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Acceptability of Interventions to Improve Engagement in HIV Care Among Pregnant and Postpartum Women at Two Urban Clinics in South Africa

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Abstract

Introduction Pregnant women initiating antiretroviral therapy (ART) in sub-Saharan Africa have been shown to have sub-optimal engagement in care, particularly after delivery, and interventions to improve engagement in care for this unique population are urgently needed.

Methods We enrolled 25 pregnant women living with HIV at each of two large antenatal clinics in Johannesburg and Cape Town, South Africa (n = 50), and conducted in-depth interviews. We assessed participants' reported acceptability of the following proposed interventions to improve engagement in care and retention monitoring data systems: financial incentives, educational toys, health education, combined maternal/infant visits, cell phone text reminders, mobility tracking, fingerprint/biometric devices, and smartcards.

Results Acceptability overall for interventions was high, with mixed responses for some interventions. Overall themes identified included (i) the intersection of individual and facility responsibility for a patient's health, (ii) a call for more health education, (iii) issues of disclosure and concerns about privacy, and (iv) openness to interventions that could improve health systems.

Discussion These findings provide insight into the preferences and concerns of potential users of interventions to improve engagement in HIV care for pregnant women, and support the development of tools that specifically target this high-risk group.

Keywords HIV · Antiretroviral therapy · Sub-Saharan Africa · Pregnancy · Intervention · Acceptability

Significance

There are few qualitative studies exploring pregnant and postpartum women's preferences for interventions to improve engagement in HIV care. This exploration of the acceptability of eight possible interventions among pregnant women living with HIV in South Africa revealed four key themes: (i) the intersection of individual and facility responsibility for a patient's health, (ii) a call for more health education, (iii) issues of disclosure and concerns about privacy, and (iv) openness to interventions that could improve health systems. These findings will inform the development and implementation of interventions to improve engagement in HIV care for this high-risk group.

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Introduction

Prevention of mother-to-child transmission (PMTCT) of HIV programs have made tremendous progress towards eliminating vertical transmission of HIV (Joint United Nations Programme on HIV/AIDS (UNAIDS) 2016a, b). A major contribution to this achievement was the wide-scale implementation of universal antiretroviral therapy (ART) for all pregnant and breastfeeding women as soon as possible, regardless of CD4 cell count or disease stage (World Health Organization 2015), followed recently by universal ART for all people living with HIV. First implemented in 2011 in Malawi (Haas et al. 2016), by 2015, 91% of the 1.1 million women receiving ART for PMTCT were on lifelong treatment (Joint United Nations Programme on HIV/AIDS (UNAIDS) 2016b).

While universal ART for pregnant women has demonstrated a resounding effect on reducing vertical transmission, engagement in HIV care—comprised of both retention in care and viral suppression—may suffer when women initiate lifelong ART during pregnancy (Myer and Phillips 2017). Studies in sub-Saharan Africa have shown that women who initiate ART during pregnancy have sub-optimal engagement in care compared to other adults, with drop-out more likely during the postpartum period (Clouse et al. 2013; Haas et al. 2016; Knettel et al. 2018; Phillips et al. 2014). A 2018 study of 617 women initiating ART during pregnancy in Cape Town, South Africa found that 71% and 65% were retained at 12 and 24 months after ART initiation, respectively (Phillips et al. 2018). Lifelong engagement in HIV care is necessary to ensure optimal PMTCT in the short term, and to reduce viral transmission to serodiscordant partners, opportunistic infections, and mortality, in the long term (World Health Organization 2015).

Barriers to engagement in HIV care are well-documented for general adult populations (Mills et al. 2006; Posse et al. 2008; Shubber et al. 2016), but pregnant and postpartum women in sub-Saharan Africa have been found to face their own unique barriers, in addition to those faced by others (Clouse et al. 2014; Gourlay et al. 2013; Hodgson et al. 2014). Given the importance of maintaining continuity of HIV care throughout the PTMCT cascade, and transitioning the mother back or into routine, lifelong ART care, interventions that specifically target pregnant and postpartum women are urgently needed (Knettel et al. 2018). A 2016 systematic review of interventions to improve PMTCT service delivery and promote retention found heterogeneous results, and emphasized the need to assess the long-term effects of interventions, particularly within the context of universal, lifelong ART (Ambia and Mandala 2016). Another 2016 systematic review specifically focused on interventions to improve postpartum retention in HIV care identified only ten qualifying studies, and only four that were considered high- or moderate-quality (Geldsetzer et al. 2016). The study emphasized the need for development and evaluation of interventions targeted to this particularly high-risk group (Geldsetzer et al. 2016).

