The use of mobile devices in HIV and AIDS communication: Opportunities for Botswana

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Abstract
Mobile and internet technologies are increasingly becoming an integral part of HIV and AIDS prevention and care across Africa and the world. The high mobile device penetration in Botswana, estimated at about 160%, provides an invaluable opportunity to leverage the use of mobile devices to support HIV and AIDS prevention and care. A non-systematic review of the literature was conducted using three databases and Google Scholar to explore the use of mobile devices in supporting HIV and AIDS prevention and care in sub-Saharan Africa, and to draw lessons for potential application to Botswana. Short messaging service (SMS) is the most commonly used tool in ART adherence support for both medication and appointment reminders. Although privacy and confidentiality continue to be significant concerns, patients are generally willing to receive reminders and messages through their mobile phones. Patient-centred mobile health (mhealth) interventions are effective at improving care, but are not as effective in the area of prevention. Overall, programmes with better outcomes seem to be those with a multi-pronged approach in which technology is coupled with human interactions.

Key words: HIV, AIDS, prevention, adherence, mobile phones, SMS, mhealth

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Introduction
Mobile Health (or mHealth) provides a promise and opportunity for delivering healthcare interventions to improve the quality of life for the HIV and AIDS-ravaged, resource-constrained settings in the sub-Saharan Africa (SSA) region (Forrest et al., 2015). Growth in access to and use of information communication technologies (ICTs) over the past decade, and substantial growth in the availability and use of internet services in the past five years have led to increased mobile networks and the quintupling of the number of cellular subscriptions globally (International Telecommunication Union, 2015). For sub-Saharan Africa (SSA), advances in ICTs have led to the proliferation of mobile phone networks and, consequently, an exponential growth in people owning cellular phones (Pew Research Center, 2015). With the growing penetration and decreasing cost of mobile devices and internet technologies, healthcare professionals and researchers, including those in SSA, are increasingly interested in the application of ICTs in healthcare delivery. ICT applications in healthcare or ehealth include telemedicine, mhealth, mobile learning (mlearning), patient management systems, and electronic prescribing.

HIV and AIDS prevention and care interventions are generally multi-pronged and increasingly, mobile devices and internet technologies are becoming an integral part of prevention and adherence support messaging (Pellowski & Kalichman, 2012; Rodrigues et al., 2015). Cellular phones, in particular, are used to support other modes of prevention messaging and adherence in HIV and AIDS-related care such as prevention of mother-to-child transmission (PMTCT), adherence to antiretroviral therapy (ART), and male circumcision patient follow-up (Kunutsor et al., 2010; Mbuagbaw et al., 2014; Mushamiri, Luo, Iiams-Hauser, & Ben Amor, 2015). SMS is the predominant technology used in HIV prevention and care in SSA (Cole-Lewis & Kershaw, 2010; Free et al., 2013), used to support clinic attendance, medication adherence, motivation, and health information. Despite concerns about privacy and confidentiality, patients are generally willing to use mobile devices for HIV prevention and care (Mushamiri et al., 2015; Reid et al., 2014; Schwartz et al., 2015).

HIV and AIDS in Botswana and around the world
The HIV and AIDS pandemic continue to be a serious public health challenge throughout the world. The Joint United Nations Programme on HIV/AIDS (UNAIDS) indicated that by the end of 2014, 36.9 million people were living with HIV globally, with 13.6 million accessing antiretroviral drugs and 1.4 million newly infected with HIV (UNAIDS, 2015). Additionally, although the overall AIDS-related deaths fell by 4% between 2004 and 2014, there were 790,000 AIDS-related deaths recorded in 2014. Sub-Saharan Africa (SSA) bears the bigger global burden of HIV with 25.8 of the 36.9 million HIV infected people living in SSA, and 66% of the global new infections emerging from SSA (UNAIDS, 2015). Three SSA nations; namely Botswana, Lesotho and Swaziland, still had adult HIV prevalence rates of over 20% as of 2014 (The Henry J Kaiser Family Foundation, 2015).

