget Survey, 2016 shows that majority of the individuals (55.5 %) with sickness or injury visited a health worker at a health facility for diagnosis. It also reported that the proportion of population living below the overall poverty line was 36.1% and specifically, in Homa Bay, 33.5 % of the population lives below poverty line (KNBS, 2018). Unfortunately, poor adherence to long-term therapies also means poor health outcomes and subsequently, this also leads to compromises to the effectiveness of care and treatment. There was a need to come up with innovative ways to improve adherence which in turn would help enhance patients' safety and lifestyles and prevent adverse health outcomes. Most of the care needed for chronic conditions is based on patient self-management (usually requiring complex multi-therapies), use of medical technology for monitoring. Due to changes in the patient's lifestyle, they face several potentially life-threatening risks if not appropriately supported by the health system (WHO, 2003). With limited resources in terms of care, constant communication with patients to ascertain that they are adhering to medication is crucial and necessary.

The purpose of this study was to evaluate the effect of communication using mobile phone text messaging for self-efficacy for treatment among people living with HIV/AIDS in the county of Homa Bay in Kenya. Kenya's healthcare system has a huge burden to support the increasing number of PLHIV and the situation was worsened by the high shortage of health workers and ever occurring strikes (UNAIDS, 2018a). Having all the PLHIV on treatment is crucial to avoid the high mortality rates. With treatment, the PLHIV are able to achieve high viral suppression and can live normal long lives. At the same time, if they were suppressed, their

bodies were able to fight opportunistic diseases. This population was at high risk of getting infected if not treated. This calls for the need to leverage technology and innovations to pass information to everyone infected, or most at risk of infection due to high viral loads, or to prevent new infections and finally, to link those who are infected to care so that they can be put on care and treatment and to reach and maintain virally suppression.

This study focused on appointment reminder text messages sent to PLHIV in Homa Bay County in Kenya. There were many health care workers or service delivery partners using this form of communication to remind patients to come for appointments or take their medications. The study aimed at evaluating whether the text messages are able to help in increasing adherence and eventually improve self-efficacy for treatment through behaviour change and adhere to treatment out of their own with or without the text messages. Poor adherence to appointments means that they may also not be adhering to their drugs and subsequently this would bring down their suppression rates. Constant communication to the patients as a reminder to keep them on track is therefore of essence.

Whereas all kinds of technology innovations to communicate can be used, there was need to pay a lot of attention to the messages being delivered and the impact of the messages. Traditionally, implementation of Information Communication and Technology (ICT) systems in the health sector in Kenya have not been followed up with systematic studies to measure improvements in health care service delivery. This study endeavored to address this gap by measuring the extent to which the selected mobile health (mHealth) solutions impacted the respective program areas in an effort to inform future program decision making related to the use of behaviour change communication on self-efficacy among users in Kenya. With poor theoretical underpinning, it becomes difficult to describe how and why implementation succeeds or fails and therefore restraining opportunities to identify factors that predict the likelihood of implementation success and develop better strategies to achieve more successful implementation (Nilsen, 2015). There have been studies done globally to show how mobile innovations and text messaging has helped patients manage their treatment better or adhere to both appointment and medication. In one study done in

Nigeria, for adherence to rapid diagnostic tests for malaria, results revealed 14.3 percent points higher in the treatment group who were sent text messages (Modrek, Sepideh; Schatzkin, Eric; Cruz, Anna D. L.; Isiguzo, Chinwoke; Nwokolo, Ernest; Anyanti, Jennifer; Ujuju, Chinazo; Montagu, Dominic; and Liu, Jenny, 2014). With most new innovations, the most appropriate theory has been the diffusion of innovation theory. However, this study looked at mobile message communication and self-efficacy and how behaviour change communication using text messages through self-efficacy model may have been applied in the implementation of the Text for Adherence system implementation.

1.2 Statement of the problem

According to the Kenya Population-based HIV Impact Assessment (KENPHIA) 2018 Report, Kenya has the world's fifth-highest number of HIV-positive people and is the main cause of adult morbidity and mortality. In Kenya, the HIV prevalence for persons aged 15 to 64 living with HIV was 4.9 percent (MOH, 2018). The fact that women outnumber men in terms of HIV prevalence (6.6 percent vs. 3.1 percent) is cause for concern (MOH, 2018). Billions of dollars have been spent in an attempt to contain Kenya's HIV/AIDS epidemic. These investments involve the creation and deployment of innovations to assist people living with HIV.

Some of these innovations are communication and systems that are meant to increase adherence. According to a recent United States (U.S) Presidents' Emergency Plan for AIDS Relief (PEPFAR) strategy fact sheet for Kenya (2018), the U.S government through PEPFAR has spent over $5.98 billion to go towards the HIV epidemic control from the financial years 2004 through June 2018 for Kenya (PEPFAR, 2018). This kind of investment calls for the need to have approaches that are sustainable beyond the funding cycles.

The Joint United Nations Program on HIV/AIDS (UNAIDS) developed the 95-95-95 program targets to track progress towards ending the HIV epidemic by 2030. These program targets call for 95 per cent of PLHIV to know their status (first 95); 95 per cent of those who know their status should be linked to treatment (second 95) and 95 per cent of those linked to treatment should be virally suppressed (third 95). Majority

of the countries including Kenya are committed towards achieving the targets (UNAIDS, 2015). The KENPHIA report revealed that 79.5% of the adults who tested positive knew their HIV status. 96% of these adults that knew their status were already linked to care and were on Antiretroviral Therapy (ART) and 90.6% of these adults who were on ART had achieved viral suppression (MOH, 2018). If we compare the 95-95-95 target stipulated by UNAIDS, by 2018, Kenya was at 79.5-96.0-90.6 and therefore has only met the second 95 of linking those who know their status to care (MOH, 2018). For Kenya to meet the UNAIDS third 95 UNAIDS target of ensuring that 95% of those linked to care are virally suppressed, there is need to work with the PLHIV and all stakeholders to ensure that proactive, easy to use, agile and sustainable solutions are in place to support care and treatment for PLHIV and ensure that there is adherence to treatment (NACC, Kenya AIDS Response Progress Report, 2016).

Adherence to medication has been identified as major problem that affects 50-60% of chronically ill patients (Anglada, Riu, Martin, Rovira, & Sotoca, 2015). While antiretroviral therapy (ART) has helped in the reduction of morbidity and mortality rates for PLHIV, non-adherence to treatment is a major contributor of treatment failure, development of drug resistance and death (Pop-Eleches, Cristian; Thirumurthy, Harsha; Habyarimana, James P.; Zivin, Joshua G.; Goldstein, Markus P.; Walque, Damien de; MacKeen, Leslie; Haberer, Jessica; Kimaiyo, Sylvester; Sidle, John; Ngare, Duncan; Bangsberg, David R., 2011).

Although the field of mHealth is rapidly making significant advances that impact peoples' daily lives throughout the world (Bosworth, A, 2012), there is very little progress in terms of research aimed at evaluating the effect of patient based mHealth solutions on self-efficacy among PLHIV. Limited research on the influence of mobile text communication on self-efficacy creates a knowledge gap. Without proper understanding of the influence of mHealth solutions on self-efficacy it is difficult to attribute the changes in behaviour to the solutions provided. This makes the evidence on the effectiveness of such solutions that are otherwise highly costly questionable in the long run. Hence, this study examined the effect of a mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County, Kenya.

Homa Bay has the highest HIV prevalence rate in Kenya of 19.6 per cent followed by Kisumu at 17.5 per cent, Siaya at 15.3 percent and Migori at 13.0 per cent (MOH, 2018). These are the 4 highest counties in prevalence. This high prevalence rate made Homa Bay a good candidate for this study.

One other challenge that faces health care systems globally and highly affecting the developing countries including Kenya is limited human resources. Due to these limited resources, patients are limited in access and utilization of health services, which subsequently impact on their health outcomes (UNAIDS, 2018a). Patients that suffer from chronic diseases constantly require follow up and strict adherence to treatment. This calls for the need to leverage on technological innovations to ascertain adherence to treatment. This study examines mobile phone communication strategies that would support health care workers in providing access to care and treatment of people living with HIV and reducing the face to face appointments.

1.3 Objectives

1.3.1 General objective

To examine the effect of mobile phone text messaging strategies on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

1.3.2 Specific objectives

1. To examine the effect of timing of mobile text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County.
2. To investigate the effect of frequency of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County.
3. To examine the effect of the type of message on perceived self-efficacy for treatment among PLHIV in Homa Bay County.
4. To examine the effect of language of choice of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

5. Assess the moderating effect of demographic characteristics on the relationship between mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV in Homa Bay County.

1.4 Study hypotheses

1. H_0: Timing of messages has no significant effect on the perceived self-efficacy for treatment among PLHIV in Homa Bay County

2. H_0: Frequency of messaging has no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County

3. H_0: Type of messaging has no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County

4. H_0: Language of choice has no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County

5. H_0: Demographic characteristics have no significant moderating effect on the effect of mobile phone text messaging strategies on perceived self-efficacy for treatment among PLHIV in Homa Bay County

1.5 Significance of the study

The study will be significant to various stakeholders involved in digital interventions and HIV management in Kenya as follows:

Policy makers

This study will contribute useful information that will anchor policy directions in terms of supporting implementation of digital interventions. The study also contributes to the available knowledge on the theories used. The study could provide useful information that could help in streamlining policies.

Donors

With billions of investments going towards the HIV epidemic control (PEPFAR, 2018), there is need to develop solutions that do not just address the short-term goals of meeting immediate needs but should target long term behaviour change. Perceived self-efficacy has been proven to impart knowledge and practical skills that are linked to long term behaviour change and therefore, it is a critical component of any solution that is aimed at changing behaviour (Bandura, Albert, 2004). In examining the effect of mobile text messaging strategies on perceived self-efficacy for treatment among PLHIV, this study provides critical evidence on the effectiveness of a mHealth solution to donors, Government stakeholders and implementing partners involved in the control of the HIV epidemic in Kenya and globally. It may also inform donors, Governments, and financial supporters on how best to align their resources for future mHealth implementations.

Practitioners and future innovators

The study also aimed at providing recommendations based on the results that can guide future projects implementations that would be beneficial to health care workers using mobile text messaging or mHealth based innovations. The study findings may shape the future digital interventions in terms of the communication strategies that can be employed. These have to be effective strategies that contribute to the achievement of the desired outcomes

1.6 Scope of the study

In terms of physical scope, this study was conducted in Homa Bay County in three facilities namely, Kiasa, Gongo and Ogongo. Homa Bay had the highest burden of HIV in the Country at 26% but in a recent report from the Ministry of Health the Homa Bay county prevalence is at 20.7%. The three facilities were where the T4A system was first implemented and thus have used the system the longest. This study looked at two theories that are relevant to the innovation being studied. These were the self-efficacy theory and the technology readiness and acceptance theory

(TRAM). The self-efficacy theory was used to assess the effectiveness of the communication influencing behaviour through the four factors under the theory.

Mobile technology innovations are not new to most Kenyans. One of the most known innovations globally is the MPESA platform, which is a mobile money transfer system. Mobile money transfer refers to the provision and availability of banking and financial services through the help of mobile telecommunication devices (Mutuku, 2011). It is evident that the mobile phone penetration rate in Kenya has progressively grown and is currently at 125.8% (CAK, 2020). The target population has also been using the T4A system for two years now since implementation. We can therefore assume that the perception of efficacy as influenced by the four factors, that is: Mastery experience; vicarious experience; Verbal persuasion; and Somatic and emotional state can be used to assess behaviour change of the users of the T4A system. The TRAM also used in the study is an integration of two theories: the technology readiness index (TRI) and the technology acceptance theory (TAM). The two integrated theories looked at the adoption and acceptance of the technology and how the technology attributes may affect how an individual perceives new technology and subsequently how this affects the usage of the technology (Porter & Donthu, 2006). Therefore, this study looked at how the T4A system was adopted or accepted based on this integrated TRAM model.

Methodologically, the study targeted PLHIV who had consented to receive mobile text messages from the facilities. The study targets participants of both male and female gender and of varying demographics. The study also involved service care providers in participating facilities. The three facilities have had the T4A system in use for two years and the study assumed that the two-year period that the system has been in use is adequate to assess if the mobile text messages may have had any effect on self-efficacy on adherence to treatment and assess any behavior change among people receiving messages. The three facilities were the only ones that had an option of selecting more than two languages for the adherence messages that the PLHIV were receiving. The languages used were Kiswahili, Dholuo and English. The study's period was between 2017 and 2019 when the text for adherence project was being implemented. The scope of the content of the study was restricted to

communication strategies as the dependent variable, demographic characteristics as the moderating variable and self-efficacy as the dependent variable.

1.7 Study limitations

Methodologically, a longitudinal pure experimental design would have been the most robust for this study as this would have elicited the improvement in self-efficacy over a long period of time. To overcome this limitation the study employed a quasi-experimental design which was suited best due to lack of randomization of the participants at the implementation stage. Another limitation of the study was that it relied on self-reported data which has potential of dishonesty due to the sensitivity of the disease. To overcome this limitation, the study used mixed methods that included questionnaires, key informative interviews and file reviews aimed at obtaining retrospective data to clarify or answer clinical questions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the theoretical and conceptual frameworks upon which the study is grounded. The chapter includes a detailed critique of existing empirical literature relevant to the study, provides a summary of the literature review in relation to the problem of the study and presents the research gap in existing literature.

2.2 Theoretical review

The study was based on two theories. These are the self-efficacy theory by Albert Bandura and the technology readiness and acceptance theory (TRAM).

2.2.1 Self-Efficacy theory

According to Bandura, Albert (2004) you cannot discuss behaviour change without discussing self-efficacy as it is a focal determinant as it affects health behaviour directly and through its influence on many other factors. Self-efficacy beliefs shape the results people expect their efforts to produce and the higher the goals and individuals' set for themselves the higher their commitment to those goals (Bandura, Albert, 2004). There are theories that have shown that values can be developed and changed vicariously by repeated exposure to modelled preferences. An individual's capability requires self-belief in one's ability to use their skills well. Modelling influences must therefore, be designed to improve self-efficacy, pass knowledge and rules of behaviour (Bandura, Albert, 2001).

These theories formed the "lie on the couch" approach of talk therapy, which became one of the best strategies to influence behaviour change. Unfortunately, research on the outcome of talk therapy revealed that although people gained insight into their behaviour, they usually did not change (Bandura, Albert, 2004). In the 1960s a new

approach viewed behaviour as the result of an interchange between three different factors; personal, behavioral, and environmental factors as an alternative of an unconscious process with psychodynamic roots, which did not consider deviant behaviour a disease symptom (Bandura, Albert, 2004). A shift in treatment occurred at this time in terms of content, location, and (behaviour) change agent. Treatment content became action oriented and focused on changing the actual deviant behaviour rather than on trying to find the psychological origins of the behaviour. Mastery experiences were used to give people the skills and belief in them to adopt healthier behaviour.

Treatment occurred in the settings where the behaviour occurred – at home, school, workplace and community rather than in a therapist's office. For example, teachers were trained to assist in reducing problem behaviours in the school setting and peers or role models who had overcome the problem behaviour themselves were also change agents (Bandura, Albert, 2004). Although both approaches were very different, research done on phobias showed that both were equally as effective. Since both approaches worked, it was apparent there was some underlying mechanism connecting them. It was Albert Bandura in the late 1970 who proposed Self-Efficacy Theory as the unifying mechanism (Bandura, Albert, 2004) (Bandura, Albert, 1997).

Self-efficacy can be the belief of one's own ability to successfully accomplish something. It is a theory by itself, as well as being a construct of Social Cognitive Theory. Self-efficacy theory tells us that people generally can only attempt things they believe they can accomplish and won't attempt things they believe they can fail in. However, people with a strong sense of efficacy believe they can accomplish even difficult tasks. The people see these as challenges that can be mastered, rather than threats that need to be avoided (Bandura, Albert, 2004), while those who doubt their ability to accomplish difficult tasks see these tasks as threats. They avoid them based on their own personal weaknesses, give up in the face of difficulty and failure, and it does not take much for them to lose faith in their capabilities.

The theory introduces the idea that the perception of efficacy is influenced by four factors:

Mastery Experience - This occurs when we attempt to do something and are successful, that's when, we have mastered something. Mastery experiences are the most effective way to boost self-efficacy because people are more likely to believe they can do something new if it is similar to something they have already done well. Example: Preoperative pelvic exercises prior to surgery for prostate cancer. This being important in the restoring urine control preoperatively. The more they perform these exercises, the higher the chance of increasing their self-efficacy and the more likely they are to regain urine control more quickly after surgery (Hayden, 2019). Mastery experience being the reason why workshops, training programs, internships, and clinical experiences are offered. To develop a strong sense of efficacy, difficult tasks need to be attempted and obstables worked through.

Vicarious Experience - Vicarious experience where individuals observes the successes and failures of others who are similar to themselves. Watching people who are similar to you successfully accomplish something you would like to attempt contributes to the increase of self-efficacy. On the other hand, if you observe someone like you fail threatens self-efficacy. The more one relates or connects with the person whose behaviour is being watched the higher the influence on the belief that they can also accomplish the behavior being observed (Hayden, 2019).

Verbal Persuasion - This can be where verbal and social persuasion is used to influence self-efficacy. It is possible to convince an individual that they can achieve or master a task thorugh verbal persuasion. Having others verbally support attainment or mastery of a task goes a long way in supporting a person's belief in himself or herself. For example, if a team was contesting for a certain sport and loses, the coaches reaction after the loss could increase or decrease self-efficacy. Positive feedback would have more positive effect on self-efficacy (Hayden, 2019).

Somatic and Emotional States - The success of failure of an individual can be influenced ty the physical and emotional states that they may be experiencing at the time. Fear, anxiety, stress and worry negatively influence self-efficacy. These stressful emotions may lead to the inability to perform certain feared tasks or leading one self-fulfilled prophecy of doom. Stressful situation create emotional arousal,

which in turn affects a person's perceived self-efficacy in coping with the situation (Hayden, 2019). For example, fear of dentists associated with pain and anxiety prevents people for making dentist appointments and discrimination or stigma prevents asthma patients from using or carrying inhalers, which are detrimental in their continued asthma care.

This study focused on examining the effect of the various communication strategies employed in the T4A project on self-efficacy for treatment among PLHIV to keep their adherence. T4A project employs mobile, web-based platform developed with the objective of improving the health outcomes of PLHIV by providing timely and reliable messages including appointment reminder messages, treatment adherence messages, and wellness messages. The theory guided the designing the project, that took into consideration the four key theoretical concepts of the self-efficacy theory as discussed above.

The study found out how these four key concepts were considered in structuring the content and delivery of the intervention. Further, the study explained the relationship between gaining mastery experience, vicarious experience, experienced verbal pursuation and strengthening of participants' somatic and emotional states and appointment adherence outcomes (keeping or missing appointments). Appointment reminder messages borrowed the concept of mastery of experience as the messages are designed to condition PLHIV by encouraging familarity through a series of repeatition, thus the more one relates or connects with the messages received the higher the influence on the belief that they can also accomplish the communicated behavior.

The context of the message encourages verbal persuation enhances self-efficacy for overcoming ART Adhereance and for implementing self-control strategies like confidence in specific challenging situations is essential to the success of therapeutic interventions (Maddux, 2012; Badura, 1997). Reit et al. (2008) hypothesizes that persuasive health messages are a central component of efforts to promote healthy behaviour specifically how persuasive health messages are framed that can manipulate an individual through somatic and emotional adaptations. Research

conducted by Kahneman and Tversky (Kahneman, 2003; Kahneman & Tversky, 1984) revealed that people can respond differently to information about the consequences of a risky choice depending on whether the same consequences were presented as gains or losses. Wellness messages as designed by T4A system is influenced on how framed health promoting message is contingent on the degree to which performing the promoted health behaviour is perceived as risky or gainful to an individual. Therefore verbal persuasion according to Reit et al. (2008) proposes that gain framed messages (positive) will be more effective than loss framed messages in motivating people to engage in (risk-free) prevention health behaviours, and loss framed messages will be more effective than gain framed messages in motivating people to engage in (risky) detection health behaviours.

Furthermore, self-efficacy beliefs are formulated by processing information derived from direct domain-specific engagement (enactive mastery experiences), and to a lesser degree verbal persuasion, vicarious experiences, and physiological states(Hassan et al., 2014). Hence, participants high in self-efficacy may be less likely to default, and more likely to set themselves goals and can take calculated, as opposed to reckless risks (not taking ART medication). T4A design therefore assumes that as respondents interact with the system, it may encourage or discourage peers to take on the innovation. Vicarious experience proposes that observing another individual successfully complete a task, especially if you perceive the individual to have a similar skill set as you, can provide a template for how you could also find success which the messages intends. According to Maddux (2012), through cognition we exercise control over our own behavior, which then influences not only the environment but also our cognitive, affective, and biological states. Hassan et al. (2012) postulates vicarious experiences are thought to be most influential when individuals are uncertain of the standards by which proficiency in an activity is measured. Social models, particularly those individuals perceived as similar in this case PLHIV within a similar facility, often act as a point of comparison as an individual form conceptions of their own confidence to adhere to medicine and clinical appointments.

The theory is broad and multi-directional and can be used to explain both negative or positive behaviour learning and adoption. In this study, participants showed either improved adherence or poor adherence. In both ways, the theory was applicable.

2.2.2 Technology readiness and acceptance model (TRAM)

The technology readiness and acceptance theory is an integration of two models; Technology readiness index (TRI) and Technology acceptance model (TAM). This integrated model was first presented by (Lin C.-H. , Shih, & Sher, & Y.-L., 2005). Porter and Donthu (2006) went ahead to explain the two research paradigms that explain the adoption and acceptance of technology. Technology attributes may affect how an individual perceives a new technology or innovation, which in return affects the usage of the technology (Porter & Donthu, 2006). Perceived usefulness and perceived ease of use are the two primary factors in TAM that influence technology uptake (Davis, Bagozzi, & Warshaw, 1989). Perceived usefulness relates to the degree to which a person feels that utilizing a specific system would improve their job performance, whereas perceived ease refers to the degree to which a person believes that using a particular system will be devoid of effort (Davis F. D., 1989). TAM has received a lot of support over the years and has been validated on a wide range of platforms. Both perceived usefulness and perceived ease of use have been demonstrated to be reliable and valid cognitive characteristics (Godoe & Johansen, 2012).

Porter & Donthu (2006) examined how an individual's personality influences the potential acceptance of the technology (Porter & Donthu, 2006). Parasuranam (2000) introduced the technology readiness index (TRI) that focuses on four personality dimensions, that is; optimism, innovativeness, discomfort, and insecurity. According to the scholar, these dimensions affect how people embrace and adapt new technologies. Technology readiness examines individuals' propensity to embrace and use technologies to accomplish goals in home life and at work (Parasuraman, 2000). Optimism and innovativeness would function as the mental enablers and discomfort and insecurity would be the mental inhibitors to accepting new technologies (Godoe & Johansen, 2012). The technology readiness combines positive and negative

technology related beliefs that are assumed to vary among individuals. These combined beliefs determine a person's tendency to interact with a new innovation (Parasuraman, A. & Colby, C. L., 2001).

Optimism is defined as the positive view of technology and a belief that the technology in itself offers people increased control, flexibility, and efficiency in their lives (Parasuraman, A. & Colby, C. L., 2001) and ideally would capture positive attitude about technology (Godoe & Johansen, 2012). Innovativeness is defined as the tendency of being a technology pioneer and thought leader (Parasuraman, A. & Colby, C. L., 2001). This dimension in most cases measures to what degree individuals perceive themselves as being at the forefront of the adoption of the new innovation (Godoe & Johansen, 2012). Discomfort is defined as the perceived lack of control over technology and the feeling that they are overwhelmed by the it (Parasuraman, A. & Colby, C. L., 2001). This dimension usually measures the fear and concerns that people may experience when using or interact with technology (Godoe & Johansen, 2012).

Insecurity can be defined as the distrust that the technology may instill skepticism about the ability to work properly (Parasuraman, A. & Colby, C. L., 2001). This dimension focuses on concerns or insecurities that people or users of the innovation may have while interacting with the technology (Godoe & Johansen, 2012). Optimism and innovativeness play a role when assessing technology readiness and a high score of these two dimensions would increase the overall readiness of the technology. On the other hand, discomfort and insecurity play a negative role in the technology readiness and thus a high score of these dimensions would reduce the overall technology readiness (Parasuraman, 2000).

In the last decade, a team of researchers, Lin, Shih, Sher, and Wang (2005) and Lin, Shih and Sher (2007) integratergrated the two models TRI and TAM into one. The integrated model is referred to as the technology readiness and acceptance model (TRAM) and was first presented by Lin et al., (2005). In recent studies, technology readiness has been directly linked to dimensions of perceived usefulness and perceived ease of use (Walczuch, Lemmink, & Streukens, 2007) (Godoe & Johansen, 2012). There have been previous studies that show established linkages between

perceived usefulness, perceived ease of use, and actual use of technology (Davis F. D., 1989) (Venkatesh & D., 2000). Previous models did not include actual use, which in this study was the only way to measure behaviour that was assumed to improve self-efficacy. It was for this reason that this particular model was relevant to this study. Through the actual use of the system and you get a more comprehensive image through the interrelationships between factors.

The integrated TRAM model (excluding hypothesized relations) is shown in figure 2.1
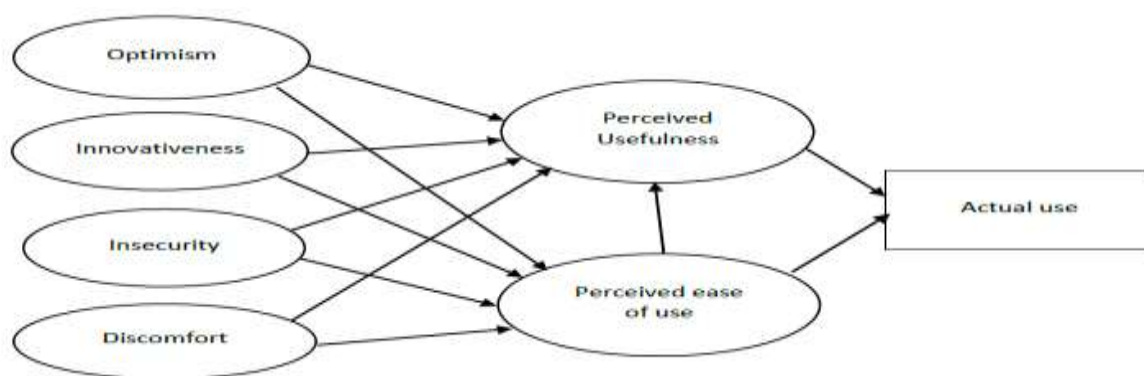
Source: (Godoe & Johansen, 2012)

Figure 2.1: The Integrated TRAM Model

This model shows how any of the four factors; optimism, innovativeness, insecurity and discomfort can affect technology's perceived usefulness or perceived ease of use. When an individual ought to be excited about technology and are optimistic about the innovations, it offers people increased control, flexibility, and efficiency in their lives and this (Parasuraman, A. & Colby, C. L., 2001) effect would potentially affect the actual use of the system. For this study, the use of the system was crucial to attain self-efficacy to treatment for the PLHIV and thus the reason this theory applied.