Given the heightened need to develop interventions to improve postpartum engagement in HIV care, our objective was to assess the potential acceptability of existing and future interventions among the target population of pregnant, HIV-positive women in South Africa. Some of the interventions—financial incentives, educational toy incentives, health education, combined maternal/infant visits, and cell phone-based text reminders—have the potential to directly impact engagement, while others—mobility-tracking interventions, fingerprint/biometric devices, and smartcards—could improve the clinic experience and enhance the ability to capture and understand engagement in care.

Methods

Study Sites and Participants

We enrolled 50 pregnant women living with HIV attending routine antenatal care services at two study sites in South Africa. Witkoppen Health and Welfare Centre (Witkoppen) is a large primary care clinic in northern Johannesburg, operated by a private, non-governmental organization with public and private support. Witkoppen offers fee-for-service antenatal and postnatal care, HIV testing and treatment on-site, and other primary care services. The second site was the Gugulethu Midwife Obstetric Unit (GMOU) based at the Gugulethu Community Health Centre in Cape Town. This large primary care antenatal clinic provides services free-of-charge to approximately 5000 women each year. The GMOU serves Gugulethu and the surrounding informal settlements. Both clinics serve populations housed in nearby formal and informal settlements; these communities are characterized by poverty, high crime, poor services, and frequent migration. The study sites were selected due to the high volume of antenatal patients seen each month. Antenatal HIV prevalence of 26–33% has been previously reported at the study clinics (Myer et al. 2016; Schwartz et al. 2015).

Study Procedures

From September 2016 to September 2017, adult (≥ 18 years), pregnant woman living with HIV and attending antenatal services at the study sites were recruited during routine antenatal care and invited to participate in a study exploring the impact of mobility on postpartum engagement in HIV

care (K01 MH107256). The written consent process and interviews were conducted in the local language preference of the participant. While two face-to-face, in-depth interviews—one at enrollment during pregnancy and one after 1 month postpartum—were completed during the study, questions related to potential interventions were only asked during the enrollment interview, and questions are shown in Supplemental Table 1. Potential interventions included financial incentives (including supermarket vouchers and transport money), educational toys for children, health education, combined maternal/infant appointments, text message reminders from the clinic, patient mobility-tracking methods, fingerprinting for identification at the clinic, and the use of smart cards for access to medical information and identification. Interventions were selected for assessment based on prominence in the field due to previous research about barriers to HIV care, at the request of the participating site, and/or the discretion of the research team. Interviews were audio recorded, de-identified, translated into English, and formatted for data coding.

Analysis

Data coding, analysis, and reporting were completed by following the COREQ guidelines (Tong et al. 2007). A hierarchical coding system was developed and refined using an inductive-deductive approach based on interview guide questions and a preliminary review of transcripts. The coding system was organized into major categories and then subcategorized to capture further thematic detail. Specific definitions along with coding rules were written for each category. Each statement within the transcript was treated as a separate quote and each quote could be assigned up to five different codes. Two trained coders independently coded the quotes, compared the coding, and established inter-rater consensus when there were differences. Quotes were sorted by category, frequency distributions were examined, and quotes were read in detail to identify higher order themes and relationships. Inductively, the analysis was guided by Social Cognitive theory (Bandura 2001) and clinical experience. Deductively, the analysis was guided by the coding categories and their frequency were used to articulate major themes and to identify relevant supporting quotes. The analysis focused on identifying the participants' views on the acceptability of different intervention strategies for improving postpartum healthcare utilization and treatment adherence.

This study was approved by the Vanderbilt University Institutional Review Board and the Human Research Ethics Committees at the University of Cape Town and the University of the Witwatersrand.

Results

A total of 50 women were enrolled in this study; 25 at Witkoppen and 25 at GMOU. Participant characteristics are shown in Table 1. Overall, the median age was 30 years (IQR: 24–34) and over one-third were diagnosed with HIV during the current pregnancy. Participants recruited at Witkoppen were older, more frequently employed, and more often diagnosed with HIV prior to this pregnancy.