According to the latest *Botswana AIDS Impact Survey* (BAIS IV), the current HIV prevalence amongst persons aged 18 months and over is estimated at 18.5% and new infections at 1.35% within the same population (Statistics Botswana, 2013). UNAIDS reported that in 2014, Botswana's HIV prevalence rate among adults (15–49) were at 25.2% and deaths relating to HIV stood at 5100 people. Botswana has been battling the AIDS epidemic since the mid-1980s when the first HIV case was reported. By the late 1990s, Botswana had the highest prevalence of HIV in the world (Capstick & Warwick, 2004). In 2001, soon after the government of Botswana declared AIDS a national emergency, the government made a bold decision and

became the first SSA nation to provide free national antiretroviral therapy (ART) through a programme called MASA (meaning "a new dawn") in an effort to stem the AIDS epidemic. Using a phased approach, the first four antiretroviral drug sites were launched between January and July 2002 with 3176 patients going on ART (Darkoh & Mazonde, 2004; Darkoh, 2004). In a further effort to curb new infections, the government, through the National AIDS Coordinating Agency (NACA), rolled out various prevention initiatives nationwide.

Currently, Botswana has a 62% ART coverage for people living with HIV, the fifth highest in the world (The Henry J Kaiser Family Foundation, 2015). New infections have decreased significantly from 15000 in 2005 to 9100 in 2013 and AIDS-related deaths have gone down from 14000 to 5800 in the same period (AVERT, 2013). Additionally, 93.5% of HIV-positive mothers are enrolled in the Prevention of mother to Child Transmission (PMTCT) programmes while 46% of HIV-positive babies are on ARTs (Statistics Botswana, 2013).

Challenges in dealing with HIV and AIDS prevention and care

Even with the progress made towards curtailing the HIV and AIDS pandemic globally, challenges in HIV and AIDS prevention and care persist, especially in ART adherence, PMTCT adherence, HIV patient follow-up, and male circumcision patient follow-up (Mbuagbaw et al., 2014; Nglazi, Bekker, Wood, Hussey, & Wiysonge, 2013). Botswana experiences some of the same challenges faced by other countries that are hard hit by the HIV and AIDS pandemic. Consistent condom use amongst the various age groups is low at 65.2%, despite this being an important aspect of the prevention message (Statistics Botswana, 2013). Concurrency of partners, measured by the number of sexual partners that people had in a twelve month period, has also not decreased in any significant way (Statistics Botswana, 2013).

Another challenge that Botswana faces is the fact that only 46.2% of HIV positive babies are on treatment (Statistics Botswana, 2013). The efficacy of treatment depends largely on compliance with treatment (Mbuagbaw et al., 2014). Non-adherence to treatment can lead to poor virological immune response, drug resistance and infectivity, relapse, disease progression and death. Failure of first-line therapy can require costly second-line therapy, and as such, adherence to ART not only improves health outcomes, but is critical to cost containment (Lester et al., 2010; Reid et al., 2014).

Technology-supported HIV and AIDS work in Botswana

In the continued fight against the HIV and AIDS pandemic, Botswana like its SSA counterparts, has been exploring the use of technology to support HIV and AIDS prevention and care. Fledgling as the implementation might be, the government of Botswana is committed through Maitlamo (the national ICT policy), to invest in the "comprehensive use of ICTs in order to increase quality, safety, timeliness and efficiency of health services to all Batswana" (Ministry of Communication Science and Technology, 2007). Additionally, there have been several projects such as the Kgakololo Study (Cardino Emerging Markets USA, 2015) using mobile devices in HIV and AIDS prevention and care, although such projects are yet to translate to long-term national or at least programmatic projects. Recently, the research team of the BAIS IV innovatively used mobile devices connected to a national server to collect data from study participants.

Purpose of the paper

Despite the high adoption rate of mobile phones in Botswana and the proliferation of their use in HIV and AIDS prevention and care around the globe, the current BAIS IV did not explore issues

related to the use of technology, particularly mobile phones. As such, perceptions and the feasibility of their use in HIV and AIDS messaging, as well as access to and ownership of mobile devices among Batswana are yet to be explored in a broad-based empirical study. The purpose of this paper is to report on the findings of a non-systematic review of the literature conducted to explore the use of mobile devices to support HIV and AIDS prevention and care in SSA countries, and to draw potential lessons from the literature that could strengthen technology-enhanced HIV and AIDS messaging in Botswana.

Methods
This article reports on the findings of a non-systematic review of the literature conducted to explore the use of mobile devices to support HIV and AIDS prevention and care in SSA countries. A non-systematic review, also sometimes called a critical synthesis or critical review of the literature focuses on considering the literature broadly, including gaps and what still needs to be done (Eva, 2008). A critical review seeks derive a "conceptual contribution" from the literature (Grant & Booth, 2009). The result of such a review is "a new perspective of an old problem, rather than simply paraphrasing what all other researchers and scholars in the field have shown or said in the past" (Eva 2008, p. 853).

