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Effect of mHealth Utilization on Access to Treatment by Teenagers Living with HIV/AIDS in Island Communities of Lake Victoria, Kenya

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ABSTRACT

Exclusion from structural and biomedical interventions, concerns with privacy and confidentiality, location and hours of operation of health facilities, cost of services, coupled with retrogressive beliefs and attitudes of health providers, are barriers to seeking health services by teenagers living with HIV/AIDS. To bridge the gap, use mobile phones (mHealth) have emerged as an attempt to ensure care and treatment for teenagers. Despite scaling up of mHealth, over 500 pilot studies have not indicated evidence of impact for sustainability. Due to limited resources for technology in healthcare, discourse on HIV/AIDS epidemic now transcends beyond access and utilization to sustainability of healthcare services. The study sought to determine the effect of mHealth utilization by teenagers living with HIV among island communities of Lake Victoria on access to treatment. Specifically, it characterized mHealth access and determined knowledge management affecting utilization by teenagers living with HIV. To support this study, four philosophies: Theory of Reasoned Action and Knowledge Management Process Model, Technology Adoption Lifecycle Model were applied. Anchored on cross-sectional study design, stratified sampling identified the psychosocial support groups of teenagers living with HIV. Probit Model was applied to the study. With a study population of approximately 409 in Ringiti, Remba, Rusinga, Mfangano and Mageta islands, questionnaires were administered to: 173 sampled teenagers living with HIV as unit of analysis, and a control group made up of 30 percent of the sample ascertained effect of mHealth on treatment access. Five focus group discussions and key informant interviews of 10 and 3 were held in each Island. Multiple linear regression analysis were used to estimate the effect of the independent variables on the dependent. Further, the results showed that *Characterization of mHealth access and Knowledge Management* had a positive and significant effect on access to treatment by teenagers living with HIV/AIDS in Island communities of Lake Victoria. Consequently, this study provides organizations promoting access to access to treatment by teenagers living with HIV/AIDS through Mhealth. The study recommended that government and organizations involved in HIV/AIDs related activities should adopt a culture of enhancing M-health. This could go a long way in ensuring there is improved access to treatment by teenagers living with HIV/AIDS in Island communities of Lake Victoria.

Keywords*:* Characterization of mHealth access, Knowledge Management, Teenagers, HIV/AIDS

INTRODUCTION

Globally, seven billion people are covered by mobile-cellular network; 84 and 67 percent are in urban and rural respectively (International Telecommunication Union [ITU], 2016). Despite 75 percent of people in Africa being non-users (ITU, 2016), Kenya's mobile penetration was at 88.1 percent with 37.8 million subscribers (Communications Authority of Kenya [CAK], 2015). As mobile penetration hit the two-thirds mark in 2010 signifying a massive shift in the global digital commons (ITU, 2010), near-universal penetration is expected by 2020 (Banjanovic, 2009). Mobile phone has become an electronic wallet, the window to the World Wide Web, an education device, and more, and globally, mobile devices outnumber PCs, credit cards, and TVs (Lane, Isenberg, & Knoop, 2007). The low-tech solution bridges the digital divide (Lane *et al.*, 2007) as growth of mobile phones is outpacing communication through mass media (Chipchase, 2005).

By 2011, more than thirty years into the HIV/AIDS pandemic, about five million young people aged 15-24 were living with HIV (UNICEF 2011); representing 41 percent of all new infections. With 890,000 acquiring HIV each year, nearly 2,500 young people are infected day (Joint UN Programme on HIV/AIDS, 2010). At least 95 percent of new infections happen in less developed countries, with SSA being the hardest hit (UNICEF 2011).While most of the new infections in SSA occur in adults over the age of 25, HIV disproportionately affects young people (UNAIDS GAP Report, 2014). More than 4 in 10 new infections among female are in those aged 15-24; a cohort at risk of equating to higher HIV prevalence rates when they are older (UNAIDS GAP Report, 2014). For example, in Mozambique, HIV prevalence is seven percent among 15-19-year-old but rises to 15 percent for 25 years old. Likewise, in Lesotho, HIV prevalence rises from four percent among 15-19-year-old to 24 percent among 20-24-year-old (UNAIDS GAP Report, 2014).

In Africa (Benin, Ghana, Senegal, South Africa, Tanzania, and Zambia), as opposed to general population, fishing communities have high HIV/AIDS prevalence rates (Kissling, Allison, Seeley, Russell, Bachmann, Musgrave, & Heck, 2005). Prevalence rates for fisherfolk were 20.3% in the Democratic Republic of Congo, 30.5% in Kenya and 24.0% in Uganda, representing 4.8, 4.5 and 5.8 times higher than in the general population respectively (Kissing *et al.*, 2005). Moreover, in Kenya and Uganda, this incidence was 2.1 and 1.8 times respectively higher than truck drivers who use roads along the lake region. Rates of HIV infection are even slightly higher for fisherfolk than for sex workers (Kissing *et al.*, 2005). In Homa Bay County, there are over 15,000 children (aged 14 and below) in need of ART; concern for continued care and treatment, with decrease in non-adherence, will presumptively reduce incidences and prevalence into their adulthood (NACC Kenya County Profile, 2014).Villages and towns in the islands of Lake Victoria (Kenya), are dominated by hotels, bars, and tailoring shops, fueled by money from daily sales of fish, and residents seemed to encapsulate a phrase describing Luo's desire to enjoy their life; '*giheroraha*,' luo for 'they love pleasure' (Okoth-Okombo, 1999). Due to casual sexual relations in such environment, and as explained by the social epidemiology concept (Berkman &Kawachi, 2000; Freund &McGuire, 1999), this relates to the early burden of the HIV/AIDS epidemic in SSA. Fishing communities in Uganda (Rakai district), Tanzania (Mwanza and Bukoba provinces) and Kenya (formerly Nyanza province) where the initial cases of HIV/AIDS were recorded in the early 1980s (Barnett &Whiteside, 2002).

Despite effort to fight HIV/AIDS in Lake Victoria regions, both biomedical and social-cultural interventions like voluntary HIV counseling and testing (VCT), prevention of mother-to-child transmission (PMTCT), voluntary medical male circumcision (VMMC), and HIV Exposed Infant (HEI) intervention, Key Populations programming (KP), Pre-and Post-Exposure Prophylaxis (PEP and PrEP), and stopping levirate culture, all exclude direct involvement and engagement of teenage population. A non-teenage focus intervention perhaps is a driver of adult-based HIV/AIDS information dissemination strategies in Kenya Exclusion of non-teenage focus intervention present teenagers living with HIV from island communities of Lake Victoria, with single option to attempt to visit health facilities for medical information and services (International Planned Parenthood Federation [IPPF], 2010). However, lack of confidentiality, fear of mistreatment, inconvenient hours and locations of facilities, high costs of services, limited knowledge of available services (Tylee, 2007), lack of privacy and confidentiality, coupled with

negative beliefs and attitudes by health care workers, are major barriers for teenagers to seek information (IPPF, 2010) at the health facility. Teenagers also shy away from service offered based on marital status (Tylee, 2007), like couple counseling during pregnancy.

In response to poor health indices catalyzed by low provision of health care services (KAIS, 2014) and low investment in healthcare infrastructure, it is presumed that mHealth ability to cross borders will bridge the gap in the islands. From 2012, teenagers living with HIV/AIDS from island communities of Lake Victoria Kenya have been exposed to various mHealth projects: K-MET's SRHR information (*e* and *m* platforms) and health insurance mTIBA, ADS Nyanza Youth ASK SMS Project; SRHR Alliance GUSO Project; Marie Stopes Kenya M4RH Project, JHPIEGO's TUPANGE Family Planning Project, among others, with continued funding to end by the year 2020. It is with this background that this study.Important for this study will be to understand mHealth by characterizing teenagers living with HIV from island communities of Lake Victoria and to what extent its (access) effects treatment. Establishing knowledge management and technology obsolescence, while exploring community-based health support systems that possibly facilitate suitable utilization of mHealth by teenagers living with HIV from the island communities of Lake Victoria. Using probit model, this study wishes to measure utilization of teenager on mHealth against access with interest in the number of: referrals made, ART initiated, and treatment adherents.