Financial Incentives

Women were asked their opinion of financial incentives, including a supermarket voucher or taxi money. As shown by quotes in Table 2, overall, respondents were positive, reporting a financial incentive intervention would be helpful, particularly for new mothers with scarce resources and women who have not returned to work yet after having the baby. The importance of using vouchers to buy food—particularly the healthy food that the clinic advised them to eat—was noted in responses such as, "*I think you can make the voucher for food and things like fruits. So they eat the same way people who work eat and the way we get counselled to eat. Like they say…you are supposed to buy olive oil, but olive oil is expensive.*" (Participant 28 [Witkoppen]). Others felt that providing financial incentives would mitigate the financial barrier of transport costs to attending visits, noted in responses like responses like, "*I think it [financial incentives] is a right thing because women miss appointments due to financial constraints.*" (Participant 17 [GMOU]). However, some participants raised concern

Table 1 Characteristics of women enrolled at the Witkoppen Health & Welfare Centre (Witkoppen) and the Gugulethu Midwife Obstetric Unit (GMOU)

	Witkoppen	GMOU	Total
Number of women	25	25	50
Median age (IQR)	33 (26–34)	26 (24–31)	30 (24–34)
Born in the same province as the study site (%)	1 (4%)	7 (28%)	8 (16%)
Employed (%)	21 (84%)	5 (20%)	26 (52%)
First pregnancy (%)	2 (8%)	5 (20%)	7 (14%)
Diagnosed with HIV in this pregnancy (%)	7 (28%)	11 (44%)	18 (36%)
Disclosed their HIV status to anyone (%)	23 (92%)	18 (72%)	41 (82%)

Table 2 Selected illustrative quotes representing participant attitudes towards proposed interventions

Financial incentives	That's a very good idea. We don't always have money. Participant 15 (GMOU) Yes, even if it's for R150, it's enough because you we know that people like things, they can buy things they want… and they know that if they don't go to the clinic they won't get it. Participant 41 (Witkoppen) I think it is a good idea…especially when someone has just delivered and they don't have money to come to the clinic. Participant 50 (Witkoppen) That is a good thing because…when a clinic is far, transport becomes a problem so the money is needed. Those vouchers will be helpful too. Participant 24 (GMOU) I can't say the money is fine, a voucher is better so they can buy something to eat such as fruit so they can get something to eat at home or at the clinic. Participant 20 (GMOU) They would misuse vouchers – If they receive vouchers' worth they might spend the vouchers for their personal needs instead of doing what the vouchers were meant for and they would end up not coming to the clinic because of not having money to come to the clinic. Participant 10 (GMOU) I don't think it's a good idea. I don't drink, but some people who are [HIV-] positive do. Some of these people might sell the voucher or use the taxi money to buy alcohol, and this may lead them to defaulting. Participant 16 (GMOU)
Educational toy incentives	Yes, because they would not afford to buy these toys [otherwise], so the baby will also be happy. Participant 23 (GMOU) Yes, they would be interested a lot. Because they can see that the child can at least put pieces together or so. Participant 19 (GMOU) No one will come back because of a toy… if it's a [supermarket] voucher they will come as the kids already have the toys. Because mothers know that a toy will be used by the baby but the voucher can even get them a packet of nappies. Participant 11 (GMOU) For me, I come to the hospital because of my health. I won't be made by a toy to come. Participant 47 (Witkoppen) As a mother, I have to think for myself. There is no need for me to be enticed with something for me to come back to the clinic. Participant 31 (Witkoppen) I don't want to lie…I don't think it's [an educational toy] a good idea. To be given an incentive to come to the clinic? No, it's not a good idea. Participant 13 (GMOU)
Health education interventions	I think it will also be a good idea. It will keep us educated on health issues and how to take care of ourselves and all of that. Participant 48 (Witkoppen) It would be great to have weekly programs, like to build up the family support when a woman is on ART. Participant 10 (GMOU) [To discuss] education about HIV, how to care and feed the kids, how to disclose your status to your partner. Participant 11 (GMOU) [To discuss] why I am living with this virus, how to take care of myself, how to accept and how to disclose my status. Participant 13 (GMOU) [To discuss] Maybe advice on pills, what it helps with and why they must be taken. Participant 17 (GMOU) [To discuss] How to take care of yourself when you are HIV positive; how to take care of your child; how to live healthy; how to educate other people yourself about the virus. Participant 27 (Witkoppen) It's a good idea…to help other women who are in denial. Participant 35 (Witkoppen) The problem is that…that class…eish. Another issue is that I work. It would be best if that class was attended on the day to collect pills. Then it would not be a problem. Participant 46 (Witkoppen)

