



COMMUNITY HEALTH SUPPORT SYSTEMS AND UTILIZATION OF MHEALTH INFORMATION BY TEENAGERS LIVING WITH HIV/AIDS IN ISLAND COMMUNITIES OF LAKE VICTORIA, KENYA

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Abstract

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. The 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. Specifically, the study sought to establish the community-based health support systems that facilitate suitable utilization of mHealth by teenagers living with HIV from the island communities of Lake Victoria and its effect on treatment access. To support this study, the study was anchored to Theory of Reasoned Action. This was anchored to the 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 the 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. The study adopted multiple linear regression analysis to determine the relationship between the community health support systems and utilization of mHealth information by teenagers living with HIV/AIDS in Island Communities of Lake Victoria, Kenya. The study results revealed that community-based health support systems had a 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 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 community-based health support systems. 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: M-health Information, Community Support Systems, Teenagers, HIV/AIDS, Island Communities

BACKGROUND INFORMATION

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).

Unlike non-smart phone text messaging (SMS) services, with 3G network, users of smart phones have increasing ability to create social change by access and broadcast of information. Thus, characterization of mobile phone handlers determines packaging and usability of information and Application Systems. Driven by market forces pegged on planned obsolescence in technology (LeBlanc *et al.*, 2013), a paradigm shift to new age of digital literacy is realized. Notably are avatars, emoticons, pictures, sounds and videos that can hold more power than the bygone era of telephones where only names and numbers mattered (LeBlanc *et al.*, 2013). Around 2010 to 2015, Sub-Saharan Africa (SSA) reigned as the world's fastest-growing mobile region, with subscriber growth rates more than twice the global average (The Mobile Economy sub-Sahara Africa [MESSA], 2015). The growth of 3G connections in SSA largely reflects the rising smartphone adoption rate, which has doubled in 2013 to 2015, that is, to 20% of total connections (MESSA, 2015). In Kenya, mobile phones are becoming widespread with 42 subscriptions per 100 people in 2008 (CAK, 2015).

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 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. The community-based health support systems are critical for making

informed decisions on programming for teenagers on mHealth and living with HIV. Consequently, this called for a study to examine the effect of community support systems on mHealth-information and care and treatment seeking behaviors among teenagers living with HIV and AIDS. This study, therefore, sought to examine the community support system that facilitates utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya.

Research Objective

To examine the community-based health support systems that facilitates utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya.

Literature Review

Participatory Development (PD) approach seeks to engage local populations in development projects (Cornwall, 2002), through a coherent and mutually supporting pattern of concepts, values, methods and actions, agreeable to wide application (Chambers, 1993). PD is often presented as an alternative to mainstream top-down development (Mohan, 2008), in the hope of achieving sustainability of projects (Cornwall, 2002). In operationalizing the theory, this study sought to determine the participation of teenagers in health facility-based HIV/AIDS support groups, in the development and utilization of mHealth Apps. as possibly a way of eliminating unjust hierarchies of knowledge, power, and economic distribution. The study sought to build insight into how community-based support systems facilitate utilization and sustainability coping mechanisms for teenagers on mHealth living with HIV from the island communities of Lake Victoria. Critical was a probe on target audience significance in decisions concerning their lives, especially in the research, design, implementation, and evaluation stages of mHealth projects. The study took cognizant of the fact that critics have faulted PD inadequacy to address other inequalities such as class. PD projects have also been accused of enabling tokenism, where a few ‘hand-picked’ local voices can speak as a ‘rubber stamp to prove participatory credentials’ (Mohan, 2008).

Discourse on sustainability of community-based HIV/AIDS projects in SSA, is because the epidemic has affected the family as a functioning system, threatened its supportive capacity, and redefined the manner of coping and adapting mechanisms (Makoe, 2005). With an estimated 2.7 million people in SSA becoming newly infected, it is projected that close to 25 million children will become orphans by the 2010 (Heymann, Earle, Rajaraman, Miller, & Bogen, 2007); this calls for a response to factors which might challenge viability and relevance of mHealth projects targeting teenagers living with HIV/AIDS.