The main objective of this study was to examine the effect of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County in Kenya. The innovation was developed to utilize mobile text messages to

communicate. The T4A technology is used as a media to deliver automated text messages that are sent to the PLHIV. In order to assess the technology readiness of the system, we had to assess optimism in relation to the T4A users. What was the belief of the users in adapting this new innovation? Did it increase control, flexibility and efficiency (Parasuraman, A. & Colby, C. L., 2001) in adhering to the appointment messaging or the wellness messages? Did the innovativeness create excitement, either by users being the first to use the innovation in the county, or in the choice of language or choice in selecting what time they get to receive their messages. Since we were studying a sensitive population, we could not ignore the stigma and discrimination that PLHIV experienced as they were also obstacles in the way of effective responses to HIV (Feyissa, Abebe, Girma, & Woldie, 2012). And for this reason; we could not ignore the insecurities mentioned in the TRAM theory that came with the use of new technology. How confidential was the information being shared across the platform? The insecurity and discomfort may also be attributed to other demographic characteristics, which were also assessed in this study. For example, was the phone shared? Who owned the phone? Do other family members know that this individual is living with HIV? If not, the individual may not be comfortable using a shared phone to communicate with the health care workers and thus may reduce the perceived usefulness of the system. The actual use of the system was crucial as it was the only way to assess the adherence to the messages and behavioral change that would subsequently confirm if self-efficacy is achieved or not. In evaluating the hypothesis provided in the model, we examined how the TRAM factors affected directly or indirectly the results of the study.

The three hospitals in Homa Bay were the first to use the T4A system and it was where the implementation began. Before the use of the innovation the PLHIV have to go through counselling and it was at that point that the innovation was introduced to them. After counselling, the clients were required to consent to receive messasges from the T4A system. If they consented to the use of the technology, they were given the option to select preferred language out of three, Swahili, English and Dholuo. They were also required to select a preferred frequency and time that they would wish to receive the messages. If the user is optimistic that this technology would help them improve the quality of their health or impact positively to their health, then

it is assumed that there would be perceived usefulness to the system. If people are optimistic and innovative to a technology, they would usually hold positive attitudes towards new technology or the use of the innovation (Godoe & Johansen, 2012). The T4A system has automated the messaging which makes it easy to use from a health care worker perspective. The health care worker does not have to manually create the messages sent. The messages are perceived to be simple and understandable. The user innovativeness in being able to respond to these messages with ease and adhere to appointments may affect positively perceived ease of usefulness. In this study optimism and innovativeness were enablers that may have positive effects on how people perceive and relate to new innovation (Parasuraman, A. & Colby, C. L., 2001).

The T4A is a technology targeting a stigmatized population living with HIV (Feyissa, Abebe, Girma, & Woldie, 2012). Any discomfort felt in the nature of the messages sent to them may affect negatively to perceived usefulness of the technology. Discomfort could also be caused by the timing of the messages. Even though the user had a choice in the time they want to receive the messages, sometimes circumstances or conditions change and the timing selected ends up creating discomfort. The same applies to the frequency of the messages received by the users. In the beginning of the implementation, a user could be ok in the frequency as it was explained by the counsellors. Only does one starts to receive the messages that the impact is truly felt. This could affect either positively or negatively to perceived ease of usefulness. Discomfort however should not be expected to have a negative impact on perceived usefulness. Users should see the main value of a system regardless of how they use it. Discomfort was expected to affect perceived ease of use (Godoe & Johansen, 2012).

The communication or information shared within the T4A platform needs to be confidential and secure. The users however may not have the confidence that their information was secure and the uncertainty of who has access to their information would cause insecurities that would subsequently affect perceived usefulness of the technology. The same insecurity towards the confidentiality of the content in the platform could affect the perceived ease of usefulness. In this study, feelings of

insecurity related to the T4A system may be associated with ambiguity and low usage (Parasuraman, A. & Colby, C. L., 2001) (Tsikriktsis, 2004). It had been widely proven that perceived ease of use contributes to perceived usefulness (Godoe & Johansen, 2012) (Lin, C.-H.; Shih, H.-Y.; Sher, P. J.; Y.-L., Wang, 2005). This assumption was based on the theoretical argument that though you may have applications that are user-friendly that could be perceived as useful, not all useful applications are user-friendly (Godoe & Johansen, 2012).

The main reason for the actual use of a new technology was its perceived usefulness (Davis F. D., 1989). It is for this reason that people adopt new innovations based on their functions, rather than based on how easy it is to perform the functions (Godoe & Johansen, 2012). Users may be willing to adopt a difficult system if it captures certain perceived valuable functions. However, previous study revealed that about 90% of research done on TAM also shows direct effects of perceived ease of use on actual use (Schepers & Wetzels, 2007). In this study, the actual use of the system is key to our findings. It was the use of the system that helped in examining the perceived self-efficacy to treatment among PLHIV.

2.3 Conceptual Framework

The key assumptions of the study were that the various strategies of communication employed in designing and delivering the T4A project, that is, i. timing of the messages ii. frequency of the messages iii. type of messages and iv. choice of language, have an effect on perceived self-efficacy for treatment among PLHIV. The effect may be i) increased self-efficacy, ii) no change in self-efficacy and iii) decreased self-efficacy at the end of the intervention. However, the study considered demographic characteristics as key moderating factor in the relationship between the T4A intervention and its effects on self-efficacy among participants. Figure 2.2 illustrates the conceptual framework and relationship between key independent variables, the dependent variable and the moderating factor.

Timing
- Morning
- Noon
- Evening

Frequency of messages
- Daily
- Weekly
- Monthly

Type of messages
- Appointment
- Wellness
- Informative

Language
- English
- Swahili
- Dholuo

Demographic characteristics
- Age
- Gender
- Marital status

Perceived level of self-efficacy
- High
- Moderate
- Low

Independent Variables   Moderating Variables   Dependent Variables
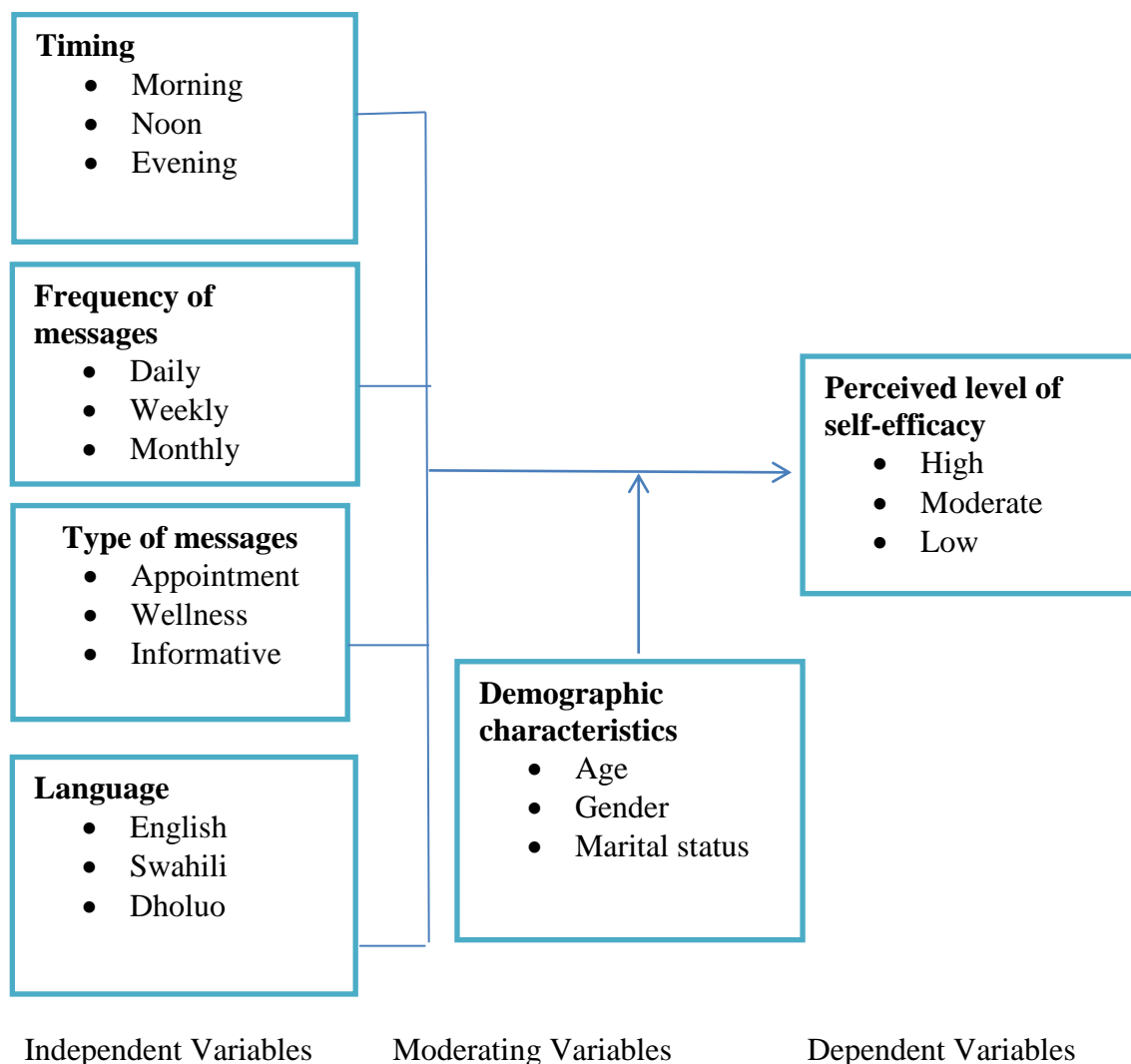
Figure 2.2: Conceptual Framework

2.4 Review of Variables

This study examined the effects of mobile text messages on a client's perceived self-efficacy through a mHealth innovation Text for Adherence system (T4A). The communication strategy was targeted to PLHIV and specifically in three facilities in Homa Bay County, Kenya. The independent variables that are reviewed in this literature are the timing of the messages. Individual's receiving T4A messages had the option of selecting the time they would wish to receive their messages. Another independent variable was frequency of the messaging. There was the option of receiving messages daily, weekly or monthly. The users of the system also had the choice of three language, that is, English, Swahili and Dholuo and option of selecting

if they wanted only appointment reminders or also inclusion of wellness check-in and informative messages. The dependent variable was perceived self-efficacy.

The assumption of the intervention strategy anticipated that to improve adherence to ART, an individual is allowed for autonomy to decide what, when and the language of T4A messages to receive. According to Riley et al., (2011), self-efficacy for patients with chronic conditions has been shown to improve with interventions that support self-management. Self-efficacy indicator in this study looks at the direct patterns of adherence in this case as participants receiving T4A messages, the strategy permits adapting and improvement in appointments within the three facilities over the course of the intervention. Does the perceived self-efficacy increase, decrease or remain the same? Factors (types of messages, timing frequency and language) intervene by making information available and permitting reminders of clinical appointment for maximal impact and effectiveness that sought to have a possibly significantly positive benefit regarding effectiveness to ART adherence.

Sending scheduled text messages to individuals with HIV can significantly improve adherence as SMS responses would establish cognitive patterns of stimuli and response that either adhering or avoid ART. By conditioning individuals though psychological processes of wellness messages and appointment reminders, whatever their form, may alter the level and strength of self-efficacy. According to Bandura (1977), it can be hypothesized that expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences. Persistence in activities that are subjectively threatening but in fact relatively safe (privacy of text messages) produces through experiences of mastery, further enhancement of self-efficacy and control in the management of HIV and corresponding reductions in defensive behavior (defaulting drugs and or clinic visits). However, we cannot ignore the effects of other confounding variables such as demographic characteristics like age, gender, level of education including the social environment; in the experience of living with HIV or the perception of the disease itself. Self-efficacy levels can be confounded with other variables, like, for instance, self-esteem, stigma to HIV/AIDS within the county and support level which could

affect the receptivity of T4A messages. Moreover, Bandura (1977) posited that self-efficacy is formed by how people interpret information. The most powerful source is the interpreted result of one's past performance, or mastery experience. As individuals engage in tasks and activities, they interpret the results from these experiences and form conceptions about how capable they are in engaging in subsequent related tasks and activities.

Therefore behaviour is influenced by perceptions of the notification content that encourage Adherence of ART as long as correct timing and confidentiality of messages maintains an individual's HIV status to other people they may interact with. Individuals appear to evaluate information about their capabilities and then regulate their choices and efforts accordingly. Successes raise efficacy and failures lower it, but once a strong sense of efficacy is developed a failure may not have much impact (Bandura, 1986). As such behaviour is influenced by individual differences as arises from the gradual acquisition of complex cognitive, social, linguistic, and/or physical skills through experience (Hassan et al., 2012).

2.4.1 Timing of mobile text messages for the T4A system

Findings in previous research showed that considering time was critical in designing and delivering any intervention aimed at changing behavior or supporting certain positive behaviors. In a previous study, 20% of the participants stated that the SMS messages were sent at the right time and 12% indicated that the messages were never sent at the right time (Anglada, Riu, Martin, Rovira, & Sotoca, 2015). Increase of adherence was experienced when devices were attached to pill bottles and would send SMS to a web portal when a patient would open the bottle. If the bottle was not opened within 30 minutes of the scheduled time it would trigger an automated phone call or message (Anglada, Riu, Martin, Rovira, & Sotoca, 2015). A study on designing opportune stress intervention delivery, timing using multi-modal data by Sano A, Johns P, And Czerwinski M., (2017) revealed that when designing stress interventions, there are at least 3 factors to be considered. These factors were, the types of interventions being provided (content), the modality of providing the intervention and the timing of the intervention for maximal impact and effectiveness.

On timing, the study found out that even in cases where a designer has appropriated the most effective interventions, presenting them at the most appropriate times could have a significantly positive benefit regarding effectiveness (Sano, Johns, & Czerwinski, 2017).

The Just-In-Time Adaptive Interventions (JITAIs) have been previously used to support people in managing their individual, daily stress experience. It has been mentioned that, JITAI can be used to remind people to engage in stress management techniques as they experience stress, help people better identify and address emotionally burdened situations as they occur, in their natural environment and support long-term learning of stress-management. Providing stress interventions during high stress situations might not be a good approach. An example would be users involved on important tasks for which they do not want to be interrupted. Sano, Johns & Czerwinski (2017) studied responses to instant messenger (IM) notifications and found that notifications sent at the wrong time could disrupt computer tasks that one was engaged in. They found that a good time for notifications was before the user became deeply engaged on an assignment or early in the task. These findings show that designing the right timing of notifications was very important to provide less destructive interruptions (Sano, Johns, & Czerwinski, 2017). On the other hand, when it comes to stress interventions that occur in the early stages of tasks the notifications would make users more aware of the benefits and the right time of taking a break. Inappropriate timings in providing stress interventions could be annoying to users and could potentially increase their stress levels. However, prolonged use of computer tasks without such guidance could lead to adverse health outcomes and reduce attention and performance. JITAI could play a role in reminding people of how to manage their stress. Stress intervention with personalized and optimal timing could increase users' productivity and health (Sano, Johns, & Czerwinski, 2017).

The timing of an SMS based solution is critical because of the varied sociodemographic characteristics among participants. For example, in a study among the youth on the suggestion about when they should receive HIV treatment adherence related messages, the youth provided varying opinions regarding the best

time which varied from morning to evenings (Sano, Johns, & Czerwinski, 2017). Other preferred times to send messages were mornings so that youth could organize their day including taking their pills and during times when youths' phones were likely to be on. This was similar to this study with the exception of messages that were sent at noon. One focus group of minor youth specifically suggested receiving messages in the late evenings so that they could access messages especially for those who shared phones (Sano, Johns, & Czerwinski, 2017). Timing was critical and therefore it was looked at as a sub-independent variable in terms of the time when participants were receiving messages to examine the effect of timing of mobile text messaging on self-efficacy for treatment among PLHIV in Homa Bay County.

2.4.2 Frequency of messaging using mobile based health communication intervention

In the study among the youth in Uganda, there was no consensus as to the number of times messages should be sent in a week. Some focus group participants preferred receiving messages every day as long as the sender was able to send since it would act as a reminder. Others mentioned wanting to receive messages at least once, twice or three times a week especially during the weekends when they face more distractions and are likely to forget things or on Mondays since it is the first day of the week (Rana, Y.; Haberer, J.; Huang, H.; Kambugu, A.; Mukasa, B.; Thirumurthy, H.; Wabukala, P.; Wagner, G. J.; Linnemayr, S., 2015). Most studies on mobile phone text messaging do not have options to choose the frequency of messaging. For example, in a study in South Africa on Mobile Phone Text Messages to Support Treatment Adherence in Adults with High Blood Pressure, personalized SMS text messages were sent to information-only message and interactive message group participants at weekly intervals at a time and in a language selected by the participant. Additional reminders were sent when medicines were ready for collection or for scheduled clinic appointments (Bobrow, K; Farmer, A. J.; Sprnger, D.; Shanyinde, M.; Yu, L.; Brennan, T.; Rayner, B.; Namane, M.; Steyn, K.; Tarassenko, L.; Levitt, N., 2016).

In another study, the effect of mobile phone text-message reminders on Kenyan health workers' adherence to malaria treatment guidelines: a cluster randomised trial, messaging was designed such that for 5 working days (Monday to Friday), two text messages (one at 9 am and one at 2 pm) were sent daily (excluding public holidays) to every health worker's mobile phone. The same process was repeated every week for 6 months (Zurovac, et al., 2011)

In a systematic review titled "Does mHealth increase adherence to medication?" Anglada-Martinez et al., (2015) argue that the frequency of text messages may also vary between adherence levels where text messages are more frequent when adherence is low (daily reminders) less frequent in patients with good adherence (weekly reminders) (Anglada, Riu, Martin, Rovira, & Sotoca, 2015). Anglada-Martinez et al. (2015) continue to discuss a study where 93% of the participants responded that they read all the SMS. There were devices that were attached to the standard pill bottle and would send an SMS to a web service portal every time the patient would open the bottle. It would produce a loud beep or a customized sound if the bottle was not opened within 30 min of the scheduled time and this would trigger an automated phone call or text message. (Anglada, Riu, Martin, Rovira, & Sotoca, 2015).

2.4.3 Type of messages

As regards the type of messages, participants in five out of the six focus groups in a study among youth on ART in Uganda preferred coded messages that would help maintain confidentiality. Overall, there was a general consensus that it would be best if the messages did not contain the words 'drugs' or 'pills' so as not to compromise participants' HIV status. Participants indicated that it would be better to have pre-agreed-on, coded messages (Rana, Y.; Haberer, J.; Huang, H.; Kambugu, A.; Mukasa, B.; Thirumurthy, H.; Wabukala, P.; Wagner, G. J.; Linnemayr, S., 2015). The following quote elaborates one participant's desire to keep the real meaning of the messages anonymous so that even if others accessed his phone they would not know about his HIV status. Participants collectively suggested keeping the content of the message straight-forward and simple so that it would not raise any suspicions,

while others suggested sending inspirational messages. In the same study, a few participants recommended changing the content of the message so that they don't get tired and bored reading the same messages (Rana, Y.; Haberer, J.; Huang, H.; Kambugu, A.; Mukasa, B.; Thirumurthy, H.; Wabukala, P.; Wagner, G. J.; Linnemayr, S., 2015).

Kenya is ahead of many other countries in Africa in terms of the legal framework and guidelines on the development and implementation of mHealth solutions. In relation to this study the 2017 Kenya Standards and Guidelines for mHealth Systems under section *5.2.2* Creation of Message Content outline the following key considerations in developing content for mHealth Systems (MOH, 2017). This standards and guidelines document recommends that the system design should consider the length of each and should consider the attention span of the target audience and ease of use; the delivery of content to the target audience must consider the frequency of the messages and preferred time of receipt of the messages; the tone of each message must be considered and should resonate most with the receiver or end users; the implementation of the mobile text message solution should consider whether and how the source or perceived source of the message can influence a user's reaction to the content; the content must adhere to the country's technical guidelines and international standards; and finally the messages must be consistent and complementary across the program and should be approved by the relevant ministry of health authorities. In addition to the considerations above, the guidelines also state that the SMS context and content used in the mobile health solutions is owned in trust by the Government of Kenya (MOH, 2017). This study looks at the effect on type of message on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

2.4.4 Choice of language

The Kenya standards and guidelines for mHealth systems provides recommendations that emphasis that language and vocabulary being used in mHealth systems should be clearly understood by the target audience and related to their health issues (MOH, 2017).

A study by Jacobs, Chen, Karliner, Agger-Gupter & Mutha (2006) found out that language barrier between service providers and their patients have potential to negatively affect service delivery. Whereas service providers were highly professional and scientific, they were faced with the challenge of providing services to sometimes, illiterate members of the community from different cultural and linguistic backgrounds. Thus a lot of existing literature suggest reaffirm the fact that quality communications and mutual understanding between service providers and patients were essential components in the provision of health care and social services (Jacobs, Chen, Karliner, Agger-Gupta, & Mutha, 2006). This literature review did not find any mHealth solutions in Kenya that provided clients with the option to choose the language of choice for the communication. The Kenya Standards and Guidelines for mHealth Systems and previous studies only state that there was need to deliver mHealth innovations in simple languages (MOH, 2017). Specialized systems with choice of language may help in alleviating language barrier challenges and significantly contributing to an effective, improved care process when foreign language patients are involved. This study examined the effect of language of choice of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

2.4.5 Effects of demographic characteristics on relationship between mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV

Mobile text messaging interventions to improve adherence are considered low-cost and have been shown to address some barriers to adherence faced by people in all socio economic levels. Text messaging interventions could be particularly suitable for adults or youth who irrespective of their demographic characteristics are ordinarily competent users of mobile phones and text messages (Rana, Y.; Haberer, J.; Huang, H.; Kambugu, A.; Mukasa, B.; Thirumurthy, H.; Wabukala, P.; Wagner, G. J.; Linnemayr, S., 2015). However, some studies have shown certain factors that could influence the effectiveness of mobile technology interventions such as demographics (gender/ age) or disease status (disease management/disease prevention) that have a likelihood of influencing success of mobile Health (Free, C;

Phillips, G; Galli, L; Watson, L; Felix, L; Edwards, P; Patel, 2013) Previously both policy and programmatic efforts have failed to acknowledge the direct link between demographic characteristics/status and people's health. Instead, these factors have been referred to as behavioral factors such as lack of physical activity in case of lifestyle diseases. However, health promotion interventions that directly address behavioral risks can, at best, support policy to promote health and, at worse, maintain inequalities in society. This was because behaviour change approaches have little impact on the broader conditions that create poor health, especially for vulnerable people such as migrants, low socio-economic status and indigenous groups (Laverack, 2017).

Personal characteristics such as educational level, age, gender, educational experience, and attitude towards technology have been hypothesized to have an influence on the decisions by individuals to adopt and make use of an innovation (Buabeng-Andoh, 2012). Studies on adoption of technology at place of work have found that an individual's level of preparedness and attitude greatly influences the adoption and integration of technological innovation at the work place. It is therefore important to consider individuals' characteristics in analysing how they adopt and make use of technological innovations. According to the Kenya Standards and Guidelines for mHealth Systems, the usability of any innovation should be enhanced by taking into account the socio-economic status of the targeted users. Therefore, mHealth innovations should be easy to install and update, with simple and well-documented process, easy to update to the extent possible and the updates should be seamless, automated and centrally managed. The system should be intuitive with the system's user interface design well thought-out and gauged to meet the interests and abilities of the intended users. The system should be efficient and fully optimized for the specific architecture on which it runs and should not result in memory leaks or any form of over utilization of shared resources. It should be easy to navigate and the system's interface should be well thought out based on "what works" for the specific device and architecture rather than on "what is trending (MOH, 2017).

2.4.6 Perceived self-efficacy

Self-efficacy theory alludes to the belief of being able to succeed or fail in a certain task and is what determines an individual's willingness attempt to do the task again. According to the theory, people with a strong sense of efficacy believe they can execute even the most difficult tasks by looking at the difficulties as challenges which can be mastered. However, the people with a low sense of efficacy view such challenges as threats and therefore may not attempt to perform them (Bandura, 1994). Mobile health platforms have been used in providing excellent opportunities in projecting supportive cognitive, motivational, and social interventions for behaviour change. These platforms have provided opportunities for measuring the dynamics of psychosocial factors as people participate in mHealth programs and provide personalized interactions that optimize desirable achievements. Unfortunately, theorizing and modelling of individual health behaviour change may not be equally fine-grained and predictive. In the theory of planned behaviour, self-efficacy has been described as an individual's belief that he or she is capable of performing a behavioral goal and the higher the level of self-efficacy, the greater the confidence an individual has in the ability to succeed at a goal and the greater the probability of achieving the goal (Pirolli, 2016).

In another study, a mHealth technology was used in dietetic practice to support the delivery of nutrition care in patient care. The study was aimed at determining the feasibility of an intervention that consisted of education and integration of mobile apps in improving the dietitians' perceived self-efficacy while using these mHealth apps (Chen & Allman-Farinelli, 2019). Dietitians in this study pointed out that, in part, their lack of motivation and subsequent low self-efficacy toward using apps were because they were unsure of the best apps to use in their field. Workshops designed for coaching and training the dieticians would enable individuals to gain mastery and proficiency in requisite skills and thus increasing their self-efficacy toward new innovations. Mastery experiences to build confidence in and individual's abilities through successful activities are among the most effective influences on self-efficacy and repetitive practice of certain behaviour can facilitate mastery experiences. The study found that integrating mHealth apps with existing dietetic

practice and systems may motivate dietitians to adopt mHealth innovations into their practice with a chance of building self-efficacy for their use (Chen & Allman-Farinelli, 2019).

