You will know that despite being HIV positive you are not alone: Content preferences for an SMS intervention to improve prevention of mother-to-child HIV transmission (PMTCT)


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Manuscript type: Original paper

Running Head: SMS content preferences

Abstract word count: 329 (limit 450)

Main article word count: 4802 (guideline 3000-5000)
Abstract

Background: Prevention of mother-to-child HIV transmission (PMTCT) relies on long-term adherence to antiretroviral therapy (ART). Mobile health (mHealth) approaches, such as short message service (SMS), may improve adherence in some clinical contexts, but it is unclear what SMS content is desired to improve PMTCT ART adherence.

Objectives: We explored SMS content preferences related to engagement in PMTCT care among women, male partners and healthcare workers (HCWs). Message content was used to inform an ongoing randomized trial of SMS (CT# NCT02400671) to enhance PMTCT ART adherence.

Methods: We conducted 10 focus group discussions (FGDs) with HIV-infected pregnant or postpartum women (n=87), and semi-structured individual interviews with 15 male partners of HIV-infected women and 30 HCWs from HIV and maternal child health (MCH) clinics in Kenya. Interviews were recorded, translated, and transcribed. Transcripts were analyzed using deductive and inductive approaches to characterize women’s, partners’ and HCWs’ perceptions of SMS content.

Results: All women and male partners, and most HCWs, viewed SMS as a useful strategy to improve engagement in PMTCT care. Women desired messages spanning 3 distinct content domains: 1) educational messages on PMTCT and MCH, 2) reminder messages regarding clinic visits and adherence, and 3) encouraging messages that provide emotional support. While all groups valued reminder and educational messages, women highlighted emotional support more than the other groups (partners or HCWs). Women felt that that encouraging messages would assist with acceptance of their HIV status, support disclosure, improve patient-provider relationships, and provide support for HIV-related challenges. All three groups not only valued
messages to support PMTCT/HIV care, but also valued messages that addressed general MCH topics, stressing that both HIV- and MCH-related messages should be part of an SMS system for PMTCT.

**Conclusions:** Women, male partners, and HCWs endorsed SMS as a strategy to improve PMTCT and MCH health outcomes. Our results highlight specific ways SMS can encourage and support HIV-infected women in PMTCT to remain in care, adhere to treatment, and care for themselves and their children.

**Registration:** Clinicaltrials.gov NCT02400671.

**Keywords:** HIV, ART, PMTCT, mobile health, SMS, adherence, retention
Introduction

Globally, over 90% of pediatric HIV infections are attributed to mother-to-child HIV transmission (MTCT), with 160,000 children newly infected with HIV in 2016 [1]. Lifelong antiretroviral therapy (ART) (known as Option B+) is recommended for prevention of MTCT (PMTCT) but depends on consistent retention in care and adherence to ART during pregnancy, postpartum, and beyond. Waning ART adherence and poor retention in care, particularly postpartum after the risk of MTCT diminishes, hinder the effectiveness of Option B+ [2–4]. Barriers to ART adherence in Option B+ stem from an interplay of sociocultural and structural factors [5–7]. Identifying and addressing these barriers is important to improve PMTCT.

There is evidence from randomized clinical trials (RCTs) and meta-analyses that short message service (SMS) messages sent to individuals on ART may improve retention, adherence and viral suppression in non-pregnant adults [8–10]. These findings, combined with the growing ubiquity and low cost of mobile phone technology in regions most affected by HIV, have led the World Health Organization to include SMS reminders as a recommendation for promoting adherence to ART as part of a package of adherence interventions [11].

There is limited understanding of message content desired by SMS recipients, or the mechanism by which messages may impact ART adherence, especially in the context of pregnancy and the postpartum period. While the design of SMS interventions for ART adherence for PMTCT may draw on lessons learned from studies in other HIV-infected populations, the unique context of pregnancy and postpartum may influence ART adherence, and SMS may need to be adapted accordingly. Few previous studies have explored desired SMS content to support women’s uptake of PMTCT services [12–15]. These studies reported desire for polite, encouraging SMS that provide information and reminders to take ART, attend
postnatal visits, and engage partners. While healthcare workers (HCWs) and male partners are have been shown to play important roles in influencing peripartum women's health behaviors and healthcare utilization [16–19], only two studies included these stakeholder groups in evaluating acceptability and desired content of SMS messages [12,15].