Statement of the Problem

The emergence of mHealth as an alternative access point for care and treatment is lauded by development agencies as ingenious innovation for bridging health care access for teenagers living with HIV/AIDS among detached communities like the islands of Lake Victoria. It is also presumed that mHealth transcends beyond teenagers' concerns with location and unfriendly hours of operation of health facilities. mHealth is alleged to increase privacy and confidentiality, reduce cost of service delivery, and loops over retrogressive cultural beliefs and attitudes exhibited by health care providers and caregivers, consequently increasing access to health information, care and treatment. With increased access to mobile phones, it is presumed that mHealth can easily reach teenagers, a population missed out on national HIV/AIDS interventions. However, despite the growth in mHealth interventions and donor agencies lining up to support its scaling up, enrollment and adherence to treatment by teenagers living with HIV/AIDS in Kenya remains a challenge; a worrisome trend as HIV epidemic in subsequent years will be largely determined by the success made in slowing the spread among teenagers. Information on characterization of mHealth utilization, knowledge management of information are critical for making informed decisions on programing for teenagers on mHealth and living with HIV. Consequently, this called for studies to examine health-information and care and treatment seeking behaviors among teenagers living with HIV and AIDS on mHealth. This study, therefore, sought to determine the effect of mHealth utilization on access to treatment by teenagers living with HIV/AIDS in island communities of Lake Victoria.

Research Objectives

The study was guided by the following research objectives:

i. Characterize mHealth utilization by teenagers living with HIV from island communities of Lake Victoria and its effect on treatment access.
ii. Establish the knowledge management of mHealth information by teenagers living with HIV from the island communities of Lake Victoria and its effect on access to treatment.

THEORETICAL REVIEW

This study was anchored on Health Belief Model and Knowledge Management Process Model. The Health Belief Model (HBM) explains and predicts health-related behaviors, particularly regarding the uptake of health services (Janz& Marshall, 1984). HBM suggests that people's beliefs about health problems, perceived benefits of and barriers to action and self-efficacy explain engagement (or lack of engagement) in health-promoting behavior (Janz& Marshall, 1984). It opines that a stimulus, or cue to action, must also be present to trigger the health-promoting behavior (Janz& Marshall, 1984). In operationalizing the theory, an attempt to establish characterization of mHealth access of teenagers living with HIV from island communities of Lake Victoria followed a cascade of (i) perceived threat (ii)

perceived behavior, and (iii) modifiers such as variables, cues to action, and self-efficacy, and probes into demographics, personality, social class, and peer and reference group pressure, costs, painful, inconvenient, and unpleasant, as an angle of finding out if teenagers believe that the benefits by far outweigh the consequences of continuing the old behavior (Center for Disease Control and Prevention, 2004). The above set provided explanations, why teenagers living with HIV use mobile phones, frequency of use, length of engagement, social media sites known and accessed, and the global connections they have, and primary reason for using the favorite mHealth network. This study took cognizant of the fact that theoretical constructs that constitute the HBM are broadly defined, as interpersonal influences are also particularly difficult to measure as cues (Rosenstock, 1974). Furthermore, the HBM does not specify how constructs of the model interact with one another (Glanz, Barbara, Viswanath, 2008). Therefore, different operationalizations of the theoretical constructs may not be strictly comparable across studies (Maiman, Marshall, John, Don, Robert, 1977).

Knowledge Management (KM) is considered the process of capturing, developing, sharing, and effectively using organizational knowledge (Davenport, 1994). KM includes (i) techno-centric - with a focus on technology that enhance knowledge sharing and creation (Alavi& Dorothy, 1999), (ii) organizational - how an organization can be designed to facilitate knowledge processes (Addicot, McGivern, Ferlie, &Ewan, 2006), and (iii)ecological - the interaction of people, identity, knowledge, and environmental factors as a complex adaptive system akin to a natural ecosystem (Carlson, Marcu, Okurowsk, & Mary, 2013).This study focused on getting the right knowledge to the right teenager at the right time, which implies a strong tie to an understanding of where and in what forms knowledge exists. This study also considered the KM creation processes that span organizational functions to ensure initiatives are accepted and supported by teenagers. This study considered the two strata of knowledge: explicit and tacit. In application, for explicit, teenagers living with HIV in the islands of Lake Victoria will be probed on: (i) if they create part of information circulating on mHealth or they are only recipients; (ii) how they store information generated or received in the wake of stigma and discrimination, privacy in accessing HIV treatment as a teenager, and staleness of information; (iii) how they share knowledge either among themselves or with other teenagers at community, national, regional and global levels; and (iv) the use of information through personal and group evaluation, refining and improving, or simply circulating it as part of routine dissemination. For tacit knowledge, with potential idiosyncratic issues arising from experiences as being a person living with HIV/AIDS, teenagers will be probed on: (i) if they do generate information on their personal lives and feed to the system; (ii) how they use the mHealth platform to synthesize tacit information – or group wares (like WhatsApp, Telegram, Instagram, among others); and (iii) how this information is stored for retrieval and usage among their groups.

Conceptual Model and Hypothesis

Conceptual framework can be defined as a set of broad ideas and principles taken from relevant fields of inquiry and used to structure a subsequent presentation (Ravitch & Carl, 2019). Figure 1 shows the conceptual framework which will be used in this study and depicts the interrelationship between the study variables. The proposed conceptual framework encompassed characterization of mHealth users and knowledge management which affect mHealth utilization among teenagers living with HIV (the dependent variable).

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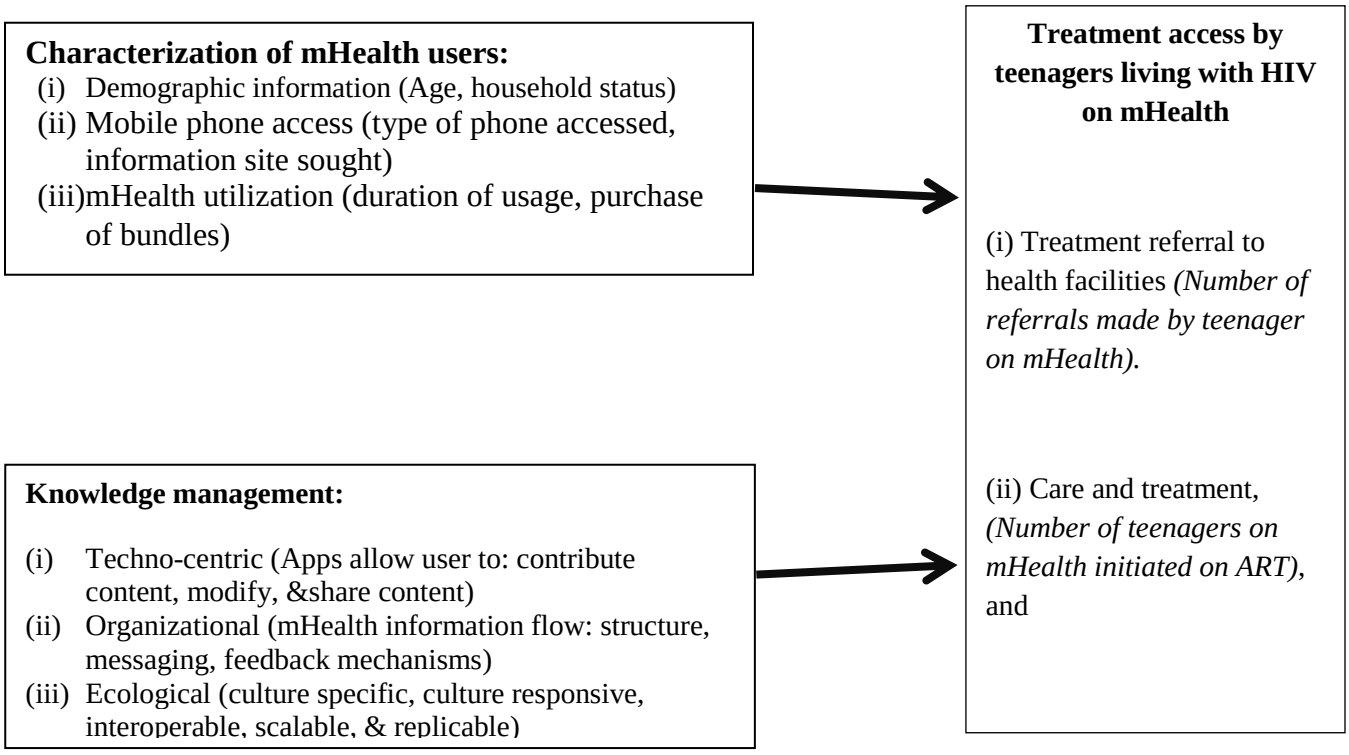
Independent Variables **Dependent Variable**