The non-systematic approach does not necessarily imply lack of rigour of the methodology (both mining and review), but speaks to the purpose of the review. The intent of the review is not necessarily to evaluate the quality of methodology and results of the individual or collective studies, but to inductively categorise and examine trends or themes found in the selected publications (Cook, 2008; Eva, 2008). Cook (2008) argues that non-systematic reviews should pay attention to principles of qualitative research such as clarifying the purpose of the review, collaboration, purposeful sampling, and considering alternate perspectives to ensure methodological rigour. We have drawn from the perspectives by Cook (2008), Eva (2008) and Grant and Booth (2009), to conduct a non-systematic review of the literature intended to combine the rigorous established process of the systematic review as a literature-based research methodology and rich, inductive analytic nature of qualitative research to identify emerging themes.

Data searching and mining
In December 2015, we, with the help of a medical subject librarian, conducted a preliminary search of the literature in PubMed and Google Scholar using the following search terms: HIV, Africa, AIDS, messaging, communication, and technology. We reviewed the collected articles to identify and compile a list of relevant search terms as shown in Table 1. In April 2016, we conducted a comprehensive search of the literature in Web of Science, Medline, PubMed, and Google Scholar using the search strategy in Table 1. Since Google Scholar is a meta-search engine and does not support complex search strategies as the three databases, it was used to fill the gaps to ensure we did not overlook any articles, and to locate full text articles we could not obtain in the three databases. We used HIV, Africa, and mobile phones as our core modifying themes while the others were variable search themes. For instance, the *mhealth* theme was modified with [Africa *AND* HIV *AND* mobile phone]. As we modified each variable theme with the core modifying themes, we reviewed titles and abstracts from each output for relevance. Ultimately, our purposeful sample was intended to include articles on the use of mobile devices to support HIV and AIDS prevention and care in SSA. At the end of the search in all the four databases, we had mined 87 articles.

Inclusion criteria

The inclusion criteria were sub-Sahara, mobiles phones, HIV prevention and care, and communication. We only used peer-reviewed articles published in English.

Exclusion criteria

We excluded studies where participants were not directly interfacing with the technology and perception studies where there was no intervention.

Table 1 Search strategy for the use of mobile devices in HIV and AIDS prevention and care in Sub-Saharan Africa

	General Theme	Keywords
Core modifying themes	Africa	Africa OR sub Sahara* OR sub-Sahara*
	HIV	HIV OR HIV/AIDS OR HIV and AIDS
	Mobile phone	mobile phone*OR smartphone*OR cell phone OR cellular phone OR mobile device
Variable themes	Text messaging	sms text OR texting OR sms messaging OR short message service OR buzzing OR reminder OR text messaging OR text message OR sms reminder
	Technology	Technology OR technology intervention OR information communication technolog* OR ICT* OR mobile health technolog* OR health technology OR medical devices OR medical equipment OR technology integration OR delivery systems OR technology based intervention
	mHealth	Mhealth OR mobile health OR telemedicine OR health applications
	Healthcare	health care service* OR healthcare OR care OR delivery of healthcare OR health service* OR health care OR health programmes
	Information	information service OR information OR communication OR messaging, information dissemination OR health communication OR education
	Intervention	intervention* OR intervention studies OR technology-based intervention* OR technology intervention* OR health interventions OR health care intervention* OR health-care intervention* OR technological intervention* OR information communication technology intervention* OR ICT intervention
	Adherence	adherence OR clinic attendance OR medical refills OR treatment adherence OR compliance
	Health programmes	health programmes OR health care programmes OR health activities OR healthcare activities OR programme activities OR research report OR health behaviour OR disease management OR surveillance OR HIV management
	Prevention	Prevention OR HIV prevention OR HIV and AIDS prevention OR PMTCT OR prevention of mother-to-child transmission OR preventing mother-to-child transmission OR ARV OR antiretroviral therapy OR programmes

Analysis of articles found

At the first level of analysis, we split the 87 articles amongst ourselves and read all of them to scrutinise them for relevance using our inclusion and exclusion criteria. We developed a review matrix (Garrard, 2007) using the following column headings: author(s), year, country, study title, purpose of study, programme type, method characteristics, and key findings to enable us to record the main elements of each article. We met often to discuss all papers and agree on their inclusion in or exclusion from the sample, and to come to a consensus on the main findings. We also used a snowballing technique to follow additional articles from a most recent review on the use of mobile devices in SSA. In the end, 24 studies were deemed relevant to the purpose of this paper.

