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Abstract

Purpose: The purpose of this study was to ascertain the effect of timing of mobile phone text messaging (as a communication strategy employed in the text for adherence intervention) on perceived self-efficacy for treatment among people living with HIV/AIDS in Homa Bay County, Kenya.

Methodology: Overall the study used a quasi-experimental design involving a control and an intervention group to assess the effect of the text messaging. This paper focusses on the intervention group. The key variables discussed in this paper are timing and perceived self-efficacy. The study comprised of both quantitative and qualitative data. Simple linear regression models and multi-linear regression models were used to estimate the relationship between the independent variable (timing of messages) and the dependent variable (self-efficacy). Qualitative data was analysed thematically and narratives provided under each section in verbatim.

Findings: The intervention group of the study achieved a sample size of 77.92 per cent (n=247/317). Timing of the messages was found to have a statistically significant relationship with perceived self-efficacy as a standalone predictor variable. However when broken down into components (morning, noon and evening) none had a relationship with self-efficacy index. Similarly, when combined with other variables that were studied (type of messages, frequency and language), timing did not have a relationship with self-efficacy.

Unique contribution to theory, practice and policy: Programs and partners involved in designing and implementing mHealth solutions need to consider and involve participants in determining communication strategies that can be effective. Timing is one of the many strategies that patients should take part in. This would ensure that interventions are highly acceptable and effective and ensure that it provides a sufficiently interesting and rewarding experience.

Key words: *Appointment adherence; Communication strategies; HIV/AIDS; Self-efficacy; Timing of messages; Text for adherence.*

1.0 INTRODUCTION

Evidence has shown that mHealth interventions especially short messages can improve adherence (Mbuagbaw, 2013); (Ronen, 2018). However, there is no consensus on how the interventions ought to be delivered (Ronen, 2018). Most of the interventions are designed by implementers with little or participation of the intended users. Ultimately, it is the designers who determine the strategies to employ such as timing of messages and the language. By mid-2019, there were 38 million people living with HIV/AIDS (PLHIV) globally. Of these, 25 million (62%) were on treatment. Kenya has the fifth-largest number of persons living with HIV in the world, and HIV continues to be a leading cause of adult morbidity and mortality. To track progress towards ending the HIV epidemic by 2030, the Joint United Nations Program on HIV/AIDS developed the 95-95-95 program targets, which calls for 95 per cent of people living with HIV to know their status; 95 per cent of those who know their status to be linked to treatment; and 95 per cent of those linked to treatment to be virally suppressed. Majority of the countries including Kenya are committed towards achieving the targets (UNAIDS, 2015). According to the President's Emergency Plan for AIDS Relief (PEPFAR), Kenya has had tremendous gains in HIV/AIDS programming (PEPFAR, 2019). According to the National AIDS Control Council, (2018), in the last decade, Kenya has had the greatest positive impact in controlling the HIV epidemic in Kenya since HIV incidence among adults aged 15-49 has declined from 3.5 per 1000 in 2010 to 1.4 per 1000 in 2018.

Adherence to treatment is an essential aspect to achievement of these goals. Adherence to treatment results in optimal outcomes across many diseases. On the other hand, poor adherence for example in the treatment of HIV is associated with less effective viral suppression, thus risking the health of the patient and resistance to treatment. There are a myriad of causes to poor adherence to HIV treatment. These include complexities that come with varying treatment regimens (e.g. pill burden and dosing frequency), treatment side effects, poor health literacy, poor patient-health provider relationship, and limited access to treatment. It is therefore important to address potential barriers to adherence in order to achieve viral suppression and optimize outcomes among people living with HIV. Some of the key strategies include fixed-dose combinations of treatment regimens to reduce dosing complexity, medication therapy management initiatives and educational interventions (Schaecher, 2013).

The field of mobile phone technology continues to experience tremendous growth globally. There is an increase in the level of mobile phone penetration and use specifically in Kenya and globally. This has continued to elicit interest towards mobile technology-based interventions. Although mHealth technology advanced rather recently, this area of research has expanded rapidly since 2002 (Hall, 2015). Text messaging interventions have been used in promoting appointment and medication adherence globally, with changing health behaviours and improved health outcomes (Hall, 2015; (Deglise, Suggs, & Odermatt, 2012) (Sharma & Agarwal, 2012)).