Empirical Review

Unlike landlines, mobile phone usage in Africa has soared; now an integral part of the economy of African countries (Aker *et al.*, 2010). Although those who initially owned and used mobile phones were educated, wealthy, male and living in urban areas, more recently, cell phone use has expanded to include those living in rural areas, and those with fewer resources (Aker *et al.*, 2010). Technology accessible by teenagers has exponentially expanded: for instance, globally, iPhone Apps. hit one billion users, Facebook added 100 million users, and YouTube uploaded an estimated 400 hours of video every minute in 2011, (Statistical Yearbook [SY], 2011). Teenager's fear of missing out was deduced by a University of Maryland study that suggested access to social media services may be addictive (Sikron, 2003).

Economic and technological advancements in SSA provide opportunities to develop mHealth solutions to improve health care (Deloitte, 2012, Open Global Mobile Survey). mHealth services, such as, simple text messaging to improve treatment compliance and applications for diagnostic and treatment support, and complex system infrastructures that enable remote monitoring and audio-visual communication for real time interaction between patients and providers are available (The Mobile Economy Report, 2014). In low-income countries, the primary focus is on reducing health care costs, optimizing assets utilization and efficiency, delivering higher quality of care, and improving patient experience (The Mobile Economy Report, 2014).

SSA, the focus is in improving access to basic health care, remote diagnosis, remote monitoring and prevention; followed by access to health-related information, quality and effectiveness of

service delivery, and reducing the shortage of well-educated health care professionals (The Mobile Economy Report, 2014). As mobile phones become widespread in Kenya (CAK, 2015), continued effort towards attaining efficient pro-poor health care requires an integrated approach, strategic partnerships and new business models (Deloitte, 2012, Open Global Mobile Survey).

Structured access is evident as, in a PMTCT study, expectant girls used cell phones to call their healthcare provider, for medication reminders and to schedule appointments. During the process, healthcare providers lauded the approach as very helpful, less time consuming, and more cost efficient than traditional methods of seeing or interacting with patients (Chang *et. al*, 2013). Increase in application of mHealth in the health care industry (VWC, 2009) is presumed to provide quality and easily accessible care at lower costs (GSMA & PwC, 2012). The health care industry is thought to be the most promising new mobile phone growth channel (Deloitte, 2012, Open Global Mobile Survey).

Globally, teenagers are sharing more information about themselves on their social media: in 2008, 91% post a photo of themselves, up from 79% in 2006, and 71% post their school's name, up from 49%. Also, 71% post the city or town where they live, up from 61% and 53% post their email address, up from 29%. A total of 20% post their cell phone number, up from 2% (SY, 2008).

It is presumed that teenagers have also been part of the increase in voice calls and short messaging services, which hit 7.0 billion minutes of calls up from 6.3 billion minutes in 2012 alone (CAK, 2013). The average/cumulative Minutes of Use (MoU) per subscriber per month increased to 76.7 up from 71.2 in the previous quarter. The increase in MoU during the period indicates that subscribers could make longer or more calls. Similarly, a total of 1.0 billion SMS was sent in the quarter compared to 986 million in the previous period representing a 10.1 percent increase (CAK, 2013). When teenagers on mHealth mutually exchange and create knowledge, it involves sharing, using and managing information which is considered Knowledge Management (Girard &Girard, 2015).

In Africa, in rural Nigeria, teenagers share information, ideas and knowledge with their peers; with over half of the respondents abstaining from sexual activities because of information received from peers (Igbinovia & Ikenwe, 2015). In Kenya, teenage girls met new people, found old friends, shared pictures, videos, and games in their network online via social media (Okaka & Makori, 2015). Also, most teenagers who contemplated termination of pregnancy chatted most with peer on how best to do so, by learning of safe methods, and related health complications (Okaka & Makori, 2015).

Knowledge has become the driving force for social development, the attention of the society to information and knowledge is rising and people's demands for information and knowledge is increasing step by step (Edem & Ani, 2010). Teenagers, recognized as a critical intervention cohort (NACC, 2017), makes it is pertinent to understand how they get informed via mHealth for decision making on matters HIV and AIDS.

METHODOLOGY

Cross-sectional study design was used to demonstrate relationships (Kothari, 2004) and describes the effect of mHealth utilization on access to treatment by teenagers living with HIV/AIDS in island communities of Lake Victoria. Applying both qualitative and quantitative research techniques (Shields *et al.*, 2013), the survey method related mHealth access to: number of referrals, number of teenagers initiated on ART, and number of teenagers adhering to treatment. The study employed the probit model for the anticipated binary response in utilization of

mHealth and access to treatment. The study was carried out in islands of Lake Victoria that is, Ringiti, Remba, Rusinga, Mfangano and Mageta, which lie in the eastern part of Lake Victoria (in Kenya). The choice of the study area was based on (i) poor health indices affecting the teenagers in the regions (i.e., HIV/AIDS, Malnutrition, Unwanted and Unplanned Pregnancies, Termination of Pregnancies, Sexually Transmitted Infections) and (ii) low provision of health care services (KAIS, 2014) due to the detachment from mainland and limited investment in healthcare infrastructure.

The population study was teenagers (13 to 19 years) who have: (i) tested HIV positive, (ii) are in registered support groups facilitated by government hospitals, and (iii) have personal mobile phones or can access one at household level.Data on number of teenagers living with HIV/AIDS among island communities of Lake Victoria is not conclusive. Despite daily initiation of new patients (teenagers), it is still difficult to tell the exact number as decision to take a HIV test and later access treatment at designated points is entirely an individual's effort. Many a times, deaths of teenagers caused by co-infections from HIV/AIDS go undocumented. Consequently, a comprehensive list of teenagers on treatment cannot be generated. This study focused on teenagers living with HIV/AIDS and is on mHealth; and a control of the same who are not on mHealth. As of July 2017, a total of 409 were registered (using unique identification codes) at various comprehensive care clinics across the five islands; this is the target population size.The sample size for this study was estimated using the following statistical sample determination formulae below by William G. Cochran:

$$n = \frac{X^2 * N * P * (1 - P)}{(ME^2 * (N - 1)) + (X^2 * P * (1 - P))}$$

…where:
n = sample size
X^2 = Chi-square for the specified confidence level at 1 degree of freedom
N = population size
P = Population proportion (.50)
ME = desired margin of error (expressed as a proportion).
…therefore:
Nis approximately 409 (from health facility records – as of July 2017)

P=0.5**ME**=5% (0.05) $\mathbf{X^2}$= 3

$$n = \frac{3*409*0.5(1-0.5)}{(ME^2*(409-1))+(3*0.5*(1-0.5))} = n = 173.30508475$$

n= 173.30508475as sample of teenagers living with HIV (this is approximately 173).

Due to the nature of the study, that is, its sensitivity and inclusion criterion, the study worked with teenage support groups. At level one, through government local health facilities, willing Health Workers engaged teenagers living with HIV at the comprehensive clinics were identified and requested to participate in the study as guides and link creators. In turn, the health workers introduced the research and researcher to existing support groups, where they were engaged as key informants, interviewees for structured questionnaire and members of a focus group discussion. At level two, stratified random sampling was applied to ensure each stratum was taken in a number proportional to the stratum's size as compared to the population. A control group was introduced to measure any differences in access to treatment between users and non-

users of mHealth. At level three, members that formed a control group were identified to help eliminated the influence of some extraneous factor (Campbell & Stanley, 1963); 30 percent of the sample size will apply as illustrated in Table 1.

