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## Smartphone usage and preferences among postpartum HIV-positive women in South Africa

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### Abstract

In South Africa, HIV-positive women receiving antiretroviral therapy often are lost to care postpartum; strategies to support long-term engagement are needed. Mobile health (mHealth) interventions are emerging as a possible solution for supporting long-term engagement in the prevention of mother-to-child transmission (PMTCT) of HIV care continuum. In order to explore acceptability and feasibility of mobile health (mHealth) interventions in this context, we conducted focus group discussions (FGDs) to assess trends in smartphone usage in postpartum women. In six FGDs, we interviewed 27 HIV-positive, postpartum women who attended regular care at the Gugulethu Community Health Centre in Cape Town, South Africa, and who use a smartphone. Questions assessed the respondent's general trends in smartphone use, as well as their exposure to and perceptions of mHealth interventions. We found little turnover in phones and phone numbers, and about half the participants shared their devices with family and friends. Respondents reported high familiarity with smartphone applications, including WhatsApp, Facebook, YouTube, and Twitter, with WhatsApp as their preferred method of smartphone communication. Data bundles were most often used to connect to the internet, motivated by the perception that data bundles last longer and are cheaper than airtime, but respondents were adept at locating Wi-Fi sources at work or other public spaces. Nearly all participants were familiar with MomConnect, a national mHealth text support service in South Africa, and most described it

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positively. Respondents expressed interest in future HIV mHealth applications including complementary health information on physical activity, nutrition, mental health and basic social services. Participants were active and engaged smartphone users with reliable internet connections and a positive attitude towards mHealth platforms. Future mHealth interventions show promise in this population.

## Keywords

smartphone; mobile health; mHealth; HIV/AIDS; pregnant; postpartum

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## Introduction

In 2012, the World Health Organisation (WHO) recommended that HIV-positive pregnant women initiate life-long antiretroviral therapy (ART) irrespective of their CD4 count, a policy known as Option B+ (Odeny et al., 2014; UNICEF, 2012; World Health Organization (WHO), 2012). This approach is endorsed for accelerating progress in eliminating new vertical HIV infections and improving maternal health outcomes, and the importance of ART adherence is emphasised for both the antenatal and postpartum phases (Gopalappa, Stover, Shaffer, & Mahy, 2014; Nachega et al., 2012; UNICEF, 2012). Some studies have shown a trend of disengagement in care and ART non-adherence during the postpartum period (Clouse et al., 2014; Myer & Phillips, 2017; Psaros, Remmert, Bangsberg, Safren, & Smit, 2015). There is an urgent need for innovative and patient-centred interventions to strengthen current prevention of mother-to-child transmission of HIV (PMTCT) strategies and improve postpartum engagement in HIV care (Bhardwaj, Carter, Aarons, & Chi, 2015; Rotheram-Borus, Tomlinson, Swendeman, Lee, & Jones, 2012).

In recent years, a growing body of evidence has explored the use of mobile health (mHealth) technology in HIV and maternal and child health (MCH) (Jennings, Ong Ech, Simiyu, Sirengo, & Kassaye, 2013; Laflamme, 2017; Lee et al., 2016; Odeny et al., 2014; Watterson, Walsh, & Madeka, 2015). Conceptual frameworks elucidating and supporting the use of mHealth interventions in resource-limited settings also have been developed, such as the Technology Acceptance Model for Resource-Limited Settings (TAM-RLS)(Campbell et al., 2017). However, most mHealth studies to date have focused on short message system (SMS) text-based interventions (Coleman et al., 2017; Joseph-Davey, Ponce, Augusto, Traca, & de Palha de Sousa, 2013; Musoke et al., 2017; Nachega et al., 2016; Odeny et al., 2014; Schwartz et al., 2015). A notable example is MomConnect, offered by the South African Department of Health since 2014, which enrolls pregnant women during antenatal care. MomConnect sends SMS-based information throughout pregnancy and facilitates requesting additional pregnancy-related information (Department, 2014; Fölster, 2017). The mobile phone landscape is changing quickly in South Africa with readily-available cheaper smartphones, and less expensive wireless networks, yet few studies have reported smartphone usage patterns and preferences among HIV-positive populations in sub-Saharan Africa (Betjeman, Soghoian, & Foran, 2013). Additionally, there is a lag in impact data from available mHealth tools aimed at supporting the continuum of MCH (Cargo, 2013; Watterson et al., 2015). Studies of acceptability and user-perception of mHealth-based