In this study, we examined preferred SMS content and perceived SMS function to support Option B+ PMTCT. We incorporated perspectives of HIV-infected pregnant and postpartum women, male partners and HCWs.

**Methods**

**Study Design and Population**

We conducted a qualitative study to inform SMS content for the Mobile WACh-X study (NCT02400671), a triple-arm, placebo-controlled, non-blinded RCT designed to assess the impact of unidirectional and bidirectional SMS messaging on maternal adherence, retention and clinical outcomes in PMTCT-ART programs in Kenya [20]. Purposive sampling was used to recruit women, male partners and HCWs from three sites; two in rural Western Kenya and one in peri-urban Nairobi. Focus group discussions (FGDs) were conducted with HIV-infected pregnant women seeking antenatal care (ANC) services, or HIV-infected postpartum women who had an uninfected child ≤2 years old. Women were purposively recruited during routine visits to ANC clinics, comprehensive HIV care clinics, and MCH clinics. To provide a range of experiences and perspectives, pregnant and postpartum women were selected based on the following experiences with ART: using ART in the peripartum period only, using ART within and outside of the peripartum period, and no ART experience. Women were eligible to participate if
they were ≥14 years of age, were HIV-infected and pregnant or postpartum, had daily access to a mobile phone, and were willing to receive SMS.

Semi-structured individual interviews were conducted with male partners and HCWs. HIV-infected and -uninfected male partners were recruited for participation. HIV-infected men in concordant relationships were recruited during their routine HIV clinic visits. HIV-uninfected men were referred to the study by HIV-infected female partners attending MCH clinics; female partners were given a referral form inviting male partners to the clinic to learn more about the study. Eligible men were age ≥18 and had an HIV-infected female partner who was pregnant or had a child ≤2 years of age and was accessing ANC or MCH services. Providers age ≥18 were purposively recruited from ANC and MCH clinics where they worked and were eligible to participate if they were directly involved in caring for HIV-infected pregnant women or HIV-exposed infants. Overall, 87 women participated in 10 FGDs (6-10 per FGD); 15 men and 30 HCWs participated in semi-structured individual interviews.

**Data Collection**

Two rounds of data collection were conducted between January and June 2015. In the first round, 6 FGDs were conducted with HIV-infected women, 15 individual interviews were conducted with male partners, and 30 individual interviews were conducted with HCWs. The objectives of the first round of data collection were to explore general opinions about health-related SMS, determine comprehension and acceptability of pre-developed SMS, and elicit ideas for additional messaging themes in order to refine message content. A second round of 4 FGDs elicited women’s feedback on refined message content.
FGDs and interviews were conducted using a semi-structured discussion guide including open-ended questions exploring three main topic areas: 1) challenges and resources for attending clinic and adhering to ART, 2) perspectives on using SMS to support adherence, and 3) perceptions of specific message content to guide message refinement. Participants were asked to provide feedback on messages in four content areas: general support, breastfeeding, family planning, and ART adherence. Messages shared a common format: they opened with a greeting to the recipient from a nurse (“[Name], this is [nurse name] at [clinic name]”), followed by a message addressing one of the content areas (Supplementary material 1) [20]. Interviews and FGDs were conducted by a trained Kenyan social scientist who was not involved in providing clinical care for participants. Pilot messages were read aloud by the discussion facilitator and participants were probed for additional message content they would like to receive not included in initial pilot messages. Socio-demographic information for all participants was collected via a tablet-based questionnaire using Open Data Kit (opendatakit.org). Interviews and FGDs were conducted in English, Kiswahili and Dholuo, depending on participant preference. FGDs ranged from 90 to 130 minutes in length; interviews ranged from 19 to 49 minutes in length. All interviews and FGDs were audio recorded, transcribed, and translated into English if necessary by the interviewer, who was fluent in all three languages.