Accordingly, an organization called mHealth Kenya in collaboration with the Ministry of Health Division of National AIDS and STI Control Program and the Elizabeth Glaser Paediatric AIDS Foundation developed and has been implementing the Text for Adherence (T4A) system in Kenya since 2017. T4A is a system designed to manage appointments and improve adherence to treatment among HIV patients. The T4A system is an integrated mobile and web-based technology platform that uses text messaging to increase awareness on HIV treatment and appointment keeping. T4A aims at improving the health outcomes of the PLHIV by providing timely and reliable messages including appointment reminder messages,

treatment adherence messages and wellness messages. The platform also provides the care provider with an electronic appointment diary and defaulters tracing module aimed at managing patients' appointments at the facility level. Patients are registered into the system by health providers at facilities. Upon consenting, patients start to receive messages. While providing consent, the patients have the option to select the time when they will be receiving messages. Thereafter, the messages are automatically sent to the patients at the most preferred time. The messages are of different type (appointment reminders, wellness, informative), are delivered in the preferred language (English, Swahili, Luo) and at the most appropriate time based on the patient's choices. A study was conducted in 2020 to assess the influence of timing of messages on perceived self-efficacy among people living with HIV/AIDS.

Objective

The T4A intervention allowed patients to select the most appropriate time of when they would like to receive messages. In this study, the indicators of timing as a variable are morning, noon and evening hours. This study aimed at assessing the effect of timing of mobile phone text messaging, as a communication strategy, on perceived self-efficacy for treatment among people living with HIV/AIDS in Homa Bay County, Kenya. This paper examines whether timing had an effect on levels of self-efficacy and whether there were any significant differences in the levels of self-efficacy among patients who received messages in the morning, noon or evening.

Study Hypothesis

The null hypothesis that was tested is:

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

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

Where Y= Self efficacy index

$\beta 0$ = 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; Frequency of messages

ε = Random error

The main study question that this paper attempts to answer is what effect does timing of messages have on perceived self-efficacy for treatment among PLHIV in Homa Bay County?

2.0 LITERATURE REVIEW

The timing of an SMS based solution is critical because of the varied sociodemographic characteristics among participants. Timing of messages influences how a target audience reacts to health messages. Individuals require messages when they are able to pay attention. 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). Some preferred receiving messages in the morning so that youth can organize their day including taking their pills and during times when youths' phones were likely to be turned on. Another 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 with their parents or other family members (Sano et al., 2017).

According to Riet et al. (2008), perceived efficacy consists of response efficacy (the perception that the recommended action can avert a threat; Rogers, 1975) and self-efficacy (confidence in the ability to perform the recommended behavior; Bandura, 1986). Thus, for T4A messages to be effective, both the perception of a certain level of threat and confidence in one's ability to adhere to treatment are important. This is likely to affect development of self-efficacy among participants. Timing including content of messages becomes an important factor to promote adherence to ART treatment for individuals. However, current research does not yet provide precise indications about when these convenient times might be or the threshold for when notifications become irritating and intrusive (Morrison et al., 2017). Sending messages at the right time ensures end users open and read them. Timing also creates a positive customer experience since messages are sent at convenient times. Czerwinski et al. (2017) findings show that designing the right timing of notifications was very important to provide less destructive interruptions (Sano, Johns, & Czerwinski, 2017).

Theoretic Framework

The self-efficacy theory was used to assess the effectiveness of the communication strategy on influencing human behavior. mastery experience; vicarious experience; verbal persuasion; and somatic and emotional state are the four major factors of the self-efficacy theory that were used to design the messages and guide the study. T4A messaging system is a mobile and web-based platform developed with the objective of improving the health outcomes of PLHIV by providing timely and reliable messages. Reit et al. (2008) hypothesizes that Persuasive health messages are a central component of efforts to promote healthy behavior specifically how persuasive health messages are framed that can manipulate an individual through Somatic and emotional adaptations. Accordingly, T4A message module included; appointment reminder messages, treatment adherence messages, and wellness messages. The expected outcome is improved appointment keeping rates by clients because of the reminders. The messages (T4A) were designed to condition PLWHA by encouraging familiarity through a series of repetition, thus the more one relates or connects with the messages, the higher the influence on the belief that they can also accomplish the communicated behavior.