In low-income countries, negative attitude of society exhibited by discrimination and stigmatization (Bonuck, 1993), affects not only physical health but mental and social conditions of persons living with HIV/AIDS (Peltzer & Ramlagan, 2011), making them experience social drift (Kadushin, 1996) with loss of family as major sources of support (Hall, 1999). Coping with HIV infection requires community support (Florence, Lutzen, & Alexius, 1994), with disclosure of status to support groups results in greater social and emotional support for PLWHA (Bor, Miller, & Goldman, 1993). It is therefore suggested that a process by which citizens act in response to public concerns, voice their opinions about decisions that affect them, and take responsibility for changes to their community should be initiated (Armitage, 1988); hence defining Participatory Approach (PA).

Despite the rapid uptake of PA approaches in the 21st century, the central danger lies in the fact that organizations are simply using the name and techniques of PA without any thought or uptake of the philosophy of PA (Chambers, 1997). It should be noted that PA is about needs identification and problem resolution at a fundamental level, that is, if no action is taken on the communities’ recommendations, the groups involved become demoralized and demotivated (Chambers, 1997). However, there are disadvantaged minorities (which may include teenagers) whose participation in development activities may be strongly resisted by gate keepers and dominant community-based groups (Nöstlinger, Loos, & Verhoest, 2015).

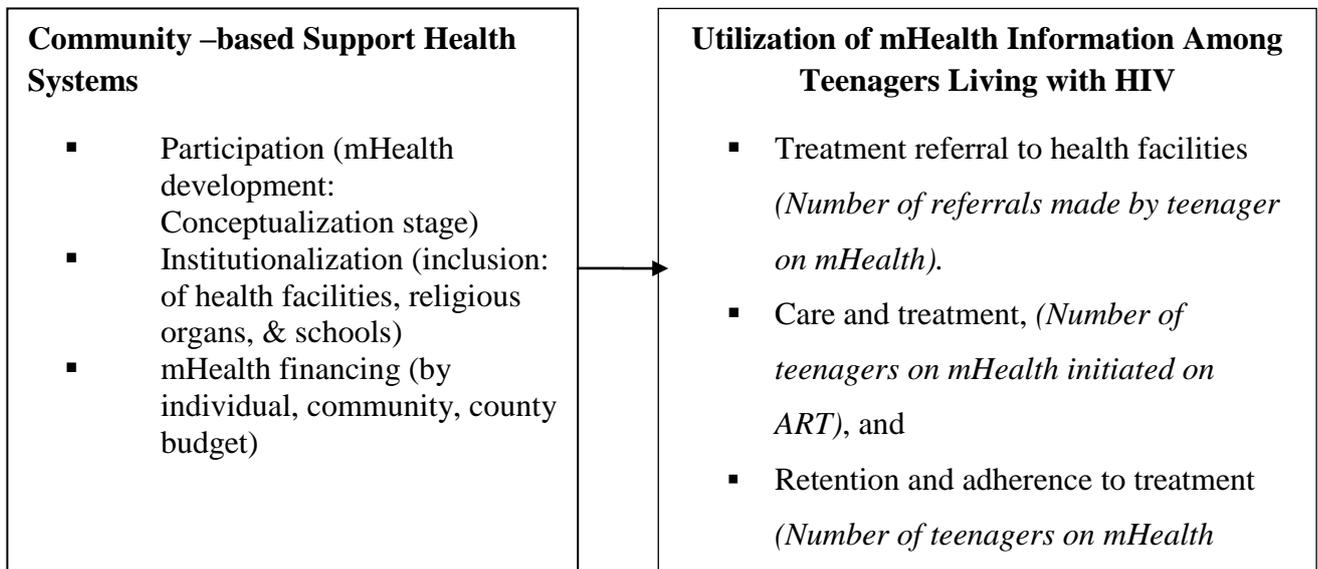
There is also the risk that a participatory methodology is providing a rational, systematic and coherent framework from which to work from (Nöstlinger *et al.*, 2015). Bad experiences with (non-) supporting agencies may have robbed them of any hope for improvement, depleted their self-confidence and increased their distrust of outsiders – resulting in a ‘culture of silence’ (Nöstlinger *et al.*, 2015). Nevertheless, PA uptake by organizations is encouraging (World Bank, 1994), as lack of appropriate participatory approaches limit uptake and sustainability of development initiatives has recently been linked to over-reliance on ‘expert’ knowledge and inadequate appreciation of local development priorities (Tufte, 2009).