**Ethical Considerations**

This study was reviewed and approved by the University of Washington Institutional Review Board and Kenyatta National Hospital / University of Nairobi Ethics and Research Committee. All study participants provided written informed consent.
Data Analysis

We performed a descriptive content analysis to identify key concepts emerging between and across groups of women, male partners and HCWs. Dedoose software (version 7.6.6) was used for data management and analysis. An initial codebook was deductively and inductively generated by JF, KBS and KR after reviewing literature and reading a subset of FGD and interview transcripts. The codebook was refined iteratively by reviewing additional transcripts and revising initial codes. A final codebook was used to perform consensus coding and facilitate discussion until agreement on code application was reached. All transcripts were coded independently by one team member (JF, KBS or KR) and reviewed by another team member. All disagreements in code application were resolved through group discussion with all three coders. The analytic framework focused on challenges living with HIV, current resources/strategies used to engage in HIV care, preferences and perceived utility of specific SMS content, and benefits/challenges to using SMS to engage in care. Themes relating to the analytic framework categories were identified and combined into a conceptual diagram.

Results

Demographic characteristics of women, male partners and HCWs are summarized in Table 1. Female participants (n=87) were young (median age 26), most (73.6%) had completed at least primary education and about one-third (34.5%) were pregnant. The majority (69.0%) had experience with ART during and outside of the peripartum period and a little over half (55.2%) were Dholuo-speakers. Male participants (n=15) were older than female participants (median age 37) and had similar levels of education (80.0% completed at least primary education). Most (80.0%) were HIV-infected and ART-experienced. HCWs had a median age of 36, and a median of 6 years in their current profession. Providers included clinical officers (n=7), nurses (n=13), counselors (n=6) and one peer counselor.
Table 1. Focus group and interview participant characteristics

<table>
<thead>
<tr>
<th></th>
<th>n (%) or median (IQR)</th>
</tr>
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<tbody>
<tr>
<td><strong>Female FGD participants (N=87)</strong></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>26 (23-32)</td>
</tr>
<tr>
<td>Pregnant (vs. postpartum)</td>
<td>30 (34.5)</td>
</tr>
<tr>
<td>ART experience</td>
<td></td>
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<tr>
<td>Peripartum only</td>
<td>19 (21.8)</td>
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<tr>
<td>Peripartum &amp; non-peripartum</td>
<td>60 (69.0)</td>
</tr>
<tr>
<td>None</td>
<td>8 (9.2)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Less than primary</td>
<td>23 (26.4)</td>
</tr>
<tr>
<td>Primary completed</td>
<td>43 (49.4)</td>
</tr>
<tr>
<td>Secondary completed</td>
<td>18 (20.7)</td>
</tr>
<tr>
<td>Above secondary</td>
<td>3 (3.4)</td>
</tr>
<tr>
<td>Language</td>
<td></td>
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<tr>
<td>Dholuo</td>
<td>48 (55.2)</td>
</tr>
<tr>
<td>Kiswahili</td>
<td>39 (44.8)</td>
</tr>
<tr>
<td><strong>Male interview participants (N=15)</strong></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>37 (32-44)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Less than primary</td>
<td>3 (20.0)</td>
</tr>
<tr>
<td>Primary completed</td>
<td>8 (53.3)</td>
</tr>
<tr>
<td>Secondary completed</td>
<td>2 (13.3)</td>
</tr>
<tr>
<td>Above secondary</td>
<td>2 (13.3)</td>
</tr>
<tr>
<td>HIV-infected</td>
<td>12 (80.0)</td>
</tr>
<tr>
<td>ART experienced</td>
<td>12 (80.0)</td>
</tr>
<tr>
<td><strong>Provider interview participants (N=30)</strong></td>
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<tr>
<td>Age</td>
<td>35.5 (31.0-44.0)</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>MCH nurse</td>
<td>6 (20.0)</td>
</tr>
<tr>
<td>Other nurse</td>
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</tr>
<tr>
<td>Family planning nurse</td>
<td>2 (6.7)</td>
</tr>
<tr>
<td>Counselor</td>
<td>6 (20.0)</td>
</tr>
<tr>
<td>Peer counselor</td>
<td>1 (3.3)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (10.0)</td>
</tr>
</tbody>
</table>

FGD, focus group discussion
ART, antiretroviral therapy
PMTCT, prevention of mother-to-child transmission
MCH, maternal child health
**SMS is acceptable but there are design requirements and challenges**

Overall, participants in all stakeholder groups (women, male partners and HCWs) were supportive of using SMS to overcome HIV-related challenges. Women universally found SMS acceptable and discussed many potential benefits of SMS, including enabling remote connection to HCWs, and providing anonymity that facilitates open communication about sensitive or potentially embarrassing topics.