The Technology readiness and acceptance model (TRAM) was also used to complement the self-efficacy theory and further assess the perception of efficacy, as predisposed by technology readiness index (TRI) and technology acceptance theory (TAM). The integrated theory looks at the adoption and acceptance of new technology and how it attributes may affect how an individual perceives the technology subsequently affecting 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. The platform also provides the care provider with an electronic appointment diary & defaulters tracing module aimed at managing patients' appointments and trace defaulters at the facility level promoting ART adherence of T4A users. The study intends to assess when users are most likely to attend and respond to notifications to promote self-efficacy.

There is limited literature that evaluates 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. Although Mahatanankoon & O' Sullivan (2008), examines that determinants of user attitude regarding

text messages are lagging behind the widespread use of text messages, there is need to establish relationship between various facets that text messages hold; which may include timing 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.

3.0 METHODOLOGY

Implementation of the text for adherence began in 2017 in three facilities in Homa Bay County. Users at facilities are provided with training on how to use the system. HIV patients are then enrolled by the facility users. Broadly, the study employed a quasi-experimental design to ascertain the overall effect of text messaging on perceived self-efficacy for appointment adherence. An important feature of experimental studies includes deciding the population you are targeting and drawing representative sample for your study (Kimalu & Marimba, 2014). Data was collected from two groups of participants (intervention and control). The intervention group comprised of PLHIV who were receiving care and treatment and had consented to receive mobile phone text messages through the text for adherence system in the three facilities that were part of the study.

The control group comprised of PLHIV who were also receiving care and treatment from the same three facilities but had not consented to receive mobile phone text through the text for adherence. This paper is based on data from within the intervention group only. This is because data on the key independent variable (timing of messages) could only be collected from the intervention arm of the study. Descriptive analysis was conducted to explore frequencies on key variables. Timing was grouped into morning, noon and evening and Perceived self-efficacy was measured using nine questions on a 4-point (4-Exactly true, 3-Moderately true, 2-Hardly true, 1-Not at all true) - Likert scale.

The following formula for quasi-experimental designs was applied to estimate the sample size:

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

Where:

n = Sample size in each arm

ṕ = 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 estimated study sample for the intervention group (which forms the basis of this paper) was 317. The control group comprised of 381 individuals. However, data in this group is not covered in this paper. Random sampling was used to recruit individuals within each group. The study used Spearman's Rho non-parametric test and simple linear regression models to examine the influence of timing on perceived self-efficacy. Key informant interviews were carried out among healthcare workers, program managers and county officials to understand

their opinions about the system and interview schedule for recipient users of the T4A messages. Quantitative and qualitative data are presented in tables and narratives respectively.

4.0 RESULTS

4.1 Response rate

The desired 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 Centre and Gongo Dispensary. The study achieved a sample size of 543 representing 77.79 % of the desired sample. The intervention group achieved a sample size of 77.92% (n=247/317) while the control group achieved a sample size of 77.69% (n=296/381). Distribution of sample size per group by facility is presented in Table 1.

Table 1: Response rate by health facility and group

	Control group			Intervention group			Total		
Study site/health facility	Expected sample size (N)	Achieved sample size (n)	% (n/N)	Expected sample size (N)	Achieved sample size (n)	% (n/N)	Total expected (N)	Achieved sample size (n)	% (n/N)
Gongo dispensary	90	71	78.89%	38	28	73.68%	128	99	77.34%
Kiasa Health Centre	116	92	79.31%	150	112	74.67%	266	204	76.69%
Ogongo sub-County hospital	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%

The focus of this paper is on the intervention group since data on the main independent or predictor variable (timing of messages) could only be obtained from patients who were receiving messages as part of the intervention.

4.2 Timing of mobile text messaging

Timing in this study was conceived to mean the instance measured in hours to receive messages. Messages were delivered during morning, noon and evening hours. Respondents were asked to report the time they preferred to receive messages. Thirty-seven percent (37.65%) of the participants preferred to receive messages in the morning. Twelve percent (12.55%) preferred to receive the messages at noon. Thirty-six percent (36.84%) opted to receiving messages in the evening while twelve percent (12.96%) did not know what time of the day they preferred to receive messages. Scores on the time preferences are summarized in Table 2.