Table 2 (continued)

Combined maternal/infant clinic visits	It would be a good idea to link the visits, to save time. Participant 13 (GMOU) Yes, that would be interesting and it could be a good idea to save money. Participant 2 (GMOU) I love the one of giving the baby and the mother the same dates of appointment. Participant 33 (Witkoppen) I don't think it would be a good idea because the clinic for child care are always busy, meaning you might not be having a chance to attend to your clinic appointment as a woman who is on ART. Participant 10 (GMOU) No… it would be better if you came on different days; the clinic would be too full if they were combined and one would go home late. Participant 15 (GMOU)
Cell phone text reminders	On my cell phone? That would be a good thing, because it's on my phone, not someone else's. Participant 21 (GMOU) I think it's one of the great ideas because sometimes I left or lost my [appointment] card I don't even know and I don't have airtime to call here at the clinic and I don't have the numbers for the clinic. But if you send reminders that I must not forget that on a certain date I will know. Everybody goes through their phone every day. It's going to be easy you know you have to go when you see that SMS. Participant 34 (Witkoppen) Yes; that really works well because even in the adherence club, if you missed your appointment or your date is scheduled for the next day they contact you telephonically to remind you about your date. Participant 6 (GMOU) A message that would remind you about when you must come to the clinic…maybe a message that can motivate you to come. I think the most important thing is support. Once you have that support that you need…you can feel that you have everything. Participant 37 (Witkoppen) It's not a good idea though; some people do not want other people to know their business. If you receive the text while someone has your phone, it might mean involuntary disclosure. Participant 13 (GMOU) These [applications] cannot be used, meaning WhatsApp, Facebook, I might miss some messages, because I do not always have data. SMS would work out better even if I do not have data. Participant 18 (GMOU)

Table 2 (continued)

Mobility-tracking interventions	It's a very good idea. So the clinic will know if you are in another province and they will then try to check up on whether you are receiving/eating your treatment where you are. Participant 13 (GMOU) I would like to have that…If I come back the next [visit] and you ask me why and where I was I can't lie and say I was here in Diepsloot and I didn't go anywhere. At least it will show people…even patients will be scared to relapse on…coming and fetching the medication. They will know that this tracker is not because we don't trust you but it's because we want to help you. It will help many people to come back. Participant 34 (Witkoppen) How [else] will they see that I am not in Johannesburg and I didn't attend to fetch my medications? That is a good idea. Participant 48 (Witkoppen) Yah. Because sometimes you go to a certain place and you don't know where the clinic is there…you find that at work they say from next month they will transfer you to work at a certain place and you don't know anything about that place. They can then tell you that we notice that you are at a certain place and your date of coming to the clinic is on this day…can you go to the nearest clinic which is…this clinic… Participant 37 (Witkoppen) If you're running short of tablets you can tell the person that you can go to the nearest clinic. Participant 36 (Witkoppen) I think it is a good idea because other people stop taking pills because they think the clinic doesn't see them. The clinic does not see that you have stopped the pills…how will they see that you are not taking the pills. Participant 48 (Witkoppen) No. This would mean that the clinic has to take responsibility for my health, and I should be the one to do that; I shouldn't have to be followed after for my own health. In any case, I would still evade you if I wanted to, despite the tracker. Participant 16 (GMOU) Not really, that is somehow an invasion of privacy. Participant 29 (Witkoppen) That you see where I am? It means even when I'm naked you will see me. Participant 41 (Witkoppen) To track me…to track me like I steal…like I stole a car. Have you ever seen when someone steals a car? Participant 46 (Witkoppen)
Fingerprint/biometric interventions	That would be helpful to identify my fingerprints and to differentiate them from other people as they are going to be kept in the computer to be retrieved when necessary. Participant 9 (GMOU) It's not a bad idea at all because I don't think they can leak patients' confidentiality to any other thing except clinic stuff. I think they would ask you; if anything comes up, they will ask for your permission. Patient 37 (Witkoppen) When the information is stored in the computer, no one will take the folder which does not belong to her. Participant 6 (GMOU) It's a way of identifying who you are. So it's not a bad thing, so it's good. Because they can know who you are. We live in a world of criminals. Someone can just use someone's papers or someone's name. They can easily identify you. Participant 27 (Witkoppen) Yeah it's a good idea, just like at the bank; it's the proof that you're the owner of the ID. Participant 26 (Witkoppen)
Smartcard interventions	No I wouldn't carry it because I wouldn't know the HIV status of the person behind me when we are on queue at the clinic and I wouldn't be comfortable for her to know my HIV status. Participant 10 (GMOU) I think it would easily get lost because it is small. Participant 17 (GMOU) Yes, it is OK, but I am concerned when you lost it someone might access your information, which is confidential. Participant 6 (GMOU) Well I believe that if someone is working at the clinic, its private information whether [or not] they know that you are this sick. If you are a person that is working at the clinic, you need to be very confidential with someone's information. So I don't mind, if that person is very confidential. Participant 27 (Witkoppen)