interventions in postpartum HIV positive women within sub-Saharan African settings are also limited (Coleman et al., 2017). Within this context, we explored the acceptability and feasibility of smartphone based mHealth interventions among HIV-positive postpartum smartphone users in Cape Town, South Africa.

## Methods

### Study Setting

This study was conducted at a large primary healthcare facility located outside of Cape Town, South Africa. The facility predominately serves a black African population with substantial poverty, high levels of unemployment, and with 60% of the community living in informal housing (Myer et al., 2015; Phillips et al., 2014). ART services are integrated with antenatal care during pregnancy and the study site provides antenatal, obstetric and postpartum services to over 4000 women annually; antenatal HIV prevalence is 30% (Myer et al., 2015, 2016). Disengagement from care within six-months postpartum is approximately 32% (Phillips et al., 2014).

### Study participants and design

From January–March 2017, we conducted six FGDs with 27 women. Women were recruited from existing studies using convenience sampling, and each participant only joined one FGD. Adult (> 18 years) women who were HIV-positive, recently postpartum (<1 year) and using a smartphone – defined here as a mobile phone with a touchscreen interface and internet access – were eligible. Participants provided written informed consent for FGD participation and audio recording. All activities were approved by the human research ethics boards of Vanderbilt University and the University of Cape Town.

### Data collection

Basic participant characteristics were collected at enrolment. The average number of participants at each FGD was 4.5 participants and FGD lasted 40–120 minutes; one FGD had only two participants due to scheduling challenges. Discussions were conducted in isiXhosa, the predominant local language, by a trained moderator using a pre-designed facilitation guide and were audio recorded. During the FGDs, participants were identified using different colours instead of names to protect confidentiality. Open-ended questions explored current smartphone usage and mobile app preferences, modes and perceived challenges in mobile connectivity, and opinions on MomConnect and future mHealth interventions.

### Data Analysis

The coding, analysis, and reporting of qualitative data was completed by following the COREQ guidelines, an evidence-based qualitative methodology (Tong, Sainsbury, & Craig, 2007). The focus group sessions were transcribed verbatim and translated to English. Transcripts were uploaded on NVivo 11 (QSR International, Victoria, Australia) qualitative data analysis software. We used a deductive approach to create a framework for analysis by identifying codes using research questions (Pope, Ziebland, & Mays, 2000). Data were analysed by grouping text into themes. Text under each theme was then examined for

convergent and divergent patterns, concepts and associations; themes were further deflated into main themes and sub-themes. We extracted relevant quotes from the text to illustrate findings. For quantitative data, we provide medians and interquartile ranges (IQR).

## Results

### Participant characteristics

Median participant age was 30 years (IQR: 23,34), time on ART was 16 months (IQR: 11,51), and time since delivery was seven months (IQR: 2,9). Median time with the current smartphone was 15 months (IQR: 8,24), and women reported having the same mobile number for a median of 48 months (IQR: 24,84).

### Overall smartphone usage

Participants reported internet, social media, emails, and camera as the top reasons for using a smartphone, noting they could send and receive messages quickly, save on cell phone operation costs, easily access multifunctional smartphone applications, and conveniently access the internet (Table 1.a.i). Most reported that their friends also used smartphones, and for similar reasons (Table 1.b.i–b.iii). Participants were split nearly evenly on the issue of sharing smartphones. Sharing occurred most commonly with immediate family members. Privacy concerns related to sharing a smartphone with a boyfriend were raised, but sharing with husbands was noted (Table 1.c.i–c.v).