Conceptual Model and Hypothesis

The proposed conceptual framework encompassed community-based health systems (as independent variables) which affect utilization of mHealth information among teenagers living with HIV (the dependent variable). This is illustrated below.

Independent Variables

Dependent Variable



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:

N is approximately 409 (from health facility records – as of July 2017)

$P=0.5$ $ME=5\%$ (0.05) $X^2=3$

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

$n= 173.30508475$ as 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

Regarding the above objective, there was the need to establish whether the teenagers had been involved in message development, social marketing and community entry of the mHealth Apps they have engaged with. The results in Table 2 showed that 2.1% of the teenagers who have been involved in message development, were involved in selecting mHealth HIV message package, 6.5% were involved in developing prototype of mHealth HIV message, 2.9% who were involved in pretesting of mHealth HIV message prototype as well as process monitoring of utilization of mHealth HIV message package and 84.80% were not involved at any stage of message development for mHealth. The study results indicate that the teenagers had been involved in message development, in selecting mHealth HIV message package, developing prototype of mHealth HIV message as well as process monitoring of utilization of mHealth HIV message package.

Pertaining to whether the respondents have been involved in social marketing activities of mHealth Apps, 16% of the teenagers posited that they identified the influencers, 49% respondents had been involved but 88 respondents had not been involved. From those who had participated in social marketing activities, 16 respondents were involved in the identification of influencers, 33 were involved in the identification of partners and 51% were not involved in social marketing activities. The study findings imply that involvement in social marketing of mHealth Apps was not for identification of the influencers or partners.

In addition, the study sought to examine the teenagers' level of community entry and the study results indicated that 2.9% identified objectives and evaluation criteria for mHealth indicators; 30.4% stated that they conducted livelihoods analysis on teenagers living with HIV, education of teenagers on m-Health access and utilization, 9.4% of the teenagers indicated that they mapped community linkages for teenagers on mHealth and 52.5% indicated that they did not involve in community entry. This can be deduced that teenagers' level of community entry was low in the communities in Islands of Victoria. The study went further to find out who could sustainably fund mHealth Apps for the use of teenagers to access treatment. The study found out that majority of the teenagers indicated that NGOs played a big role to fund mHealth Apps (58.0%), the CBOs also funded (35.5%), 3.6% of the respondents indicated that the church could fund m-Health Apps and existing health facility also funded the mHealth Apps (3.6%).

The study results indicated that NGOs played a big role to fund mHealth Apps for the teenagers to access treatment for the communities living with HIV in Islands of Victoria.

The study also sought to examine on the teenagers incentivization to use mHealth Apps. The study findings indicated that 18.10% of the respondents indicated provision of airtime, 20.30% of the respondents stated awarding of points of accessing the Apps, 10.10% of the respondents indicated purchase of mobile phones for teenagers, 2.90% indicated facilitation of exchange tours and 48.60% of the respondents stated none of the above. This indicated that awarding of points of accessing the Apps, purchase of mobile phones for teenagers and indicated facilitation of exchange tours could not enhance teenager's incentivization to use mHealth Apps in communities in Islands of Lake Victoria.