that women would misuse the incentive, and the theme of individual versus facility responsibility for a patient's health featured prominently in discussions of financial incentives.

Educational Toy Incentives

Enthusiasm for an educational toy incentive for the newborn was more tempered. Similar to other financial incentives, respondents noted the lack of financial means to purchase toys themselves. However, many noted that a toy was not enough incentive to attend the clinic. Continuing the theme of the intersection of individual and facility responsibility for a patient's health, some participants were fundamentally opposed to the idea of incentives of any kind, reporting that patients should be coming to clinic for their health without additional enticement from the clinic, as illustrated by this response: "*I don't think they would come back for the sake of toys. I would appreciate to receive a toy for my child but that could never be a reason to come to the clinic."* (Participant 2 [GMOU]).

Health Education Interventions

Health education interventions were viewed favorably by most women and presented a new theme to the discussions: a call for increased health education. A number of suggestions about topics to be covered were presented. One respondent in favor of an educational intervention stated, *"We as women have different problems. Talking about your relationship, sharing about your virus, are important to a woman."* (Participant 22 [GMOU]). Participants emphasized educational programs centered on HIV education, self-care and acceptance of HIV status, social support systems, childcare, HIV status disclosure, and medication advice. Some participants noted that education interventions should not be burdensome to attend and should be scheduled to correspond with clinic visits.

Combined Maternal/Infant Care

Opinions on integrated care for mother and baby on the same day were mixed. Participants who were enthusiastic about the idea noted that combined visits may offer savings of transport money and time spent at the clinic. However, some women questioned the logistics of a combined visit day, wondering if both mother and baby could be seen on the same day, and also if combined visits would result in overcrowded facilities. This discussion introduced a theme of openness to interventions that could improve health systems related to engagement in HIV care. One respondent who saw combined visits as a time- and money-saver remarked, *"I think it's the best idea, because it will save you money from coming up and down. It will also save you time. It's the best idea."* (Participant 27 [Witkoppen]).

Cell Phone Text Reminders

Many participants felt that it would be very useful to receive a text message reminder and that the message could serve as a motivator to attend her clinic appointment. In addition to simple reminders, text messages offer the opportunity to provide motivational messages to encourage engagement in care. This discussion continued earlier themes of calling for more health education and openness to interventions that improve health systems, but also introduced a theme of issues of disclosure and concerns about privacy. Some saw cell phone reminders from a health facility as a risk to privacy and were concerned about inadvertent disclosure to others. The appropriateness of cell phone-based interventions relative to disclosure status was illustrated by responses like, *"It would work for some. But for some people who are not ready to disclose, it might prove to be an issue of privacy if someone else sees the message.*" (Participant 16 [GMOU]). When asked about smartphone applications, participants said they would prefer text messages, as they do not always have data for internet access.