Hansen (2015) conducted a feasibility pilot study on the use of complementary therapies delivered via mobile technologies on Icelandic surgical patients' reports of anxiety, pain and self-efficacy in healing. Complementary therapies such as relaxation technique, massage, guided imagery and acupuncture have been shown to benefit patients undergoing surgery. The aim of the study was to determine the feasibility of using audio relaxation technique, music intervention, nature video application with music and nature video application without music delivered via mobile technologies in a clinical setting (Hansen, 2015). The results of the study revealed no statistical differences in the patients' perceived self-efficacy between the groups from the first day to pre-operative visit but there was a significant increase in self-efficacy from pre- to post-operative visit and a significant increase from pre-operative to tenth (10) day follow-up appointment. This was a novel study in regards to the use of nature scenes delivered via an iPad for SDS patients coping with anxiety, pain, and self-efficacy in healing. This significant finding of an increase in self-efficacy for the ART group and NVAM over a period of six days is to be noted and further investigated. Overall, 33 participants (31%) of the 105 participants enrolled in the study reported that they had previous experienced in the use of complementary medicine. This indicates the Icelandic adult population is open to complementary or other alternative ways of healing. This number of participants may possibly have swayed the approached population to participate in this study (Hansen, 2015).

Based on previous studies, it was evident that mobile health innovations are capable of increasing perceived self-efficacy in different aspects of health, whether it was in communicable or non-communicable diseases. Communication using mobile text messaging can represent the verbal persuasion which was an important factor in the theory of self-efficacy. As seen in the study done by Chen & Allman-Farinelli (2019), coaching and training was a key component in increasing mastery experience, which would subsequently increase the confidence levels of using the

mobile apps (Chen & Allman-Farinelli, 2019). The uptake of Text for Adherence system was preceded by counselling of the patient by the health care worker before the patient could consent to receiving messages. The constant receiving of messages and responding to these messages for long duration of time is assumed would expose the users of the system to mastery experience and eventually lead to change in behaviour.

2.5 Empirical review of relevant studies

Mobile phone text messaging has been recommended and applied as a means of promoting medication adherence for all kinds of conditions, for example tuberculosis (TB) (Nglazi, Bekker, Wood, Hussey, & Wiysonge, 2013), HIV positive people on Antiretroviral Therapy (Abdulrahman, S. A.; Rampal, L.; Ibraham, F.; Radhakrishnan, A. P.; Shahar, H. K.; Othman, N., 2017) and other long-term chronic illnesses (Free, C; Phillips, G; Galli, L; Watson, L; Felix, L; Edwards, P; Patel, 2013). Patients who do not adhere to medication and appointments often do not achieve sufficient health outcomes due to non-compliance (Choi, A.; Lovett, A. W.; Kang, J; Lee, K.; Choi, L, 2015). Non-adherence can be referred to as intentional, which could be caused by discouragement when they do not receive expected or immediate results. Adherence can also be unintentional, usually caused by carelessness or forgetfulness but unfortunately non-adherence affects patients negatively in most cases whether it was intentional or not (Choi, A.; Lovett, A. W.; Kang, J; Lee, K.; Choi, L, 2015).

There are a number of conditions whose treatment takes long periods of time and thus if not adhered to may affect treatment outcomes. For example, the treatment of TB takes at least six months long and sometimes the process may be complicated by high burden of pills and thus patients may forget to take their pills. Mobile phone text messaging has the potential to promote the adherence of TB treatment (Nglazi, Bekker, Wood, Hussey, & Wiysonge, 2013) and medication reminder systems may be helpful especially in cases where non-adherence was unintentional (Choi, A.; Lovett, A. W.; Kang, J; Lee, K.; Choi, L, 2015). In a systematic review done by Choi, et al. (2015) the researchers' results revealed that various mobile based

applications were helpful in improving patient adherence. In the review, they lined adherence to quality of life.

Mobile phone text messaging has been used as reminders for appointments or medication to improve adherence and treatment outcomes for communicable and non-communicable diseases. Mobile apps or mobile based systems in the area of wellness and health and therefore they are not limited to patient's alone. However, stigma, discrimination and poor adherence all remain a stumbling block to the success of many treatment programs (Abdulrahman, S. A.; Rampal, L.; Ibraham, F.; Radhakrishnan, A. P.; Shahar, H. K.; Othman, N., 2017). Recent innovations using mobile phone text messages to improve medication adherence among PLHIV or patients' on ART have been implemented in many countries with high quality evidence suggesting efficacy of text messages to patients in improving adherence as compared to the standard treatment care (Abdulrahman, S. A.; Rampal, L.; Ibraham, F.; Radhakrishnan, A. P.; Shahar, H. K.; Othman, N., 2017). One randomized clinical trial done by Abdulrahman, et al. (2017) in Malasia on HIV positive patients on ART, an intervention consisting of SMS and telephone call reminders by trained research assistants for a period of 24 consecutive weeks. This started from date of ART initiation and it also included adherence counseling at every clinic visit. The length intended for each follow up was 6 months where data on adherence behavior of the patient was collected (Abdulrahman, S. A.; Rampal, L.; Ibraham, F.; Radhakrishnan, A. P.; Shahar, H. K.; Othman, N., 2017).

This clinical trial had a lot of similarities to this study since it targeted the same population of PLHIV and on ART. It had automated reminder messages with the goal of improving adherence. The care and treatment procedures used for both were World Health Organizations and countries' local guidelines. Another similarity for both is that one needed to have a valid phone number, which could be a shared number within the family so long as no two people in the family are enrolled. To be included in the study, one had to be enrolled in the facility of study and had to consent to receive messages. The primary outcome of the study was improved adherence both in clinic attendance and uptake of medication. The conclusion for the study was that mobile phone reminders, with SMS or telephone call reminders

together with counseling are effective in improving adherence and treatment outcomes among PLHIV in Malasia (Abdulrahman, S. A.; Rampal, L.; Ibraham, F.; Radhakrishnan, A. P.; Shahar, H. K.; Othman, N., 2017).

In another previous published protocol for a randomized control trial by Islam, et al. (2014), they aimed at measuring the impact of a mobile phone SMS service on treatment success of newly diagnosed type 2 diabetes in an urban area in Bangladesh (Islam, S.M. S.; Lechner, A.; Ferrari, U.; Froeschl, G.; Alan, D. S.; Holle, R.; Seissler, J.; Niessen, L. W., 2014). Another very similar randomized trial by Bobrow, et al. (2016), mobile phone text messages to support treatment adherence in adults with high blood pressure. This study was slightly different to most literatures that were reviewed in that the study population were randomized into three categories. There were those that received information-only SMS text messages, those that received interactive SMS text messages and those that received usual care with no mobile text messages (Bobrow, K; Farmer, A. J.; Sprnger, D.; Shanyinde, M.; Yu, L.; Brennan, T.; Rayner, B.; Namane, M.; Steyn, K.; Tarassenko, L.; Levitt, N., 2016). Those who received usual care were similar to those that were used in the control group for this study. This study by Bobrow, et al. (2016) targetted patients with high blood pressure living in low-income communities around Cape Town. The messages were designed to address common issues as shown in previous literature of lack adherence to treatment. The SMS text messages used in the intervention were developed, translated, and tested in English, isiXhosa, and Afrikaans, which were the three most commonly spoken languages by people living in Cape Town (Bobrow, K; Farmer, A. J.; Sprnger, D.; Shanyinde, M.; Yu, L.; Brennan, T.; Rayner, B.; Namane, M.; Steyn, K.; Tarassenko, L.; Levitt, N., 2016). This aspect of language was very similar to this study. The choice of the three facilities included in this study in Homa Bay County in Kenya was because they were the only three facilities where the people were receiving text messages from the T4A system had a choice of three languages, English, Swahili and Dholuo. The initial content development was done in English and then translated to Swahili and Dholuo but no other materials including the consents to receive the text messages from the T4A system were translated from English.

The difference with the randomized group of patients in the Cape Town study that was receiving interactive SMS text messages was the option of canceling or changing their appointments and changing the timing and language of the text messages. This was quite an innovative feature of their intervention. All the materials used in that study included information sheets and consent forms were in all the three languages, English, isiXhosa and Africaans (Bobrow, K; Farmer, A. J.; Sprnger, D.; Shanyinde, M.; Yu, L.; Brennan, T.; Rayner, B.; Namane, M.; Steyn, K.; Tarassenko, L.; Levitt, N., 2016). All SMS text messages were tracked and any undelivered messages were followed up with a phone call to a friend or relative to obtain a new mobile phone number. This trial demonstrated that behavioral intervention to support adherence to blood pressure treatment through an automated SMS text message platform can improve adherence and decrease blood pressure at a 12 month period.

As it has been demonstrated in previous literature in this study, nonadherence to ART can lead to poor health outcomes, decrease in life expectancy and therefore increasing the risks of transmission and decrease in viral load suppression (Dowshen, Kuhns, Johnson, Holoyda, & Garofalo, 2012). In a pilot study conducted by Dowshen, et al. (2012), they used a pre-post design at a community-based health center that was providing clinical services to youth living with HIV/AIDS in Philadelphia, United States of America (USA). The purpose of the pilot study was to evaluate the feasability, acceptability, and preliminary efficacy of short messsage service or text message reminders to improve adherence to ART for youth aged 14 to 29 years living with HIV/AIDS with demonstrated poor ART adherence (Dowshen, Kuhns, Johnson, Holoyda, & Garofalo, 2012). They defined poor adherence as missing more than 3 medication doses in the last month, or mssing any doses in the last month and not achieving viral suppression after 24 weeks of an appropriate regimen, or documented poor adherence by a clinician. In this study by Dowshen, et al. (2012), patients worked with the study coordinator to design personalized SMS reminder messages, which were then programmed to be delivered at a time specified by the patient. They also designed personalized follow-up message that would be sent one hour after the initial message to assess whether they took their medication. Participants were able to contact their study coordinator at any time throughout the study period to change the message or to reprogram the message

if their mobile phone service was ever interrupted. The main outcome of interest was increase in adherence measures seen as early as 6 weeks and sustained all through the 24 week period of study. It demonstrated that daily, interactive, personalized text message reminders were feasable and acceptable as tools to help youth living with HIV/AIDS in adhering to ART (Dowshen, Kuhns, Johnson, Holoyda, & Garofalo, 2012).

The literature above demonstrates that mobile phone text messaging interventions have been used to improve adherence for communicable and chronic diseases. There is limited literature on mobile phone text messages on perceived self-efficacy for treatment for both communicable and non-communicable diseases.

2.6 Critique of existing literature relevant to the study

Involving the client is critical for optimal treatment and management of long-term chronic diseases. Providing the client with information enables them to decide whether to adhere to prescribed schedules, and medication (Newby, L. K.; LaPointe, N. M. A.; Chen, A. Y.; Kramer, J. M.; Hammill, B. G.; DeLong, E. R.; Muhlbaier, L. H.; Califf, R. M., 2005). It therefore becomes critical to encourage and support health care consumers to adopt healthy behaviours and to self-manage chronic diseases (Free, C; Phillips, G; Galli, L; Watson, L; Felix, L; Edwards, P; Patel, 2013). Due to limited resources including human, health facilities and time, the amount of information, encouragement, and support that can be conveyed during consultations, within existing service infrastructures or through other traditional media (such as leaflets), is inadequate particularly in the low resource settings. Mobile technologies are a means for providing individual level support to health care consumers. Mobile health interventions for health care consumers have been designed to increase healthy behaviour, or improve disease management (for example, by increasing adherence to prescribed medication, improving management of diabetes or asthma, or delivering therapeutic interventions) (Free, C; Phillips, G; Galli, L; Watson, L; Felix, L; Edwards, P; Patel, 2013).

Several studies and systematic reviews have shown that mHealth innovations have potential to improve adherence to treatment because they are easy to use, they are

cost effective, they address issues of forgetfulness, and that they can be accessed at any given time and place (Anglada, Riu, Martin, Rovira, & Sotoca, 2015) (Free, C; Phillips, G; Galli, L; Watson, L; Felix, L; Edwards, P; Patel, 2013) (Horvath, Azman, Kennedy, & Rutherford, 2012) (Ingersoll, et al., 2015) (Strandbygaard, Thomsen, & Backer, 2010). Evidence has showed that when the mobile applications require patients to enter information in the applications themselves, this may be very time consuming and inconvenient if the users do not have the necessary skills to type or enter information. This then increases the chances for making errors and poor quality information. It therefore makes it easier for patients when information is automatically populated, either from an Electronic Medical Record or from a central system. (Choi, A.; Lovett, A. W.; Kang, J; Lee, K.; Choi, L, 2015).

With mobile innovations, the main primary concerns are always privacy and security of the patient information shared in the platforms. Some popular applications may retain personal health records and do not provide passwords for security (Choi, A.; Lovett, A. W.; Kang, J; Lee, K.; Choi, L, 2015). Unfortunately, policies and regulations may not address adequately when it comes to privacy and security of health information. Studies have suggested the development of more specific and suitable policies and regulations (Choi, A.; Lovett, A. W.; Kang, J; Lee, K.; Choi, L, 2015) so as to protect patient information and this would most likely assure patients or mobile applications' users that may be in doubt. In Kenya, the standards and guidelines for mHealth systems stipulate that all data collected using mHealth applications must be protected and should be done according to the laws governing protected health information and personally identifiable information (MOH, 2017). There have been calls for offering more in-depth technology knowledge for children to make, design and build innovative technologies (Livari, Molin-Juustila, & Kinnula, 2016) and therefore most innovators of technologies are usually young and fresh from school or college. The challenge is that most of these young developers or health information technology innovators may not have appropriate knowledge or experiences when it comes to mobile privacy and security policies or guidelines in both the development and management of the information. In addition to this, many users of these innovations may not be aware of the lack of security when it comes to

the sharing of their personal health information (Choi, A.; Lovett, A. W.; Kang, J; Lee, K.; Choi, L, 2015).

This study examined the effect of mobile phone text messaging reminders on perceived self-efficacy for treatment among PLHIV. Self-efficacy is achieved over time through behavior change. In one cluster randomized controlled trial done in Kenya, the research team studied the effect of mobile phone text message reminders on Kenyan health workers' adherence to malaria treatment guideline. Their findings showed that simple one-way communication using text message reminders sent to the health care workers personal phones improved on the quality of management. This was noted on both short term and long term effect of the interventions with improvements showing even 6 months afterwards (Zurovac, et al., 2011). While this study was targeted to health care workers, it did not disqualify that mobile text messaging would have the same impact on patients. The same study however noted that text messaging should not replace the traditional package of care-management interventions like training, supervision, dissemination of guidelines and job aids. Zurovac, et al. (2011) recommended that text message reminders should complement existing interventions (Zurovac, et al., 2011). Due to the high penetration of mobile phones in Kenya (CAK, 2020), any mobile based technologies still provides a great platform for targeted health interventions and it does not really matter the nature of the epidemic (Abdulrahman, S. A.; Rampal, L.; Ibraham, F.; Radhakrishnan, A. P.; Shahar, H. K.; Othman, N., 2017).

From the literature reviewed in this study, none showed how demographic characteristics influences adherence to medication. One thing that the literature highlighted was that this study had not factored the impact of perceived security and privacy of information that is shared on the mobile platform. These two factors can be included in the demographic characteristics of the study. There has not been any other study undertaken that examines the effect of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County or anywhere else in Kenya.

2.7 Research gaps

Recent studies have shown that text messaging is one of the most accessible, feasible, and effective mobile phone-based technology for delivering health interventions (Amankwaa et al., 2018; Cole-Lewis & Kershaw, 2010). However, there is limited literature that goes further to evaluate determinants of self-efficacy that promote health outcome on lifelong disease using the mHealth innovation. This study sought to evaluate the relationship between mHealth innovation, its design and implementation and self-efficacy for treatment adherence among participants particularly PLHIV in Kenya. Nevertheless, study by Mahatanankoon & O' Sullivan (2008) that examines determinants of user attitude regarding text messages are lagging behind the widespread use of text messages. However, there is need to establish relationship between various facets that text messages hold; which may include frequency, timing, language and context of messages and the potential to tailor mobile text messages to optimize the effectiveness of Mobile-Health Technology, for Health Behavior Change or Disease Management Interventions for Health Care Consumers specifically in developing countries.

According to Free et al. (2013), existing systematic reviews of mHealth interventions focus on the application of specific devices (e.g., mobile phones), specific mobile technology functions (e.g., text messaging), or individual diseases or types of illness (e.g., diabetes care or chronic disease management) whose reviews require updating. Some types of interventions for health care consumers targeting healthy behavior or disease management have not been covered by previous reviews (Free, C; Phillips, G; Galli, L; Watson, L; Felix, L; Edwards, P; Patel, 2013). There is therefore need for more research that goes beyond providing applications that provide health promotion to ensuring security and privacy of mobile based innovations and how patient information is secured while being shared. HIV/AIDS is still a disease that has stigma attached to in Africa, Kenya included. A study done in Western Kenya to investigate the stigma Index of People Living with HIV survey found 1086 people living with HIV in 2009 to 2010 and established that 30% of respondents reported experiencing stigma in the past year and that 50% of respondents blamed themselves for their infection, including nearly 1 in 5 who reported feeling suicidal (Mc Henty et

al., 2017). Consequently the need to investigate what has been done globally to protect patient health data; including modifying text messages to encourage and support self-management, which allow patient control and taker over responsibility of a lifelong disease as data is being pooled across mobile platforms. For example, what technologies were used to secure the data, how was the content designed to ascertain privacy of information and what policies and regulations exist to protect patient information. There is slight evidence that sensitized or involved patients in the privacy of their data when sharing information on mobile based platforms or systems (Choi, A.; Lovett, A. W.; Kang, J; Lee, K.; Choi, L, 2015)). This kind of information would inform various ministries of health on what policies they could adopt to protect their own patients' information.

2.8 Summary

mHealth innovations are critical in promoting adherence to treatment. Legal frameworks, empirical and theoretical literature either explicitly or implicitly provide evidence that there are key elements of mHealth innovations that need to be considered in designing and implementing such innovations. Key among them; was the type of messages and language used in the innovation, the timing of the solution and frequency of the messages. These four are the key independent variables in this study. Demographic characteristics determine the readiness of an individual to take up and use an innovation. This study examined how demographic characteristics influenced the process and outcomes of perceived self-efficacy for treatment among participants in the T4A project.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This section addresses the methodology that was used in the study, which includes the research design, hypothesis, and population, sampling frame, inclusion and exclusion criteria, sample size calculation, sampling procedures, validity and reliability, instruments of data collection, data collection processes and analysis.

3.2 Research design

This study used a quasi- experimental design. Quasi-experimental designs can be prospective or retrospective studies that enable participants, and in this case patients, to self-register into a group or cluster instead of being randomized. The most common quasi-experiment designs are retrospective study of a single treatment group that would be compared with a non-equivalent group that can either be self-registered into the group or a provider or health care worker and select or register them on behalf of the patients or participants (Maciejewski, 2020). In this study, there was the intervention group which comprised of PLHIV who have consented to receive mobile phone text messages through the T4A system and are receiving care and treatment from the three facilities which were part of the T4A study.

The other group comprised patients who were receiving care and treatment from the three facilities which were part of the T4A study but were not receiving messages through the T4A system. The control group was compared with the intervention group in assessing the overall influence of the mobile phone text messaging through T4A on perceived self-efficacy for treatment among PLHIV. Quasi-experimental design suited best due to lack of randomization of the participants at the implementation stage. The independent variable was manipulated but participants were not randomly assigned to conditions or orders of conditions (Cook & Campbell, 1979). The rest of the factors remained constant.

Because of the in-depth nature of the T4A implementation, the findings of this research shed light on aspects of human thinking and behavior development resulting from the T4A intervention. The study included a control group that makes it possible to compare with those using the T4A intervention. Assuming that the two groups were initially equivalent, the researcher can compare their performance. In this design, it became easier to determine cause and effect. When you decide to use this design, you must be certain of the dependent and independent variables and guard against the influence of extraneous variables (Kombo & Tromp, 2006).

The independent variable was manipulated before the dependent variable was measured; therefore, the use of a quasi-experimental research eliminated the directionality problem. In research directionality problem is where two variables are being studied and it is becomes challenging to exactly know which one is the cause and which one is the effect. But because participants in the implementation were not randomly assigned—making it likely that there were other differences between conditions—quasi-experimental research does not eliminate the problem of confounding variables.

This study ensured that extraneous factors were controlled by narrowing the study period to between 2017 and 2019. In terms of internal validity, therefore, quasi-experiments are generally somewhere between correlational studies and true experiments. However, the choice of this design is appropriate because participants in the implementation of the T4A project were not randomized. Participants in this study were randomly sampled within the control and intervention group.

3.3 Population of the Study

In any study there is usually a defined population upon which a sample is properly selected using different methodologies. This sample is usually referred to as the target population (Banerjee & Chaudhury, 2010). The target population in this study was PLHIV who accessed HIV care and treatment services at the three facilities namely Gongo, Ogongo and Kiasa in Homa Bay County in Kenya. The three facilities were part of the initial implementation of the T4A system. These were the only three facilities that took up the use of the T4A system. These facilities provided

patients with the option of selecting any of the three languages, that is English, Swahili and Dholuo.

There were 980 PLHIV who had consented to receiving appointment messages using the T4A intervention across the three facilities and had been part of the T4A for more than 2 years. Specifically, the numbers of consented clients per facility were as follows; Ogongo 402, Gongo 118 and Kiasa 460 clients. This study also included a control group. The control group comprised of 1,195 PLHIV from the same facilities (Ogongo 551, Gongo 288 and Kiasa 356) that had not consented to receive mobile text messages on T4A in total the facilities had a population of 2175 PLHIV.

Inclusion criteria for the intervention group was PLHIV, accessing services at the three participating facilities, aged 18-65 years, of either sex, who had consented to be enrolled in the Text for Adherence system and to receive messages from the platform, had a mobile phone or had access to a mobile phone and were able to give written informed consent for participation in the study. They needed to have been part of the intervention for a period of 1 (one) year or more. For the control group, inclusion criteria included participants accessing services at the three facilities, aged 18-65 years of either sex who had not consented to be enrolled in the Text for Adherence system and were able to give written informed consent to participate in the study. Individuals less than 18 years meeting the criteria above whose parents/caregivers assented on their behalf also were allowed to participate. They had received care and treatment in those facilities for a period of 1(one) year or more.

3.4 Sampling frame

The T4A system that was being used as the mobile phone text messaging platform was collecting data that was stored in a database. This data in the study is referred to as program data. Based on program data from the selected facilities and from the T4A database on the current people receiving HIV care and treatment, the total population of PLHIV that were receiving care and treatment in the three selected facilities was a total of 2,175. Forty-five (45%) of these 2,175 had consented to receiving messages while 55 per cent were not receiving messages.

3.4.1 Sample and sampling techniques

The formula for quasi experimental design sampling was applied as follows;

$$n = \frac{2(\acute{p})\,(1-\acute{p})(Z\alpha + Z\beta)^2}{d^2}$$

Where:

n = Sample size in each arm

$\acute{p}$ = Measure of variability (from 90% adherence to 94.5% adherence)

Zα = 1.96 (critical value at 95% confidence interval and 0.05 significance level)

Zβ = 0.84 (critical value at 80% desired power)

d= 4.5% (Effect size of the intervention /difference in proportion)

A study in Kenya found out that overall, less than 10% of Kenyans aged 15–64 years on ART were not adhering to their HIV medication, highlighting the success of the Kenyan national ART program (Mukui et al., 2016). This study therefore assumed that the T4A system would have an effect of 4.5% improvement.

The sample size for the study was 698 individuals.

Considering population proportion of individuals within the intervention and control group as well as the facilities, the expected sample sizes were as shown on Table 3.1.

Table 3.1: Sample size calculation

Study site	Control group expected sample size	Intervention group expected sample size	Total expected sample size
Gongo dispensary	90	38	128
Kiasa Health Centre	116	150	266
Ogongo sub-County hospital	175	129	304
Total	**381**	**317**	**698**

3.4.2 Sampling procedure

The three facilities were included by consensus because they were the only facilities where implementation of the T4A was initiated and have used the system the longest. They were also the only three facilities that provided the option of three languages, English, Swahili and Dholuo. Stratified random sampling was used to sample study participants for the quantitative survey. The stratified random sampling technique involved first dividing a population into sub-populations based on facilities (Gongo, Ogongo and Kiasa) where they were receiving care. The second task was to divide the participants into intervention group or control group. This was based on whether they were enrolled on T4A or not.

This was followed with random sampling methods to each subpopulation (intervention and control) per facility to form the sample that participated in the study. Stratified random sampling ensures that subpopulations are proportionately represented and accounts for the differences in subgroup characteristics (Oso & Onen, 2016). It was relevant for this study in the reduction of sampling errors, increasing representativeness of the population characteristics and reduced travel and other costs of data collection.

One disadvantage is when researchers cannot classify every member of the population into a subgroup. In this study it was easy to stratify participants because they are enrolled at the specific facilities. Research assistants stationed at the health facilities in collaboration with the healthcare workers at the Comprehensive Care

Centers (CCCs) came up with a sampling framework based on how clients were being scheduled for appointments to the health facility for the weeks the researcher and the research assistants were at the facility. The CCCs are specific clinics within health facilities where PLHIV receive care. The study involved systematic sampling whereby on a daily basis, every third client appearing at the facility from the appointment list or any client who showed up for care and treatment that was not on the appointment list was recruited upon provision of consent until the sample size for the facility was reached. This approach was considered as the most appropriate because it did not interfere with the normal running of activities at the facilities and that it did not inconvenience clients by requiring them to come on days when they had not planned. Moreover, the approach avoided biases in recruiting participants because it was objective and simple based on how clients were already scheduled to come in to the facility for care. This provided participants with an equal chance based on the proportions allocated per facility (Creswell, 2014) (Kothari, 2004).

3.4.3 Key Informant Interviews

Participants in the Key Informant Interviews were recruited through purposive convenient sampling. The participants were supposed to have had experience with the text for adherence system in Homa Bay County. The targeted respondents for the qualitative study as per cadre or group are presented in Table 3.2.

Table 3.2: Qualitative study participants

Cadre	Number of participants
Healthcare providers	6
Program staff from EGPAF	2
County staff	2
Total	10

The six (6) health care service providers were the actual users of the T4A system. Each of the three facilities had two users. A higher number, more than two per facility and six overall could not have been realized from the three facilities.

The two (2) key program staff from EGPAF were the Homa Bay county technical adviser on adherence and the program officer in charge of the three facilities. These

were considered key as they were they main individuals who were directly involved in the implementation and management of the T4A system in the three facilities.

The two (2) County staff were the County AIDS and STI Coordinator and the Sub-County AIDS and STI Coordinator in charge of the three facilities.

3.5 Data collection procedures

Data collection procedures factored in all the considerations in making sure that the data and patient information was protected. There are several research procedures in social science research as expounded by (Nachmias & Nachmias, 1996). These include observational methods, survey research, which incorporates personal interviews and questionnaires, secondary data analyses, and qualitative research. The procedure adopted in this study involved combining both quantitative and qualitative data. Both methods were applied concurrently for triangulation of findings. Whereas focus is put on methods equally, in practice, priority is given to one method. In this study questionnaires were administered to patients while key informant interviews were administered to health managers at county level and EGPAF as well as among service providers in participating health facilities. The advantage of using concurrent technique is that shorter time and resources are used to collect data.