### Familiarity with smartphone apps

Participants showed high familiarity with smartphone applications; WhatsApp was reported as the most popular application and the preferred method to communicate on smartphones, rather than making voice calls (Table 2.a.i, a.ii). After WhatsApp, Facebook was the most widely reported app, followed by YouTube and Twitter. Only two of the 27 participants reported never using smartphone apps. Voice calls were noted for use when communicating with those who use basic phones, particularly older family members who may not be acquainted with the technology of smartphones (Table 2.b.i, b.ii).

### Internet connectivity

Nearly all respondents reported purchasing data bundles as their primary method of accessing the internet on their smartphones. The use of a combination of data bundles and airtime for internet surfing was less frequently noted. Data bundles were preferred over airtime because they were cheaper and perceived to last longer (Table 2.c.i, c.ii). Some of the respondents reported also using Wi-Fi from their workplaces or from available public Wi-Fi hotspots in places such the mall and local restaurants (Table 2.c.iii–c.v).

Many participants noted cost savings associated with communicating via WhatsApp using inexpensive data, compared to airtime for phone calls and text messaging (Table 2.d.i, d.ii).

Some participants suggested that if they did not have airtime or data bundles, they would easily borrow a smartphone device from friends or family members (Table 2.e.i). In addition to internet access, respondents reported battery life as a frequent limitation to connectivity,

especially in informal settlements where electricity may not be readily available to charge their devices (Table 2.e.ii).

### **Knowledge and perceptions of MomConnect**

Most women reported some level of familiarity with the text service MomConnect offers, from both first-hand experience, and having heard about the services at a certain point in time (Table 3.a.i, a.ii). Nearly all of the participants reported having positive opinions about MomConnect (Table 3.b.i, b.ii), but still felt there was more that could be done to improve the services (Table 3.c.i–c.v). For example, some women reported inconsistency in receiving the messages after registering with MomConnect. When participants were asked how to improve MomConnect, some indicated the need to choose a preferred language to receive messages in, so as to prevent language barriers. Participants also highlighted the need to correctly register the women's gestational age at registration so that messages received correspond with their actual stage of pregnancy, hence tailoring messages to a woman's individual pregnancy experiences and needs. Others reported wishing for a two-way interaction with MomConnect. Participants reported that the MomConnect services were characterised by uni-directional flow of information that did not offer them a platform to ask more personalised questions.

### **Attitudes towards future mHealth interventions**

Most participants expressed interest in receiving health information using their smartphone, because of the convenience of having the information readily available in an electronic format. When asked about the type of health-related messages they would prefer accessing from mHealth initiatives, respondents suggested that, in addition to HIV-related information, messages should include complementary health information on physical activity, child nutrition, mental health, domestic violence and basic social services. The variability of responses offered for future mHealth initiatives suggests that participants recognised that health is a social aspect that should be addressed holistically. Women expressed a particular need for assistance accessing child-grants and social services (Table 3.d.i–d.v).

## **Discussion**

These findings show that mHealth interventions have potential to support PMTCT services in this setting. Postpartum, HIV-positive women with access to smartphones attending care in a public clinic in Gugulethu, South Africa, reported being active and engaged users of the technology and were highly amenable to mHealth interventions. Respondents confidently engaged popular smartphone applications – particularly WhatsApp – and reported few connectivity difficulties.

Data bundles were overwhelmingly cited as the main source of internet connection, given their lower cost than airtime. A previous study assessing mobile phone ownership and internet usage among pregnant women in Johannesburg in 2013, noted low internet usage overall (Clouse et al., 2015). However, among those who did access the internet there was a strong preference for accessing the internet on mobile devices. Also, the same study predicted an increase in internet use in future years as internet-enabled phones became more

affordable (Clouse et al., 2015). The perceived affordability of data bundles is consistent with reports of steady declines in data prices, as well as the emerging data usage explosion in African countries (Ericsson, 2016).