“It is eas[i]er to share information about shameful diseases by SMS than telling the doctor face to face. For instance when I have a wound in my private parts... I can send him a message and he gives me a response immediately to use a particular medicine.” (Postpartum woman)

“[The SMS messages] keep records of treatment and conversations for future reference for the patients, and also helps you to identify your patients individually and that creates a bond between you and your patients; they feel that you have them at heart, and then they feel that you are concerned about their health.” (Clinical Officer, 4 years in profession)

A few providers expressed concerns about the ability to reach patients using SMS, specifically noting the inability to confirm message receipt and challenges related to requirements for patients to have a phone, be literate, and have access to electricity.

“I don’t know whether the SMS can work, but maybe a phone call [is better] so that you are very sure that the message has reached the client... comparing the two, I prefer the phone call. However automated messages has worked in several occasions, in other fields, but what I am saying that it depends on the people or rather the region you are dealing with. If they have phone and [are] staying in a powered house, it is well and good, but in villages that may be a setback.” (Nurse, 8 years in profession)
While many participants were supportive of delivering health education on HIV care, several women and HCWs expressed concern about SMS privacy and risks of HIV status disclosure if messages were read by people other than the intended recipient. All three stakeholder groups commented that the risk of inadvertent disclosure by other individuals reading SMS should be minimized and the phrasing of HIV-related health education should be tailored based on disclosure status and recipient desires. These concerns are discussed in detail in a separate publication [21].

Figure 1 summarizes topic areas included in the interview guides and related themes that emerged during FGDs and interviews. The figure shows the challenges participants identified for women receiving PMTCT care, potential roles for SMS messages to address these challenges, and possible pathways through which SMS may impact clinical outcomes. Discussions on desired SMS content highlighted three types of messages, with different perceived functions: 1) reminders for medication and clinic attendance, 2) health education messages, and 3) encouragement to remain in care, seek support and live positively.

Figure 1. Summary of themes discussed in focus group discussions and interviews
SMS may serve as adherence reminders during the stressful peripartum period and avoid stigmatizing HCW interactions due to missed visits

Women identified forgetting to take medication or attend clinic as a significant challenge in ART adherence and believed SMS reminders could help overcome this obstacle. They attributed forgetfulness to various stressors, including some stressors unique to, or heightened during, pregnancy or postpartum, such as caring for newborns.

“There are…those who take…medicine, but considering how busy they are, she is the breadwinner, so sometimes she is occupied until time passes. She forgets, so when you send her a message she will remember “tomorrow I am to go to the hospital”. Like here… some of us go to work on the rice farms, others to the farm, others casual labour, maybe that is what she depends on because she is the mother and the father. So when she receives a message, it will alert her.” (Postpartum woman)

Women also described negative interactions with HCWs, including feeling stigmatized and treated harshly if they missed appointments or delayed seeking HIV care. Women and providers suggested SMS reminders to attend scheduled appointments could help prevent conflict with providers.

“I think that SMS is better than the card that we are given, because sometimes you leave out the card somewhere and you forget and by the time you remember it has passed by one day, and if you are reminded you will be quarreled [with] at the hospital, yet it is just forgetfulness that makes you to default” (Postpartum woman)

Providers concurred with the sentiments expressed by women, noting that SMS could reduce missed visits due to forgetfulness and ensure timely follow-up for women.
“I think for SMS… it’s good for them because some they tend to forget, others… they say I didn’t know when to attend the clinic, [it’s] when I have seen my bottle is empty, or I have seen my child… is ten months already (you know at nine months that is the time when you have to bring the child for [HIV] antibody [testing])… So when the SMS is there, the services will be at the right time and evaluation will be done early.” (Nurse, 4 years in profession)

Women and their partners noted that male partners had an important role in reminding women to take medication and attend clinic if women disclosed their status to them. Male partners thought SMS messages could complement the role they played in reminding their partners, especially when they could not be physically present.