A second level of analysis entailed the review of the matrix data recorded for the 24 articles to inductively categorise and examine trends and themes.

Findings and discussion

In this section we present the findings and discussions in two phases. First we present a summary of the basic characteristics of the 24 studies. Then we present emerging themes from the findings of the 24 studies and discuss some potential applications that could strengthen technology-enhanced HIV and AIDS messaging in Botswana.

Characteristics of the 24 Studies

The 24 studies published between 2010 and 2016 represented eight SSA countries: Botswana (1), Cameroon (1), Kenya (10), Malawi (1), Nigeria (1), South Africa (6), Swaziland (1) and Uganda (3). The collection of studies used a variety of qualitative (e.g. ethnographic case study, semi-structured interviews, and focus groups) and quantitative (e.g. single to multi-site randomized control trials, and cross-sectional surveys) methodologies. Except for two studies (Cameroon and Malawi) that targeted mother-child pairs in PMTCT programmes, all other studies targeted adult participants. Additionally, the studies covered seven prevention and care programmes as shown in Table 2.

Table 2 Summary of 24 studies by programme type

Programme	Programme strategies	Studies	Summary of Key findings
Testing and counselling	Use of SMS to promote testing, provide counselling and encourage early linkage to care for HIV+ participants	Pai et al., 2013	91% of participants rated a positive experience with the strategy. All sero-positive participants were linked to care after the test.
		Van Zyl, Brown & Pahl, 2015	Calling individuals to link them to care is perceived as useful.
Educational campaigns	Text message campaign used to disseminate and measure HIV and AIDS knowledge and promote testing.	Chib, Wilkin, & Hoefman, 2012	The SMS can reduce sociocultural vulnerabilities due to the confidential nature of messages to individual owners.
Post-exposure prevention	Using SMS reminders to women to use microbicidal gel after sexual activity	Gengiah et al., 2014	Cell phone reminders generated were useful in supporting the dosing strategy.
Circumcision	Use of SMS to promote post-operative clinic attendance and delayed resumption of sexual activity post-surgery	Odeny et al., 2012	Modest improvement in attendance in males receiving daily SMS reminder post-circumcision.
		Odeny et al., 2014	SMS intervention as used did not reduce early resumption of sexual activity after circumcision
Early linkage to care	Use of SMS to promote linkage to care and result collection	Siedner et al., 2015	Use of mobile technologies feasible in rural areas. Intervention did not improve clinic attendance
		Maduka & Obin-West, 2013	Adherence counselling and text message reminders improved adherence among HIV patients.
		Kliner, Knight, Mamvura, Wright & Walley, 2013	Improvement in return to clinic time. Improvement in ART initiation.
ART adherence	Use of SMS to support ART adherence and monitoring, provide support to patients through check-in messages, clinic attendance reminders, medication and appointment reminders	Kinyua et al., 2013	Patients preferred calls over SMS reminders. Preferred interaction for medical advice more so than reminders. Concern for confidentiality tied to age.
		Kunutsor et al., 2010	Mobile phones have potential to improve clinic attendance. Patients willing to be contacted using mobile phones.
		Lester et al., 2010	Patients receiving SMS reminders had improved ART adherence and rates of viral suppression.
		Madhvani, Longinetti, Santacatterina, Forsberg, & El-Khatib, 2015	Patients use different modalities to remember appointments (both cards and cell phones). Educated males under 35 more likely to use phone reminders.