Table 2: Teenager's involvement in message development, social marketing and community entry

Category	Case	
	n = 138	%
Involvement in message development of mHealth Apps		
Selecting mHealth HIV message package	4	2.9
Developing prototype of mHealth HIV message	9	6.5
Pretesting of mHealth HIV message prototype	4	2.9
Process monitoring of utilization of mHealth HIV message package	4	2.9
Not involved at any stage	117	84.8
Involvement in social marketing of mHealth Apps		
Identification of influencers	16	22.1
Identification of partners	33	45.5
Not involved in social marketing activities	51	70.4
Involvement in community entry for mHealth Apps		
Identify objectives and evaluation criteria for mHealth indicators	4	2.9
Conduct livelihoods analysis on teenagers living with HIV	42	30.4
Education of teenagers on mHealth access and utilization	13	9.4
Mapping of community linkages for teenagers on mHealth	7	5.1
Not involved in community entry	72	52.2
Who can sustainably fund mHealth Apps?		
The church	5	3.6
Health facility	4	2.9
NGOs	80	58.0
CBOs	49	35.5
Teenagers incentivization to use mHealth Apps		
Provision of airtime	25	18.1
Awarding of points of accessing the Apps	28	20.3
Purchase of mobile phones for teenagers	14	10.1
Facilitation of exchange tours	4	2.9
None	67	48.6

The study investigated on the usage of Apps that prompts referral for medical attention by the teenagers in the study area. The study findings in Table 3 indicated that 32.6% of the

respondents stated drug picking, 30.40% indicated drug taking, 37.0% of the respondents indicated did not use a phone to prompt appointments. On the method for prompt via m-Health, 48.60% of the respondents indicated mobile phone alarm with dates, 13.0% got calls from the health facility, 1.40% Pre-set SMS to send to self and 37.0% did not use a phone to prompt appointments. The study sought to examine the usage of apps that prompts referral for medical attention, 8.6% of the respondents indicated the sought counseling on HIV issues, 11.50% of the respondents indicated tested HIV, 5.80% indicated treatment of opportunistic infections and 74.10% stated that they did not use an app that prompted referral. The study findings indicated that usage of apps prompted referral for medical attention, counseling on HIV issues, tested HIV, treatment of opportunistic infections and to some extent prompted referrals.

On what facilitated the process of referral most; 85.50% of the respondents indicated that they did not make referrals using the mHealth App., 7.20% of the respondents stated services were available in their island, 1.40% of the respondents stated distance to health facility was not an issue, 4.3% of the respondents indicated health care workers was receptive and 1.40% of the respondents indicated an operational teenage friendly center at the facility. The study findings imply that make referrals using the m-Health App, services available in their island, distance to health facility, health care workers and operational teenage friendly center at the facility facilitated the process of referral most in the study area.

On the referral information desired by teenagers to be on m-Health, 85.5% of the respondents indicated emergency medical attention, 7.2% of the respondents stated place to seek counseling, 1.4% of the respondents indicated place to test for HIV, 4.35 of the respondents stated treatment for opportunistic infections and 1.4% indicated contraceptive information. The study findings indicated that emergency medical attention, place to seek counseling, place to test for HIV, treatment for opportunistic infections and contraceptive information were some of the reasons for referral information desired by teenagers to be on mHealth.

Table 3: Use of mHealth Apps to prompt referral for medical attention

Category	Case n = 138	%
Prompts via mHealth		
Drug picking	45	32.6
Drug taking	42	30.4
Did not use a phone to prompt appointments	51	37.0
Method for prompt via mHealth		
Mobile phone alarm with dates	67	48.6
Get calls from the health facility	18	13.0
Pre-set SMS to send to self	2	1.4
Did not use a phone to prompt appointments	51	37.0
Use of Apps that prompts referral for medical attention		
Seek counseling on HIV issues	12	8.6
Testing of HIV	16	11.5
Treatment of opportunistic infections	8	5.8

Did not use an app that prompts referral	103	74.1
What facilitated the process of referral most		
Did not make referrals using the mHealth App.	118	85.5
Services are available in my island	10	7.2
Distance to health facility is not an issue	2	1.4
Health care workers are receptive	6	4.3
An operational teenage friendly center at the facility	2	1.4
Referral information desired by teenagers to be on mHealth		
Emergency medical attention		35
Place to seek counselling		24
Place to test for HIV		14
Treatment for opportunistic infections		64
Contraceptive information		1

Correlation Analysis

The study sought to establish the relationship between community-based health systems 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 4 show a correlation ($r(138) = 0.339$; $p < 0.05$) between the community-based health systems and access to treatment by teenagers living with the HIV. This implies that the community-based health system 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 community-based health systems and access to treatment by teenagers living with the HIV.