“Just like sometimes someone may forget, so you send a message to alert her that on a particular day she should be going to the clinic. So that would help her, it would also help me because I may not be at home to remind her that she should go for medicine or to the clinic” (HIV-infected male partner)

**SMS may provide health education about PMTCT-ART, information on clinical status, answers to questions, and may catalyze discussions with others**

Women expressed desire for educational messages to fill gaps in their knowledge and understanding about HIV care, including information about common ART side effects, modes of MTCT, and effective PMTCT strategies. Women believed educational SMS messages could inform them about PMTCT and the ability to have healthy HIV-uninfected babies even if they are HIV-infected, and that improved knowledge would increase motivation to engage in care throughout pregnancy and breastfeeding.
“What I would like to know, I thought that if you are sick then you cannot give birth to a healthy baby but I hear that if you are on HIV care and treatment then you can give birth to a healthy baby who is HIV negative” (Postpartum woman)

Women frequently stated they wanted to receive SMS advice on how to discuss HIV and ART with partners. Some women believed SMS containing credible information could be shared with their partners and serve as a catalyst to engage in conversation.

“I can say that [SMS] can help. My husband has refused to accept [being tested] but he helps me financially when I have hospital appointments. So I think that the SMS can help: if I give him to read he can be encouraged and he may decide to come out and know his status”. (Postpartum woman)

Additionally, several participants viewed SMS as a platform to receive updates on their viral load, CD4 count and treatment status. Delivery of test results through SMS was seen as a way to remove physical barriers to the clinic and prevent delay of information women could use to make personal health choices in real time.

“Sometimes I go to do CD4 test and I will get the result later…so I can ask by SMS before my clinic date and get the results, so when the time for clinic reaches if the doctors asks me if I know my CD4 results I will say that it [is] like this and this.” (Postpartum woman)

Both male partners and HCWs found it acceptable and beneficial to deliver educational content to women via SMS, and highlighted the importance of delivering this information quickly and efficiently, since traveling to clinic for basic health information was often burdensome. Some participants suggested that using SMS to address minor health questions could enable triaging and avert unnecessary clinic visits.
“[SMS] is good, it is one-on-one. If you have any problems [the provider] can help you, you can ask questions and you just handle it then when you are at home without going to the hospital. It might be small issues like rashes you handle and need not go to the hospital” \((\text{HIV-uninfected male partner})\)

Similarly, HCWs commented that delivering educational information via SMS would be beneficial not only to women, but also to themselves, as it would ease their workload.

“To me, I think…use of SMS, it will be good. It will be good [be]cause sometimes…mothers come to flock here, [be]cause of even minor illnesses that you could have just given advice… So in order to decongest MCH, such minor cases maybe if we can use SMS, it will be of a great [help] to us...” \((\text{Nurse, 20 years in profession})\)

**SMS may provide general encouragement to improve self-acceptance and combat stigma, which in turn could motivate ART adherence**

Many women thought SMS messages could provide encouragement and motivation to help engage in HIV care, adhere to ART and accept their status. Although women reported that encouraging SMS would help them engage in HIV care, they did not feel this required language directly addressing HV-related topics. Rather, many women spoke of SMS providing encouragement to live a healthy and positive life while pregnant or postpartum, to stay strong and have a positive outlook on life for themselves and their children, and to not lose hope. Women frequently mentioned that they would feel happy and encouraged if they received an SMS from their provider, even if it was simply to ask about potential challenges they may be facing (related or unrelated to their HIV care). Many women spoke of the potential of SMS messages to provide a sense of connection and acceptance from the sender during times of
hopelessness or isolation, noting that this connection would lift their morale and improve their ability to engage in HIV care.

“If you receive the message… you will not feel lonely, you will know that there is someone who is concerned about you and that despite being HIV positive you are not alone.” (Postpartum woman)

Indeed, some participants suggested their sense of feeling cared for grew out of the knowledge that the sender had invested time to send SMS, rather than use of encouraging language per se in the SMS.