Table 1 - Study Sample Size

Islands	Approximated population of teenagers living with HIV on care and treatment (*N* = 409)	Proportion to total population (%)	Sample size (*n* = 173)	Control Group sample (30% of *n*)
Ringiti	39	9.535	16.496	4.9488
Rusinga	133	32.518	56.256	16.8768
Mfangano	114	27.873	48.22	14.4660
Remba	22	5.379	9.306	2.7918
Mageta	101	24.694	42.721	12.8163
Total	**409**	**100**	**172.998**	**51.8997**

RESULTS AND DISCUSSION

Response Rate

Questionnaires were issued to a sample of 173 respondents domiciled in Ringiti, Remba, Mfangano, Rusinga and Mageta all lying in the eastern part of Lake Victoria-Kenya. A total of 138 questionnaires were received back, giving a response rate of 80.2% which the study considered adequate for the purposes of analysis. According to Mugenda and Mugenda (2012), a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. Based on the assertion, the response rate was excellent and, therefore, representative and satisfactory to make conclusions for the study. This collaborates with the assertion by Brymann and Bell (2015) that a response rate of 50% is adequate, while a response rate greater than 70% is very good.

Characterization of m-Health Users

The study sought to examine the mobile phone ownership and access by teenagers living with HIV/AIDS on mHealth. It was established that with regards to the access of a mobile phone, 20.3% of the respondents own a mobile phone. Given this fact, Table 2 shows access to mobile phones for teenagers who do not own one. Up to 44.9% rely on their parents to access mobile phones, while Siblings and healthcare workers were collectively at 5.1%. Of the phones accessed by teenagers, only 39.1% are Smart phones, that is, a cellular phone that performs many of the functions of a computer, typically having a touch screen interface, internet access, and an operating system capable of running downloaded applications. Regarding the frequency of access to mobile phones, most teenagers indicated occasionally (only when the mobile phone owner is around them), and once and twice a day (in the morning or evening), accounting to 46.4% and 31.1% respectively. With regards to access to HIV information on the mobile phones, 29.7% of the respondents accessed alone. Notably, as indicated in Table 2, most of the teenagers at 63.8% accessed HIV information on mobile phone with a Caregiver.

This study sought to establish who buys airtime for mobile phones used by teenagers. Results in Table 2 indicates 65.2% were bought by those whom teenagers considered parents (Father, Mother, Uncle, Aunt, and Elder Cousins), while the Civil Society Organizations (NGOs and FBOs) getting contributed 1.4% respectively. In another development, a summary was collated on who buys internet bundles that the teenagers use. Table 2 indicates the Civil Society

Organizations (NGOs and FBOs) leads at 57.2%. Using both airtime and bundles, majority of teenagers, at 49.2% spend between 6 to15 minutes accessing HIV information via mobile phones, while 24.7% of the respondents operate at a maximum of five minutes and less.A key informant who overseas health programs in the County under the Anglican Development Services Project (ADS), has engaged young people on matters of SRHR through m-Health in Mfangano, Takawiri, Ringiti and Remba Islands. He alludes to the availability of m-Health activities through a trio-approach of the ADS services in the islands: FaceBook (Youth4srhr), WhatsApp (Youth4srhrmfangano) and the SMS Platform (initially 20141 and now 20394). One of the factors why the Civil Society Organizations leads in bundle purchase (at 57.2%) as indicated in Table 2.

Table 2: Mobile phone ownership and access by teenagers living with HIV/AIDS on mHealth

Characteristic	Case	
	n = 138	%
Mobile phone ownership		
Yes	28	20.3
No	110	79.7
Ways of accessing a mobile phone		
Friends	11	8.0
Siblings	3	2.2
Healthcare worker	4	2.9
Parents	62	44.9
Caregiver (non-parental)	30	21.7
Personal phone	28	20.3
Mobile phone access		
Smartphone	54	39.1
Non-smartphone	84	60.9
Frequency of mobile phone access		
Once a day	26	18.8
Twice a day	17	12.3
Three time a day	10	7.2
Occasionally	64	46.4
Always	21	15.2
Access to HIV information on mobile phone		
Alone	41	29.7
With a friend	5	3.6
In a group	4	2.9
With caregiver	88	63.8
Airtime purchase		
Self (the teenager)	26	18.8
Friend (the teenagers friends)	6	4.3
Healthcare worker (those are the health facility)	14	10.1
Parent (also guardian)	90	65.2
CSO (NGO, FBO)	2	1.4
Bundles purchase		
Self (the teenager)	37	26.8
Friend (the teenagers friends)	6	4.3
Healthcare worker (those are the health facility)	6	4.3
Parent	10	7.2
CSO (NGO, FBO)	79	57.2
Minutes spent accessing HIV information		
≤ 5	34	24.7
6 to 15	68	49.2
16 to 25	30	21.8
≥ 26	6	4.3

Further, on the HIV/AIDS information searched by teenagers living with HIV/AIDS on m-Health, most teenagers searched information sources to understand test results and treatment options. In both the case and control groups, understanding test results and treatment options recorded a grouped score of 52.2% and 55.5% respectively. Table 3 indicates that matters of (collectively identified as HIV testing) attracted teenagers in the case and control groups respectively. As part of the study, no respondent alluded to seeking information on how to conduct disclosure at family, friends and or sexual partners.This study sought to establish non-mHealth HIV related information resource points for the control group. Table 3 indicates health facility and parents/guardians at 44.4% and 24.4% respectively led as information points, while teachers at 2.2% were least on the list. A key informant from a The DREAMS project supported by USAID, serving the girl child in Homa Bay County through mHealth, reaches adolescent and young girls 15-24 years who were newly initiated (18 months and below) on HIV/AIDS care and treatment. The main purpose of the project was to improve adherence among the girls by reminding them to take their drugs and whenever they were due for a clinic visit. The App. also motivated the girls in two ways; monetary motivation (they would receive some token on a weekly basis based on their interaction on the App) and psychosocial support (the App had pop-up messages that would periodically appear on their screens encouraging them to take drugs)to enhance to treatment.Regarding the sites that the teenagers used to seek for HIV related information, the majority, at 79.7% used social media (that is, Facebook, WhatsApp, YouTube, Instagram, Google, LinkedIn, Telegram, Twitter),while 5.8% used NGO specific sites to seek for such information. As shown in Table 3, the rest, at 14.5% used Text-based (SMS) to solicit for such information.

Table 3: HIV/AIDS Information Searched by Teenager

Characteristic	Case		Control	
	n = 138	%	n = 45	%
Sites Searched for HIV related information				
Social media	110	79.7	-	-
CSO-based (NGO, FBO)	8	5.8	-	-
SMS (Text-based)	20	14.5	-	-
HIV related information Searched for				
Risk reduction(Reducing sexual exposures, pre-exposure prophylaxis, blood transfusion, drugs and substance abuse)	22	15.9	7	15.6
HIV testing (HIV test locations, HIV testing frequency, Confidential and Anonymous)	17	12.3	6	13.3
Immune system (HIV Lifecycle, Stages of HIV Infection, Physical Changes)	27	19.6	7	15.6
Understanding test results(Types of Lab Tests, CD4 Count, Viral Load, Drug resistance)	28	20.3	11	24.4
Treatment options(Reasons to Start Treatment, Side Effects, Medication Adherence, Drug Resistance)	44	31.9	14	31.1
Disclosure of HIV status	0	0.0	0	0.0
Non-mHealth HIV related information resource points				
Health facility	-	-	20	44.4
Parents/Guardians	-	-	11	24.4
Friends	-	-	7	15.6
Siblings	-	-	6	13.3
Teachers	-	-	1	2.2

Correlation Analysis

The correlation coefficient is a measure of linear association between two variables. Values of the correlation coefficient are always between -1 and +1. A correlation coefficient of +1 indicates that two variables are perfectly related in a positive linear sense, a correlation coefficient of -1 indicates that two variables are perfectly related in a negative linear sense, and a correlation coefficient of 0 indicates that there is no linear relationship between the two variables. A correlation coefficient of between 0.0 and 0.19 is considered to be "very weak", between 0.20 and 0.39 is considered to be "weak", between 0.40 and 0.59 is considered to be "moderate", between 0.60 and 0.79 is considered to be "strong" and between 0.80 and 1.0 is considered to be "very strong". The study conducted a correlation analysis between the variables of the study using Pearson product-moment correlation coefficient. Pearson Product moment correlation was used to determine the relationship between independent variable (Characterization of m-Health users) and dependent variable (access to treatment by teenagers living with the HIV).