Participants were also familiar with alternative wireless internet sources (Wi-Fi), which they accessed at work and other public spaces. This is consistent with reports showing that South Africa and other LMIC are investing in improved wireless infrastructures as well as faster transmission speed (Ericsson, 2016; Rotheram-Borus et al., 2012; World Health Organization, 2011). Expanded connectivity enables people from diverse economic backgrounds to access affordable internet options and highlights the opportunity for mHealth interventions in populations within lower-income settings, like the one in our study. However, more research and program investment is still needed to assess the availability of such infrastructure outside of a peri-urban setting like ours.

Contrary to common anecdotal reports of frequent phone number turnover, we found that women had kept the same number for about two years. This consistency of phone number has positive implications for mHealth interventions and aligns with a similarly long median period (three years) reported in an earlier Johannesburg study (Clouse et al., 2015). A longer trend in number ownership could be due to the SIM-swap system that enables consumers to request retain their old number in the event of a phone loss or change in the SIM card.

Participants' responses of occasional lack of electricity for charging smartphones are consistent with those found in a qualitative study conducted in Kenyan HIV-positive peripartum women, who cited a lack of electricity as a potential barrier to an mHealth intervention (Musoke et al., 2017). Smartphone-based interventions pose an added burden on daily battery consumption and researchers should be aware of this challenge, particularly in rural areas and informal settlements, where electricity scarcity may hinder equitable access to the benefits offered.

Most participants had previously received health-related text messages through MomConnect and found the messages useful for addressing their pregnancy-related needs, emphasising potential acceptability of similar mHealth interventions. One participant said she could not understand the messages as they were delivered in English, instead of isiXhosa. However, MomConnect offers all 11 South African languages (Barron et al., 2018). Similarly, complaints were lodged about the timing of messages. Although MomConnect is designed to target messages to specific gestational time points, if the gestational age is not correctly specified at enrolment these messages will not be stage-appropriate. These experiences demonstrate the misconceptions that can arise when users are not efficiently trained to effectively use mHealth tools, and also potential shortcomings of MomConnect's system. We suggest providers consider providing support to users to ensure a better user experience, as well as to ensure the sustainability of the interventions. Many participants emphasized the importance of two-way interaction on smartphones, whether with friends on WhatsApp, or with a health facility on MomConnect.

Participants expressed willingness to engage future general health-related messages on their devices to enhance their knowledge, noting the convenience of accessing the messages

whenever needed. Messages providing information on child nutrition, mental health, domestic violence, as well as social services available in their community were most commonly requested. Participants suggested that integration of these different topics within a single application would offer an opportunity to address their concurrent health challenges, and again stressed the need for person-to-person interaction.

This study had several limitations, including a population limited to postpartum women attending a single health facility and who already used smartphones. We acknowledge the findings may not be generalizable to women who never attended the clinic or do not use smartphones and further research is needed to quantify the penetration of smartphones in this and other low-resource areas. While smartphone ownership and usage preferences may vary in other settings, smartphone use is increasing rapidly and we sought to explore user behaviour in this setting to inform future interventions. Although the sample size was small, it was appropriate for drawing rich information on experiences, perceptions and needs regarding mHealth interventions during the FGDs.

## Conclusion

This study provides novel insights into smartphone use as well as perceptions and preferences of smartphone-based interventions for HIV-positive women in low-income settings. Despite the rising availability of smartphones, inexpensive data, and public Wi-Fi which allows users in low-resource settings to access smartphone applications and on-demand information, studies of smartphone use and preferences in low-income settings are lacking. Our results show that HIV-positive, postpartum women from a low-resource, peri-urban community in South Africa with access to smartphones are active users of the technology who support the development of integrated, interactive mHealth interventions in this population. Further research is needed to assess the feasibility and potential impact of mHealth interventions in this and other low-resource settings.