Patient Tracking Interventions

Patient-tracking methods were also proposed to participants. Specifically, participants were asked about using the signal from a patient's cell phone to alert the clinic when the person was out of town, so that the clinic could check with her about ART supply, upcoming visits or connecting to a new facility. Many felt this idea could be a valuable resource for staying connected to care while traveling, and as a sign from the clinic that "we want to help you." Others appreciated the fact that the clinic would automatically know their location when visits are missed. Still, some saw patient tracking as an invasion of privacy—continuing the earlier themes of concerns about privacy and personal responsibility—with one respondent likening it to anti-theft car tracking devices that are common in South Africa. This concept confused some, with some respondents simply misinterpreting the idea of being tracked, or believing that the clinic would be able to "see" them through a mobile device.

Fingerprinting Interventions

Keeping with the theme of openness to interventions that could improve health systems, the concept of using fingerprints as a biometric intervention to improve management of patient files was enthusiastically received. Participants noted that it would be "helpful" for the clinic to "know who you are." Much of this discussion related to disclosure and

privacy, and many saw fingerprinting interventions as an enhanced privacy measure by avoiding the possibility of paper files being switched or missing, noting that, *"I feel fine because no one can come and take my file and use it because they can see it's not the right person."* (Participant 41 [Witkoppen]). Respondents reporting trusting computers to securely house their data.

Smartcard Interventions

The potential of using a smartcard—a credit card-shaped tool that can be used to access patient's health data when swiped at the clinic—for increasing speed and efficiency of administrative processes was noted. In one respondent's view, "*That would make a huge change and the system could go fast compared to this system of folders which is very slow."* (Participant 9 [GMOU]). However, respondents frequently reported the fear of losing the card—particularly given the small size—and also the fear of disclosure from information printed on the card, or the card inadvertently ending up in the wrong person's possession.

Discussion

Numerous different interventions to improve engagement in HIV care among pregnant and postpartum women have been and are currently being assessed, however there are few qualitative data exploring women's intervention preferences. This exploration of the acceptability of various possible interventions among pregnant, women living with HIV in South Africa revealed the following key themes: (i) the intersection of individual and facility responsibility for a patient's health, (ii) a call for more health education, (iii) issues of disclosure and concerns about privacy and (iv) openness to interventions that could improve health systems related to engagement in HIV care.

In this study, an overarching theme emerged about the intersection of individual responsibility for one's own health and the responsibility of clinic and health providers to support and encourage engagement in care. Particularly with respect to physical incentives such as cash and vouchers or educational toys, many women highlighted that this should not be the reason they attend the clinic. Discussions about mobility-tracking interventions also echoed concerns about patients not taking responsibility for their own health and placing this responsibility on the clinic. Despite some concern about shifting responsibility for one's own health, financial incentives were largely reported to be acceptable in this patient population. Studies, including those in pregnant and postpartum women specifically, have found high acceptability (Clouse et al. 2018; Greene et al. 2017; Yotebieng et al. 2016). Financial incentives have successfully been used in HIV prevention and current evidence shows promise for improving retention in care, yet there are few studies reporting the efficacy of financial incentives on this outcome (El-Sadr et al. 2017; Yotebieng et al. 2016). A recent qualitative study highlighted that patients may feel incentivized to varying degrees depending on their circumstances and their existing commitment to their treatment (Tolley et al. 2018). High acceptability in our cohort may not translate to high efficacy of the intervention at a population level.

Women in our study were universally interested in health education initiatives. All participants talked about a desire for additional health education and only one concern was raised about the logistics and timing of additional education sessions. These findings are in line with results of systematic reviews of interventions to improve retention and adherence in general adult populations, which have reported education and counselling interventions as possible strategies (Bärnighausen et al. 2011; Chaiyachati 2014). They also align with a study from HIV-positive women attending antenatal care in Johannesburg, South Africa, who reported that health education and regular counseling were the top two things that clinics could do to encourage HIV-positive women to remain in care (Clouse et al. 2018). Further formative research is warranted to understand the types of counseling and education interventions that will be most acceptable and effective within this population.