		Moyer, 2014	Human factor is a critical component in adherence support. Social support services such as those provided by community health care workers should not be considered ad hoc.
		Pop-Eleches et al., 2013	Receiving SMS associated with better adherence and less likelihood of missed dose of >48hrs.
		Reid et al., 2014	Medication and clinic attendance reminders are acceptable to patients and found to be somewhat helpful to very helpful (93% of patients). Intervention patients less concerned about accidental disclosure.
		Smillie et al., 2015	Increased communication via the text messaging intervention has the potential to enable early identification of problems, leading to timely problem solving that may improve retention and engagement in care during the first year after diagnosis.
		Van der Kop et al., 2016	No difference in proportion of men or women having access to a phone. Few participants had concerns about receiving message to participants.
PMTCT	Use of SMS as a platform fora PMTCT support group, appointment reminders for missed appointments, combination of SMS and voice calls to support PMTCT	Bigna, Noubiap, Kouanfack, Plottel & Koulla-Shiro, 2014	Reminders of scheduled HIV appointments for carers of paediatric patients can increase attendance.
		Dean, Makin, Kydd, Biriotti & Forsyth, 2012	SMS worked well in answering straightforward, specific questions, e.g. CD4 count goals. Close involvement of a health professional necessary to correct serious medical misconceptions.
		Jennings, Ong'ech, Simiyo, Sirengo & Kassaye, 2013	Perceived benefits include receiving information and reminders, connecting with health-care worker, protecting confidentiality.
		Mwapasa et al., 2014	73% improvement in retention rate at 12 months postpartum among HIV+ mothers on Option B regimen.
		Odeny et al., 2014a	19.6% increased attendance in maternal postpartum clinic compared to 11.8% in the control group.
		Schwartz et al., 2015	Post-partum depression and emotional and motivational support found to be invaluable by participants.

In addition to the study characteristics described above, four overarching themes emerged from the analysis of the 24 articles as discussed below.

SMS interventions can improve health outcomes
Overall, the findings suggest improvement in health outcomes with the use of mobile devices, particularly SMS and voice calls. There seemed to be an overall improvement in outcomes when SMSes were used to support clinic attendance, including initiation for care (Kunutsor et al., 2010; Maduka & Obin-West, 2013; Siedner et al., 2015), ART adherence (Lester et al., 2010; Pop-Eleches et al., 2013); or even programme engagement and retention, particularly in PMTCT (Bigna et al., 2014; Mwapasa et al., 2014; Odeny et al., 2014a).

The circumcision studies in Kenya demonstrate the nuances in the findings. On the one hand, the use of daily SMS reminders to promote attendance of post-operative clinics showed modest improvements in clinic attendance (Odeny et al., 2012). On the other hand, the use of SMS reminders to delay sexual activity after surgery did not reduce early resumption of sexual activity (Odeny et al., 2014). As such, it seems that the use of SMS to support behaviour change

(e.g. the Kenyan circumcision study) and initiation to care (e.g. the Swaziland *buzzing* study) is much more tenuous than support for other forms of care.

Human interactions are important
The findings suggest that overall, patients and healthcare workers valued combining mhealth-based interventions with human interactions. Interventions that combined mhealth applications with human interactions included the use of peer mentors to provide counselling, follow-up of non-adherents, and the encouragement and tracking of treatment in Kenya (Moyer, 2014); the inclusion of fathers to support mothers in a PMTCT programme in Kenya (Jennings et al., 2013); and the use of case workers to make telephone contact with patients enrolled in a PMTCT programme in South Africa (Schwartz et al., 2015). Human interactions have been used to address problems, correct misconceptions and provide culturally appropriate advice (Dean et al., 2012), and provide the necessary psycho-social support (Moyer, 2014).

The existence of community healthcare workers (CHWs) in Botswana's healthcare system provides an established network of people already embedded in the community. As such, CHWs are well-placed to bridge and leverage what Forrest et al. (2015) described as patient care-focused and health system-focused mhealth interventions to support initiation and adherence to care. CHWs and peer mentors can provide psycho-social support to link to and initiate care among people who otherwise might have difficulty accepting their status, and therefore less likely to start treatment, and more likely to struggle with adherence once treatment has commenced (Moyer, 2014).

Privacy and confidentiality are important but non-deterring concerns
The findings suggest that since HIV and AIDS are highly stigmatised conditions, patients have concerns about privacy and confidentiality of information communicated to them through the use of mobile devices (Jennings et al., 2013; Kinyua et al., 2013). However, patients are still open to SMS communication for clinic attendance reminders, medication adherence, motivational support, and health information (Kunutsor et al., 2010; Reid et al., 2014). But due to concerns about privacy, patients tend to prefer non-HIV specific messaging (Reid et al., 2014) and using their personal phones to communicate with healthcare workers for confidentiality (Kinyua et al., 2013).