Table 2: Time preferences for receiving messages

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

4.3 Timing as a communication strategy

Most of the participants agreed that the timing of the messages was innovative (83.8%), secure (85.40%) and comfortable (85.8%) as indicated in Table 3. This implies a high possibility that the messages were read by the participants resulting in the desired outcome of improving health outcomes. In this study, timing was specified and preferred by the patients. This is similar to other studies including (Dowshen, Kuhns, Johnson, Holoyda, Garofalo, 2012); Belzer, Naar-King, Olson, Sarr, Thornton, Kahana, et al., 2014). In other studies timing of messages was based on dosing time such that messages were received when patients were supposed to take their doses (Da Costa, Barbosa, Costa, Sigulem, De Fátima, Filho, et al., 2014); (Ammassari, Trotta, Shalev, Tettoni, Maschi, Di Sora, et al.,2011). In most of the other short messaging interventions, messages were sent at fixed times (Lester, Ritvo, Mills, Kariri, Karanja, Chung et al., 2010); (Pop-Eleches, Thirumurthy, Habyarimana, Zivin, Goldstein, de Walque, et al.,2011).

Table 3: Perceptions on timing as a communication strategy

		Frequency	Percent %
It was innovative to select the time of receiving messages	I don't know	35	14.2
	No	5	2.0
	Yes	207	83.8
	Total	247	100.0
The time of receiving messages is was secure	I don't know	33	13.4
	No	3	1.2
	Yes	211	85.4
	Total	247	100.0
I was comfortable receiving messages at the selected time	I don't know	33	13.4
	No	2	0.8
	Yes	212	85.8
	Total	247	100.0

4.4 Perceived self –efficacy

Self-efficacy indicator looks at the direct patterns of adherence by participants receiving T4A messages, thus permits adapting the intervention to the individual over the course of the intervention itself (Riley et al. 2011). Self-efficacy scores were measured using 4-likert scale. The measures were categorized into high, moderate and low levels of self-efficacy. Individuals with high level of self-efficacy scored exactly true on all questions, while;

individuals who scored moderately true were classified as having moderate level of self-efficacy. Low level of self-efficacy comprised of individuals who scored hardly true and not at all true on all questions. Table 4 presents the perceived self-efficacy.

Table 4: Perceived self-efficacy among members of the intervention group

Self-efficacy statement	Response	Frequency	Percent	Level of self-efficacy
If I try hard enough, I can always keep all my appointments attended	Exactly true	212	85.83%	High
	Moderately true	32	12.96%	Moderate
	Hardly true	2	0.81%	Low
	Not at all true	1	0.40%	Low
	Total	247	100.00%	
No one can influence me not to keep my appointments	Exactly true	217	87.85%	High
	Moderately true	26	10.53%	Moderate
	Hardly true	3	1.22%	Low
	Not at all true	1	0.40%	Low
	Total	247	100.00%	
It is easy for me to stick to my aims and accomplish my goals including keeping all my appointments	Exactly true	214	86.64%	High
	Moderately true	26	10.53%	Moderate
	Hardly true	5	2.02%	Low
	Not at all true	2	0.81%	Low
	Total	246	100.00%	
Thanks to my resourcefulness, I know how to handle unforeseen situations so that I keep my appointments	Exactly true	208	84.21%	High
	Moderately true	36	14.58%	Moderate
	Hardly true	2	0.81%	Low
	Not at all true	1	0.40%	Low
	Total	247	100.00%	
I can solve most problems if I invest the necessary effort to attend my appointments	Exactly true	212	85.83%	High
	Moderately true	32	12.96%	Moderate
	Hardly true	2	0.81%	Low
	Not at all true	1	0.40%	Low
	Total	247	100.00%	
I can remain calm when facing difficulties by relying on my coping abilities to keep all my appointments attended	Exactly true	203	82.19%	High
	Moderately true	40	16.19%	Moderate
	Hardly true	3	1.22%	Low
	Not at all true	1	0.40%	Low
	Total	247	100.00%	
When I am confronted with a problem, I can usually find several solutions to keep my appointments	Exactly true	210	85.02%	High
	Moderately true	32	12.96%	Moderate
	Hardly true	4	1.62%	Low
	Not at all true	1	0.40%	Low
	Total	247	100.00%	