The study sought to establish the relationship between characterization of m-Health users and access to treatment by teenagers living with the HIV. A Pearson Correlation was performed and the result of the Pearson correlation test as presented in Table 4show a correlation ($r(138) = 0.318$; $p<0.05$) between the characterization of m-Health users and access to treatment by teenagers living with the HIV. This implies that the characterization of m-Health users is positively correlated to the access to treatment by teenagers living with the HIV. In addition, the correlation between these two variables was significant, that is $p<0.5$ implying a linear relationship between the characterization of m-Health users and access to treatment by teenagers living with the HIV. This shows that characterization of m-Health users had a significant effect on access to treatment by teenagers living with the HIV in the Islands of Lake Victoria.

Table 4: Correlation Analysis of Characterization of m-Health Users

		Access to Treatment
Access to Treatment	R	1.000
	Sig. (2-tailed)	.
	N	
Characterization of m-Health Users	R	.318
	Sig. (2-tailed)	.000
	N	138

Regression Analysis

Regression analysis is a form of predictive modeling technique which investigates the relationship between a dependent and independent variable(s). This study applied a regression model to identify the effect of characterization of m-Health Users and their impact on access to treatment by teenagers living with HIV. Regression analysis was conducted to determine the proportion of access to treatment (dependent variable) which could be predicted by characterization of m-Health users (independent variable). It was hypothesized that:

H_{a1}: There is significant relationship between characterization of m-Health users and treatment access by teenagers living with HIV from island communities of Lake Victoria.

To test this hypothesis, the model $Y= \beta_0 + \beta_1 X_1 + \varepsilon$ was fitted. Where y is treatment access by teenagers living with HIV from island communities of Lake Victoria X_1 is characterization of m-Health users

Regression model summary results in Table 5 indicate the goodness of fit for the regression between characterization of m-Health users and treatment access by teenagers living with HIV from island communities of Lake Victoria was satisfactory in the linear regression model. An R squared of 0.101 indicates that 10.10% of the variances in treatment access by teenagers living with HIV from island communities of Lake Victoria are explained by the variances in characterization of m-Health users. However, the model failed to explain 89.90% of the variation in treatment access by teenagers living with HIV from island communities of Lake Victoria. This means that there are other factors associated with treatment access by teenagers living with HIV from island communities of Lake Victoria which were not explained by the model. The correlation coefficient of 0.318 indicates characterization of m-Health users have a positive correlation with treatment access by teenagers living with HIV from island communities of Lake Victoria.

Table 5: Model Summary (Characterization of m-Health users and Access to Treatment)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.318[a]	.101	.053	.488

a. Predictors: (Constant), Characterization of m-Health users

The ANOVA results in Table 6 shows that ($F(1,136) = 14.688$, $p < 0.05$). This shows that the overall model significant. The findings imply that characterization of m-Health users was statistically significant in explaining treatment access by teenagers living with HIV from island communities of Lake Victoria. Therefore, at $p < 0.05$ level of significance, null hypothesis is not supported thus rejected and the alternative hypothesis (H_{a1}) which states that "There is a significant relationship between characterization of m-Health users and treatment access by teenagers living with HIV from island communities of Lake Victoria" is accepted implying that characterization of m-Health users have significant influence on treatment access by teenagers living with HIV from island communities of Lake Victoria.

Table.6: ANOVA Statistics (Characterization of m-Health users and Treatment Access.)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.489	1	3.489	14.688	.000[b]
	Residual	31.011	136	.228		
	Total	34.500	137			

A. Dependent Variable: Care

b. Predictors: (Constant), characterization of m-Health users

Regression of coefficients results in Table 7 shows that there is a positive and significant relationship between characterization of m-Health users and treatment access by teenagers living with HIV from island communities of Lake Victoria as supported by a $p<0.05$ and a beta coefficient of 0.388. This implies that a unit increase in characterization of m-Health users would increase the treatment access by teenagers living with HIV from island communities of Lake Victoria by 0.388 units. This was supported by the t values whereby $t_{cal} = 9.023 > t_{critical} = 1.96$ at a 95 percent confidence level which depicts that we reject the null and accept the alternative hypothesis. Further, this confirms the positive effect of characterization of m-Health users on treatment access by teenagers living with HIV from island communities of Lake Victoria. The fitted equation is as shown below: $Y = 4.876 + 0.388X_1$ that is treatment access by teenagers living with HIV from island communities of Lake Victoria = 4.876 + 0.388 Characterization of m-Health users

Table 7: Regression Coefficients (Characterization of m-Health users and Treatment Access

Model		**Unstandardized Coefficients**		**Standardized Coefficients**		
		B	**Std. Error**	**Beta**	**T**	**Sig.**
1	(Constant)	4.876	.710		6.867	.000
	Characterization of m-Health Users	.388	.043	.367	9.023	.000

a. Dependent Variable: Treatment access by teenagers living with HIV from island communities of Lake Victoria.

Knowledge Management

The study sought to examine the mostly used and preferred formats to receive m-Health information for m-Health. The study established that even though there were a variety of formats that presented the m-Health information, the respondents were required to clearly state which format they would most prefer. As indicated in Table 8, about 52.9% of the respondents indicated received such information in text format, 10.9% stated through pictorial, 19.6% indicated received such information in audio while 16.7% received them in video formats. The study results imply that text was the most preferred format for teenagers to access treatment in the study area.In addition, the study sought to examine the reason for preferred format (Text, Audio & Video) to receive m-Health. The study results indicated that 48.6% stated that it attracted attention, 4.3% of the respondents posited that it could be distributed in various ways., 23.9% of the respondents stated that it provided the basic information on HIV health services, 23.9% of the respondents stated that it demonstrated steps of doing something and 7.2% of the respondents stated that they could engage with source of information. The study results indicates that preferred format (Text, Audio & Video) to receive m-Health was to attract attention, that it could be distributed in various ways, it demonstrated steps of doing something and could engage with source of information.

Table 8 – Mostly used and preferred format to receive m-Health

Category	Case	
	n = 138	%
Format mostly used for m-Health access		
Text	73	52.9
Pictorial	15	10.9
Audio	27	19.6
Video	23	16.7
Preferred format to receive m-Health		
Text	40	29.0
Pictorial	8	5.8
Audio	30	21.7
Video	60	43.5
Reason for preferred format (Text, Audio & Video) to receive m-Health		
Attracts attention.	67	48.6
Can be distributed in various ways.	6	4.3
Provides basic information on HIV health services.	22	15.9
Demonstrates steps of doing something.	33	23.9
I can engage with source of information.	10	7.2

The study sought to find out the time and reason for HIV related m-Health Information is accessed. According to the study results, Table 9 indicates 21.7% stated Morning hours (Early & Mid-morning), 31.90% of the respondents stated afternoon hours (Around noon and afternoon);and 46.4% of the respondents' access HIV related m-Health information during evening hours (Around evening and night).The study results show that teenagers access HIV related m-Health information any time of the day.

Relatedly, the study sought to ask respondents the reason of choosing time to access HIV related m-Health information any time of the day. It was established that most of the respondents at 60.1% suggested that they did so because of the availability of mobile phone, 27.50% of the respondents indicated it was because of privacy while 8% teenagers cited easy downloads of the contents due to improved connectivity and 4.3% of the respondents' stated due to correspondence was instantaneous. This imply that teenagers could be having a variety of reasons for choosing time to access HIV related m-Health which include availability of mobile phone, privacy, content downloads easy and correspondence being instantaneous.