Upon signing of the consent form, participants were taken through the questionnaire with the guidance of a trained researcher. Given that the intervention was conducted in a rural county of Homa Bay, the questionnaire was administered by a researcher and the research assistants to avoid the challenges of inability to read among participants. No patient personal identification information was collected. Quantitative data was collected electronically using the Hoji platform. Hoji is an application hosted on an Open Data Kit platform with inbuilt data validation checks which ensured data integrity during abstraction. The platform also provided live dashboards where the researcher and the supervisor were able to supervise data collection process by the research assistants. This ensured that any changes in the data collection processes were noticed in good time so that they were addressed within the shortest time possible. Qualitative research involved discussions between

researchers and the respondents. Notes were recorded for transcription, translation and analysis.

3.6 Data Collection Instruments

The study used a key informant interview guide and a questionnaire. A file review was also done to collect data on appointment information. The data was used to validate the information collected from the patients through the questionnaire.

3.6.1. Key Informant Interview Guide

Key informative interviews usually involve interviews with selected group of individuals whose intention is to provide needed insights or information within a particular subject matter. These interviews are usually qualitative in nature and usually target people that know what is going on in the community. The purpose of these interviews is usually to collect information from a wide range of people ranging from professional, field experts, community leaders and residents within a community. Key informant interviews can be conducted face-to-face or through telephone interviews (Kumar, 1989). In this study, a key informant guide provided guidance to the interviews with experts who designed the T4A intervention and the service providers at the health facilities. The key informants were people with key information regarding the technical aspects of the T4A system and how it was implemented. A total of 10 key informant interviews were conducted among participants indicated above. The total number of key informants was guided by the total number of stakeholders that contributed to the implementation of the T4A system. The stakeholders considered as key informants are the health care workers that work with PLHIV, the implementing partner in charge of supporting the particular facilities, in this case Elizabeth Glaser Pediatric AIDS Foundation (EGPAF), the county officers that are key stakeholders to the success of the implementation, individuals who participated in the content development and finally technical developers of the system. A key interview guide (Appendix 2) was used to explore the design, implementation strategies that are part of the T4A solution that are aimed for improving self-efficacy among participants.

3.6.2 Questionnaire

In this study we utilized a detailed questionnaire with questions designed to answer to our broad and specific objectives. The content of a questionnaire must relate to the broad research question and the researcher needs to familiarize with relevant local and international works on the research area (McGuirk, 2016). A survey questionnaire was administered to participants in both control and intervention group. The questionnaire aimed at looking at the use of the T4A solution, aspects of the T4A solution, demographic characteristics, and self-efficacy assessment data. A structured survey questionnaire (Appendix 3) was used to collect data on the key variables that were used to measure relationships. The questions that were attempted to evaluate each of the stated variables. The Likert scale used to measure the perceived self-efficacy was guided by the General Self-Efficacy Scale (GSE). This scale was a self-report measure of self-efficacy. According the Schwarzer & Jerusalem (1995), the internal reliability for GSE = Cronbach's alphas between .76 and .90. The validity of the General Self-Efficacy Scale was correlated to emotion, optimism, and work satisfaction. Negative coefficients were found for depression, stress, health complaints, burnout, and anxiety. The guidance given for scoring was, (1) Not at all true, (2) Hardly true, (3) Moderately true, and (4) Exactly true. The highest score of (4) would indicate more self-efficacy with a (1) indicating no efficacy. (Schwarzer & Jerusalem, 1995)

3.6.3 File Review

A clinical record review or a file review is usually a process that is aimed at obtaining retrospective data to clarify or answer clinical questions. It is referred to as chart review, clinical chart review or retrospective data analysis. It is widely used in clinical disciplines (Sarkar, 2014). While this was not a clinical study, a file review was necessary to validate the number of appointments kept by the patients included in the study. The file in this study was the "green card". The cards are normally used in health facilities providing HIV services. All the appointment schedules and attendance are recorded on the green card. In this study the file review focused on the green card where patient appointment details are recorded. The green card review

was conducted to retrieve enrolment date of the participant to the facility, appointment dates and outcomes for a period of one year from the enrolment date into the T4A platform for the intervention group and enrolment date at the facility into care for the control group.

The research assistants were provided with a file review table (Appendix II) that guided them on the information they needed to collect.

3.7 Ethical consideration

This study ensured that all necessary approvals were obtained through the appropriate departments at the Jomo Kenyatta University of Agriculture and Technology. Further ethical approvals for the collection of data were requested and approved by the National Commission for Science, Technology and Innovation (NACOSTI). Since this study was being conducted in Homa Bay County, approvals were granted by the Director of Health Services in the county.

Key staff who included the research assistants involved in the data collection underwent human subjects' protection and protocol-specific training to ensure they understood how to conduct this activity and ensured that confidentiality of all information was maintained and the data was managed, reviewed and corrected appropriately. Facility level Consent/agreement to participate was sought using the participant agreement form (Appendix 4) from the heads of implementing partners or facilities involved before actual data collection begun. Written informed consent (Appendix 1) was separately obtained from all participants invited to participate in the qualitative interviews.

3.8 Data cleaning and preparation

3.8.1 Data cleaning

All audio and handwritten data collected from the workshops and interviews were stored securely. Electronic notes, transcripts and translations were stored electronically and password-protected. Only members of the qualitative research methods team had access to these documents. Consent forms containing identifying

details were kept physically separate from the other data collected, and stored in a locked filing cabinet. Pseudonyms were allocated to all participants and were used throughout the analysis and reporting to protect participants' confidentiality.

3.8.2 Potential Risks and Benefits

The qualitative study did not involve collection of any personalized information. Thus there are no major anticipated potential risks, physical, mental or otherwise. Discussions generally revolved around the use of the system. The findings from the study were beneficial to inform policy in strengthening health systems using mobile technology innovations for better treatment outcomes.

3.8.3 Data handling confidentiality procedures

Only the research assistants had access to the data. All paper forms and electronic databases used in this study were protected by procedures consistent with applicable laws, directives, policies, regulations, and standards in Kenya, where the data was managed. The analytical dataset which was used for data analysis were stored at the mHealth Kenya servers and were treated with the same level of data security as the data set stored at the Ministry of Health (MOH) and the National AIDS and STI Control Program (NASCOP). After the completion of the study, the databases containing data and findings were   housed in the MOH server and were encrypted and password protected using standard security procedures. A dedicated qualified data manager was in charge of database management to ensure that there was security of the data at all times. All members of the study team signed the non-disclosure form (Appendix 5).

3.8.4 Data De-identification

This took place at the data collection stage and all individually identifiable information was anonymized prior to the analysis. The patient's gender and date of birth only was collected for record matching. No personally identifiable information was available during data analysis and reporting. Destruction of the tools and data followed the Ministry of Health destruction policy.

3.8.5 HIV notification policy

A HIV notification policy was not applicable for this study as there was no intention of testing individuals for HIV. The study only evaluated the effect of the T4A system in improving adherence to treatment.

3.8.6 Pilot test

Before embarking on actual data collection, piloting was important to help improve the internal validity of the research instruments (Murray, 2003). A pilot was conducted two weeks before the main data collection activities to test the data collection tools. This gave the researcher enough time to amend any parts of the tools that required editing before the actual data collection activity to ascertain that the study was of quality.

The piloting of the instruments ensured the validity of the instruments. The piloting was conducted in Mbita health facility in Homa Bay County where the current version of T4A was also being implemented. The Mbita health facility was not included in the actual study.

The questionnaire was piloted and at least 55 participants who represented more than 10% of the sample size were interviewed. Cocks and Torgerson (2013) in their study estimated that a pilot trial should have at least 9% of the main study population (Cocks, Kim; Torgerson, David J., 2013) and therefore the 10% sample size in this study was sufficient. Some of the adjustments that were made to the tool preloading the list of the facilities that would be part of study on the hoji tool to prevent typing errors. Farming was also added as an economic activity given that the population in Homa bay was more rural based. An option of "do not have phone" was added with the understanding that losing phones was common. An option was also added to question 35 such that if the respondent is for the intervention group, then the researcher needed to confirm by showing the participants sample T4A message on the phone. This was upon realization that maybe the participants may have been in other interventions that were not necessarily T4A. All questions were phrased in

positive tense for conformity. The statements on the self-efficacy scale were reduced from 13 to 9. This was aimed at curbing repetition and confusion to the participants.

During the pilot, the file reviews were also done for all the 55 participants, which gave the researcher and the research assistants a feel of the interviewing process and approximation of how much time the interviewing process would take. This was important because it helped the research team in planning the actual data collection exercise and the timelines it was expected to take.

3.8.7 Validity and reliability

The piloting was to be critical in assessing both validity and reliability of the tool. Validity of an assessment was the degree to which it measures what it was supposed to measure, (Kramer, 2009). Through piloting it was possible to tell whether the tool was capturing the correct data or not. Secondly the study used both quantitative and qualitative methods to triangulate data sources so as to check the validity of one instrument against another. Furthermore, content analysis by both the researcher and supervisors was conducted to assess if they generally agreed that the instrument contained items covering all features of the variable being investigated. A validity index may be calculated to ascertain the proportion of items given a rating of quite/very relevant by both raters involved or the proportion of items given a rating of 3 or 4 by both raters involved (Waltz, Strickland, and Lenz, 2005).

To ensure reliability, most of the questions on self-efficacy and adherence in the questionnaire were adopted from previous studies and scales that have been tested and proven to provide accurate data. Additionally, the pilot study was conducted and results obtained from the pilot instruments were analyzed to determine whether or not they capture the required data. Having achieved this, split-half method of estimating the reliability was used. The pilot instruments were divided into two and the precision of scores obtained to indicate how closely participants' scores on the instrument corresponded to their real characteristics. To ensure internal consistency, the scores were subjected to Cronbach's alpha coefficient with which a test score of 0.7 was prescribed as a cut off or benchmark for items to be included in the study

(Bryman, 2011; Cronbach and Richard, 2004). High correlation between the findings of both tests indicates a high reliability of the instrument.

3.9 Data processing and analysis

3.9.1 Quantitative analysis

Descriptive and inferential analysis of quantitative data was conducted using SPSS version 25. Some of the descriptive tests that were conducted include percentages, means and standard deviations. Results of the descriptive analysis are provided in tables on key variables of the study.

Levels of self-efficacy were determined using scores on a 9-question self-efficacy scale that was responded to using a Likert scale. Scores of 4 (exactly true) were considered as indication of high self-efficacy. Scores of 3 (Moderately true) were considered as moderate level of self-efficacy while scores of 2 (hardly true and) and 1 (Not at all true) were considered as low levels of self-efficacy.

A normality test was conducted using the Kolmogorov-Smirnov Test. Based on the results, inferential statistics on the data was done using non-parametric tests. Spearman's rho correlation test was used to test for relationships between independent and dependent variables. Linear regression models were used to show the significance of the independent variables in determining the dependent variable. The general regression model used to prove the null hypothesis for this study, which was;

H_0: Mobile phone texting strategies has no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

$$Y = \left\{ \sum_{i}^{n} \beta_0 + MV \left[\beta_i X_i + \cdots \beta_n X_n \right] \right\} + \varepsilon$$

Where;

Y = dependent variable

β_0 = The intercept

MV = Moderating variable

β_i = Regression coefficients shows the change in the value of Y from a unit change in X

X_i = Independent variables

ε = Random error

The study explored the effects of factors in the five strategies under study to determine if they have influence on perceived self-efficacy. The four objectives were reduced into four factors by computing each set of variables in each objective into one. The resultant variables were then subjected to one regression model and were each subjected to three demographic factors as moderating variables. Before then, the original variables before computing were also subjected to the three moderating factors to ascertain if there was any effect to warrant further investigation.

3.9.2 Qualitative analysis

Qualitative data was transcribed verbatim and translated into English when conducted in Kiswahili. Data was then imported into a qualitative data analysis tool Nvivo version 11 for thematic analysis. Transcripts were coded inductively, clustered to reflect emerging themes, and checked for consistency of interpretation. . Qualitative data was presented in narratives as quotations in the report.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This section presents the findings of the study on the examination of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County in Kenya. The study concentrated on specific objectives; 1) to examine the effect of timing of mobile text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County; 2) to investigate the effect of frequency of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County; 3) to examine the effect of the type of message on perceived self-efficacy for treatment among PLHIV in Homa Bay County; 4) to examine the effect of language of choice of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County; 5) assess the moderating effect of demographic characteristics on the relationship between mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV in Homa Bay County. The chapter also presents the results of the hypothesis that were derived from the four objectives that were investigated in the study.

The chapter starts with descriptions of the respondents and a discussion of assumptions made in the study that would guide analysis and interpretation of the presented result. Data has been analyzed and presented first in descriptive format and then inferential with interpretations of the trends noted. Hypotheses have been tested and discussions made to link the study with the existing body of knowledge. This section is arranged according to research objectives to help the chapter have a logical flow.

4.2 Response rate

A response rate in any research is key and scholars depend on the willingness of the participants to respond to their questionnaires. The goal for any research is to have

the highest response rate as possible but where responding is voluntary, 100% response rates are rarely achieved. The goal for any researcher is to achieve the highest response rate as possible but response rate issues are widely understood (Baruch & Holtom, 2008). The sample size of this study was 698 people living with HIV in Homa Bay County and accessing care in the three facilities namely Ogongo Sub-county Hospital, Kiasa Health Center and Gongo Dispensary. The study achieved a sample size of 543 participants representing an overall 77.79 per cent of the desired sample. The test group achieved a sample size of 77.69 per cent while the control group achieved a sample size of 77.92 per cent.

Within control and test groups sample sizes per facility were achieved as follows: In Gongo, control group achieved 78.89 per cent while test group achieved 73.68 per cent. In Kiasa, control group achieved 79.31 per cent while test group achieved 74.67 per cent. In Ogongo sub-county hospital, control group achieved 76.00 per cent while test group achieved 82.95 per cent of the desired sample size. These results are shared in Table 4.1.

Table 4.1: Achieved sample size by group and facility

Study site	Control group			Test group			Total		
	Expected sample size (N)	Achieved sample size (n)	% (n/N)	Expected sample size (N)	Achieved sample size (n)	% (n/N)	Total (N)	Sample size (n)	% (n/N)
Gongo*	90	71	78.89%	38	28	73.68%	128	99	77.34%
Kiasa*	116	92	79.31%	150	112	74.67%	266	204	76.69%
Ogongo*	175	133	76.00%	129	107	82.95%	304	240	78.95%
Total	**381**	**296**	**77.69%**	**317**	**247**	**77.92%**	**698**	**543**	**77.79%**

*Gongo (Gongo Dispensary); Kiasa (Kiasa Health Centre); Ogongo (Ogongo Sub-County Hospital)

In a study done in 2009, where 463 studies using questionnaires were examined, the response rates averaged around 50%. In fact, scholars have previously suggested that a benchmark of approximately 35% to 40% benchmark should be used (Baruch & Holtom, 2008). The study therefore conclude that an average response rate of

77.79% is good. To achieve this response rate, the researcher and the research assistants had to extend the data collection activity by a week. This was because the data collection started early in the year, a period when appointment keeping was quite low. This may have been attributed by the fact that most parents were concentrating on sending their children to school are were getting back to their homes after a festive season.

4.3 Tests of assumption

4.3.1 Sample adequacy test

It is crucial to sample the right set of variables in order to detect any meaningful issues or underlying structure with any study sampling. A sample adequacy test was conducted on the entire sample as combined and on the samples separately as control and test sample sizes. The test indicated a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.92 for the combined factor analysis, 0.911 for the control group and 0.909 for the test group sample size. These demonstrated that the sample sizes for the study were adequate. Glen, 2007 argues that KMO values between 0.8 and 1 indicate the sampling is adequate, KMO values less than 0.6 indicate the sampling is not adequate and that remedial action should be taken. KMO values close to zero means that there are large partial correlations compared to the sum of correlations. In other words, there are widespread correlations which are a large problem for factor analysis. For reference, Kaiser put the following values on the results: 0.00 to 0.49 unacceptable, 0.50 to 0.59 miserable, 0.60 to 0.69 mediocre, 0.70 to 0.79 middling, 0.80 to 0.89 meritorious, and 0.90 to 1.00 marvelous (Kaiser, The revised measure of sampling adequacy for factor-analytic data matrices, 1981). The sample adequacy test results are shown in Table 4.2

Table 4.2: Sample adequacy tests

Factor Analysis – Combined data (Test plus Control)		
KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.932
Bartlett's Test of Sphericity	Approx. Chi-Square	4833.941
	df	36
	Sig.	0
Factor Analysis – Control group		
KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.911
Bartlett's Test of Sphericity	Approx. Chi-Square	2314.592
	df	36
	Sig.	0
Factor Analysis – Test group		
KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.909
Bartlett's Test of Sphericity	Approx. Chi-Square	1921.415
	df	36
	Sig.	0

It is recommended that values greater than 0.5 are acceptable as any values below this should lead you either to collect more data or rethink which variables need to be included. Furthermore values of 0.5 and 0.7 are mediocre and values between 0.7 and 0.8 are considered good. Any values of 0.8 and 0.9 are great values and above 0.9 are excellent (Kaiser, 1974).

4.3.2 Reliability analysis

The Cronbach's test of reliability on all the nine Likert scale questions used to measure self-efficacy indicate that all the questions had high levels of reliability of above 0.9. Glen (2014) argues that in general, a score of more than 0.7 is usually okay. However, values of above 0.90 are excellent. Reliability test results are presented in Table 4.3 indicating that all the variables were reliable as they had values of above 0.9.

Table 4.3: Reliability test

Reliability Statistics

Cronbach's Alpha

| 0.942 | N of Items | 9 |

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
If I try hard enough, I can always keep all my appointments attended	11.32	48.243	0.663	0.941
No one can influence me not to keep my appointments.	11.39	48.8	0.686	0.939
It is easy for me to stick to my aims and accomplish my goals including keeping all my appointments	11.37	48.365	0.716	0.938
Thanks to my resourcefulness, I know how to handle unforeseen situations so that I keep my appointments	11.27	46.028	0.792	0.934
I can solve most problems if I invest the necessary effort to attend my appointments	11.32	46.487	0.8	0.933
I can remain calm when facing difficulties by relying on my coping abilities to keep all my appointments attended	11.22	45.074	0.825	0.932
When I am confronted with a problem, I can usually find several solutions to keep my appointments	11.31	45.711	0.861	0.93
If I am in trouble associated with keeping my appointments, I can usually think of a solution	11.31	45.931	0.844	0.931
I can usually handle whatever comes my way to keep my appointments	11.35	46.943	0.788	0.934

4.3.3 Normality test

The one sample Kolmogorov-Smirnov test was used to determine whether the sample collected comes from a population that was normally distributed. With a sample size of 247 for the test group, this was the appropriate test compared to the Shapiro-Wilk Test which is more appropriate for small sample sizes (< 50 samples). The test result at p-value<0.001 led to the rejection of the null hypothesis hence the

conclusion that the sample was drawn from a population that was not normally distributed. The normality test summary results are shown in Table 4.4.

Table 4.4: Normality hypothesis test summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of age is normal with mean 40 and standard deviation 10.800.	One-Sample Kolmogorov-Smirnov Test	.001[a]	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .050.

a. Lilliefors Corrected

One-Sample Kolmogorov-Smirnov Normal Test Summary

Total N		247
	Absolute	0.08
Most Extreme Differences	Positive	0.08
	Negative	-0.043
Test Statistic		0.08
Asymptotic Sig.(2-sided test)		.001[a]
a. Lilliefors Corrected		

Figure 4.1 presents the graphical representation of the normality test.

One-Sample Kolmogorov-Smirnov Normal Test

Normal Parameters
Mean 39.9
Std. Deviation 10.80
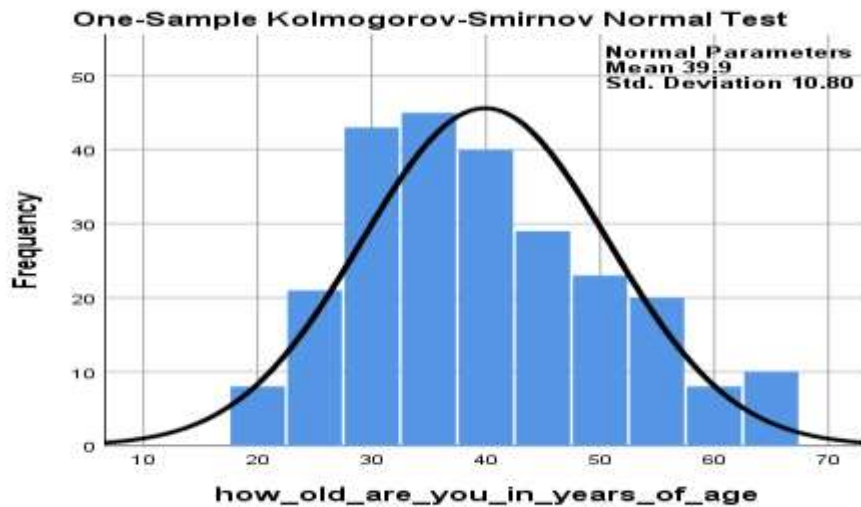
Figure 4.1: Normality test graph

4.3.4 Outliers test

Using age as the key variable to test for outliers the data shows that there were no outliers. The minimum age was 20 while the maximum age was 65. The mean age was 39.91 years (95% CI 38.56-41.27). This age bracket was critical for the study because they could have access to mobile phones. The inclusion criteria for this study was individuals aged between 18 and 65 in line with the Kenya AIDS Indicator Survey 2012 which was a population-based, household survey of persons aged 18 months-64 years conducted in 2012–2013 (National AIDS and STI Control Programme (NASCOP) Kenya, 2012). Summaries of the outlier test are indicated in Table 4.5.

Table 4.5: Outliers test

Descriptive statistics				Statistic	Std. Error
Age in years	Mean			39.91	0.687
	95% Confidence Interval for Mean	Lower Bound		38.56	
		Upper Bound		41.27	
	5% Trimmed Mean			39.61	
	Median			38	
	Variance			116.639	
	Std. Deviation			10.8	
	Minimum			20	
	Maximum			65	
	Range			45	
	Interquartile Range			15	
	Skewness			0.418	0.155
	Kurtosis			-0.501	0.309

Extreme Values

			Case Number	Value
Age in years	Highest	1	69	65
		2	152	65
		3	183	65
		4	230	65
		5	238	65
	Lowest	1	147	20
		2	51	20
		3	14	20
		4	6	20
		5	5	20

4.3.5 Collinearity test

Challenges associated with multi-collinearity inability to assess and determine the actual influence of each variable. Multi-collinearity makes it tedious to assess the relative importance of the independent variables in explaining the variation caused by the dependent variable. As such, a multi-collinearity test helps to diagnose the presence of multi-collinearity. In this study, the collinearity test was conducted and

all the variance inflation factor (VIF) values were greater than 1 and less than 10 indicating that there was no problem of multi-collinearity across all independent variables. Table 4.6 presents the VIF values of all variables.

Table 4.6: Collinearity test

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-0.064	0.087		-0.736	0.463		
	Z-score: (timing)	0.03	0.085	0.032	0.355	0.723	0.709	1.41
	Z-score: (age)	-0.029	0.089	-0.031	-0.329	0.743	0.672	1.488
	Z-score: (religion)	-0.074	0.078	-0.081	-0.955	0.341	0.801	1.249
	Z-score: (income)	0.139	0.078	0.147	1.777	0.078	0.844	1.185
	Z-score: (gender)	-0.075	0.086	-0.077	-0.867	0.387	0.73	1.37
	Z-score: (marital status)	0	0.095	0	0.004	0.997	0.792	1.263
	Z-score(language)	-0.061	0.08	-0.062	-0.764	0.446	0.865	1.155
	Zscore(appointment)	-0.237	0.166	-0.23	-1.426	0.156	0.222	4.511
	Z-score(wellness)	-0.107	0.079	-0.11	-1.362	0.175	0.889	1.124
	Z-score(informative)	-0.031	0.133	-0.037	-0.234	0.815	0.236	4.238
2	(Constant)	-0.111	0.074		-1.505	0.134		
a. Dependent Variable: Z-score(self-efficacy index)								

4.4 Descriptive analysis

4.4.1 Socio-demographic characteristics of the respondents

The questionnaire used in this study was designed to collect demographic information from the participants. There were thirteen questions in this section that were open-ended. They focused on collecting information like gender, age, marital status, religion, number of children and dependents and income. Additionally and specific to this study, it was important to find out if the participant had access to a phone, the main communication service and if the phone is owned by the participants or shared among the family members. This information is crucial as the study was focused on mobile phone text messaging and the lack of access to a phone especially during the period of the study would have meant an individual was excluded from the study. The most important socio-demographic characteristics of the participants of the study included gender, age, marital status, level of education and income as these would be compared with other studies and overall population of people living with HIV in Kenya. Overall, female the sample was comprised of 68.14 per cent women and 31. 86 per cent male. Distribution of female participants was 55.68 per cent control group and 44.32 test group. Distribution of male participants was 52.02 per cent control group and 47.98 per cent test group. Studies among HIV participants including the KAIS 2012, the NACC report of 2018 and KENPHIA report of 2020 show that there is a higher prevalence of HIV among women almost doubling that among males and therefore likely to have higher samples and response rates compared to their male counterparts (**National AIDS and STI Control Programme** (NASCOP) Kenya, 2012) (Ministry of Health & NASCOP, 2020) (National AIDS Control Council, 2018).

In terms of participants' marital status, of those cohabiting, 65.71 per cent were part of the control group while 34.29 were part of the test group. Of those legally married, 47.22 per cent were control group while 52.78 per cent were test group. Among those separated or divorced 55.56 per cent were control group while 44.44 per cent were test group. Participants who were single comprised of 76.47 per cent control group and 23.53 per cent of test group. Of the participants who were widowed, 59.13 per

cent were control group while 40.87 per cent were test group. As per the KAIS 2012 report, HIV prevalence varied significantly by marital status. HIV prevalence was highest among women (20.3%) and men (19.2%) who had ever been widowed. Women who had been separated or divorced (14.5%) and men in polygamous marital relationships (12.1%) also had high HIV prevalence. Women and men who had never married or cohabited had the lowest prevalence rates, at 3.5% and 1.4% respectively (National AIDS Control Council, 2018).