“[SMS] will help to encourage me that someone was concerned about me by taking their time to send the messages. It costs you and I get help. So I think that it helps to encourage knowing that someone somewhere is concerned and has accepted me.” (Pregnant woman)

Similarly, some male partners suggested that SMS messages could encourage and support women struggling with status acceptance and help them identify other sources of support.

“The messages…should be sent to let [people] know that they are not alone. So many people are undergoing what they are going through so they are not left alone, and there are people who are always there to assist them… [S]o they should accept the situation and try as much as they can to maybe look for people who…can be there for them.” (HIV-infected male partner)

HCWs placed a stronger emphasis on using SMS to provide reminders and health education than on their use for emotional support. However, some providers noted that SMS had potential to serve as an encouragement system, working beyond “tracing defaulters”.
“I think [SMS] will be really good for the newly diagnosed mothers to give them that psychosocial support that they lack. Because we usually see them after two weeks – you know [in] two weeks there is so much that can happen – so that by the time she is coming back after two weeks, she is really happy.” (Nurse, 25 years in profession)

**General MCH SMS content was felt to be useful in addition to PMTCT SMS messages**

Although discussions with all participants were framed as addressing experiences of HIV-infected women with PMTCT, women, men and HCW repeatedly expressed desire for SMS to support general MCH care in addition to those to support HIV care. Topics requested included breastfeeding instructions, challenges to exclusive breastfeeding and maternal nutrition. Functionally, the MCH-related messages participants suggested were mostly educational rather than reminders or supportive messages.

“[Please include messages] about nutrition during pregnancy: what a woman can eat so that at the time of birth she has enough strength to deliver and enough milk to breastfeed the baby.” (Pregnant woman)

“How can we help a baby who is not feeding? Because you cannot tell it to breastfeed, yet when you give it breastmilk it does not suckle, yet this first milk is what it must take, so the doctor should help us with that because we don’t know.” (HIV-infected male partner)

**Discussion**

**Principal Results**

In this study, HIV-infected women, male partners, and HCWs in Kenya endorsed SMS as a way to optimize retention and adherence to PMTCT-ART. Participants proposed three SMS content
areas that could serve complementary function: reminders, education, and encouragement. Women, partners and HCWs endorsed SMS as a useful mechanism for reminding women to take medication and return for clinic visits. SMS reminders were seen as particularly useful in the peripartum period, when the stresses of delivery and newborn care increased forgetfulness. Additionally, women and HCWs indicated difficult interactions following missed visits could be avoided with reminder SMS. Health education was also valued, including reinforcement of the importance of ART to prevent infant HIV and the likelihood of success in having a healthy baby. Women desired timely access to their own clinical data, and to interactive messaging to ask questions without the need for an in-person clinic visit or embarrassing face-to-face conversation. Additionally, SMS was viewed as a promising intervention to engage and inform partners, if disclosed, to leverage their influence on maternal ART adherence [18,19,22]. SMS was also viewed as an important enabler of emotional support and encouragement. Women spoke of SMS messages as providing connection with HCWs and validating that they were worthy of care, which improved their mental health, helped them overcome internalized stigma, and increased their motivation to adhere to treatment. Importantly, in addition to HIV-related topics, women, partners and HCWs were interested in SMS that supported women’s general MCH care, for example breastfeeding, maternal nutrition and facility delivery.

**Comparison with prior work**

Previous qualitative studies have explored acceptability and content preferences of SMS interventions to improve ART adherence in the general HIV-infected population, reporting desired content prior to SMS interventions [23,24], or post-intervention perspectives [25]. Four studies focused on SMS content preferences to support PMTCT. Two [12,13] were conducted in Kenya prior to roll-out of Option B+ PMTCT, when PMTCT involved short-term antiretroviral regimens during the period of highest risk of MTCT. One study interviewed postpartum women, male partners and healthcare workers, and reported that all were supportive of SMS as
appointment reminders and to provide education regarding antenatal care, facility delivery and partner engagement [12]. The other only involved peripartum women and reported that they desired encouraging, educational messages about postpartum visit attendance and infant HIV testing [13]. Our findings were similar in that participants desired SMS regarding general MCH topics as well as HIV-related information. Additionally, we found that women desired SMS for emotional support in the face of isolation and internalized stigma. Two studies were conducted after Option B+ roll-out: one interviewed pregnant women in South Africa [14] and the other interviewed women, partners and HCWs in Kenya [15]. These studies reported a desire for SMS as reminders, information and encouragement, but did not identify a need for messaging about general MCH topics beyond HIV care. Our findings are consistent with these studies and provide additional insights regarding the need for encouragement and MCH messaging.