If I am in trouble associated with keeping my appointments, I can usually think of a solution	Exactly true	210	85.02%	High
	Moderately true	32	12.96%	Moderate
	Hardly true	4	1.62%	Low
	Not at all true	1	0.40%	Low
	Total	247	100.00%	
I can usually handle whatever comes my way to keep my appointments	Exactly true	215	87.04%	High
	Moderately true	30	12.16%	Moderate
	Hardly true	1	0.40%	Low
	Not at all true	1	0.40%	Low
	Total	247	100.00%	

Findings from this study established that majority of the respondents scored high level of self-efficacy ranging between 82.19 per cent and 87.85 per cent on all the nine statements. The statement on which participants scored the highest in terms of self-efficacy was *"No one can influence me not to keep my appointments"* (87.85%). This implies that participants were empowered enough to make decisions without negative influence from anyone else. The proportion of respondents who presented moderate levels of self-efficacy ranged between 10.53 per cent and 12.96 per cent on all the nine questions. A response of "hardly true" or "not at all true" was considered to be low self-efficacy. Fewer respondents reported low levels of self-efficacy.

The proportion of individuals who reported "not at all true" stood at 0.40 per cent on all the nine questions. The proportion of individuals who reported "hardly true" ranged between 0.40 to 2.02 per cent on all the nine questions The question that had most individuals scoring low level of self-efficacy was "It is easy for me to stick to my aims and accomplish my goals including keeping all my appointments" (2.44%)*"*. This suggests that there could be other issues leading to poor adherence to appointments that go beyond the patient's ability. Table 4 presents a summary of how participants scored on the nine statements regarding levels of self-efficacy.

4.5 Effect of Mobile Text Message Timing on Perceived Self-efficacy for Treatment among PLHIV in Homa Bay County

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 6. 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). The adjusted R square showed that the model could only predict 3.7 percent of variance in the dependent variable (self-efficacy). Summary of the findings is presented in Table 5.

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Table 5: Effect of timing on self-efficacy

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 7.

Table 7: 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

4.6 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 8.

Table 2: 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)

4.7 Qualitative Findings:

Majority of the key informants 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 in terms of receiving messages. According to the respondents such an innovating way would go a long way avoiding situations where messages would be received at times when participants could not be able to read. Some respondents stated:

*"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

Text messaging of any kind, whether personal or not can be inappropriate and annoying if sent at night and especially when the receiver is married or living with a partner. Late messages could be a source of conflict in a marriage or relationship. This risk is even higher if the messages are meant to be confidential or have a chance of raising stigma. HIV in itself has been stigmatized and a person receiving the messages may not want the partner to know and therefore in this case the timing of message and the selection of when to receive the message is crucial. The only time one should receive messages at night is when they have consented to do so. There are many professionals that work at night and may opt to receiving messages at night upon consent.

*"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."*_ County AIDS and STI's Coordinator (CASCO)

Other participants felt that sending messages at the wrong time could expose their status to the people they share mobile phones with hence creating stigma. HIV/AIDS is still a sensitive matter that required caution when communicating about it. A respondent 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

5.0 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Discussion

This study is based on a long term intervention that commenced in 2017 unlike most of the previous studies that are based on short term pilot interventions or trials. 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 allows storing and forwarding of messages and the communication is often 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 this study timing is seen as a significant communication strategy that was employed to ensure that patients receive messages at the right time when they can read comfortably. Results show that the most preferable times of receiving messages were in the morning and evenings. These could be the most convenient times when patients can read messages. Reading messages in the evening before or the morning of appointment day prepares the patient to go for the services. The fact that patients had the opportunity to select when to receive messages informs the findings that most of the participants found the timing of messages to have been secure and comfortable. This implies that the patients enjoyed receiving the messages at the particular times that they were being sent. Majority of respondents were found to have improved self-efficacy levels. This is in line with Amankwaa et al., (2018) that reports sending scheduled text messages (as opposed to real time, triggered reminders) to individuals with HIV can significantly improve adherence. Applications may be quickly discarded if notifications are perceived to be irritating or intrusive. On the other hand, notifications appear to be most acceptable when users are provided with control over if, when, and how they are received, and when notifications are delivered at convenient times that do not disrupt daily routine (Dennison et al., 2013).