In terms of the participants' highest level of education, of those who had completed primary school, 51.79 per cent were control group while 48.21 were test group. Participants who had completed secondary school comprised of 49.02 per cent control group and 50. 98 per cent test group. Participants who had completed tertiary education comprised of 55.00 per cent control group and 45.00 test group. Of those who had no education at all, 58.82 were control group and 41.18 were test group. Of participants who had not completed primary education, 56.28 per cent were control group while 43.72 per cent were test group. Among participants who had not completed secondary education, 58.93 per cent were control group while 41.07 were test group. The KAIS report shows that HIV prevalence was lowest among women (4.0%) and men (2.4%) reporting no primary education. Among women, HIV prevalence was highest among those reporting secondary or higher education at 7.4%. Among men, HIV prevalence was highest among those reporting complete primary education (4.8%) (National AIDS Control Council, 2018).

On weekly income, 60.00 per cent who had no income at all were part of the control group while 40.00 per cent were part of the test group. Of those who were receiving less than 100 Kenya shillings, 53.68 per cent were control group while 46.32 per cent were test group. Within the income band of 101 to 500 Kenya shillings, 46.61 per cent were control group while 53.39 per cent were test group. In the income band of 500 to 1000 Kenya shillings, 60.00 per cent were control group while 40.00 per cent were test group. In the band of 1001 to 2000 Kenya shillings, 67.19 per cent were control group while 32.81 per cent were test group. In the band of 2000 and above Kenya shillings, 63.16 per cent were control group while 36.84 per cent were test group. Homa Bay being a rural setting, these results indicating low levels of income

are in line with the KAIS (2012) results which demonstrated that in urban households, 89.6% were in the highest wealth quintile and 58.7% fell within the fourth wealth quintile. In contrast, among rural households, the majority fell within the lowest (94.3%), second (87.3%), and middle (76.6%) wealth quintile(National AIDS and STI Control Programme (NASCOP) Kenya, 2012).

Summary of the demographic characteristics are presented in Table 4.7.

Table 4.7: Socio-demographic characteristics of participants

		Control group		Test group		Total	
		Count	Row N %	Count	Row N %	Count	Row N %
Gender	Female	206	55.68%	164	44.32%	370	100.00%
	Male	90	52.02%	83	47.98%	173	100.00%
	Total	296	54.51%	247	45.49%	543	100.00%
Marital Status	Cohabiting/Live-in partners	69	65.71%	36	34.29%	105	100.00%
	Legally/formally married	136	47.22%	152	52.78%	288	100.00%
	Separated/divorced	10	55.56%	8	44.44%	18	100.00%
	Single	13	76.47%	4	23.53%	17	100.00%
	Widowed	68	59.13%	47	40.87%	115	100.00%
	Total	296	54.51%	247	45.49%	543	100.00%
Education	Completed primary school	87	51.79%	81	48.21%	168	100.00%
	Completed secondary school	25	49.02%	26	50.98%	51	100.00%
	Completed tertiary training	11	55.00%	9	45.00%	20	100.00%
	None	10	58.82%	7	41.18%	17	100.00%
	Not completed primary school	130	56.28%	101	43.72%	231	100.00%
	Not completed secondary school	33	58.93%	23	41.07%	56	100.00%
	Total	296	54.51%	247	45.49%	543	100.00%
Income	Ksh 2001 & above	24	63.16%	14	36.84%	38	100.00%
	Ksh 1001- Ksh 2000	43	67.19%	21	32.81%	64	100.00%
	Ksh 501- Ksh 1000	60	60.00%	40	40.00%	100	100.00%
	Ksh.101- Ksh 500	103	46.61%	118	53.39%	221	100.00%
	Less than Ksh. 100	51	53.68%	44	46.32%	95	100.00%
	No income	15	60.00%	10	40.00%	25	100.00%
	Total	296	54.51%	247	45.49%	543	100.00%

4.4.2 Mobile phone text messaging strategies

The text message strategies employed in the project included giving the participants the ability to choose the timing of messages, frequency of the messages, the language and type of messages they preferred. Descriptive statistics on the strategies are presented per specific objective as follows:

Objective 1: To examine the effect of timing of mobile text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County

On the timing of messages, majority of the participants, 37.65 per cent received messages in the morning, while 36.84 received messages in the evening. Only12.55 per cent received messages at noon. It is important to note that these participants were given the option to select the preferred time they wanted to receive their messages when they were being enrolled in the T4A system. Previous studies have shown that timing of messages is crucial maximal impact and effectiveness of the communication (Sano, Johns, & Czerwinski, 2017). Peoples' schedules are varied and the selection of time may be based on a time when one is less busy and able to read messages. In a previous study that studied responses to instant messenger, notifications that were sent at the wrong time were found to be disruptive and therefore designing the messages so that they are sent at a time when they are less disruptive would have more impact and less annoying (Sano, Johns, & Czerwinski, 2017). Table 4.8 shows the descriptive statistics on timing of messages.

Table 4.8: Descriptive statistics on timing of messages

	Timing of messages	
Evening	91	36.84%
I don't know	32	12.96%
Morning	93	37.65%
Noon	31	12.55%
Total	247	100.00%

Objective 2: To investigate the effect of frequency of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County

As shown in Table 4.9 only 8.10 per cent received messages on a daily basis, while two quarters, 11.74 per cent received messages on a weekly basis. Five quarters of the respondents, 66.40 received messages on a monthly basis. From these numbers, it may seem that most people would prefer to receive their messages less frequently and in reference to this study, monthly. But in a previous study, some focus group participants preferred to receive messages every day as long as the sender was able to send as this acted as a reminder. There were those who chose to receive once to three times a week and preferably on weekends as they felt that there were less distractions (Rana, Y.; Haberer, J.; Huang, H.; Kambugu, A.; Mukasa, B.; Thirumurthy, H.; Wabukala, P.; Wagner, G. J.; Linnemayr, S., 2015) In another study on the effect of mobile phone text-message reminders on Kenyan health workers' adherence to malaria treatment guidelines: a cluster randomised trial, messaging was designed such that for 5 working days (Monday to Friday), two text messages (one at 9 am and one at 2 pm) were sent daily (excluding public holidays) to every health worker's mobile phone. The same process was repeated every week for 6 months (Zurovac, et al., 2011). It is not stated if the health care workers had a choice in the selection of time and frequency but one would wonder if they would have chosen to receive the messages that frequently considering the busy schedules that nurses tend to have. On the other hand, if the information being received is supposed to help them increase the efficiency in their work, then the frequent messages would be important.

Table 4.9: Descriptive statistics on frequency of messages

Frequency of messages	(n)	% %
Daily	20	8.10%
I don't know	34	13.77%
Monthly	164	66.40%
Weekly	29	11.74%
Total	**247**	**100.00%**

Objective 3: To examine the effect of the type of message on perceived self-efficacy for treatment among PLHIV in Homa Bay County

Type of message respondents received consisted of information, appointment and wellness messages. Respondents were asked if they received informative, wellness and appointment messages. Figure 4.2 shows the distribution of text messages received by type of messages to respondents.
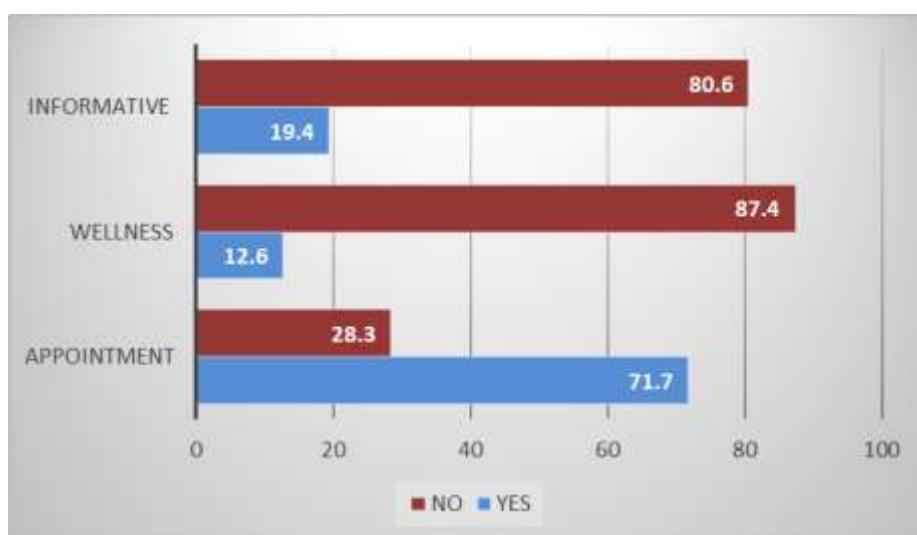
Figure 4.2: Type of messages received

Appointment messages 71.7 percent were the most popular type of messages followed by informative messages (19.4%). The least received type of messages included wellness at 8.4 percent and informative 80.6 percent. The values show that appointment messages 71.7 percent were the most popular with only 28.3 percent of the respondents who reported to not use this type of messages.

Objective 4: To examine the effect of language of choice of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County

Language options were an important variable in this study as it determines the attitude, assimilation and use of messages. . There is evidence supporting the notion that attitude toward information technology influences its usage (Mahatanankoon & O'Sullivan, 2008).   Language of use can determine acceptance of the mobile messages to be incorporated into a participant's lifestyle. Languages of messaging used on mobile phone messages included in the intervention were English, Swahili

and Dholuo. Participants were given the opportunity to select their own language of preference. Findings on language used by participants are shown in Figure 4.3.
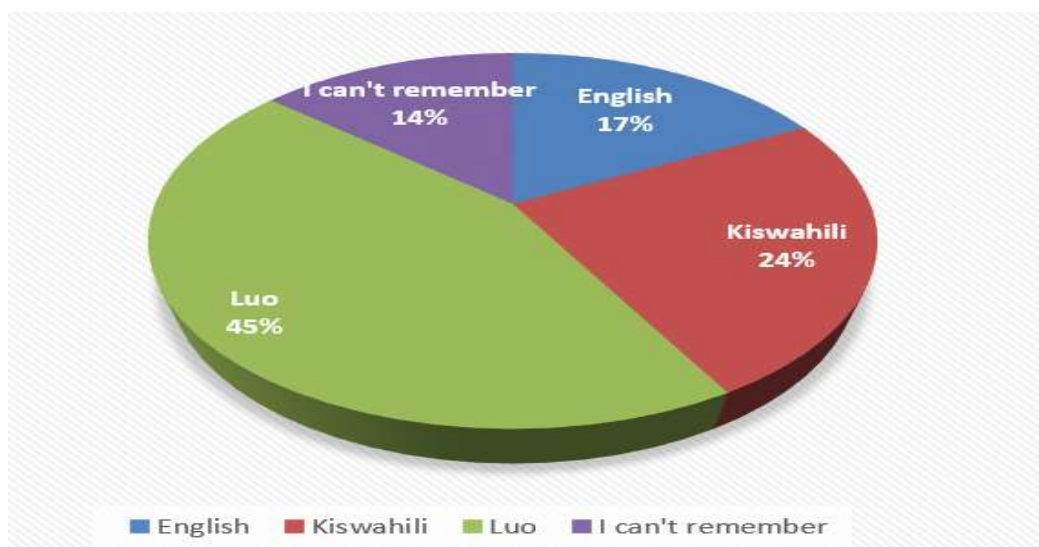
Figure 4.3: Distribution of Messages by Language preference

Two thirds of the population (44.5%), chose to receive message in Dholuo. Kiswahili (24.3%) was the second most popular language used. Only 17.4% of the participants preferred to receive messages in English while 13.8% reported that they were not sure of the language they preferred. One respondent in the qualitative study observed that having given the clients the opportunity to choose their language of preference was a good thing. Health Care workers admitted that patients were able to understand the messages because they had the option of choosing the most comfortable language in which to receive messages.

"No I don't think it was bad because the messages were in a language that the patients chose so it was easy to understand." Health facility user

4.4.3 Perceived self –efficacy

Perceived self-efficacy has been defined as people's beliefs on their capability to perform or influence other events that affect their lives. Those people with high

confidence levels may approach difficult situations as challenges to be mastered and not threats that need to be avoided (Bandura, 1994). To measure the level of perceived self-efficacy this study used nine questions based on a 4 point-Likert scale (1) Not at all true, (2) Hardly true, (3) Moderately true, and (4) Exactly true. The scores were categorized into high, moderate and low level of self-efficacy as follows: Individuals who scored exactly true on the nine questions were classified as having high level of self-efficacy; individuals who scored moderately true were classified as having moderate level of self-efficacy while individuals who scored hardly true and not at all true on all questions were classified as having low level of self-efficacy. Table 4.10 presents the range of perceived self-efficacy among test group.

Table 4.10: Perceived self-efficacy for intervention and control groups

*(1) Not at all true, (2) Hardly true, (3) Moderately true, and (4) Exactly true

	Intervention n (%)			group	Control n (%)			group
Likert scale on self-efficacy	4	3	2	1	4	3	2	1
If I try hard enough, I can always keep all my appointments attended	212 (85.83%)	32 (12.96%)	2 (0.81%)	1 (0.40%)	143 (48.31%)	134 (45.27%)	19 (6.42%)	0 (0.00%)
No one can influence me not to keep my appointments.	217 (87.85%)	26 (10.53%)	3 (1.21%)	1 (0.40%)	151 (51.01%)	125 (42.23%)	17 (5.74%)	3 (1.01%)
It is easy for me to stick to my aims and accomplish my goals including keeping all my appointments	214 (86.64%)	26 (10.53%)	5 (2.02%)	1 (0.40%)	139 (46.96%)	134 (45.27%)	22 (7.43%)	1 (0.33%)
Thanks to my resourcefulness, I know how to handle unforeseen situations so that I keep my appointments	208 (84.21%)	36 (14.57%)	2 (0.81%)	1 (0.40%)	127 (42.91%)	138 (46.62%)	30 (10.14%)	1 (0.33%)
I can solve most problems if I invest the necessary effort to attend my appointments	212 (85.83%)	32 (12.96%)	2 (0.81%)	1 (0.40%)	122 (41.22%)	147 (49.66%)	25 (8.45%)	1 (0.33%)
I can remain calm when facing difficulties by relying on my coping abilities	203 (82.19%)	40 (16.19%)	3 (1.21%)	1 (0.40%)	118 (63.51%)	154 (52.03%)	23 (7.77%)	1 (0.33%)

to keep all my appointments attended								
When I am confronted with a problem, I can usually find several solutions to keep my appointments	210 (85.02%)	32 (12.96%)	4 (1.62%)	1 (0.40%)	118 (63.51%)	157 (53.04%)	21 (7.09%)	0 (0.00%)
If I am in trouble associated with keeping my appointments, I can usually think of a solution	210 (85.02%)	32 (12.96%)	4 (1.62%)	1 (0.40%)	128 (43.24%)	146 (49.32%)	22 (7.43%)	0 (0.00%)
If I am in trouble associated with keeping my appointments, I can usually think of a solution	215 (87.04%)	30 (12.15%)	1 (0.40%)	1 (0.40%)	147 (49.66%)	128 (43.2%)	21 (7.09%)	0 (0.00%)

Across all the nine questions, a large majority of the respondents in the intervention group scored high level of self-efficacy ranging between 82.19 per cent and 87.85 per cent. The respondents that we are looking at in this section were those that agreed to consent and had been receiving mobile text messages. It is therefore assumed that they were receptive to the technology. It is not surprising that a large majority of them scored high level of self-efficacy. The self-efficacy theory tells us that people will generally attempt things they believe they can accomplish and may refuse to attempt difficult tasks or responsibilities due to their own perceived weaknesses (Bandura, Albert, 2004). We can assume that the respondents scored high levels of self-efficacy in this study because they had no doubt in their ability to accomplish the tasks expected upon receiving the communication from the mobile phone text messages they were receiving.

Respondents who exhibited moderate levels of self-efficacy ranged between 10.53 per cent and 12.96 per cent. Respondents that scored moderate levels of self-efficacy may have had the good will to enroll on the T4A platform only to encounter a situation that slowed them down. According to the self-efficacy theory, it is possible to convince an individual that they can achieve or master tasks through verbal persuasion (Hayden, 2019). In the case of T4A system, the use of mobile phone text messages replaced the verbal communication and this was the way to persuade the

respondents to adhere to their appointments and respond to their treatment. This category or cohort of people is the reason systems should be evaluated so that they are caught before they fall off. Low levels of self-efficacy within the intervention group ranged between 0.80 to 2.44 per cent.

Proportion of scores across the nine questions within the control group ranged as follows: Not at all true (0.00-1.01 per cent), hardly true (5.74-10.14 per cent), moderately true (42.23-53.04 per cent) and exactly true (51.01-63.51 per cent). The statement that scored the highest level of self-efficacy for the control group was "When I am confronted with a problem, I can usually find several solutions to keep my appointments" at 63.51 percent.

While this cohort that scored low is a small percentage it would be important especially in a clinical setting to offer more intervention to reach out to them. If their perceived self-efficacy is low they may not be going for their appointments and may subsequently end up at risk of having poor viral load suppression. The success or failure of an individual can be influenced by the physical and emotional states that one may be experiencing at a given time. Fear, anxiety, worry and high stress levels may lead to one's inability to perform certain tasks and could potentially lead a negative influence to self-efficacy (Hayden, 2019).

Overall, the level perceived of self-efficacy indices ranged between 93.39 per cent and 95.28 per cent. The overall index of perceived level of self-efficacy within the intervention group was 94.52 per cent. Calculation of the indices for the intervention group was critical for inferential statistics. Table 4.11 presents the perceived levels of self-efficacy indices per question for the test group.

Table 4.11: Perceived levels of self-efficacy indices for the test group

Question	Test (%)
If I try hard enough, I can always keep all my appointments attended	94.74
No one can influence me not to keep my appointments.	95.28
It is easy for me to stick to my aims and accomplish my goals including keeping all my appointments	94.33
Thanks to my resourcefulness, I know how to handle unforeseen situations so that I keep my appointments	94.20
I can solve most problems if I invest the necessary effort to attend my appointments	94.74
I can remain calm when facing difficulties by relying on my coping abilities to keep all my appointments attended	93.39
When I am confronted with a problem, I can usually find several solutions to keep my appointments	94.20
If I am in trouble associated with keeping my appointments, I can usually think of a solution	94.20
I can usually handle whatever comes my way to keep my appointments	95.28
Overall	**94.52**

Findings from this study corroborate with other studies that have demonstrated that type of messages is an important aspect to be considered. (Montague & Perchonok, 2012) found "personally relevant and contextually situated health technology is more likely than broader technology to create behavior changes". Self-efficacy for patients with chronic conditions has been shown to improve with interventions that support self-management; however, it cannot be successful unless strategies are implemented to break down barriers and sustain behaviors (Camron et al., 2018).

4.5 Inferential statistics

4.5.1 Objective 1: To examine the effect of timing of mobile text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County

H_0: Timing of messages has no significant effect on the perceived self-efficacy for treatment among PLHIV in Homa Bay County

Hypothesis one: $Y = \beta_0 + \beta_1 X_1 + \varepsilon$

Where Y= Self efficacy

β_0 = The intercept

β_1 = Regression coefficients shows the change in the value of Y from a unit change in X

X_1 = Timing of messages

ε = Random error

In this study, all participants in the test group chose the time they wanted to receive their messages. There were those who chose early morning, during the day or evening and the different choice of time may also have been influenced by the fact that the phones could have been shared. A previous study corroborates with the results of this study as it revealed that even in cases where a system or innovation has appropriated the most effective interventions, presenting them at the most appropriate times could have a significantly positive benefit regarding effectiveness. It also found that a good time for notifications was before the user became deeply engaged on an assignment or early in the task. Notably, the findings show that designing the right timing of notification will have more impact as it provides less interruptions (Sano, Johns, & Czerwinski, 2017). It is therefore prudent that when designing any communication platforms, allow the participants to select the appropriate time that they would wish to receive their messages.

A linear regression model was used to determine the extent to which there was a linear relationship between timing of messages and self-efficacy as shown in Table 4.12

The results on the analysis of variance (ANOVA) test indicated timing was a significant predictor of self-efficacy (F (3, 246) =4.112, p=0.007, CI=0.05). Based on these results, the study rejects the null hypothesis. The R square showed that the

model could only predict 4.8 percent of variance in the dependent variable (self-efficacy). Summary of the findings is presented in Table 4.12

Table 4.12: Linear regression model on effect of timing on self-efficacy index

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.220[a]	0.048	0.037	0.98154619

a. Predictors: (Constant), Zscore: Noon, Zscore: Evening, Zscore: Morning

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.886	3	3.962	4.112	.007[b]
	Residual	234.114	243	0.963		
	Total	246.000	246			

a. Dependent Variable: Zscore(selfindex)

b. Predictors: (Constant), Zscore: Noon, Zscore: Evening, Zscore: Morning

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-4.695E-16	0.062		0.000	1.000
	Zscore: Evening	0.143	0.098	0.143	1.469	0.143
	Zscore: Morning	-0.102	0.098	-0.102	-1.048	0.296
	Zscore: Noon	0.007	0.082	0.007	0.083	0.934

a. Dependent Variable: Zscore(selfindex)

None of the sub-variables of timing showed significant effect on self-efficacy in a combined model. However, when analyzed separately receiving of messages in the evening ($p<0.001$; CI=95%) and morning ($p<0.003$; CI=95%) appeared to have significant relationship with self-efficacy. Receiving messages in the noon time did

not have relationship with self-efficacy (p<0.944; CI=95%). ANOVA for the sub-variables of timing are provided in Table 4.13.

Table 4.13: Analysis of individual sub-variables of timing and self-efficacy

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.045	1	10.045	10.430	.001[b]
	Residual	235.955	245	0.963		
	Total	246.000	246			

a. Dependent Variable: Zscore(selfefindex2); b. Predictors: (Constant), Zscore: Evening

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.827	1	8.827	9.119	.003[b]
	Residual	237.173	245	0.968		
	Total	246.000	246			

a. Dependent Variable: Zscore(selfefindex2); b. Predictors: (Constant), Zscore: Morning

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.005	1	0.005	0.005	.944[b]
	Residual	245.995	245	1.004		
	Total	246.000	246			

a. Dependent Variable: Zscore(selfefindex2); b. Predictors: (Constant), Zscore: Noon

Multi-linear analysis

A second level of multi-linear analysis involved three other variables namely language of the messages, type of messages and frequency of messages. In this model, timing of messages did not have significant effect on the self-efficacy p<0.537; >0.05; CI=95%) as indicated in Table 4.14.

Table 4.14: Multi-linear analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.048	0.078		0.619	**0.537**
	Timing of messages	-0.932	0.811	-0.297	-1.148	0.252
	Language of messages	-0.174	1.168	-0.011	-0.149	0.882
	Type of messages	-0.176	0.089	-0.137	-1.977	0.049
	Frequency of messages	0.262	0.268	0.251	0.978	0.329

a. Dependent Variable: Zscore(self-efficacy index)

The quantitative findings are confirmed with outcomes in the qualitative study. Participants in the qualitative study observed that providing patients with the ability to choose when to receive the messages was critical for the purposes of ensuring that there were no inconveniences created. According to the respondents such an innovating way would go a long way, avoiding stigmatization of the patients and making the patients feel valued. This was because HIV was a sensitive matter due to high stigma that required caution when communicating about it. The respondents noted that proper timing would ensure messages are read. Other participants felt that sending messages at the wrong time could expose them to the people they share mobile phones with hence creating stigma. Some of the respondents provided explanations as follows:

> *"T4A provided the option of morning, noon and evening. It was important to provide users with option of selecting time when they want to receive messages to prevent stigma and discrimination since the patient will receive the message at the time when they are free to use the phone without any third party viewing the messages."_* Health facility user

> *"The timing of the messages is important and giving them the option to choose when to receive the messages is okay and appropriate. However in all, the timing has to be during the day because if you send the messages at night it may not auger well."_* Program officer

"Definitely the client should be allowed to choose when to receive messages. HIV is sensitive. The messages should be sent at the right time so that the wrong person does not receive it."_ CASCO

Timing of messages has been found to be a critical predictor of the impact of messaging interventions. Messages that are delivered at the wrong time are unlikely to be read hence no impact on expected outcomes among targeted beneficiaries (Mohammed et al., 2014). In telemedicine, timing is critical because it defines interventions. Telemedicine that allows storing and forwarding of messages, or asynchronous, telemedicine involves the exchange of pre-recorded data between two or more individuals at different times. For example, the patient or referring health professional sends an e-mail description of a medical case to an expert who later sends back an opinion regarding diagnosis and optimal management. In contrast, real time, or synchronous, telemedicine requires the involved individuals to be simultaneously present for immediate exchange of information, as in the case of video conferencing(World Health Organization Global Observatory for eHealth, 2010).

In a study on examining the design and delivery of a stress intervention analyzed if participants' self-reported likeness and effectiveness were higher when the interventions were provided at good timing. Self- reported likeness and effectiveness were collected only when participants rated good or neutral timing and they requested stress interventions voluntarily. Therefore, comparison was conducted on their likeness and effectiveness among the following 3 cases: (1) good timing (2) neutral timing (3) voluntary request (Linear Mixed-Effects Models). Effectiveness was higher when interventions were provided at good timing (mean: 3.4) than at neutral timing and voluntarily (mean: 3.2, 3.3, respectively). The average likeness was highest when the interventions were provided voluntarily (3.8), followed by when rated good timing (3.7) and rated neutral timing (3.6); however, there was no statistical significant differences. These results suggest providing stress interventions at opportune timing could become more effective (Sano, Johns, & Czerwinski, 2017)

4.5.2 Objective 2: To investigate the effect of frequency of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County

H0: Frequency of messaging has no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County

Hypothesis two: $Y = \beta_0 + \beta_2 X_2 + \varepsilon$

Where Y= Self efficacy

β_0 = The intercept

β_2 = Regression coefficients shows the change in the value of Y from a unit change in X

X_2=Frequency of messages

ε = Random error

In a previous study among adults with high blood pressure, personalized SMS text messages were sent to participants on a daily basis but at a time and in frequency that was selected by the participants. Additional reminders were sent when medicines were ready for collection or for scheduled clinic appointment (Bobrow, K; Farmer, A. J.; Sprnger, D.; Shanyinde, M.; Yu, L.; Brennan, T.; Rayner, B.; Namane, M.; Steyn, K.; Tarassenko, L.; Levitt, N., 2016). This was very similar to this study and reveals the importance of having participants select how often they would wish to receive messages. In another study among the youth in Uganda, there was no consensus as to the number of times messages should be sent in a week. There were those that preferred receiving every day as long as the send was able to send to act as a reminder.

Spearman's Rho, non-parametric test was used to measure the strength of association between frequency of messages and self-efficacy index as shown in Table 4.15.