Because of the existence of the money transfer platforms such as *Myzaka* and *Orange Money*, utilising unstructured supplementary service data (USSD) encryption technologies that provide password-protected SMSs, provide a platform to leverage such technologies for secure communication with patients. For instance, reminders for test results, clinic attendance or other messaging can be communicated securely.

A multi-modal approach allows for addressing diverse needs
The findings suggest that a combination of media platforms, particularly SMS and voice, had better outcomes (Bigna et al., 2014; Kinyua et al., 2013), and that patients preferred to use voice calls over SMS even though SMS is more cost effective (Bigna et al., 2014). Chib et al. (2013) argued for the inclusion of the community in crafting messages to ensure sensitivity to sociocultural vulnerabilities.

In Botswana, NACA, in what seems to be a thriving HIV prevention campaign called *Wise Up*, targeting adolescents and young adults aged 10–24 seems to be successfully using various media platforms (National AIDS Coordination Agency (NACA), 2011). Evaluation of programmes such as *Wise Up* could provide useful lessons for application to other programmes

and projects. Even within the same media platform, studies show that a combination of SMS and voice has better outcomes (Kinyua et al., 2013) and that there is a preference for voice over SMS, even though SMS is more cost effective (Bigna et al., 2014).

Limitations and future work
The paucity of peer-reviewed published literature on the use of mobile devices in HIV and AIDS interventions in Botswana limited the depth and breadth to which we could explore the subject locally. Future studies exploring the impact and durability of various mobile platforms used in HIV and AIDS interventions should be done to see how mhealth technologies could be optimised. In addition, research into cost comparison of various mhealth-enabled HIV and AIDS initiatives should be conducted.

Conclusions
Our national context presents several opportunities for leveraging the benefits of mobile devices for supporting HIV and AIDS prevention and care. The high penetration of mobile devices in African countries, Botswana included, presents an opportunity for mhealth initiatives that could potentially enhance HIV and AIDS prevention and care initiatives. Several SSA countries continue to leverage SMS to support HIV prevention and adherence to treatment. With its capability to be efficient even on the least advanced mobile devices, SMS provides a promising opportunity for HIV messaging in Botswana as in other African countries. It promises to have practical application in the rural areas where internet access is most likely limited.

Great financial investments already made by the Botswana government in e-infrastructure provides an opportunity to integrate patient-level SMS interventions into broader health system infrastructure for better outcomes, as seen in the case of Kenya (Mushamiri et al., 2015) and South Africa (Gengiah et al., 2014; Van Zyl et al., 2015). However, the utility and scalability of existing platforms for HIV and AIDS initiatives are yet to be fully exploited. Further integrations of ICT infrastructure could strengthen connectivity of health facilities and interfacing with mobile devices to reach a broader population spectrum and thereby greatly enhancing HIV and AIDS patient management.

Leveraging private partnerships to build on government commitments and events provides transcending disparate donor and NGO-driven systems to create a cohesive national ehealth infrastructure. Already two of the mobile service providers in Botswana, *Mascom* and *Orange*, have a tradition of supporting local mhealth initiatives. Mascom was one of the contributing partners in the Kgakololo Project aimed at providing the Ministry of Health with evidence on leveraging Botswana's technological infrastructure and the high cell phone penetration rate to improve HIV treatment adherence (Cardino Emerging Markets USA, 2015). Orange Botswana has collaborated with Botswana-UPenn Partnership in various telemedicine projects (Littman-Quinn, Mibenge, Antwi, Chandra, & Kovarik, 2013) and with the University of Botswana Faculty of Medicine on an mlearning project (Kebaetse, Nkomazana, & Haverkamp, 2014). Continuing to leverage these partnerships and cultivating new ones can provide opportunities for trying out new ideas and evaluating existing ones for improvement.

Irrespective of the technological platform used, there is a need to consider technology and its use in the context of client-centred services. There needs to be continued and consistent provider-client and provider-provider interaction with technology serving as the medium for two-way communication. It is also important to consider ways in which peer-to-peer communications can be facilitated through using technology.

In light of the work being done around mhealth in Botswana and the opportunities our current context present, improved health outcomes can be realised when mhealth applications are informed by a robust research agenda that evaluates the utility and efficacy of mhealth applications in Botswana. We therefore recommend that future BAIS (*Botswana AIDS Impact Survey*) research should also seek to establish how ICTs are being exploited at personal level so that the results can inform HIV and AIDS prevention and care intervention programmes**.**

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