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**Table 1.**

## Illustrative quotes related to overall smartphone usage

|                                      |  |
|--------------------------------------|--|
| a. Reasons for smartphone preference |  |
| i.                                   | “The reason I use a smartphone is that I can easily access anything so I do not need to go to the internet café. Because, like, you send emails from home, all you need is data then you are sorted. It gives you access to social media.” [Maroon, FGD 6]   |
| b. Smartphone usage among friends    |  |
| i.                                   | “My friend...most of the time she likes perhaps to go out and boast to me so she believes in taking photos and likes to send me pictures to show me what her weekends are like...So, it is easy for her to take photos, but if she was having a ‘tilili’ [standard phone] she wouldn’t be able to take photos.” [White, FGD 5] |
| ii.                                  | “Most of my friends are using smartphones for WhatsApp because when... airtime runs out, it is easy to communicate by WhatsApp and Facebook. The other thing with a smartphone you can go to a place even if you don’t know where it is, it directs you...GPS.” [Red, FGD 1]   |
| iii.                                 | “My friends are using it and I don’t; WhatsApp and Facebook they are using them...I use it to send SMS and phoning only.” [Red, FGD 2]   |
| c. Phone sharing                     |  |
| i.                                   | “No, I don’t share. Mine is having a password and I am the only one who knows it.” [White, FGD 2]  |
| ii.                                  | “I don’t share my phone with other people...what is on the phone is mine. Facebook is mine, WhatsApp is mine, messages are mine, numbers on the phone are mine.” [Green, FGD 4]  |
| iii.                                 | “I do share whenever someone asks to use my phone. Maybe their phone has problems and they wanted to use WhatsApp.” [Black, FGD 4]   |
| iv.                                  | “I share with my family my phone; the person I don’t share my phone with is my boyfriend.” [Purple, FGD 1]   |
| v.                                   | “I share my phone with my husband, especially Facebook and WhatsApp.” [Blue, FGD 1]  |

**Table 2.**

## Illustrative quotes relating to familiarity with smartphone apps and internet connectivity

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| <p>a. Preferred smartphone application and method to communicate</p> <p>i. "I only like WhatsApp...there is no other thing besides WhatsApp." [Yellow, FGD 2]</p> <p>ii. "Say we are going to do an event...maybe have a group...we organize through our WhatsApp." [Blue, FGD 3]</p> <p>b. Use of voice calls</p> <p>i. "I connect by WhatsApp, because WhatsApp is cheaper than phoning, but when I phone my father, my father doesn't have WhatsApp. I phone him, and other people who don't have smartphones, I SMS." [Red, FGD 1]</p> <p>ii. "I like to use phone calls because mostly I like to call elderly people who don't understand WhatsApp." [Gold, FGD 1]</p> <p>c. Preferred method to connect to the internet</p> <p>i. "Airtime does not last at all, so it is better to use data bundles." [Maroon, FGD 6]</p> <p>ii. "I cannot survive without data bundles." [Black, FGD 6]</p> <p>iii. "I buy bundles but when I am at work I use Wi-Fi." [Black, FGD 4]</p> <p>iv. "If I go to the mall I will locate the Wi-Fi hot spots, such as KFC, and sit for two hours." [Black, FGD 6]</p> <p>v. "I use data or airtime and then when I am in the area with free Wi-Fi, I close my data and use Wi-Fi." [Yellow, FGD 5]</p> <p>vi. "I use data bundles because Wi-Fi is difficult to find unless you got it in your house or workplace." [Maroon, FGD 6]</p> <p>d. Perceived benefits of using data bundles</p> <p>i. "When you have data and don't have airtime, you can make a call on WhatsApp." [Black, FGD 1]</p> <p>ii. "For WhatsApp, I buy R8.50 worth of data for a month...If I was using airtime, I would have to buy more airtime than that." [White, FGD 2]</p> <p>e. Limitations to connectivity</p> <p>"In my case, if I don't have data and don't have airtime, I borrow a phone from someone who has data at home and do what I want to do." [Orange, FGD 1]</p> <p>i. "We are staying at [informal settlement] with no electricity. To have electricity, you charge in other areas with electricity sometimes." [Red, FGD 5]</p> |
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**Table 3.**