Table 4.15: Correlation between frequency of messages and self-efficacy

		Frequency			
		Daily	**Weekly**	**Monthly**	**Self-Efficacy Index**
Daily	Correlation Coefficient	1.000			0.145
	Sig. (2-tailed)				0.542
	N	20	0	0	20
Weekly	Correlation Coefficient		1.000		0.135
	Sig. (2-tailed)				0.485
	N	0	29	0	29
Monthly	Correlation Coefficient			1.000	-.181[*]
	Sig. (2-tailed)				0.020
	N	0	0	164	164
Self-efficacy index	Correlation Coefficient	0.145	0.135	-.181[*]	1.000
	Sig. (2-tailed)	0.542	0.485	0.020	
	N	20	29	164	247

* Correlation is significant at the 0.05 level (2-tailed)

Data shows that there was no significant relationship between receiving messages on a daily basis (p=0.52; >0.05, CI=95 per cent) as well as on a weekly basis (p=0.485; >0.05, CI=95 per cent) on the self-efficacy index. However, there was an inverse relationship in correlation {negative but weak relationship} between receiving messages monthly to self-efficacy index(C=-0.181; p=0.02 ;< 0.05). Thus if individuals received messages on a monthly basis only they were likely to have low levels of self-efficacy. Further, a linear regression model was also used to ascertain the overall statistical significance of frequency of messages on self-efficacy in Table 4.16.

Table 4.16: Regression model on frequency of messages and self-efficacy index

Regression Model-Coefficient[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	-5.343E-16	0.063		0.000	1.000
	Z-score (Frequency)	0.026	0.064	0.026	0.402	0.688

a. Dependent Variable: Z-score (self- efficacy index)

The result (p=0.688; >0.05; CI=95 per cent) implies that there was no significant evidence to reject the null hypothesis, hence the conclusion that frequency of messages had no statistically significant effect on the self-efficacy. The sub-variables of frequency were assessed separately as shown in Table 4.17 and results indicate that after individual assessment none of them had an effect on the self-efficacy index (daily, p-value <0.567; weekly, p-value<0.696 and monthly, p-value<0.090; CI=95%. Results of ANOVA of individual sub-variables of frequency are shown in Table 4.17.

Table 4.17: Analysis of individual sub-variables of frequency of messages and self-efficacy

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.671	1	0.671	0.340	.567b
	Residual	35.517	18	1.973		
	Total	36.188	19			

a. Dependent Variable: Zscore(self-efficacy index)
b. Predictors: (Constant), Zscore(daily)

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.231	1	0.231	0.156	.696b
	Residual	39.948	27	1.480		
	Total	40.179	28			

a. Dependent Variable: Zscore(self-efficacy index)
b. Predictors: (Constant), Zscore(weekly)

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.556	1	2.556	2.903	.090b
	Residual	142.631	162	0.880		
	Total	145.187	163			

a. Dependent Variable: Zscore(self-efficacy index)
b. Predictors: (Constant), Zscore(monthly)

The qualitative findings demonstrate the importance of considering the frequency of messages. Majority of the respondents said that the frequency of the messages mattered a lot because it was important to ensure that patients are not bored by many messages. However, some observed that this would depend on other factors such as the type of messages and the stability of the patients.

>*"Yes the frequency was important because it would have affected some patients complained of getting many messages at the same time thus*

raising questions with their partners why they were receiving all those messages."_ Program officer

"I think the frequency of the messages largely depends on the model in which the patient is receiving care. Patients on differentiated care model are stable and may not need to receive the messages so much frequently. However if one is not coming to the facility and you keep on sending the messages then it means they are not working. Patients who are stable with suppressed viral load can even come after six months. So the condition of the patient and model of care matter a lot in determining the frequency."_ DASCO

These findings corroborate with findings in the study in Uganda where there was no consensus as to the number of times messages should be sent in a week. The respondents argued that the frequency of messages would depend on ability of the sender to pay for the messages or depending on the targeted user's convenience to read the messages (Rana, Y.; Haberer, J.; Huang, H.; Kambugu, A.; Mukasa, B.; Thirumurthy, H.; Wabukala, P.; Wagner, G. J.; Linnemayr, S., 2015).

Some scholars have argued that the frequency of text messages may also vary between adherence levels where text messages were more frequent when the adherence level was low and thus increasing to daily reminders and for patients with good adherence, reducing them to weekly reminders (Anglada, Riu, Martin, Rovira, & Sotoca, 2015). These findings from this study and the scholars then would encourage those designing communication platforms since it reveals frequency of messaging has no significant influence on self-efficacy whether they are daily, weekly or monthly reminders. However, from this study, there was positive relationship between monthly reminders and self-efficacy.

4.5.3 Objective 3: To examine the effect of language of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County

H0: The language of messaging using mobile phone text messages has no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

Hypothesis three: $Y = \beta_0 + \beta_3 X_3 + \varepsilon$

Where Y= Self efficacy

β_0 = The intercept

β_3= Regression coefficients shows the change in the value of Y from a unit change in X

X_3=Language of messages

ε = Random error

The spearman's rho correlations test result (p=0.262; >0.05, CI=95%) indicates that there is no significant evidence to reject the null hypothesis. Thus the results show that the language of messaging using mobile phone text messages has no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County. The correlation of language and self-efficacy are shown in Table 4.18.

Table 4.18: Correlation of Language and Self-efficacy

Spearman's rho Correlations		
	Language	Self-efficacy index
Correlation Coefficient	1	-0.072
Sig. (2-tailed)		0.262
N	247	247
Correlation Coefficient	-0.072	1
Sig. (2-tailed)	0.262	
N	247	247

Results from a simple linear regression model revealed that language as a combined variable was a significant predictor of self-efficacy F (3, 246) =2.716, p=0.045, <0.05). Nonetheless, the R square value implies that language could only explain 3,2 per cent of the variance in the self-efficacy index. As combined, none of the sub-variables of language (Dholuo, p=0.347, English p=0.285 and Swahili p=0.297; CI=0.05). Table 4.19 presents the regression model of language and self-efficacy.

Table 4.19: Linear regression model of language and Self-efficacy

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.180[a]	0.032	0.020	0.98969750

a. Predictors: (Constant), Zscore: Kiswahili, Zscore: English, Zscore: Dholuo

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.981	3	2.660	2.716	.045[b]
	Residual	238.019	243	0.980		
	Total	246.000	246			

a. Dependent Variable: Zscore(self-index)

b. Predictors: (Constant), Zscore: Kiswahili, Zscore: english, Zscore: Dholuo

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-5.040E-16	0.063		0.000	1.000
	Zscore: Dholuo	0.091	0.097	0.091	0.942	0.347
	Zscore: English	0.092	0.086	0.092	1.071	0.285
	Zscore: Kiswahili	-0.095	0.091	-0.095	-1.046	0.297

a. Dependent Variable: Zscore(selfindex)

One respondent in the qualitative study observed that having given the clients the opportunity to choose their language of preference was a good thing.

> *"No I don't think it was bad because the messages were in a language that the patients choose so it was easy to understand."_ Health facility user*

This finding does not necessarily differ with findings in other studies that found language to be a significant factor in uptake and use of mHealth interventions (Mohammed et al., 2014). However, Arora (2014) studies show language spoken and appointment type emerged as significant independent variables on bivariate analysis.

Simple, user-friendly interfaces and systems that people with little to no technical expertise and limited English-language knowledge can operate are important means of overcoming barriers to implementation and enabling a swift diffusion of telemedicine applications in health care within developing countries (World Health Organization Global Observatory for eHealth, 2010).

According to Farag (2015), "socio-cultural factors that influence people must be accounted for, so that misunderstanding does not lead to a dissolution of a useful technology". One study demonstrates that mHealth acceptance requires overcoming a number of social and acceptance challenges which include winning hearts and minds of targeted users and taking into account the cultural issues such as the use of language (Tariq, 2011). Interpretation of this finding should be contextualized to demonstrate that participants were given the opportunity to select their own language of preference and that overall, all participants regardless of which language they were receiving messages in, had better self-efficacy outcomes compared to their counterparts in the control group.

4.5.4: Objective 4: To examine the effect of type of messages of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County

H_0: The type of messages has no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

Hypothesis four: $Y = \beta_0 + \beta_4 X_4 + \varepsilon$

Where Y= Self efficacy

β_0 = The intercept

β_4 = Regression coefficients shows the change in the value of Y from a unit change in X

X_4=Type of messages

ε = Random error

Using the spearman's rho correlation statistic it is evident that appointment (p=0.021; <0.05; CI=95%) and wellness messages had a positive relationship with self-efficacy index (p=0.025; <0.05; CI=95%). However the informative messages did not have a significant effect on the self-efficacy index (p=0.534; <0.05; CI=95%).Table 4.20 shows the summary of the correlation between type of messages and self-efficacy.

Table 4.20: Correlation between type of message and self-efficacy

		Appointment	Wellness	Informative	Self-efficacy index
			Spearman's rho Correlations		
Appointment	Correlation Coefficient	1	.184**	-.509**	-.147*
	Sig. (2-tailed)		0.004	0	0.021
	N	247	247	247	247
Wellness	Correlation Coefficient	.184**	1	0.092	-.143*
	Sig. (2-tailed)	0.004		0.15	0.025
	N	247	247	247	247
Informative	Correlation Coefficient	-.509**	0.092	1	0.04
	Sig. (2-tailed)	0	0.15		0.534
	N	247	247	247	247
Self-efficacy index	Correlation Coefficient	-.147*	-.143*	0.04	1
	Sig. (2-tailed)	0.021	0.025	0.534	
	N	247	247	247	247

A linear regression model as shown in Table 4.21 indicates that the type messages was a significant predictor of self-efficacy index $F_{(3, 243)}$ =3.034, p=0.030; CI=95%. These results are statistically significant to reject the null hypothesis. However, the R square indicates that type of messages only predicted 3.6% variance in the self-efficacy index.

Table 4.21: Linear regression on type of messages and self-efficacy

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.190[a]	0.036	0.024	0.98782182

a. Predictors: (Constant), Zscore(Informative), Zscore(Wellness), Zscore(Appointment)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.883	3	2.961	3.034	.030[b]
	Residual	237.117	243	0.976		
	Total	246.000	246			

a. Dependent Variable: Zscore(selfindex)

b. Predictors: (Constant), Zscore(Informative), Zscore(Wellness), Zscore(Appointment)

Coefficients for each type of messages indicated that wellness messages had a significant effect on the self-efficacy index (P=0.050) while appointment messages (p=0.364) and informative messages (p=0.254) did not have a significant effect on the self-efficacy index. Table 4.22 presents the coefficients of various types of messages and self-efficacy.

Table 4.22: Coefficients of type of messages and self-efficacy

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-9.670E-16	0.063		0.000	1.000
	Zscore(Appointment)	-0.069	0.076	-0.069	-0.909	0.364
	Zscore(Wellness)	-0.129	0.066	-0.129	-1.970	0.050
	Zscore(Informative)	0.086	0.075	0.086	1.142	0.254

a. Dependent Variable: Zscore(selfindex)

Most respondents agreed that the content of the messages was good. They said that patients were able to understand because they had the option of choosing the most comfortable language in which to receive messages. The nature of the messages was tailored to ensure that patients were not stigmatized and that the content was informative enough.

> *"The content was good since it was easy to understand and passed the message to the patients for instance patients are reminded of appointments and also on taking medication."_ Health facility user*

> *"I think it is very important to consider the nature of messages because if not well considered could be stigmatizing. Sometimes the messages may not even be talking about the HIV but people may interpret that way. You know the person living with HIV is surrounded by people and therefore the messages are supposed to be general so that other people do not know what is being talked about"_ CASCO*

> *"The nature of the messages should also be informative based on what is being conveyed. Look at what you want to communicate and convey it properly"_ DASCO*

Findings from this study corroborate with other studies that have demonstrated that type of messages is an important aspect to be considered. Montague and Perchonok (2012) found, "personally relevant and contextually situated health technology is more likely than broader technology to create behavior changes". Self-efficacy for patients with chronic conditions has been shown to improve with interventions that support self-management; however, it cannot be successful unless strategies are implemented to break down barriers and sustain behaviours (Camron et al., 2018). In particular, most studies have found appointment reminders to be all effective in promoting adherence to antiretroviral therapy. Henry et al. (2012) examined the effectiveness of adding an automated telephone reminder to improve appointment attendance for HIV-positive patients in Los Angeles. The study showed that the intervention was effective for patients who were not homeless, not diagnosed with depression, or had five or more appointments scheduled in six months. The

intervention was not effective in increasing attendance among patients who were homeless, from ethno racial minorities or had mental health issues(The Ontario HIV Treatment Network, 2015). This study demonstrates the need to consider other factors at the patient level that go beyond receiving of messages.

Findings in this study found information messages had no significant effect on the self-efficacy index. Some studies show that SMS reminders may have a deteriorating effect on quality (Mannheimer, 2006), as the reminders are seen to be intrusive and therefore produces habituation and response fatigue. Appointment and wellness messages had a positive relationship with self-efficacy index. The findings corroborates other studies that scheduled and reminder text messages to individuals with HIV can significantly improve follow-up (Amankwaa, 2018; Arora et al., 2014). A similar study showed combined mobile phone SMS and telephone call reminders together with peer counselling found significant improvement in adherence and treatment outcomes among HIV positive patients on ART in Malaysia (Abdurrahman, 2018).

4.5.5 Objective 5: Assess the moderating effect of demographic characteristics on the relationship between mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV in Homa Bay County

H_0: Demographic characteristics have no significant effect on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

Hypothesis Five: $Y = \beta_0 + \beta_5 X_5 + \varepsilon$

Where Y= Self efficacy

β_0 = The intercept

β_5= Regression coefficients shows the change in the value of Y from a unit change in X

X_5= Demographic characteristics

ε = Random error

Using the spearman's rho correlation statistic, results in Table 4.23 show that on their own, all the demographic characteristics did not have significant relationships with the self-efficacy index. Age (p=0.847), gender (p=0.121) and marital status (p=0.763) (>0.05, CI= 95%) were all not significantly related to self-efficacy index.

Table 4.23: Correlation of demographic characteristics and self-efficacy

Spearman's rho

	Age	Gender	Marital status	Self-Efficacy index
Correlation Coefficient	1	.397**	.127*	-0.012
Sig. (2-tailed)		0	0.046	0.847
N	247	247	247	247
Correlation Coefficient	.397**	1	-.171**	-0.099
Sig. (2-tailed)	0		0.007	0.121
N	247	247	247	247
Correlation Coefficient	.127*	-.171**	1	-0.019
Sig. (2-tailed)	0.046	0.007		0.763
N	247	247	247	247
Correlation Coefficient	0.076	-0.092	.165**	-0.086
Sig. (2-tailed)	0.231	0.149	0.01	0.177
N	247	247	247	247
Correlation Coefficient	-0.012	-0.099	-0.019	1
Sig. (2-tailed)	0.847	0.121	0.763	
N	247	247	247	247

In the linear regression model used, demographic characteristics as predictors of self-efficacy Age (p=0.592, gender (p=0.116 and marital status (p=0.370; >0.05; CI=95%) imply that there was no evidence significant enough to reject the null hypothesis, hence the conclusion that demographic characteristics had no statistically significant effect on the self-efficacy. Table 4.24 shows the linear regression model for soci-demographic characteristics and self-efficacy index.

Table 4.24: Linear Regression model for socio-demographic characteristics and self-efficacy

	Linear Regression Model Coefficients				
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0	0.063		0	1
Z-score (Age)	0.039	0.072	0.039	0.537	0.592
Z-score (Gender)	-0.115	0.073	-0.115	-1.576	0.116
Z-score (Marital status)	0.062	0.069	0.062	0.898	0.37

a. Dependent Variable: Z-score (self-efficacy level index)

To test this hypothesis two linear regression models were calculated to demonstrate 1) Effect of combined communication strategies without the moderating variable on self-efficacy 2) Effect of combined communication strategies with the moderating variable on self-efficacy 2

Effect of combined communication strategies without the moderating variable on self-efficacy

H_0: Demographic characteristics have no significant moderating effect on the effect of mobile phone text messaging strategies on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

Hypothesis Five: $Y = \beta_0 + \beta_5 X_5 + \varepsilon$

Where Y= Self efficacy

β_0 = The intercept

β_5= Regression coefficients shows the change in the value of Y from a unit change in X

X_5= Combined communication strategies

ε = Random error

The combined strategies without the moderating variable did not have significant effect on the self-efficacy index (F (4, 208) =1.371, p=0.245). As per the R square, this model could only predict 2.6 percent of the variance in self-efficacy. This finding is a good finding in the sense that the variables that were studied (Frequency, Type of messages, Language and Timing) were preferred by the patients. In other words, the model means that these variables did not bias the patients in any way. That all the patients who participated in the text for adherence intervention were all treated equally by the intervention in terms of the communication strategies employed.   Individual coefficients table indicate that type of messages was significantly associated with self-efficacy index (p=0.049; CI=0.05). This indicates that based on the type of messages, probably some patients were slightly disadvantaged compared to others as indicated under objective 4.4. Table 4.25 presents the Linear regression model between combined mobile text messaging strategies and self-efficacy.

Table 4.25: Effect of mobile text messages communication strategies without the moderating variable on self-efficacy index

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.160[a]	0.026	0.007	1.03863532

a. Predictors: (Constant), Zscore: Frequency, Zscore: Type of messages, Language, Timing

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.916	4	1.479	1.371	.245[b]
	Residual	224.383	208	1.079		
	Total	230.299	212			

a. Dependent Variable: Zscore(selfindex)

b. Predictors: (Constant), Zscore: Frequency, Zscore: Type of messages, Language, Timing

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.048	0.078		0.619	0.537
	Timing	-0.932	0.811	-0.297	-1.148	0.252
	Language	-0.174	1.168	-0.011	-0.149	0.882
	Zscore: Type of messages	-0.176	0.089	-0.137	-1.977	0.049
	Zscore: Frequency	0.262	0.268	0.251	0.978	0.329

a. Dependent Variable: Zscore(selfindex)

Effect of combined communication strategies with the moderating variable on self-efficacy

H_0: Demographic characteristics have no significant moderating effect on the effect of mobile phone text messaging strategies on perceived self-efficacy for treatment among PLHIV in Homa Bay County.

Hypothesis Five: $Y = \beta_0 + \beta_5 X_5 + MV + \varepsilon$

Where Y= Self efficacy

β_0 = The intercept

β_5= Regression coefficients shows the change in the value of Y from a unit change in X

X_5= Combined communication strategies

MV=Moderating variable

ε = Random error

The communication strategies combined moderated by the socio-demographic characteristics had a significant effect on the self-efficacy $F_{(9, 203)} = 2.138$, p=0.028. Based on the adjusted R square, the combined communication strategies with the moderating variable (socio-demographic characteristics) could only explain 4.6 per cent of the variations in the self-efficacy index within the intervention group. The coefficients on each of the variables included in the model indicated that only type of messages (p=0.045; <0.05) and weekly income (p=0.032 ;< 0.05) had significant effect on the self-efficacy index as shown in Table 4.26.

Table 4.26: Effect of combined communication strategies with the moderating variable on self-efficacy

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.294[a]	0.087	0.046	1.01796937

a. Predictors: (Constant), Zscore: Marital status_, Zscore: Frequency, Zscore: Appointment, Zscore: Weekly income_, Zscore(Gender), Zscore(Religion), Language, Zscore(Age)), Timing

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.938	9	2.215	2.138	.028[b]
	Residual	210.361	203	1.036		
	Total	230.299	212			

a. Dependent Variable: Zscore(self-efficacy index)

b. Predictors: (Constant), Marital status_, Zscore: Frequency, Zscore: Appointment, Zscore: Weekly income_, Zscore(Gender), Zscore(Religion), Language, Zscore(Age)), Timing

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.062	0.078		0.792	0.430
	Zscore: Type of messages	-0.178	0.088	-0.138	-2.020	0.045
	Zscore: Frequency	0.263	0.265	0.253	0.995	0.321
	Timing	-0.730	0.800	-0.232	-0.913	0.362
	Language	-0.671	1.180	-0.041	-0.569	0.570
	Zscore(Age)	0.057	0.087	0.053	0.654	0.514
	Zscore(Religion)	-0.139	0.075	-0.133	-1.839	0.067
	Zscore: (Weekly income)	0.161	0.075	0.152	2.162	0.032
	Zscore(Gender)	-0.159	0.083	-0.150	-1.928	0.055
	Zscore: (Marital Status)	0.014	0.076	0.013	0.182	0.856

a. Dependent Variable: Zscore(self-efficacy index)

Further analysis was done to each objective to assess how each moderating factor individually influenced each mobile phone text messaging strategy.

Strategy 1 – Timing of Messages

H_0: Timing of messages has no significant effect on the perceived self-efficacy for treatment among PLHIV in Homa Bay County

Timing of Messages Moderated with Age

H_{01}: Timing of messages has no significant effect on the perceived self-efficacy for treatment when moderated by age among PLHIV in Homa Bay County.

Hypothesis four moderated by age: $Y = \beta_0 + A\{\beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3\} + \varepsilon$

Where Y= Self efficacy

β_0 = The intercept

$\beta_1, \beta_2, \beta_3$ = Regression coefficients shows the change in the value of Y from a unit change in X

X_1, X_2, X_3 = Timing (Morning, Noon and Evening)

A = Age as a moderating factor

ε = Random error

Timing

When moderated with age, there was a slight or no change in R^2 indicating low moderation effect for age but when moderated with gender and marital status, there was high change in R^2 an indication there was moderation effect for both gender and marital status on timing (Table 4.27, Table 4.28 Table 4.29, Table 4.30 and Table 4.31). Table 4.27 also shows the R^2 was higher for morning and evening when moderate by age, gender and marital status but lower in for afternoon.

Table 4.27: Timing Model Summary of R^2

Variable	Unmoderated R^2	Moderation by age R^2	Moderation by gender R^2	Moderation by marital status R^2
Morning	0.036	0.036	0.046	0.040
Afternoon	0.000	0.001	0.016	0.004
Evening	0.041	0.041	0.055	0.046

Table 4.28: Timing R^2 without moderating variables

Regression - Morning without moderating variable
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.189[a]	0.036	0.032	0.98389601

a. Predictors: (Constant), Zscore: Morning

Regression - Noon without moderating variable
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.004[a]	0.000	-0.004	1.00202862

a. Predictors: (Constant), Zscore: Noon

Regression - Evening without moderating variable
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.202[a]	0.041	0.037	0.98136742

a. Predictors: (Constant), Zscore: Evening

Table 4.29: Timing R^2 moderation effect of age

Regression- morning with age as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.189[a]	0.036	0.028	0.98590631

a. Predictors: (Constant), Zscore(agecoded), Zscore: Morning

Regression- Noon with age as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.025[a]	0.001	-0.008	1.00376966

a. Predictors: (Constant), Zscore(agecoded), Zscore: Noon

Regression - Evening with age as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.203[a]	0.041	0.033	0.98327855

a. Predictors: (Constant), Zscore(agecoded), Zscore: Evening

Table 4.30: Timing R² moderation effect of gender

Regression - morning with gender as moderating variable
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.215[a]	0.046	0.039	0.98053028

a. Predictors: (Constant), Zscore(gender), Zscore: Morning

Regression - noon with age as moderating variable
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.126[a]	0.016	0.008	0.99609689

a. Predictors: (Constant), Zscore(gender), Zscore: Noon

Regression - evening with age as moderating variable
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.234[a]	0.055	0.047	0.97629709

a. Predictors: (Constant), Zscore(gender), Zscore: Evening

Table 4.31: Timing R^2 moderation effect of marital status

Regression - Timing morning with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.200[a]	0.040	0.032	0.98377531

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore: Morning

Regression - Timing noon with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.063[a]	0.004	-0.004	1.00211630

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore: Noon

Regression - Timing evening with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.214[a]	0.046	0.038	0.98077640

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore: Evening

Strategy 2 – Frequency of Messaging

When moderated with age, gender and marital status, there was high change in R^2 an indication there was moderation effect for all the moderating variables on frequency (Table 4.32, Table 4.33, Table 4.34, Table 4.35 and Table 4.36). The moderation was higher for the Daily variable as compared to Weekly and Monthly variables.