These findings challenges Morrison et al. (2017) study findings that tailoring notification delivery to user-designated 'good' times places unnecessary burden on the user since convenient moments are not necessarily consistent day to day thus adaptive tailoring of notification timing does not always enhance their use. However, this finding corroborates other studies which demonstrated that interventions were more effective when they were delivered at the correct timing. Evidence show that when messages are sent at the wrong time, the recipients are unlikely to read the messages (Free et al., 2013; Leon et al., 2015)(Sano et al., 2017).

Study findings compliment Riet et al, (2008) that self-efficacy was confounded with other variables, like, for instance, self-esteem, stigma to HIV/AIDS within the county and support levels. Receptivity of T4A messages was likewise influenced by perceptions of the notification content that encourage Adherence of ART within the three facilities as long as correct timing of messages maintained confidentiality about and individual HIV status to other people they ma interact with.

Conclusion

Timing of messages is critical communication strategy that ensures patients only receive messages when they are able to read and when it is convenient for them. Evening and morning hours are the most preferred among patients to receive messages. Receiving messages in the evening and morning have significant relationships with self-efficacy. It would be inconveniencing to send out messages during times when individuals are for example, busy or engaged in social activities that do not need disturbances. Further, for individuals who share phones with their family members, spouses or partners timing of the messages is critical because they would only want to receive the messages when they have access to the phones. This strategy has potential in reducing stigma among PLHIV or any other conditions that are stigmatized in any community.

Recommendations

Programs and partners involved in designing and implementing mHealth solutions need to consider and involve participants in determining communication strategies that can be effective. Timing is one of the many strategies that patients should take part. 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.

REFERENCES

1. Ammassari A, Trotta MP, Shalev N, Tettoni MC, Maschi S, Di Sora F, et al. Timed short messaging service improves adherence and virological outcomes in HIV-1-infected patients with suboptimal adherence to antiretroviral therapy. J Acquir Immune Defic Syndr [Internet]. 2011;58(4):e113–5. Available from: http://ezproxy.derby.ac.uk/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=22033235&site=ehost-live pmid:22033235

2. Amankwaa, I., Boateng, D., Quansah, D., Y., Akuoko, C., P., & Evans, C. (2018). Effectiveness of short message services and voice call interventions for antiretroviral therapy adherence and other outcomes: A systematic review and meta-analysis. PLoS ONE 13(9): e0204091. https://doi.org/ 10.1371/journal.pone.0204091

3. Anglada-Martinez, H., Riu-Viladoms, G., Martin-Conde, M., Rovira-Illamola, M., Sotoca-Momblona, J. M., & Codina-Jane, C. (2015). Does mHealth increase adherence to medication? Results of a systematic review. International Journal of Clinical Practice, 69(1), 9–32. https://doi.org/10.1111/ijcp.12582

4. Belzer ME, Naar-King S, Olson J, Sarr M, Thornton S, Kahana SY, et al. The use of cell phone support for non-adherent HIV-infected youth and young adults: An initial randomized and controlled intervention trial. AIDS Behav. 2014;18(4):686–96. pmid:24271347

5. Da Costa TM, Barbosa BJP, E Costa DAG, Sigulem D, De Fátima Marin H, Filho AC, et al. Results of a randomized controlled trial to assess the effects of a mobile SMS-based intervention on treatment adherence in HIV/AIDS-infected Brazilian women and impressions and satisfaction with respect to incoming messages. Int J Med Inform [Internet]. 2012;81(4):257–69. Available from: http://dx.doi.org/10.1016/j.ijmedinf.2011.10.002 pmid:22296762

6. Dennison, L., Morrison, L., Conway, G., & Yardley, L. (2013). Opportunities and challenges for smartphone applications in supporting health behavior change: Qualitative study. J Med Internet Res.;15(4):e86. pmid:23598614

7. Dowshen N, Kuhns LM, Johnson A, Holoyda BJ, Garofalo R. Improving adherence to antiretroviral therapy for youth living with HIV/AIDS: A pilot study using personalized, interactive, daily text message reminders. J Med Internet Res. 2012;14(2):168–75.