One potential implication of the differences between our findings and those of previous studies may be that the need and perceived utility of SMS for emotional support is greater in the context of long-term ART adherence compared with short-course PMTCT. Indeed, the ability of SMS to serve a supportive, caring function regardless of message content has been suggested by previous studies of SMS for long-term adherence support in the general HIV-infected population. For example, a qualitative evaluation of the experiences of recipients of real-time adherence monitoring and SMS reminders found that recipients interpreted simple reminder messages as a sign of caring from the health system [25]. Similarly, results from the WelTel trial, one of the first to report that an SMS intervention improved ART adherence, suggested participants viewed a sense of support and caring as an important function of SMS [26–28]. These findings are consistent with the associations between depression and low social support and poor ART adherence reported in some studies [29–31].
PMTCT is HIV care in the context of pregnancy, childbirth, and postpartum. Unlike other HIV care, which is focused entirely on HIV, women are undergoing a life event of perceived higher impact than their HIV infection. Thus, addressing HIV without acknowledging concerns about pregnancy, delivery, and the infant in SMS does not address women’s needs for holistic care. Women in our study desired SMS on MCH topics such as breastfeeding, infant health, and maternal nutrition. It is perhaps unsurprising that women’s experiences and needs as peripartum women were not fully defined by their HIV status, but this observation highlights the demand and untapped potential for SMS-based interventions to provide comprehensive care to peripartum women. An important question for future investigation is whether in addressing both MCH and ART adherence, SMS messages lose focus and effectiveness in improving ART adherence.

**Strengths and limitations**

Our study has several strengths and limitations. The qualitative design allowed for depth of understanding on SMS perceptions and content preferences among HIV-infected pregnant and postpartum women. We purposively sampled both pregnant and postpartum women with a range of ART experiences to capture a breadth of perspectives. Additionally, inclusion of HCW and male partner perspectives provided complementary insights on how SMS may improve delivery of Option B+ and fit into the broader context of influences on women receiving care. Limitations include the possibility that participants felt uncomfortable discussing personal experiences if they perceived these as criticisms of the healthcare facility. This was mitigated by having interviewers who were unrelated to the facility and conducting interviews in a private room. Our study population was drawn from women engaged in care, and may not be generalizable to women out of care. Similarly, recruitment of men by referral from their female partners likely excluded men who were unaware or unsupportive of their partners’ care; these men may have different views about their partners receiving SMS. Finally, desired SMS
messages are not necessarily effective SMS messages and it will be important to further
examine not only whether SMS improves outcomes but which SMS messages are specifically
helpful. However, input from women, partners, and HCWs is essential to design messages that
address a felt need and have relevance.

**Conclusions**

In summary, our findings support the use of SMS messaging to enhance PMTCT and general
MCH care. They suggest SMS may meet women's desires for medication and appointment
reminders, health education and emotional support; SMS may complement partners' supportive
roles and enable efficiencies in HCWs' care provision. Moreover, our findings shed light on the
unique needs of HIV-infected peripartum women, and indicate these women desire support for
not only HIV and PMTCT care, but also their general health and their children's health. In
addressing these desires, SMS approaches can provide comprehensive PMTCT/MCH support,
but may face challenges in balancing and focusing effective message strategies to improve ART
adherence.
**Acknowledgements**

We thank the study participants for voicing their stories and making this study possible. We thank Kirsten Senturia for manuscript review and guidance. This work was supported by grants NIH/NICHD R01 HD080460, NIH P30- AI027757 UW/CFAR and NIH/NIAID K01 AI116298 (ALD).

**Conflicts of interest**

The authors have no conflicts of interest to declare.
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