Table 4.32: Frequency Model Summary of R^2

Variable	Unmoderated R^2	Moderation by age R^2	Moderation by gender R^2	Moderation by marital status R^2
Daily	0.019	0.046	0.249	0.166
Weekly	0.006	0.010	0.038	0.022
Monthly	0.018	0.023	0.033	0.018

Table 4.33: Frequency R^2 without moderating variables

Regression – (Frequency) daily without moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.136[a]	0.019	-0.036	1.40469677

a. Predictors: (Constant), Zscore(daily)

Regression – (Frequency) weekly without moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.076[a]	0.006	-0.031	1.21636884

a. Predictors: (Constant), Zscore(weekly)

Regression – (Frequency) monthly without moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.133[a]	0.018	0.012	0.93831725

a. Predictors: (Constant), Zscore(monthly)

Table 4.34: Frequency R^2 moderation effect of age

Regression – (Frequency) daily with age as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.216[a]	0.046	-0.066	1.42471368

a. Predictors: (Constant), Zscore(agecoded), Zscore(daily)

Regression – (Frequency) weekly with age as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.099[a]	0.010	-0.066	1.23699560

a. Predictors: (Constant), Zscore(agecoded), Zscore(weekly)

Regression – (Frequency) monthly with age as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.153[a]	0.023	0.011	0.93846576

a. Predictors: (Constant), Zscore(agecoded), Zscore(monthly)

Table 4.35: Frequency R^2 moderation effect of gender

Regression – (Frequency) daily with gender as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.499[a]	0.249	0.161	1.26397271

a. Predictors: (Constant), Zscore(gender), Zscore(daily)

Regression – (Frequency) weekly with gender as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.195[a]	0.038	-0.036	1.21923082

a. Predictors: (Constant), Zscore(gender), Zscore(weekly)

Regression – (Frequency) monthly with gender as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.182[a]	0.033	0.021	0.93383916

a. Predictors: (Constant), Zscore(gender), Zscore(monthly)

Table 4.36: Frequency R^2 moderation effect of marital status

Regression - (Frequency) daily with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.407[a]	0.166	0.068	1.33256624

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore(daily)

Regression - (Frequency) monthly with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.149[a]	0.022	-0.053	1.22932531

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore(weekly)

Regression – (Frequency) monthly with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.134[a]	0.018	0.006	0.94100484

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore(monthly)

Strategy 3: Language of Messaging

When moderated with age, there was a slight or no change in R^2 indicating no moderation effect for age but when moderated with gender and marital status, there was high change in R^2 an indication there was moderation effect for both gender and marital status on language. This means gender and marital status have positive moderation effect on language. (Table 4.37, Table 4.38, Table 4.39. Table 4.40 and Table 4.41)

Table 4.37: Language Model Summary of R^2

Variable	Unmoderated R^2	Moderation by age R^2	Moderation by gender R^2	Moderation by marital status R^2
Luo	0.010	0.010	0.026	0.017
Kiswahili	0.027	0.028	0.038	0.037
English	0.006	0.007	0.021	0.009

Table 4.38: Language R^2 without moderating variables

Regression - Luo language without moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.102[a]	0.010	0.006	0.99686119

a. Predictors: (Constant), Zscore: Luo

Regression - Kiswahili language without moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.166[a]	0.027	0.023	0.98818134

a. Predictors: (Constant), Zscore: Kiswahili

Regression - English language without moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.080[a]	0.006	0.002	0.99884448

a. Predictors: (Constant), Zscore: english

Table 4.39: Language (Luo) R^2 moderation effect of age

Regression – Language (Luo) with age as moderating variable

		Model Summary		
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.102[a]	0.010	0.002	0.99887877

a. Predictors: (Constant), Zscore(agecoded), Zscore: Luo

Regression – Language (Kiswahili) with age as moderating variable

		Model Summary		
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.168[a]	0.028	0.020	0.98976531

a. Predictors: (Constant), Zscore(agecoded), Zscore: Kiswahili

Regression – Language (English) with age as moderating variable

		Model Summary		
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.084[a]	0.007	-0.001	1.00056411

a. Predictors: (Constant), Zscore(agecoded), Zscore: english

Table 4.40: Language (Kiswahili) R^2 moderation effect of gender

Regression - Language (Luo) with gender as moderating variable

		Model Summary		
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.162[a]	0.026	0.018	0.99088006

a. Predictors: (Constant), Zscore(gender), Zscore: Luo

Regression- Language (Kiswahili) with gender as moderating variable

		Model Summary		
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.194[a]	0.038	0.030	0.98508027

a. Predictors: (Constant), Zscore(gender), Zscore: Kiswahili

Regression - Language (English) with gender as moderating variable

		Model Summary		
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.144[a]	0.021	0.013	0.99362576

a. Predictors: (Constant), Zscore(gender), Zscore: english

Table 4.41: Language R^2 moderation effect of marital status

Regression - Language (Luo) with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.130[a]	0.017	0.009	0.99556843

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore: Luo

Regression - Language (Kiswahili) with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.192[a]	0.037	0.029	0.98549199

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore: Kiswahili

Regression - Language (English) with marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.097[a]	0.009	0.001	0.99939177

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore: english

Strategy 4 – Type of Messaging

When moderated with age, there was a slight or no change in R^2 indicating no moderation effect for age on messaging but when moderated with gender and marital status, there was high change in R^2 an indication there was moderation effect for both gender and marital status on messaging. (Table 4.42, Table 4.43, Table 4.44, Table 4.45 and Table 4.46)

Table 4.42: Summary of R^2

Variable	Unmoderated R^2	Moderation by age R^2	Moderation by gender R^2	Moderation by marital status R^2
Appointment	0.019	0.019	0.035	0.023
Wellness	0.018	0.019	0.035	0.022
Informative	0.012	0.012	0.025	0.019

Table 4.43: Unmoderated equations for messaging

Regression - Appointment without moderating variables

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.136[a]	0.019	0.015	0.99267223

a. Predictors: (Constant), Zscore(appointment)

Regression - wellness without moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.134[a]	0.018	0.014	0.99297131

a. Predictors: (Constant), Zscore(wellness)

Regression - informative without moderation variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.109[a]	0.012	0.008	0.99608439

a. Predictors: (Constant), Zscore(informative)

Table 4.44: Moderation effect of age model summary

Regression - appointment age as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.137[a]	0.019	0.011	0.99457648

a. Predictors: (Constant), Zscore(agecoded), Zscore(appointment)

Regression - wellness age as a moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.137[a]	0.019	0.011	0.99460781

a. Predictors: (Constant), Zscore(agecoded), Zscore(wellness)

Regression - informative with age as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.109[a]	0.012	0.004	0.99812025

a. Predictors: (Constant), Zscore(agecoded), Zscore(informative)

Table 4.45: Moderation effect by Gender model summary

Regression - (appointment) gender as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.186[a]	0.035	0.027	0.98647927

a. Predictors: (Constant), Zscore(gender), Zscore(appointment)

Regression - (wellness) gender as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.187[a]	0.035	0.027	0.98628518

a. Predictors: (Constant), Zscore(gender), Zscore(wellness)

Regression -(informative) gender as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.160[a]	0.025	0.017	0.99123107

a. Predictors: (Constant), Zscore(gender), Zscore(informative)

Table 4.46: Moderation effect by Marital status model summary

Regression – (Appointment) marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.152ᵃ	0.023	0.015	0.99239740

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore(appointment)

Regression – (wellness) marital status as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.148ᵃ	0.022	0.014	0.99310170

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore(wellness)

Regression – (informative) marital as moderating variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.139ᵃ	0.019	0.011	0.99430146

a. Predictors: (Constant), Zscore: what_is_your_current_marital_status_, Zscore(informative)

Participants in the qualitative study reported that various demographic characteristics would affect a patient's ability to keep appointments. Critical among them were level of education, gender and age. They also observed that the patients' demographics would determine the need for the short message communication intervention.

> *"On education level 90 % have not gone beyond primary school. Poverty levels are very high in this area, people lack basic needs. Yes, this is so because people are not educated since they don't go beyond primary school therefore poverty levels are high. They therefore find it difficult for them to*

understand things like why going to facility is important and reading of the messages would be a big challenge to them."_ Health facility user

"Yes, women are more likely to keep appointments than men. Women are less stigmatized when accessing services than men. Men use women to know their status."_ CASCO

"Younger populations are able to disclose. They are also more likely to keep appointments. Somehow the society is starting to appreciate the need to get services but stigma is still there."_ Program officer

"People with basic education would benefit from the platform. Majority of people in rural areas are illiterate. Those who rely on being interpreted to what the messages mean may not have benefitted."_ DASCO

"Women are more receptive to interventions than men. They are good health seekers. Men do not like being pushed. There are stereotypes towards men and I do not think men would like to be reminded always they like feeling they are responsible and can make independent decisions."_ DASCO

These findings are in contradiction with what some other studies have found that certain factors that could influence the effectiveness of mobile technology interventions are personal characteristics such as educational level, age, gender, educational experience, and attitude towards technology have been hypothesized to have an influence on the decisions by individuals to adopt and make use of an innovation (Free et al., 2013) (Buabeng-Andoh, 2012).

Behavioral intention has a direct influence on the usage of technology (Petersen et al., 2020; Venkatesh, 2007). In this study it is evident that regardless of ones socio-demographic characteristics, as long as one was receiving messages the level of self-efficacy were high and better as compared to the control group in the next section. A potential drawback to the use of text-message-based mHealth interventions is potential marginalization of certain populations, such as those that are illiterate or do not have access to a mobile phone for financial reasons (Mahatanankoon et al.,

2008). Further, efficiency and convenience has also been discussed as an important factor which influences technology adoption. From the perspective of self-determination theory, convenience is that users believe that a technology or a system is helpful in their task completion (Hoque, 2016). This study found out that most participants preferred to receive messages in Dholuo language signifying the importance of cultural background when designing text message adoption. Comprising local language to telehealth interventions goes a step further to considering the end users cultural background allowing them to have a sense of belonging and adaptation to mHealth messages.

The innovativeness employed in the text messaging including preference for language, timing of messaging and message type may have worked equally for all participants regardless of their socio-demographic characteristics. The potential of including local languages to overcome language and cultural barrier in T4A system is excellent to promoting ART adherence in the rural settings. This overcomes the disconnection of health care professional and patient communication and or attitudes that eventually affect a client's health seeking behave.

4.5.6 Overall Difference in the Effect of Mobile Texting within the Test Group Compared to the Control Group

In an effort to demonstrate the effectiveness of the intervention, the study also involved abstracting data on outcomes of up to four appointments in terms of whether the appointments were kept or missed for both control and test groups. This was for the period of one year during which the text for adherence was being implemented. Using both the number of appointments kept and the perceived self-efficacy based on the 9-question scale as measures of self-efficacy, results show that overall, there was significant differences in level of self-efficacy among participants in the test group compared to their counterparts in the control group (p-value <0.01; CI 95%). Table 4.43 provides the summary of the overall effect.

Table 4.45: Overall effect of text messaging on self-efficacy for adherence

Effect of message texting within the test group and control group based on actual appointments kept

Level of self-efficacy group	W	p-value	Conclusion
Overall comparison of all samples	46096	<0.01	Reject H0

Effect of text messaging on self-efficacy between the control and test groups based on the 9-questions scores

Level of self-efficacy group	W	p-value	Conclusion
Overall comparison of all samples	56715	< 0.01	Reject the H0

In the qualitative study, it is evident that the respondent's opinions reflect an intervention that was effective. Generally, the respondents talked about the text for adherence as an essential system focusing on appointment and treatment reminders for the patients. The majority of the respondents reported that the system was a good communication innovation aimed at improving keeping appointments and reducing the defaulter rate among patients.

> *"T4A is a good initiative as it helps patients in keeping appointments thus reducing defaulter rate"*_ Health facility user

> *"I think it is a good thing. To us as healthcare workers and peer educators, it really reduces our clients who are defaulting from care."*_ Facility level user

> *"A text is a good compliment to calling the clients when they default. It gives you the opportunity to reach more clients at once."*_ Program officer

However, some key informants expressed concerns about not being able to register all participants and an implementation process that was not all inclusive.

"I think the innovation was a good one to lead to positive improvements in attendance to appointments. However the implementation should change. It has to come from the ministry and not look like an EGPAF project."_ DASCO

"Text for adherence is a good system but we have not managed to register all our clients."_ Program Officer

Several studies have indicated that text messaging interventions have potential to improve appointment and medication adherence globally (Badawy et al., 2017). In one study done in Nigeria, for adherence to rapid diagnostic tests for malaria, results revealed 14.3 percent rates higher in the treatment group who were sent the SMS (Modrek, Sepideh; Schatzkin, Eric; Cruz, Anna D. L.; Isiguzo, Chinwoke; Nwokolo, Ernest; Anyanti, Jennifer; Ujuju, Chinazo; Montagu, Dominic; and Liu, Jenny, 2014). In Another review, almost all the studies 90% of mHealth communication interventions reviewed showed that there was improvement in adherence to treatment or self-management and care among patients.

The process of text messaging itself may tap important constructs (e.g., cues to action, reinforcement, social support) central to many behavioral theories (Lewis & Kershaw, 2010), that demonstrate improvement of self-efficacy in an individual. Studies have found that periodic prompts and reminders are an effective method to encourage and reinforce healthy behaviors given HIV/AIDS still has stigma attached (Fry & Neff, 2009). Although a potential drawback to the use of text-message-based mHealth interventions is potential marginalization of certain populations, such as those that are illiterate or do not have access to a mobile phone for financial reasons.

4.6 Summary of the Chapter

The findings of this study are encouraging and corroborate with many scholars that the use of mobile innovations in communicating with the patients will increase the perceived self-efficacy. This is important especially when you are dealing with a sensitive population and in order to increase adherence to treatment.

The findings also showed that the use of language or the frequency of the messaging has no relationship to the perceived self-efficacy. This is important for those who do not have the resources to translate the communication to multiple languages, so long as the recipients has one language that they are comfortable with. In Kenya, we have more than 45 languages spoken across the country. It would be very expensive to translate all communication to all these languages. However, most people can speak Swahili or English and with any of these two, any communication platform will be able to reach most people even in the rural areas.

In reference to the frequency of messaging, we have seen that monthly messages had a positive relationship to the perceived self-efficacy. For those who may not have the resources to send daily or weekly messages, they could decrease these and still have increased self-efficacy. However, this may not work for programs that require to have close and frequent contact with their clients.

In the study, the strategies were moderated to analyze the effect of the moderating factors which were age, gender and marital status. When moderating timing of messaging with age, there was a slight or no change in R^2 indicating low moderation effect for age but when moderated with gender and marital status, there was high change in R^2 an indication there was moderation effect for both gender and marital status on timing. This evidence could mean that timing is an important factor when considering messages to certain gender and or marital status as the messages could have certain implications that could affect how the message is received. The R^2 was higher for morning and evening when moderate by age, gender and marital status but lower in for afternoon. This evidence shows that there is more impact when messages are sent in the morning or evening. We can assume that afternoons are also a busy time of day and messages sent at that time may not be read or responded to.

When moderating the frequency of messaging with age, gender and marital status, there was high change in R^2 which is an indication that there was moderation effect for all the moderating variables, age, gender and marital status on frequency. The moderation was much higher for the Daily variable as compared to Weekly and Monthly variables.

When moderated with age, there was a slight or no change in R^2 indicating no moderation effect for age but when moderated with gender and marital status, there was high change in R^2 an indication there was moderation effect for both gender and marital status on language. This means gender and marital status have positive moderation effect on language.

When moderated with age, there was a slight or no change in R^2 indicating no moderation effect for age on messaging but when moderated with gender and marital status, there was high change in R^2 an indication there was moderation effect for both gender and marital status on messaging.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The primary goal of this study was to investigate the influence of mobile phone text messaging on perceived self-efficacy for HIV treatment among patients living with HIV in Kenya's Homa Bay County. The study has five particular objectives to do this. They were to 1) investigate the effect of timing of mobile text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County, 2) investigate the effect of frequency of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County, 3) investigate the effect of message type on perceived self-efficacy for treatment among PLHIV in Homa Bay County, and 4) investigate the effect of language of choice of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County, 5) to assess the moderating effect of demographic characteristics on the relationship between mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV in Homa Bay County.

This chapter summarizes the findings of the study. The chapter also presents the conclusions and recommendations based on the research findings, and suggest areas for further research. Thus, the chapter proceeds as follows: Section 5.2: Summary of findings; Section 5.3: Conclusions; Section 5.4: Recommendations; Section 5.5: Study's contribution to theory and existing body of knowledge and Section 5.6: Areas for future research.

5.2 Summary of findings

5.2.1 To examine the effect of timing of mobile text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County

All participants in the qualitative study indicated that it was critical to provide the users with ability to choose the timing of when to receive the messages. This created convenience in using the system. Quantitative findings support this observation in

the sense that there were no significant differences in terms of levels of self-efficacy among individuals who chose to receive messages in the morning, afternoon or evening. This indicates that when people are given an opportunity to choose the timing of the messages then they are likely to use the intervention given the high levels of self-efficacy among individuals in the test group regardless of the timing of the messages.

5.2.2 To investigate the effect of frequency of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County

From the qualitative study, it is evident that the frequency of the messaging patients would largely depend on the purpose of the messages. However, most participants observed that many messages would definitely become boring to the patients. Quantitative findings show that individuals who were receiving messages on a monthly basis and daily basis had slightly better appointment outcomes than those who were receiving messages on a weekly basis. It is important to note that the frequency of the messages also depended on the number of messages one had to receive based on the type of messages chosen. Whether one received messages once, twice or thrice did not really have significant effect on the appointment outcomes. Those who were receiving all the three types of messages including wellness, informative and appointment reminders were likely to have received more messages than the rest.

5.2.3 To examine the effect of the language of choice of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County

Participants in the qualitative study observed that the nature of the messages was good. They said that in designing the messages it is important to ensure that the messages do not create stigma. As such, messages have to conceal some information such as the status of the patient. Quantitative results indicate that regardless of the language of choice, all individuals who were in the test group had high level of self-efficacy. This demonstrates the importance of giving patients the ability to choose a language they are comfortable with. In terms of the type of messages, results show

that there were no significant differences in appointments outcomes among individuals who were receiving appointment reminders alone, appointment reminders plus wellness and appointment reminders plus informative messages. It's critical to note that appointment reminders were mandatory to all clients who had consented to receive messages. The appointment reminders were the messages directly linked to the appointment outcomes.

5.2.4 To examine the effect of type of messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County

This study posits that individuals' self-efficacy over their health outcomes are determined by message type and language preference toward text messages albeit the degree of their immediate social environment. Messages that were directly related to appointments yielded better outcomes among participants. Appointment reminders and wellness messages had better outcomes compared to informative messages. Qualitative findings show that the content of the messages in terms of message type was good.

5.2.5 To assess the moderating effect of demographic characteristics on the relationship between mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV in Homa Bay County.

The qualitative inquiry revealed that demographic characteristics are a major factor in determining the uptake of such solutions as well as appointment outcomes. Participants observed that women and their younger children were more likely to keep appointments. Men had the highest defaulter rates while the youth were more likely to disclose their status and would benefit from such an intervention because they had higher accessibility to mobile phones and ability to read. Quantitative results show that there was no relationship between demographic characteristics and self-efficacy.

5.2.6 Effect of mobile phone text messaging strategies on perceived self-efficacy for treatment

Results show that there were significant differences in the level of self-efficacy between patients in the test group and those in the control group. Participants in the test group had higher levels of self-efficacy based on both ability to keep appointments and perceived self-efficacy using the 9 question scale.

5.3 Conclusions

5.3.1 To examine the effect of timing of mobile text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County

In any communication platforms it is important for one to have the option to select a preferred time that they would wish to receive messages. In cases where there is stigma or discrimination, the patients can receive messages when they are free to read to use their phones without having interference from a third party. Also, giving people the option to select time empowers an individual and they may appreciate the system more and thus increasing their perceived self-efficacy which could lead to increased adherence to treatment.

5.3.2 To investigate the effect of frequency of mobile phone text messaging on perceived self-efficacy for treatment among PLHIV in Homa Bay County

Providing patients with options of frequency would lead to much better outcome. The frequency of the messages should depend on the model of care. Various studies showed that daily, weekly or monthly messaging could be equally effective if it fits well within the program and the patients were comfortable with it. If a patient is required to visit the hospital after six months, daily or weekly messages could prove to be annoying.

5.3.3 To examine the effect of the type of message on perceived self-efficacy for treatment among PLHIV in Homa Bay County

The type of messages sent to patients could have a positive or negative impact to any desired outcome if not well planned. This study noted that a positive relationship between appointment messages and perceived self-efficacy. However, when it came to general health information, most participants did not wish to receive them. This may be because of information overload or because one can access any information they need to get from the web. Most people will seek for information that they wish to receive at their own time and may not need a mobile platform informing them. In this study it was evident that if the information is related to the patient and is for their benefit it was well received and had a more positive outcome.

5.3.4 To examine the effect of language of choice of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County

We have observed from this study that choice of language has no significant effect on perceived self-efficacy and therefore we can assume that for as long as the receipient can understand the message in whatever language selected, there is high possibility of positive outcome. What is important to note is that the individual receiving the message understands it.

5.3.5 Assess the moderating effect of demographic characteristics on the relationship between mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV in Homa Bay County.

We observed that women were more receptive to the intervention than men. Studies have also shown that the HIV burden is higher on women than men. Men need to be encouraged to take up these interventions which could be done through peer sensitizations. People with basic education that can understand either English or Swahili can also benefit from mobile interventions.

Overall, providing patients with the ability to choose preferred timing, language, frequency and nature of messages make the intervention more comfortable, more

innovative and convenient to the needs of the patients. Overall text messaging could potentially lead to building of self-efficacy for certain desired behaviours for example keeping appointments.

5.4 Recommendations

5.4.1 General recommendations

First, based on findings in this study we can recommend the use of text messaging in health communication. Text messaging has ability to reach more people in a cost-effective way and thus creating impact in terms of changing behaviours at population level. Text messaging creates the impression that someone somewhere cares among the patients hence changing behaviours to the desired outcomes.

Secondly, this study recommends timing as one of the key strategies that should be considered and patients should take part in determining at what time they should receive messages. This would ensure that interventions are highly acceptable and effective and ensure that it provides a sufficiently interesting and rewarding experience. Future mHealth interventions should ensure that they send messages at the right time. This provides the recipient of the messages control of the timing of the messages and as seen in this study, has potential of increased perceived self-efficacy in treatment. Thirdly, the study recommends consideration of frequency of messaging as a way of ensuring that interventions are not only highly acceptable but effective too.

Future interventions should ensure that they send messages at the right frequency. However, messages should only be sent out on a monthly basis as it appears to have statistically significant effect on outcomes such as self-efficacy as demonstrated in this study.

Fourthly, type of messages has to be prioritized. There is no need to send messages that do not speak to the needs of intended beneficiaries. More focus should be put on appointment and wellness messages Appointment messages should be vital to improve adherence outcomes. Wellness messages promotes self-confidence and control over clients health thereby improving self-efficacy outcomes and should be

included more as compared to informative messages which get repetitive and exhaustive over time losing significance to the end user.

Fifth, giving beneficiaries the option of selecting the language of choice is important. An intervention delivered in a language that is easy to bu is more likely to have better outcomes. Using one language limits the beneficiaries in terms of receiving messages in the preferred language.

5.4.2 Policy recommendations

The Ministry of health has already recognized the role of text messaging to people living with HIV in Kenya. These findings further augment the effectiveness of messaging on building self-efficacy for appointments. The HIV antiretroviral treatment guidelines in Kenya provide for consenting of patients on a short messaging service platform for reminder messaging. This recommendation requires to be beefed up with enforcement, clear mandate and support to the county governments, partners implementing HIV programs and health facilities to ensure that the text messaging interventions and services are fully integrated in care. This would result in optimization of the impact of the solutions.

5.5: Areas for future research

There is need for longitudinal studies to be carried out on the role of text messaging in building self-efficacy for the long time wellbeing of populations as contained in the sustainable development goal three. Further, use of text messaging should be explored among other types of clients to find out its impact on a larger scale.

REFERENCES

Abdulrahman, S. A., Rampal, L., Ibraham, F., Radhakrishnan, A. P., Shahar, H. K., & Othman, N. (2017, May 16). Mobile phone reminders and peer counselling improve adherence and treatment outcomes of patients on ART in Malaysia; A randomized clinical trial. *PLOS ONE*.

Adler, A. J., Martin, N., Mariani, J., Tajer, C. D., Serrano, N. C., Casas, J. P., & Perel, P. (2015). Mobile phone text messaging to improve adherence to cardiovascular disease secondary prevention interventions. *Cochrane Database of Systematic Reviews, 8*.

Anglada, H. -M., Riu, G. -V., Martin, M. -C., Rovira, M. -I., & Sotoca, J. M.-M. (2015, January). Does mHealth increase adherence to medication? Results of a systematic review. *The International Journal of Clinical Practice, 69*(1), 9-32.

Badawy, SM; Barrera, L; Sinno, MG; Kaviany, S; O'Dwyer, LC; Kuhns, LM. (2017). Text Messaging and Mobile Phone Apps as Interventions to Improve Adherence in Adolescents with Chronic Health Conditions: A Systematic Review. (G. Eysenbach, Ed.) *JMIR MHEALTH AND UHEALTH, 5*(5), 1-17.

Bandura, A. (1994). Self-efficacy. *Encyclopedia of human behavior, 4*, 71-81.

Bandura, Albert. (1997). Self-Efficacy: Toward a unifying theory of behavioural change. *Psychological Review*.

Bandura, Albert. (2001). Social cognitive theory of mass communication. *Mediapsychology*, 265-299.

Bandura, Albert. (2004). Health promotion by social cognitive means. *Health Education & Behavior, 31*(2), 143-164.

Bandura, Albert. (2012, January). On the functional properties of perceived self-efficacy revisited. *Journal of Management, 38*(1), 9-44.

Banerjee, A., & Chaudhury, S. (2010, Jan-Jun). Statistics without tears: Populations and samples. *Industrial Psychiatry Journal, 19*(1), 60-65. doi:10.4103/0972-6748.77642

Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizatinal research. *Human Relations, 61*(8).

Bigna, J. J., Noubiap, J. J., Kouanfack, C., Plottel, C. S., & Koulla-Shiro, S. (2014). Effect of mobile phone reminders on follow-up medical care of children exposed to or infected with HIV in Cameroon (MORE CARE): A multicentre, single-blind, factorial, randomised controlled trial. *The Lancet Infectious Diseases, 14*(7), 600-608.

Bobrow, K., Farmer, A. J., Sprnger, D., Shanyinde, M., Yu, L., Brennan, T., . . . Levitt, N. (2016). Mobile Phone Text Messages to Support Treatment Adherence in Adults With High Blood Pressure (SMS-Text Adherence Support [StAR]) A Single-Blind, Randomized Trial. 592-600.

Bosworth, A. (2012). How can innovative uses of technology be harnessed to improve medication adherence? *Expert review of pharmacoeconomics & outcomes research, 12:2*, 133-135.

Bosworth, H. B.; Granger, B. B.; Mendys, P.; Brindis, R.; Burkholder, R.; Czajkowski, S. M.; Daniel, J. G.; Ekman, I.; Ho, M.; Johnson, M.; Kimmel, S. E.; Z., Liu. L.; Musaus, J.; Shrank, W. H.; Buono, E. W.; Weiss, K.; B., Granger. C. (2011). *Medication Adherence: A call for action*, *162*(3)

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology, 8*(1), 136-155.

Cafazzo, J. A., Casselman, M., Hamming, N., Katzman, D. K., & Palmert, M. R. (2012). Design of an mHealth App for the Self-management of Adolescent Type 1 Diabetes: A Pilot Study. *Journal Medical Internet Research, 14*(3).

CAK. (2018). *Communication Authority of Kenya, FIRST QUARTER SECTOR STATISTICS REPORT Financial Year 2018/2019.*

CAK. (2020). *Communication Authority of Kenya, First Quarter Sector Statistics Report for the Financial Year 2020/2021.*

Chen, J., & Allman-Farinelli, M. (2019, March). Impact of Training and Integration of Apps Into Dietetic Practic on Dietitians' Self-Efficacy With Using Mobile Health Apps and Patient Satisfaction. *JMIE mHealth and uHealth, 7*(3).

Choi, A., Lovett, A. W., Kang, J., Lee, K., & Choi, L. (2015). Mobile application to Improve medication adherence: Existing apps, quality of life and future directions. *Advances in Pharmacology and Pharmacy, 3*(3), 64-74.

Cole-Lewis, H., & Kershaw, T. (2010, March 30). Test Messaging as a Tool for Behavior Change in Disease Prevention and Management. *Epidemiologic Review, 32, 2010*, 56-69.

Cole-Lewis, H., & Kershaw, T. (2010). Text messaging as a tool for behaviour change in disease prevention and management. *Epidemiologic Review, 32*, 56-69.

Cook, T. D., & Campbell, D. T. (1979). Quasi-experimental: Design and analysis issues for field setting.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4 ed.). Sage Publications.

Davis, D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*, 982-1003.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*, 319-340.

Deglise, C., Suggs, L. S., & Odermatt, P. (2012). SMS for disease control in developing countries: a systematic review of mobile health applications. *J Telemed Telecare, 18*(5), 273-281.

Dimitrov, D., Moore, J. R., Donnell, D. J., & Boily, M. (2020). Achieving 95-95-95 may not be enough to end the AIDS epidemic in South Africa. (p. Abstract # 1095). Boston, Massachusetts: Conference on Retroviruses and Opportunistic Infections.