8. Fischer, J., E., Greenhalgh, C., & Benford, S. (2011). Investigating episodes of mobile phone activity as indicators of opportune moments to deliver notifications. In: Byland M, Juhlin O, Fernaeus Y, editors. Proceedings of the 13th International Conference on Human Computer Interaction with Mobile Devices and Service; Aug 30 –Sep 02; Stockholm, Sweden. New York, NY: ACM; 2011. p. 181–190.

9. Free, C., Phillips, G., Watson, L., Galli, L., Felix, L., Edwards, P., Patel, V., & Haines, A. (2013). The Effectiveness of Mobile-Health Technologies to Improve Health

Care Service Delivery Processes: A Systematic Review and Meta-Analysis. PLoS Medicine, 10(1). https://doi.org/10.1371/journal.pmed.1001363

10. Hall, A., Cole-Lewis, H., & Bernhardt J., M. (2015). Mobile Text Messaging for Health: A Systematic Review of Reviews. The Annual Review of Public Health. 36 :393–415.

11. Mohammed, S., Islam, S., Lechner, A., Ferrari, U., Froeschl, G., Alam, D. S., Holle, R., Seissler, J., & 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. 1–9.

12. Morrison, L., G., Hargood, C., Pejovic, V., Geraghty, A., Lloyd, S., Goodman, N., et al. (2017). The Effect of Timing and Frequency of Push Notifications on Usage of a Smartphone-Based Stress Management Intervention: An Exploratory Trial. PLoS ONE 12(1): e0169162. https://doi.org/10.1371/journal.pone.0169162 pmid:28046034

13. National AIDS and STI Control Programme (NASCOP) Kenya. (2012). Kenya AIDS Indicator Survey 2012; Final Report. Nairobi, NASCOP.

14. National AIDS Control Council (NACC). (2018). Kenya HIV Estimates Report 2018. Ministry of Health, Kenya, 1–28. https://doi.org/10.1111/j.1365-2664.2007.0

15. Pop-Eleches C, Thirumurthy H, Habyarimana JP, Zivin JG, Goldstein MP, de Walque D, et al. Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: a randomized controlled trial of text message reminders. AIDS [Internet]. 2011;25(6):825–34. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21252632%5Cnhttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3718389 pmid:21252632

16. Rana, Y., Haberer, J., Huang, H., & Kambugu, A. (2015). Short Message Service (SMS) -Based Intervention to Improve Treatment Adherence among HIV-Positive Youth in Uganda : Focus Group Findings. 1–14. https://doi.org/10.1371/journal.pone.0125187

17. Riet, J., Ruiter, A., C., Werrij, M., Q., & Vries, H. D. (2008). The influence of self-efficacy on the effects of framed health messages. European Journal of Social Psychology (38), 800–809. DOI: 10.1002/ejsp.496

18. Riley, W. T., Rivera, D. E., Atienza, A. A, Nilsen, W., Allison, S. M., & Mermelstein, R. (2011). Health behavior models in the age of mobile interventions: Are our theories up to the task? Translational Behavioral Medicine 1(1), 53-71.

19. Ronen, K., Unger, J. A., Drake, A. L., Perrier, T., Akinyi, P., Osborn, L., Matemo, D., O'Malley, G., Kinuthia, J., & John-Stewart, G. (2018). SMS messaging to improve ART adherence: perspectives of pregnant HIV-infected women in Kenya on HIV-related message content. AIDS care, 30(4), 500–505. https://doi.org/10.1080/09540121.2017.1417971

20. Sano, A., Johns, P., & Czerwinski, M. (2017). Designing Opportune Stress Intervention Delivery Timing using Multi-modal Data. 0–7.Schaecher KL. The importance of treatment adherence in HIV. Am J Manag Care. 2013 Sep;19(12 Suppl):s231-7. PMID: 24495293.

21. 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/

22. UNAIDS. (2015). Understanding Fast-Track Accelerating Action to End the AIDS Epidemic by 2030.

23. World Health Organization Global Observatory for eHealth. (2010). Telemedicine: Opportunities and developments in Member States. Observatory, 2, 96. https://doi.org/10.4258/hir.2012.18.2.153