Table 9: Time to Access m-Health information and reason for choosing time

Category	Case	
	n = 138	%
Time to access HIV related mHealth information		
Morning hours (Early & Mid-morning).	30	21.7
Afternoon hours (Around noon and afternoon).	44	31.9
Evening hours (Around evening and night).	64	46.4
Reason for reason for choosing time		
Availability of mobile phone.	83	60.1
Privacy.	38	27.5
Content downloads easy.	11	8.0
Correspondence is instantaneous.	6	4.3

As indicated in Table 10, the study investigated how the teenagers kept or stored information accessed on HIV. From the study findings it was established that 31.90% of the respondents stated they used SD card, 21.7% indicated they used phone memory, 2.2% of the teenagers stated that they used cloud-based and majority of the teenagers (44.2%) indicated that they did not store information. This can be deduced that majority of the teenagers did not store information related to m-Health HIV. Further, teenagers were requested to indicate duration of information storage and it was established that 21% indicated after one month, 23% stated after a week, 4% stated after two days and majority of the teenagers (315) deleted information after reading it.

On reasons for deletion of information, teenagers stated bulkiness of information (15.2%), majority of the teenagers (42.0%) stated need privacy, 8% of the respondents indicated insecure information, 14.5% of the respondents stated that is how the system was designed and 20.3% indicated due to fear of stigma and discrimination. This implies that teenagers deleted HIV related information due to privacy, fear of stigma and discrimination.

Table 10 – mHealth information storage, duration, and reason for deletion period

Category	Case	
	n = 138	%
Method of information storage		
SD Card.	44	31.9
Phone memory.	30	21.7
Cloud-based.	3	2.2
Do not store information.	61	44.2
Duration of information storage		
Delete information after a month.	29	21
Delete information after a week.	32	23
Delete information after two days.	6	4
Delete information after one day.	25	18
Delete information after reading.	47	31
Reasons for deletion of information		
Bulkiness of information	21	15.2
Need privacy	58	42.0
Insecure information	11	8.0
That is how the system is designed	20	14.5
Fear of stigma and discrimination	28	20.3

The study went further to find out the mostly sought for information, purpose and utilization given the need to know the kind of information the teenagers use m-Health for, the results indicated that information mostly shared on m-health by teenagers considered that 15.2% for HIV transmission, 50.0% on HIV treatment, 23.90% on New programs in HIV management by government, 2.9% of the teenagers

stated on the research on HIV and 9.4% indicated on the Stigma and discrimination. The study findings indicated that information mostly shared in mHealth was on HIV treatment and new programs in HIV management by government.

On whom information is mostly shared with, teenagers stated that friends (28.3%), siblings (11.6%), parents/guardians (50.0%) and members of support group (10.1%). This indicated that teenagers were sharing information related to HIV with their parents and friends. On whether teenagers added views on circulating m-Health information, 81.90% of the teenagers indicated that they did and 18.10% of the teenagers indicated otherwise. This indicated that to a great extent whether teenagers added views on circulating m-Health information.

Further, as highlighted in Table 10, the study sought to examine the platform mostly used to share m-Health information, 55.10% of the teenagers indicated via social media, 21.70% of the teenagers stated via NGO based mobile and 23.20% of the teenagers stated via face to face. The study findings indicated that teenagers preferred social media as the platform to share m-Health information. Finally, the respondents were asked to give reason on why they found/ m-Health content appealing. It was established 51.40% of the teenagers on new information, 16.70% of the teenagers stated that they used language (slung and symbols) that is teenage friendly, 14.50% of the teenagers that message was simple to understand, 1.40% stated it was from sources they(teenagers) know & acknowledge as credible and 15.90% posited it came in a multimedia format (audio and video).The study results indicated that teenagers were found m-Health content appealing due to new information and used language (slung and symbols) that was teenage friendly.

Table 10: mHealth format in style, information mostly shared in mHealth, with whom and platform used

Information mostly shared on mHealth		
HIV transmission	21	15.2
HIV treatment	69	50.0
New programs in HIV management by government	33	23.9
Researches on HIV	2	1.4
Stigma and discrimination	13	9.4
mHealth content currently in style		
HIV transmission	8	5.8
HIV treatment	57	41.3
New programs in HIV management by government	48	34.8
Researches on HIV	4	2.9
Stigma and discrimination	21	15.2
Whom information is mostly shared with		
Friends	39	28.3
Siblings	16	11.6
Parents/guardians	69	50.0
Members of support group	14	10.1
Whether teenagers added views on circulating mHealth information		
Yes	113	81.9
No	25	18.1
Platform mostly used to share mHealth information		
Social media	76	55.1
NGO-based Mobile Apps.	30	21.7
Face-to-Face	32	23.2
Why mHealth content is appealing		
New information	71	51.4
Uses language (slung and symbols) that is teenage friendly	23	16.7
Message is simple to understand	20	14.5
It is from sources they(teenagers) know & acknowledge as credible	2	1.4
Comes in a multimedia format (audio and video)	22	15.9

Correlation Analysis

The study sought to establish the relationship between knowledge management and access to treatment by teenagers living with the HIV. A Pearson Correlation was performed, and the result of the Pearson correlation test as presented in Table 11 show a correlation (r (138) = 0.549; p<0.05) between the knowledge management and access to treatment by teenagers living with the HIV. This implies that the knowledge management is positively correlated to the access to treatment by teenagers living with the HIV. In addition, the correlation between these two variables was positive and significant, that is p<0.5 implying a linear relationship between the knowledge management and access to treatment by teenagers living with the HIV.

Table 11: Correlation Analysis of Knowledge Management

		Access to Treatment
Access to Treatment	R	1.000
	Sig. (2-tailed)	.
	N	
Knowledge Management	R	.549
	Sig. (2-tailed)	.000
	N	138

Regression Analysis

This study applied a regression model to identify the effect of knowledge management and impact on access to treatment by teenagers living with HIV. Regression analysis was conducted to determine the proportion of access to treatment (dependent variable) which could be predicted by knowledge management (independent variable). It was hypothesized that:

H_{a2}: There is significant relationship between knowledge management and treatment access by teenagers living with HIV from island communities of Lake Victoria.

To test this hypothesis, the model $Y= \beta_0 + \beta_2 X_2 + \varepsilon$ was fitted. Where Y is treatment access by teenagers living with HIV from island communities of Lake Victoria X_2 is Knowledge Management

Regression model summary results in Table 12 indicate the goodness of fit for the regression between knowledge management and treatment access by teenagers living with HIV from island communities of Lake Victoria was satisfactory in the linear regression model. An R squared of 0.248 indicates that 24.80% of the variances in treatment access by teenagers living with HIV from island communities of Lake Victoria are explained by the variances in knowledge management. However, the model failed to explain 75.20% of the variation in treatment access by teenagers living with HIV from island communities of Lake Victoria. This means that there are other factors associated with treatment access by teenagers living with HIV from island communities of Lake Victoria which were not explained by the model. The correlation coefficient of 0.498 indicates knowledge management has a positive correlation with treatment access by teenagers living with HIV from island communities of Lake Victoria.

Table 4.12: Model Summary (Knowledge Management and Access to Treatment)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.498a	.248	.202	1.455

a. Predictors: (Constant), Knowledge Management

The ANOVA results in Table 13 shows that (F (1,136) = 44.922, p <0.05). This shows that the overall model significant. The findings imply that knowledge management was statistically significant in explaining treatment access by teenagers living with HIV from island communities of Lake Victoria. Therefore, at p <0.05 level of significance, null hypothesis is not supported thus rejected and the alternative hypothesis (H_{a2}) which states that "There is a significant relationship between knowledge management and treatment access by teenagers living with HIV from island communities of Lake

Victoria" is accepted implying that knowledge management has a significant influence on treatment access by teenagers living with HIV from island communities of Lake Victoria.