Dowshen, N., Kuhns, L. M., Johnson, A., Holoyda, J. B., & Garofalo, B. (2012). Improving Adherence to Antiretroviral Therapy for Youth Living with HIV/AIDS: A Pilot Study Using Personalized, Inter. *Journal of Medical Internet Research, 14*(2).

Egbert, N., & Omosun, F. (2017, May). Messag-induced self-efficacy and its role in health behavior change. *Health and Risk Communication*.

Feyissa, G. T., Abebe, L., Girma, E., & Woldie, M. (2012, July 13). Stigma and discrimination against people living with HIV by healthcare providerss, Southwest Ethiopia. *BMC Public Health*.

Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P., & Patel. (2013). The effectiveness of mobile-health technologybased health behaviour change or disease management interventions for health care consumers: a systematic review. *London School of Hygiene & Tropical Medicine*.

Godoe, P., & Johansen, T. S. (2012). Understanding adoption of new technology: Technology readiness and technology acceptance as an integrated concept. *Journal of European Psychology Students, 3*.

Green, J. C. (2007). Mixed methods in social inquiry.

GSMA. (2019). *The Mobile Economy 2019*.

Gurman, T. A., Rubin, S. E., & Roess, A. A. (2012). Effectiveness of mHealth behavior change communication interventions in developing countries: A systematic review of literature. *Journal of Health Communication, 17*, 82-104.

Hall, C. S., Fottrell, E., Wilkinson, S., & Byass, P. (2014, October 27). Assessing the impact of mHealth interventions in low- and middle-income countries - what has been shown to work? (U. Nawi Ng, Ed.) *Global Health Action, 7*, 1-12.

Hansana, V., Sanchaisuriya, P., Durham, J., Sychareun, V., Chaleunvong, K., Boonyaleepun, S., & Schelp, F. P. (2013). Adherence to Antiretroviral Therapy (ART) among People Living With HIV (PLHIV): a cross-sectional survey to easure in Lao PDR. *BioMed Central Public Health*.

Hansen, M. M. (2015). A feasiibility pilot study on the use of complementary therapies delivered via mobile technologies on Icelandic surgical patients' reports of anxiety, pain, and self-efficacy in healing. *BMC Complementary & Alternative Medicine, 15*(92).

Hayden, J. (2019). *Introduction to Health Behavior Theory* (3 ed.). New Jersey: Jones & Bartlett Learning.

Horvath, T., Azman, H., Kennedy, G. E., & Rutherford, G. W. (2012). Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection.

Ingersoll, K. S., Dillingham, R. A., Hettema, J. E., Conaway, M., Freeman, J., Reynolds, G., & Hosseinbor, S. (2015). Pilot RCT of bidirectional text messaging for ART adherence among nonurban substance users with HIV. *Health Psychology, 34*, 1305-1315.

Irimu, G.; Ogero, M,; Mbevi, G.; Kariuki, C.; Gathara, D.; Akech, S.; Barasa, E.; Tsofa, B.; English, M. (2018). Tackling health professinals' strikes: an essential part of health system strenthening in Kenya. *BMJ Global Health, 3*(e001136).

Islam, S. S., Lechner, A., Ferrari, U., Froeschl, G., Alan, D. S., Holle, R., . . . Niessen, L. W. (2014). Mobile phone intervention for increasing adherence to treatment for type 2 diabetes in an urban area of Bangladesh: protocol for a randomized controlled trial. *BMC Health Services Research, 14*(586).

Jacobs, E., Chen, A. H., Karliner, L. S., Agger-Gupta, N., & Mutha, S. (2006). The need for more research on language barriers in health care: A proposed research agenda. *The Milbank Quarterly, 84*(1), 111-133.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 31-36.

Kaiser, H. F. (1981). The revised measure of sampling adequacy for factor-analytic data matrices. *Educational and Psychological Measurement, 41*(2), 401-415.

Kimalu, P. K., & Marimba, K. (2014). *Research Methods Monitoring and Evaluation.* Nairobi: Kamuni Enterprises Limited.

KNBS. (2018). Kenya Integrated Household Budget Survey - Basic Report. *Kenya National Bureau of Statistics*.

Kombo, D. K., & Tromp, D. L. (2006). *Proposal and Thesis Writing: An Introduction.* Nairobi: Paulines Publications Africa.

Kothari, C. (2004). Research Methodology: Methods and techniques.

Krah, E. F., & de Kruijf, J. G. (2016). Exploring the ambivalent evidence base of mobile health (mHealth): A systematic literature review on the use of mobile phones for the improvement of community health in Africa. *Digital Health, 2*(0), 1-20.

Kumar, K. (1989). *Conducting Key Informant Interviews in Developing Countries.* A.I.D Program and Evaluation Methodology Report No. 13.

Larasati, N., Widyawan, & Santosa, P. I. (2017, April). Technology readiness and technology acceptance model in new technology implementation process in

low technology SMEs. *International Journal of Innovation, Management and Technolog, 8*(2).

Laverack, G. (2017). The challenge of behaviour change and health promotion. *MDPI, 8*(25).

Lester, R. T., Mills, E. J., Kariri, A., Ritvo, P., Chung, M., Jack, W., . . . Plummer, F. A. (2009). The HAART cell phone adherence trial (WelTel Kenya1): a randomized controlled trial protocol. *Trials, 10*(1), 1-10.

Lin, C.-H., Shih, H.-Y., & Sher, P. J. (2007, May 24). Integrating technology readiness into technology acceptance: The TRAM model. *Wiley Online Library, 24*(7).

Lin, C.-H., Shih, H.-Y., & Sher, P. J., & Y.-L., W. (2005). Consumer addoption of e-service: Integrating technology readiness with the technology acceptance model. Proceedings of PICMET '05: Technology Management: A Unifying Discipline for Melting the Bounderings. *24*(7), 843-488.

Livari, N., Molin-Juustila, T., & Kinnula, M. (2016). The Future Digital Innovators: Empowering the Young Generation with Digital Fabrication and Making. *Thirty Seventh International Conference on Information System, Dublin*.

Maciejewski, M. L. (2020). Quasi-experimental design. *Biostatistics & Epidemiology, 4*(1), 38-47.

Martinez-Mesa, J., Gonzalez-Chica, D. A., Duquia, R. P., Bonamigo, R. R., & Bastos, J. L. (2016, May-June). Sampling: how to select participants in my research study? *Anais Brasileiros De Dermatologia, 3*, 326-330.

McGuirk, P. M. (2016). Using questionnaires in qualitative human geography. *Qualitative Research Methods in Human Geography*(2518), 246-273.

Modrek, Sepideh; Schatzkin, Eric; Cruz, Anna D. L.; Isiguzo, Chinwoke; Nwokolo, Ernest; Anyanti, Jennifer; Ujuju, Chinazo; Montagu, Dominic; and Liu,

Jenny. (2014). SMS messages increase adherence to rapid diagnostic test results among malaria patients: results from a pilot study in Nigeria. *Malaria Journal*.

MOH. (2017). Kenya Standards and Guidelines for mHealth Systems. *Ministry of Health, Kenya*.

MOH. (2018). *Kenya Population-based HIV Impact Assessment (KENPHIA) 2018.* Ministry of Health.

Montague, E., & Perchonok, J. (2012, May). Health and wellness technology use by historically underserved health consumers: systematic review. *J Med Internet Res., 14*(3).

Mutuku, J. N. (2011). *The effect of M-PESA technology strategy on the performance of Kenya Commercial Bank Ltd.* University of Nairobi, Lower Kabete. Retrieved from http://erepository.uonbi.ac.ke/bitstream/handle/11295/ 12429/Mutuku_The%20Effect%20Of%20M-Pesa%20Technology%20 Strategy%20On%20The%20Performance%20Of%20Kenya%20Commercial %20Bank%20Ltd.pdf?sequence=3&isAllowed=y

NACC. (2016). *Kenya AIDS Response Progress Report.* Ministry of Health, National AIDS Control Council.

NACC. (2016b). *Kenya National AIDS Spending Assessment Report For The Financial Years 2012/13 - 2014/15.* National AIDS Control Council.

NACC. (2018). *Kenya HIV Estimates Report.* Ministry of Health, National AIDS Control Council.

Newby, L. K., LaPointe, N. M., Chen, A. Y., Kramer, J. M., Hammill, B. G., DeLong, E. R., . . . Califf, R. M. (2005). Long-Term Adherence to Evidence-Based Secondary Prevention Therapies in Coronary Artery Disease. *Health Services and Outcomes Research*.

Nglazi, M. D., Bekker, L. G., Wood, R., Hussey, G. D., & Wiysonge, C. S. (2013). Mobile phone text messaging for promoting adherence to anti-tuberculosis treatment: a systematic review protocol. *Systematic Reviews, 2*(6).

Nilsen. (2015). Making sense of implementation theories, models. *BioMed Central*.

ODK. (2020). *opendatakit.org*. Retrieved from opendatakit.org

Oso, W. Y., & Onen, D. (2016). *A General Guide to Writing Research Proposal and Report: A handbook for Beginning Researchers.* Nairobi, Kenya: The Jomo Kenyatta Foundation.

Osterberg, L., & Blaschke, T. (2005). Adherence to medication. *The New England journal of Medicine*.

Parasuraman, A. & Colby, C. L. (2001). Techno-ready marketing: How and why your customers adopt technology. *New York: Free Press*.

Parasuraman, A. (2000). Technology readiness index (TRI): A multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research, 2*, 307-320.

PEPFAR. (2018). *PEPFAR Strategy Country Fact Sheet: Kenya.*

Pirolli, P. (2016, December). A computational cognitive model of self-efficacy and daily adherence in mHealth. *Translational Behavioral Medicine, 6*(4), 496-508.

Pop-Eleches, Cristian; Thirumurthy, Harsha; Habyarimana, James P.; Zivin, Joshua G.; Goldstein, Markus P.; Walque, Damien de; MacKeen, Leslie; Haberer, Jessica; Kimaiyo, Sylvester; Sidle, John; Ngare, Duncan; Bangsberg, David R. (2011). Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders. *NIH Public Access*.

Porter, C. E., & Donthu, N. (2006). Using the technology acceptance model to explain how attitudes determine internet usage: The role of perceived barriers and demographics. *Journal of Business Research, 59*, 999-1007.

Rana, Y., Haberer, J., Huang, H., Kambugu, A., Mukasa, B., Thirumurthy, H., . . . Linnemayr, S. (2015, April 16). Short message service (SMS) - Based intervention to improve treatment adherence among HIV-Positive Youth in Uganda: Focus group findings. *The University of North Carolina of Chapel Hill, 10*(4).

Sano, A., Johns, P., & Czerwinski, M. (2017). Designing opportune stress intervention delivery timing using multi-modal data. *Seventh International Conference on Affective Computing and Intelligent Interaction*.

Sarkar, S. &. (2014, September). Conducting Record Review Studies in Clinical Practice. *Journal of Clinical & Diagnostic Research, 8*(9).

Schepers, J., & Wetzels, M. (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information & Management, 44*, 90-103.

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, *Measures in health* (pp. 35-37). Windsor, UK: NFER-NELSON.

Sharma, P., & Agarwal, P. (2012). Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection. Retrieved from http://apps.who.int/rhl/hiv_aids/cd009756_sharmap_com/en/

Strandbygaard, U., Thomsen, S. F., & Backer, V. (2010). A daily SMS reminder increases adherence to asthma treatment: A three-month follow-up study. *Respiratory Medicine, 104*(2), 166-171.

Tsikriktsis, N. (2004). A technology readiness-based taxonomy of costumers: A replication and extension. *Journal of Service Research, 7*, 42-52.

UNAIDS. (2015). *Understanding Fast-Track: Accelerating action to end the AIDS epidemic by 2030.* Retrieved January 24, 2019, from http://www.unaids.org/sites/default/files/media_asset/201506_JC2743_Understanding_FastTrack_en.pdf

UNAIDS. (2016). *Prevention Gap Report.* Geneva: Joint United Nations Programme on HIV/AIDS. Retrieved from http://www.unaids.org/sites/default/files/media_asset/2016-prevention-gap-report_en.pdf

UNAIDS. (2018a). *Country factsheets, Kenya 2017 - 2018.* UNAIDS. Retrieved from http://www.unaids.org/en/regionscountries/countries/kenya

UNAIDS. (2018b, jULY). Ending the AIDS epidemic - Fact sheet. Retrieved from http://www.unaids.org/en/resources/fact-sheet

Valimaki, M., Hatonen, H., & Adams, C. E. (2012). Mobile.net: Mobile telephone text messages to encourage adherence to medication and to follow up with people with psychosis: Methods and protocol for a multicenter randomized controlled two-armed trial. *JMIR Research Protocols, 1*(2).

Venkatesh, V., & D., D. F. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*, 186-204.

Walczuch, R., Lemmink, J., & Streukens, S. (2007). The effect of service employees' technology readiness on technology acceptance. *Information & Management, 44*, 206-215.

WHO. (2003). *Adherence to long-term therapies: Evidence for action.* Geneva: World Health Organization. Retrieved from http://apps.who.int/iris/bitstream/handle/10665/2682/9241545992.pdf;jsessionid=41B21BE6DE1E933D1A6222D339807CFB?sequence=1

WHO. (2011). *Global HIV/AIDS Response: Epidemic update and health sector progress towards Universal Access - Progress Report 2011.* World Health

Organization. Geneva: World Health Organization. Retrieved from http://www.who.int/hiv/pub/progress_report2011/en/

WHO. (2016). *Consolidated Guidelines on HIV Prevention, Diagnosis, Treatment and Care for Kenya Populations - 2016 Update.* Geneva: World Health Organization.

Zulkosky, K. (2009, May). Self-Efficacy: A Concept Analysis. *Nursing Forum*, 93-102.

Zurovac, D., Sudoi, R. K., Akhwale, W. S., Ndiritu, M., Hamer, D. H., Rowe, A. K., & Snow, R. W. (2011, August 4). The effect of mobile phone text-message reminders on Kenyan health workers' adherence to malaria guidelines: a cluster randomised trial. *Lancet, 378*, 795-803.

APPENDICES

Appendix I: Consent form for qualitative inquiry

EFFECT OF MOBILE PHONE TEXT MESSAGING STRATEGIES ON PERCEIVED SELF-EFFICACY FOR TREATMENT AMONG PLHIV/AIDS IN HOMA BAY COUNTY, KENYA

Hi, my name is ……………………………... I am collecting data on behalf of Cathy Mwangi, a PhD student at Jomo Kenyatta University of Agriculture and Technology.

Having been part of a mobile based intervention for adherence, you are invited to participate in a study on how the messages you have been receiving have helped you.

Please read/listen to this document in full before deciding whether to participate. Feel free to ask me any questions, or contact the researcher/student for more information:

>**Researche**r: Cathy Mwangi
>**Mobile phone**: 0712636688

>**Email**: cathy.w.mwangi@gmail.com

>**Institution**: Jomo Kenyatta University of Science and Technology

What is the study about?

This study is about assessing the effect of mobile phone text messaging strategies on perceived self-efficacy for treatment among PLHIV/AIDS in Homa Bay County, Kenya. You have been chosen to take part in interviews because we are interested in your opinions about the system (s).

If you agree, we will ask you to participate in a focus group interview with between 6-8 other participants. Some of the things we will talk about in the group include:

- ✓ Your adherence to appointments

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- ✓ Your experience in using the solution
- ✓ Your opinions on the solution

The interview will last about 30-45 minutes. You can choose to do the interview in English or Kiswahili. It will be recorded (sound only, not video), transcribed (written down) and translated into English (if in Kiswahili).

What if you don't want to participate?

Your participation is completely voluntary. There is no penalty if you decide not to do an interview. You can still take part in other services or programs being implemented. If you want to take part, you will need to sign the consent form. This means that you understand and agree with the information here. During the interview, you don't have to answer any questions that you don't want to. There are no right or wrong answers to the questions. You may stop the interview at any time if you don't feel comfortable.

Benefits of being in the study

You may find it enjoyable and helpful to share your opinions and experiences with us. Findings from this study will help in creating knowledge about mobile solutions, informing policy and programmes

Risks of being in the study

There are no risks of participating in this study. However, if participation causes you distress, or something happens you may choose to stop the interview at any time.

Payment

You will not be paid for taking part in this study. However, your participation will be highly appreciated.

Confidentiality and privacy

The information you give will remain private. Your name and contact details will be kept separate from your answers to the interview questions.

We plan to publish the results in reports and journal articles, and we may present the results at conferences. We may publish quotes from the interviews, but will not use names or other identifying information. We will never publish any information that could be used to identify you or people you have told us about.

How will we store your information?

The audio recordings and documents containing your answers to the interview questions will be stored on a computer. They will only be accessible by the research team using a password. Your name will not be written on these documents. Your contact details will be kept in a private secure computer file only accessible to the members of the research team in case they need to contact you.

The information collected will be stored for at least 5 years. It will then be destroyed if it is no longer required.

Results

Results from this study will be published in a PhD thesis that will be available on Jomo Kenyatta University of Science and Technology's website.

Complaints

This research has been approved by Jomo Kenyatta University of Science and Technology. For any complaints please contact the researcher/student

Student: Mwangi Cathy

Mobile phone: 0712636688

Or

Jomo Kenyatta University of Science and Technology

Thank   you.

CONSENT FORM/CERTIFICATE

I have been asked to take part in the study. I have read and understood the Information Sheet and I agree to participate.

Name of participant:

Participant Signature (or thumb print) *:   Date: _____

*Name of Researcher _____

Researcher signature: _____

Date_____

Appendix II: Study Instrument: File Review

Intervention Group

Assigned Participant Number	Facility	Enrolment Date into the T4A system	Appointment dates	Appointment Outcome	Viral Load Test Result

Control Group

Assigned Participant Number	Facility	Enrolment Date into care and treatment at the facility	Appointment dates	Appointment Outcome	Viral Load Test Result

Appendix III: In-depth Interview guide

Warm up question

- Tell me what you know about T4A
- What are your general opinions on the T4A solution?

Objective 1: To examine the effect of timing of mobile text messaging on self-efficacy for treatment among PLHIV in Homa Bay County

- What options did the T4A solution provide to users in terms of selecting the timing of the messages?
- In terms of building self-efficacy why was it important to provide users with the option of selecting the time when they would receive messages?
- Do you think the provision of participants with the option of selecting time resulted in building self-efficacy? Probe why/why not

Objective 2: To investigate the effect of frequency of mobile phone text messaging on self-efficacy for treatment among PLHIV in Homa Bay County

- How frequent were messages sent out to participants?
- Why was it (frequency) that way? Probe for daily, weekly, monthly
- Do you think the frequency of messages would have affected building of self-efficacy among user? Probe why/why not

Objective 3: To examine the effect of the type of message of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County

- What is your opinion on the type of messages in the T4A platform?
- Do you think the nature of messages would have affected building of self-efficacy among user? Probe why/why not

Objective 4: To examine the effect of language of choice of mobile phone text messages on perceived self-efficacy for treatment among PLHIV in Homa Bay County

- What is your opinion on the language of choice in the T4A platform?
- Do you think the choice of language would have affected building of self-efficacy among user? Probe why/why not

Objective 4: Assess the moderating effect of demographic characteristics on the relationship between mobile phone text messaging strategies and perceived self-efficacy for treatment among PLHIV in Homa Bay County.

- What is your opinion on the demographic characteristics of the people who participated in the T4A project? Project level of education, age, poverty levels.
- Do you think the demographic characteristics of the participants in the T4A project would have affected building of self-efficacy among user? Probe why/why not

Appendix IV: Quantitative Survey Questionnaire

EFFECT OF MOBILE PHONE TEXT MESSAGING STRATEGIES ON PERCEIVED SELF-EFFICACY FOR TREATMENT AMONG PLHIV/AIDS IN HOMA BAY COUNTY, KENYA

Interviewer number |_____|_____|

Gender/Sex |_____|

Start Time |_____|_____|: |_____|_____|

Introduction: Thank you for meeting with me today. We're interviewing people who participated or are participating in a mobile phone texting project (T4A) to improve adherence.

This study is about assessing the effect of mobile phone text messaging strategies on perceived self-efficacy for treatment among PLHIV/AIDS in Homa Bay County, Kenya. The purpose for the study is mainly academic (as part of PhD requirements of Jomo Kenyatta University of Science and Technology).

You have been chosen to take part in interviews because we are interested in your opinions about the system (s) and its effects on your appointments keeping behaviour.

If you agree, I will ask you to participate in a one-one interview. The interview will take 30-45 minutes.

Confidentiality and consent: Some people may find these questions difficult to answer. Your answers are completely confidential. Your name will not be written on this form, and will never be used in connection with any of the information you tell me. You do not have to answer any questions that you do not want to answer, and you may end this interview at any time you want to. However, your honest answers to these questions will help us better understand what people think, say and

do about appointments to care and treatment. We would greatly appreciate your help in responding to these questions. Would you be willing to participate?" YES [ ] NO [ ]

Interviewers initial: |_____|_____|_____|

(Interviewer's initial certifying that informed consent has been given verbally by respondent)

*notes – all questions will have a 'don't know' and 'choose not to respond' option. All responses should be read out unless otherwise indicated.

*All participants must have given written consent before answering any questions

No.	Questions and filters	Categories	Codes	Skip
SECTION 1: Demographics Characteristics I am going to start by asking you some questions about yourself. Please try and relax, there are no right or wrong answers. Remember that everything you tell me will be kept secret and that you can refuse to answer any question you do not wish to answer.				
	Gender of the participant	Male Female	1 2	
	How old are you? (in years of age)		|__|__|	
	What is your <u>current</u> marital status?	Legally/formally married Single Cohabiting/Live-in partners Separated/divorced Widowed	1 2 3 4 5	
	What is your highest level of education?	None Not completed prim. school Completed primary school Not completed sec. school Completed secondary school Completed tertiary training	1 2 3 4 5 6	
	What is your religion?	Protestant Catholic Muslim Other (Specify)_____	1 2 3 4	
	How many children are currently living with you?		|___|___|	
	Number of dependants or people you support financially		|___|___|	
	In the last <u>6 months,</u> what are your sources of income? (*multiple responses possible*)	Commerce Formal employment Casual labour Husband/boyfriend Other (Specify)_____	1 2 3 4 5	
	In the last <u>6 months,</u> what is your <u>average weekly</u> income?	Less than Ksh. 100 Ksh.101- Ksh 500 Ksh 501- Ksh 1000 Ksh 1001- Ksh 2000 Ksh 2001 & above No income	1 2 3 4 5 6	

No.	Questions and filters	Categories	Codes	Skip
	What type of phone do you own? (multiple-response allowed)	Basic Feature phone Smart phone I don't know	1 2 3 999	
	Who is your main communication service provider (SIM card)	Safaricom Airtel You Orange Other I don't know	1 2 3 4 5 999	
	Does anybody else use your phone or read your messages? (multiple-response allowed)	Nobody Partner Other family Friends Other (specify) _____	1 2 3 4 5	
	Has your main mobile phone number changed in the past 6 months?	Yes No No response / Don't know	1 2 3	

Section 2: Use of TEXT FOR ADHERENCE (Independent variable)

I will now ask you questions on how you have been interacting with the TEXT FOR ADHERENCE team

Language

	In which language were you receiving messages	Dholuo Kiswahili English I don't know	1 2 3 998	
	Do you think the language used in the messages gave you hope?			
	The language used/ (selection of language) in the messages was good?			
	The language used in the messages was insecure? ……………………………………………………………………….			
	The language used in the messages was not comfortable? …………………………………………………………………………			

Message Types

	What type of messages were/are you receiving	Appointment messages Wellness messages Informative messages all of the above I don't know	1 2 3 4 998	
	Was the type of messages used optimistic?...			
	Was the type of messages used innovative?..			

No.	Questions and filters	Categories	Codes	Skip
	Were the type of messages used insecure?…………………………………			
	Were the type of messages used not comfortable?…………………………….			
Timing of the messages				
	At what time are/were you receiving messages from T4A	Morning Noon Evening I don't know	1 2 3 998	
	Was it innovative to select the time of receiving messages?..................................			
	The time of receiving messages is/was insecure?.......................................			
	I was not comfortable receiving messages at the selected time?.................................			
	It was insecure to receive messages at the selected time?..............................			
Frequency of the messages				
	How many times are you receiving messages from T4A	Daily Weekly Monthly I don't know	1 2 3 998	
	Were you comfortable receiving messages on: Daily basis? Weekly basis? Monthly basis? ……………………………………………………..			
	Did it feel insecure to receive messages on: Daily basis? Weekly basis? Monthly basis? ……………………………………………………………			
Section 3: Self-efficacy (Dependent Variable) *Click what applies*				
	If I try hard enough, I can always keep all my appointments attended	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	

No.	Questions and filters	Categories	Codes	Skip
	No one can influence me not to keep my appointments.	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	
	It is easy for me to stick to my aims and accomplish my goals including keeping all my appointments	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	
	Thanks to my resourcefulness, I know how to handle unforeseen situations so that I keep my appointments	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	
	I can solve most problems if I invest the necessary effort to attend my appointments	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	
	I can remain calm when facing difficulties by relying on my coping abilities to keep all my appointments attended	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	
	When I am confronted with a problem, I can usually find several solutions to keep my appointments	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	
	If I am in trouble associated with keeping my appointments, I can usually think of a solution	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	

No.	Questions and filters	Categories	Codes	Skip
	I can usually handle whatever comes my way to keep my appointments	Not at all true Hardly true Moderately true Exactly true I don't know	1 2 3 4 998	

Appendix V: Non-disclosure Agreement

(All Research Assistants Collecting Data on Behalf of Catherine W. Mwangi

Check if Appropriate   □

I _____ shall at all times maintain the privacy & confidentiality of the facilities, staff, patients, and/or Health Care Workers that maybe part of the data collection process. I shall not at any given time record any information related to the facility, staff, patient and/or HCW in a way that is not in-line with the intended process or purpose of the process. At no time shall I disclose any information related to the processes and procedures that I may be privy to in relation to the reporting tools and/or systems. The privacy & confidentiality of the registers, forms and any questions that are related to the process shall be observed.

Signed by: _____

Job Position: _____

Facility Name: _____

Witness 1: _____   Witness 2: _____

Date: _____

Appendix VI: NACOSTI permit

NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 366928

Date of Issue: 22/November/2019

RESEARCH LICENSE

This is to Certify that Dr. Catherine Mwangi of Jomo Kenyatta University of Agriculture and Technology, has been licensed to conduct research in Homabay on the topic: EFFECT OF MOBILE PHONE TEXT MESSAGING STRATEGIES ON PERCEIVED SELF-EFFICACY FOR TREATMENT AMONG PLHIV/AIDS IN HOMA BAY COUNTY, KENYA for the period ending : 22/November/2020.

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