## Illustrative quotes relating to knowledge and experience with MomConnect

|  |   |
|--|---|
| a. Familiarity with MomConnect                   |   |
| i.   | "I had heard about MomConnect and then...while I was also pregnant last year I got a number there, sometimes the number is outside your booklet and enter those digits, even now I am still getting SMS's from them on what must you do when your child is crawling, when he is having diarrhoea, what must you give him, things like that." [Black, FGD 1] |
| ii.  | "I heard about it here, at the clinic...they tell you that when the baby is in this stage what you must do and when the baby is in this situation what must you do...It is where they explain to you about your pregnancy and after you gave birth." [White, FGD 3]   |
| b. Experiences with MomConnect                   |   |
| i.   | "MomConnect helps a lot; it's encouraging in a lot of things...Sometimes it tells you that when you feel certain pains, go to the clinic...It gives you information." [Red, FGD 5]  |
| ii.  | "[The] messages were very helpful to me in things related to high blood pressure – on how dangerous is it – so I had the information." [Green, FGD 3]   |
| iii.   | "In my case...I think I got it while I was two weeks pregnant and then I was told three times what I must do about my pregnancy...I don't [know] what happened after that...I have never received any SMSs again." [Pink, FGD 1]  |
| c. Women's suggested improvements for MomConnect |   |
| i.   | "Their messages are late. If only when you are registering there could be something saying 'how many months are you pregnant' so that they could know that you had a child this month, so that your messages won't be late or early." [Red, FGD 1]  |
| ii.  | "They must send SMS's written in Xhosa, not English only because other people don't understand English, they cannot even read it." [Black, FGD 1]   |
| iii.   | "My baby is a premature, so their messages are counting with my months that I was supposed to give birth, whereas he has been here long ago." [White, FGD 3]  |
| iv.  | "I think they give us good information; the only thing is that we also would like to ask questions because in most cases they are the ones who are talking, so you are left with question mark and on the day you go to the clinic, you have forgotten it because maybe the time has long passed." [Pink, FGD 3]  |
| v.   | "In WhatsApp there is 'WhatsApp call.' Maybe when you want to talk with someone or you need counselling...maybe have a calling side where you can make calls or landline which you can call when you need help." [Black, FGD 1]   |

**Table 4.**

## Illustrative quotes relating to preferences for future mHealth initiatives

|  |   |
|--|---|
| a. Overall acceptance of mHealth interventions       |   |
| i.   | “It would be nice because we lose the pamphlets...and you lose out on the important information about your baby’s diet, for example.” [Maroon, FGD 6]   |
| ii.  | “It would be nice because some of us do not have enough knowledge. So, I would like it.” [White, FGD 6]   |
| b. Preferred messages for future mHealth initiatives |   |
| i.   | “Children’s nutrition, because other people seem like they get confused on how to feed the children. A person would feed the child yoghurt for the day and would think that the child is full. Yoghurt it is a snack, not food for the child.” [Yellow, FGD 2]  |
| ii.  | “If they could maybe, let’s say, have programmes like sports...We are [HIV] positive people so most of the time we are staying in the houses...[but if an app] said ‘in a certain hall we are having a certain programme at a certain time,’ we would be doing exercises for HIV-positive people just for fun so that they don’t keep on thinking such things and their blood doesn’t stand in one place.” [Red, FGD 5] |
| iii.   | “I would say the counselling thing is important because [a] person doesn’t get enough. When she hears that she is HIV positive, she goes to the clinic and [is] counselled, but doesn’t get enough and [she] doesn’t know what she can do. So at least even if there can be an app sometimes she can talk with maybe [someone] who can she tell.” [Pink, FGD 1]   |
| iv.  | “I am thinking that ‘child sexual abuse’ could be added.” [Blue, FGD3]  |
| v.   | “Explain how do you get a birth certificate and where.” [Yellow, FGD 2]   |