Table 4: Correlation Analysis of Community Based Health Systems

		Access to Treatment
Access to Treatment	R	1.000
	Sig. (2-tailed)	.
	N	
Community Based Health Support Systems	R	.339
	Sig. (2-tailed)	.000
	N	138

Regression Analysis

This study applied a regression model to identify the effect of community-based health systems 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 community-based health systems (independent variable). It was hypothesized that:

H_0 : There is no significant relationship between community-based health support systems and utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya.

To test this hypothesis, the model $Y = \beta_0 + \beta_1 X_1 + \varepsilon$ was fitted. Where Y is utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya and X_1 is community-based health support systems.

Regression model summary results in Table 5 indicate the goodness of fit for the regression between community-based health support systems and utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya had a R squared of 0.216 indicates that 21.60% of the variances in utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya are explained by the variances in community-based health support systems. However, the model failed to explain 78.40% of the variation in utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya. This means that there are other factors associated with utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya were not explained by the model. The correlation coefficient of 0.465 indicates community-based health support systems have a positive correlation with utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya.

Table 5: Model Summary (Community Based Health Support Systems and utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.465a	.216	.207	3.9876

The ANOVA results in Table 6 shows that ($F(1,136) = 37.470, p < 0.05$). This shows that the overall model significant. The findings imply that community-based health systems were statistically significant in explaining utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya. Therefore, at $p < 0.05$ level of significance, null hypothesis rejected and concluded that there is a significant relationship between community-based health support systems and utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya.

Table 6: ANOVA Statistics (Community Based Health Systems and Treatment Access.)

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	78.425	1	78.425	37.470	.000 ^b
1 Residual	284.655	136	2.093		
Total	363.080	137			

Regression of coefficients results in Table 7 shows that there is a positive and significant relationship between community-based health systems and utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya as supported by a $p < 0.05$ and a beta coefficient of 0.408. The fitted equation is as shown below: $Y = 3.908 + 0.408 X_1$ that is utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya = $3.908 + 0.408$ community-based health systems This implies that a unit increase in community-based health systems would

increase the utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya by 0.408 units. This was supported by the t values whereby $t_{cal} = 2.266 > t_{critical} = 1.96$ at a 95 percent confidence level which depicts that we reject the null and conclude that community-based health systems positively and significantly influence utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya.

Table 7: Regression Coefficients (Community Based Health Systems and Treatment Access

	Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.908	.909		4.299	.000
	Community based health Support systems	.408	.180	.216	2.266	.000

CONCLUSION & RECOMMENDATIONS

The study sought to explore community-based health support systems that facilitate utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya. From the regression and correlation analysis, the study concludes that community-based health support systems positively and significantly influenced utilization of mHealth Information by teenagers living With HIV/AIDS in Island Communities of Lake Victoria, Kenya. The study results are in line with the findings by Makaoae (2005) found out that discourse on sustainability of community-based HIV/AIDS projects in SSA, is because the epidemic has affected the family as a functioning system, threatened its supportive capacity, and redefined the manner of coping and adapting mechanisms. Coping with HIV infection requires community support with disclosure of status to support groups results in greater social and emotional support. It is therefore suggested that a process by which citizens act in response to public concerns, voice their opinions about decisions that affect them, and take responsibility for changes to their community should be initiated, hence defining participatory approach. The policy implications will be highly relevant regarding mHealth utilization which require to be implemented through multi-dimensional approach may render improved utilization of mHealth Information by teenagers living and 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 mHealth utilization and implementation strategies to policymakers.

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.24 http://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.

- Guiltnan 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 Care giving 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.
- Igbinoia 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 from http://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 Grameen phone (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>.
- Makoe 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 from <http://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*). 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.