Table 13: ANOVA Statistics (Knowledge Management and Treatment Access.)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	90.160	1	90.160	44.922	.000[b]
	Residual	272.920	136	2.007		
	Total	363.080	137			

a. Dependent Variable: Access to Treatment

b. Predictors: (Constant), Knowledge Management

Regression of coefficients results in Table 14 shows that there is a positive and significant relationship between knowledge management and treatment access by teenagers living with HIV from island communities of Lake Victoria as supported by a $p<0.05$ and a beta coefficient of 0.388. This implies that a unit increase in knowledge management would increase the treatment access by teenagers living with HIV from island communities of Lake Victoria by 0.512 units. This was supported by the t values whereby $t_{cal} = 16.516 > t_{critical} = 1.96$ at a 95 percent confidence level which depicts that we reject the null and accept the alternative hypothesis. Further, this confirms the positive effect of knowledge management on treatment access by teenagers living with HIV from island communities of Lake Victoria. The fitted equation is as shown below: $Y = 6.876 + 0.512X_2$ that is treatment access by teenagers living with HIV from island communities of Lake Victoria = 6.876 + 0.512 Knowledge Management

Table 14: Regression Coefficients (Knowledge Management and Treatment Access

		Unstandardized Coefficients		**Standardized Coefficients**		
Model		**B**	**Std. Error**	**Beta**	**T**	**Sig.**
1	(Constant)	6.876	.436		15.771	.000
	Knowledge Management	.512	.031	.449	16.516	.000

a. Dependent Variable: Treatment access by teenagers living with HIV from Island Communities of Lake Victoria.

CONCLUSION

Based on the inferential analysis findings, it can be concluded that characterize m-Health utilization by teenagers positively and significantly affected access to treatment by teenagers living with HIV/AIDS in island communities of Lake Victoria. The study findings are in line with the findings by Deloitte (2012) state that characterize m-Health utilization by teenagers and provided opportunities to develop m-Health solutions to improve health care. Characterization of m-Health determine the services, such as, simple text messaging to improve treatment compliance and applications for diagnostic and treatment support, and complex system infrastructures that enable remote monitoring and audio-visual communication for real time interaction between patients and providers that are available.

From the inferential analysis, the results indicates that that knowledge management of m-Health information by teenagers living with HIV positively and significantly affected access to treatment by teenagers living with HIV/AIDS in island communities of Lake Victoria. The study findings are in line with the findings by Edem and Ani (2010) observed that knowledge has become the driving force for social development, the attention of the society to information and knowledge is rising and people's demands for information and knowledge is increasing step by step Teenagers, recognized as a critical intervention cohort, makes it is pertinent to understand how they get informed via m-Health for decision making on matters HIV and AIDS.

RECOMMENDATION

The study found that all four m-health dimensions had a significant positive effect on access to treatment by teenagers living with HIV/AIDS in island communities of Lake Victoria. The policy implications will

be highly relevant regarding m-health utilization which requires to be implemented through multi-dimensional approach may render improved access to treatment by teenagers living with HIV/AIDS than the single-dimensional approach in island communities of Lake Victoria. This has important implications for the design of m-health utilization and implementation strategies to policymakers. Moreover, the strength of the influence of characterization of m-Health, technology obsolescence, community support systems and knowledge management are highly relevant for policymakers in developing countries in the context of on-going health sector management and institutional reforms. If m-health process can render larger positive effects on access to treatment by teenagers living with HIV/AIDS, designing adequate m-health utilization and frameworks in the Islands of Lake Victoria could help significantly in increasing the quality of life of teenagers through better access to treatment services. The study thus assists policymakers in coming up with policies geared towards improving access to treatment by teenagers living with HIV/AIDS in island communities of Lake Victoria.

REFERENCES

Addicott, R., McGivern, G., & Ferlie, E. (2006). Networks, organizational learning and knowledge management: NHS cancer networks. *Public Money and Management*, *26*(2), 87-94..

Agar, J. (2013). *Constant touch: A global history of the mobile phone*. Icon Books Ltd.

Alavi, M., &Leidner, D. (1999). Knowledge management systems: issues, challenges, and benefits. *Communications of the Association for Information systems*, *1*(1), 7.

Alin A (2010). Multicollinearity. Wiley Interdisciplinary Reviews: Computational Statistics, *2*(3), 370-374.

Allison P (2012). When can you safely ignore multicollinearity. Statistical Horizons, 5(1).

Barnett T & Whiteside A (2002). AIDS in the 21st Century Disease and Globalization. London: Routledge. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3387685/#R3

Berkman F &Kawachi I (2000). A Historical Framework for Social Epidemiology. In: Berkman Lisa F, Kawachi Ichiro., editors. Social Epidemiology. New York: Oxford University Press; 2000. pp. 3–12. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3387685/#R5

Bonuck K (1993). AIDS and families: cultural, psychosocial, and functional impacts. *Social Work in Health Care*. 1993;18(2):75–89.

Bor R, Miller R, & Goldman E (1993). HIV/AIDS and the Family: A Review of Research in the First Decade.Journal of Family Therapy. 1993;15:187–204.

Bwisa H. and Gacuhi A. (1999), *Africa Technology Policy Studies*, Working Paper no. 19,

Carlson L,Marcu D, and Okurowsk E (2013).Building a Discourse-Tagged Corpus in the Framework of Rhetorical Structure Theory (PDF). University of Pennsylvania. Retrieved 19 April.

Campbell D & Stanley C (1963). Experimental and quasi-experimental designs for research. Chicago: Rand McNally.https://journals.uair.arizona.edu/index.php/jmmss/article/viewFile/18302/18037

Chambers R (1997). Whose Reality Counts: Putting the First Last. London: Intermediate Technology Publications.

Chambers R (1993). Challenging the professions: Frontiers for rural development. London: Intermediate Technology Publications. Pg. xvi.

Cohen J, Cohen P, West G & Aiken S (2013). Applied multiple regression/correlation analysis for the behavioral sciences. Routledge.

Cornwall A (2002). Beneficiary, Consumer, Citizen: Perspectives on Participation for Poverty Reduction. Sida Studies, pp 11.

Darlington, R. B., & Hayes, A. F. (2016). Regression and linear models. New York: Guilford Press.

Davenport H (1994). Saving IT's Soul: Human Centered Information Management. Harvard Business Review 72 (2): 119–131.

Edem N & Ani O (2010). Knowledge management in academic libraries in Nigeria, A Paper presented at the national conference and AGM of the NLA tagged. Unity 2010, held at the Africa hall of the international conference centre, Abuja.

Ethridge E (2004). Research Methodology in Applied Economics. John Wiley & Sons,

p.24http://research-methodology.net/research-methodology/research-design/conclusive-research/descriptive-research/#_ftn2

Florence M, Lutzen K, & Alexius B (1994). Adaptation of Heterosexual Infected HIV Positive Women: A Swedish Pilot Study. Health for Women International. 1994;15(4):265–273

Garson D (2012). Testing statistical assumptions. Asheboro, NC: Statistical Associates Publishing.

Garson D. (2013). Factor analysis. Statistical Associates Publishing.

Germanakos P, Mourlas C, & Samaras G (2005). A Mobile Agent Approach for Ubiquitous and Personalized eHealth Information Systems. Proceedings of the Workshop on Personalization for e-Health of the 10th International Conference on User Modeling (UM'05). Edinburgh, July 29, 2005, pp. 67–70.

Girard P & Girard L (2015). Defining knowledge management: Toward an applied compendium (PDF). Online Journal of Applied Knowledge Management. 3 (1): 14.

Glanz K, Barbara R, & Viswanath K (2008). Health behavior and health education: theory, research, and practice. (4th ed.). San Francisco, CA: Jossey-Bass. pp. 45–51. ISBN 978-0787996147.https://en.wikipedia.org/wiki/Health_belief_model#cite_note-HBM_Decade_Later-1

Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O, and Peacock R (2005). Storylines of Research in Diffusion of Innovation: A Meta-narrative Approach to Systematic Review. Social Science & Medicine 61: 417–430. doi:10.1016/j.socscimed.2004.12.001.

Guiltinan J (2009). Creative Destruction and Destructive Creations: Environmental Ethics and Planned Obsolescence. Journal of Business Ethics.

Gujarati D (2014). Econometrics by example. Palgrave Macmillan.

Hair J, Black C, Babin J, and Anderson E (2014). Multivariate data analysis.

Hall V (1999). The relationship between social support and health in gay men with HIV/AIDS: an integrative review. *Journal of the Association of Nurses in AIDS Care*. 1999;10(3):74–86.

Heymann J, Earle A, Rajaraman D, Miller C, Bogen K. Extended Family Caring for Children Orphaned by AIDS: Balancing Essential Work and Caregiving in a High HIV Prevalence Nations. AIDS Care.2007;19(3):337–345.

Hocking R (2013). Methods and applications of linear models: regression and the analysis of variance. John Wiley & Sons.

Igbinovia O &Ikenwe J (2015).Influence of Knowledge Sharing in Reducing the Spread of HIV/AIDS among Adolescents in Rural Areas in Delta State, Nigeria

Janz K & Marshall B (1984). The Health Belief Model: A Decade Later. Health Education & Behavior 11 (1):1–47.https://en.wikipedia.org/wiki/Health_belief_model#cite_note-HBM_Decade_Later-1

Joint United Nations Programme on HIV/AIDS (2010). Global Report. Geneva: UNAIDS, 2010. Accessed April 12, 2012 fromhttp://www.unaids.org/globalreport/Global_ report.htm

Kadushin G (1996). Gay men with aids and their families of origin: an analysis of social support. Health and Social Work. 1996;21(2):141–149.

Katz E, Levin M, & Hamilton H (1963). Traditions of Research on the Diffusion of Innovation. American Sociological Review 28 (2): 237–252.doi:10.2307/2090611.

Kissling E, Allison H, Seeley A, Russell S, Bachmann M, Musgrave D, & Heck S (2005). Fisherfolk are among those most at risk to HIV: a cross-country comparison of estimated prevalence and numbers infected among groups at risk. AIDS 19: 1939-1946

Kumar S, Nilsen W, Pavel M, & Srivastava M (2013). Mobile health: revolutionizing healthcare through trans-disciplinary research. Computer. 2013; 46(1):28–35.

Kurpius R & Stafford E (2006). Testing and measurement: A user-friendly guide. Thousand Oaks: Sage Publications.

Lamb W, Hair H, & McDaniel D (2009). Essentials of marketing. 6th ed., international student ed. Mason (Ohio): South-Western:, 2009.

Lane D, Isenberg D, & Knoop C (2007).Iqbal Quadir, Gonofone, and the Creation of Grameenphone (Bangladesh).Boston: Harvard Business School Publishing.

Mail & Guardian Africa Business Magazine (2015).http://mgafrica.com/article/2015-06-15-african-youth-account-for-65-of-the-continents-80-billion-consumer-spending-and-ad-targeting.

Makoae N (2015). The Symptom Experience of People Living with HIV/AIDS in Southern Africa. Journal of the Association of Nurses in AIDS Care. 2005;16(3):22–32.

Mertler A & Reinhart R (2016). Advanced and multivariate statistical methods: Practical application and interpretation. Routledge.

Miller K (2005). Communication Theories: Perspectives, Processes, and Contexts. New York City: McGraw-Hill Education. p. 126.

Mohan G (2008). Participatory Development. The Companion to Development Studies. Hodder Education. pp 46.

Mulaik S (2009). Foundations of Factor Analysis, Second Edition. CRC Press.

Nancy K & Marshall (1984). The Health Belief Model: A Decade Later - https://deepblue.lib.umich.edu/bitstream/handle/2027.42/66877/10.1177_109019818401100101.pdf

National AIDS Control Council of Kenya (2014). Kenya AIDS Response Progress Report 2014: Progress towards Zero.

Nöstlinger C, Loos J, &Verhoest X (2015). Coping with HIV in a culture of silence: results of a body-mapping workshop. Jan 31(1):47-8. doi: 10.1089/aid.2014.0316. AIDS Res Hum Retroviruses.

O'brien M (2007). A caution regarding rules of thumb for variance inflation factors. Quality & Quantity, 41(5), 673-690.

Okaka P &Makori M (2015).Social Media Influence on Termination of Slum Teenage Pregnancy; Nyalenda Slum, Kisumu County. LAP Lambert Academic Publishing. ISBN10 3659670537

Okoth-Okombo D (1999). Language and ethnic identity: the case of the Abasuba, Kenya Journal of Sciences (Series C, Humanities and Social Sciences) 5, 1, 21–38.

Pallant J (2010). SPSS survival manual: A step by step guide to data analysis using SPSS. Maidenhead.

Peltzer K &Ramlagan S (2011). Perceived stigma among patients receiving antiretroviral therapy: a prospective study in KwaZulu-Natal, South Africa. AIDS Care. 2011;23(1):60–68.

Pimmer C &Tulenko K (2015). The convergence of mobile and social media. Affordances and constraints of mobile networked communication for health workers in low- and middle-income countries. Mobile Media & Communication. 4: 1–18.

Qiang C, Yamamichi M, Hausman V, & Altman D (2011). Mobile applications for the health sector. Washington: World Bank.

Robert H (2010). Financing of HIV/AIDS programme scale-up in low-income and middle-income countries, 2009–31, The Lancet, Volume 376, Issue 9748, 1254 - 1260

Rogers E (2003). Diffusion of Innovations, 5th Edition. Simon and Schuster. ISBN 978-0-7432-5823-4.

Rogers M (1962). Diffusion of innovations (1st ed.). New York: Free Press of Glencoe. OCLC 254636.

Sheppard H, Hartwick J, &Warshaw R (1988). The Theory of Reasoned Action: A Meta-Analysis of Past Research with Recommendations for Modifications and Future Research. Journal of Consumer Research. 15 (3): 325–343. JSTOR 2489467. doi:10.1086/209170.

Shields P & Nandhini R (2013). A Playbook for Research Methods: Integrating Conceptual frameworks and Project Management. Stillwater, OK: New Forums Press.

Tabachnick G &Fidell S (2007). Profile analysis: the multivariate approach to repeated measures. Using multivariate statistics, 311-374.

Tavakol M &Dennick R (2011). Making sense of Cronbach's alpha. International journal of medical education, 2, 53.

Thanasegaran G (2009). Reliability and Validity Issues in Research. Integration & Dissemination, 4.

Tomlinson M, Rotheram-Borus M, Swartz L, & Tsai A (2013). Scaling Up mHealth: Where Is the Evidence? PLoS Med 10(2): e1001382. doi:10.1371/journal.pmed.1001382

Tufte P (2009). Participatory communication a practical guide ([Online-Ausg.] ed.). Washington, DC: World Bank. pp. 5,6. ISBN 978-0-8213-8010-9.

UNAIDS Outlook Report (2012). Young People Are Leading the Prevention Revolution. Accessed

fromhttp://www.unaids.org/outlook/YoungPeople.aspx on June 27, 2012.

UNAIDS, WHO HIV/AIDS Programme (2008). Guidance on Provider-Initiated Testing and Counseling in Health Facilities. World Health Organization.May, 2007.http://whqlibdoc.who.int/publications/2007/9789241595568_eng.pdf.

UNAIDS (2016). Fast-track update on investments needed in the AIDS response.

UNICEF HIV Data (2015). http://data.unicef.org/hiv-aids/adolescents-young-people.html

United Nation's Children's Fund (2011). Opportunity in Crisis: Preventing HIV from early adolescence to young adulthood. New York: Unicef; 2011. Accessed November 1, 2011 from http://www.unicef.org/publications/files/ Opportunity_in_Crisis-Report_EN_052711.pdf

Vital Wave Consulting (2009). mHealth for Development: The Opportunity of Mobile Technology for Healthcare in the Developing World *(PDF).* United Nations Foundation, Vodafone Foundation. p. 9. Archived from *the original* (PDF) on 2012-12-03.

Walkey Hand Welch W (2010). Demystifying factor analysis: How it works and how to use it. Bloomington, Ind.: Xlibris Corp.

WHO (2014). HIV/AIDS: Prevention of mother-to-child HIV transmission.

World Health Organisation (2012). Voluntary medical male circumcision for HIV prevention.