Privacy, confidentiality and fear of disclosure were the primary concerns raised with respect to cell phone reminders, mobility tracing using cell phones, and interventions using a smartcard to house health information history. Improved privacy and security was also the key advantage seen in using fingerprint identification. These concerns have been well documented and are at the forefront of patients' minds, even with respect the organization of health services and which clinics they choose to attend (Colvin et al. 2014; Hodgson et al. 2014). There is growing evidence on the efficacy using cell phones for patient reminders and adherence support and these approaches have shown high acceptability in various settings in sub-Saharan Africa (Musoke et al. 2018; Nachega et al. 2016; Ronen et al. 2018). Concerns about privacy could be addressed using opt-in approaches or different messaging options depending on a woman's preferences (Ronen et al. 2018). Women expressed initial support for mobility-tracking interventions, viewing this as a reliable connection to the health facility and an indication that the facility cares for their health. However, some concerns were raised about privacy, and others had difficulty understanding the concept. Continued investigation of mobility tracking interventions should heed consideration of privacy concerns. Opt-in strategies' careful assessment of the understanding of the participant will be required. Both cell phone reminders and mobility-tracking interventions could also be implemented without HIV-specific language and have the

potential to expand to include non-HIV services to reduce stigma and disclosure concerns (Ronen et al. 2018).

Another theme that emerged across multiple interventions was the health system structure. Long waiting times and clinic inefficiencies have been highlighted as barriers to care in many settings, particularly where resources are few and there is a large burden of HIV (Colvin et al. 2014). Additionally, unofficial transfer between health facilities is highly common throughout the region—often dubbed "silent transfer"—and the inability to link patient movement between facilities negatively impacts quality of care and estimates of engagement in care (Clouse et al. 2017; Fox et al. 2018; Geng et al. 2010; Phillips et al. 2018; Phillips et al. 2015; Sikombe et al. 2018). Women were excited about innovations of fingerprint or biometric interventions, and smartcard interventions, because of their potential to streamline activities in the clinic. Biometric approaches are increasingly common for banking, workplace attendance, and government services in South Africa; while they are not frequently used in low-resource healthcare settings, some studies have demonstrated their feasibility and acceptability in resource-limited settings (Serwaa-Bonsu et al. 2010; Wall et al. 2015). Apart from streamlining, women felt more confident in the security of their information using biometric identification, noting distrust in the clinic staff, which has also previously been documented in the literature (An et al. 2015; Dapaah and Senah 2016; Stern et al. 2017).

While this is the first paper, to our knowledge, to assess the potential acceptability of multiple HIV engagement interventions among pregnant women, our results may offer insight into potential interventions for the broader population initiating universal ART. Pregnant and postpartum, HIV-positive women experience some barriers unique to pregnancy (Clouse et al. 2014; Gourlay et al. 2013; Kohler et al. 2014) but many barriers are common to engagement in HIV care more broadly (Bogart et al. 2012; Govindasamy et al. 2012; Merten et al. 2010; Posse et al. 2008; Shubber et al. 2016). The proposed intervention of combined maternal and infant visits is specific to pregnant and postpartum women, but the concept of combined visits—such as HIV and non-communicable diseases services—is widely applicable and has been shown to be acceptable (Kemp et al. 2018; Venables et al. 2016). Financial incentives by design are most appropriate for short-term, targeted periods that warrant extra attention (Sindelar 2008), such as the transitions of care inherent within the pregnancy and postpartum periods. Other studies have documented the acceptability of incentive interventions among general populations for HIV prevention (MacPhail et al. 2013), HIV testing (Chamie et al. 2018; Sibanda et al. 2017) and improving engagement in care (Linnemayr et al. 2017; Maughan-Brown et al. 2018), but with varying efficacy. The proposed interventions that addressed limitations in the patient tracking and data linkage abilities of clinics also are broadly applicable and are particularly urgent given the expansion of treatment under universal ART.

Our results should be viewed in light of study limitations. Our study represents the views of 50 pregnant, HIV-positive women from two sites in South Africa; the small sample size allowed for meaningful discussion during interviews. Despite some demographic differences by study site, women from both sites had similar perspectives about the presented intervention options. However, acceptability may vary in other countries or in more rural areas. Our study was not designed for sub-group analyses or to compare interventions. Additionally, our study interviewed women currently engaged in care; individuals who have already fallen out of care may report different preferences for potential interventions. This study presented women with a broad description of potential intervention modalities and did not go into detail of any specific intervention and did not cover all potential interventions. Some suggested interventions, such as mobility tracking, were not well understood by all participants, and concerns were raised about some of the more specific details of how the intervention would be designed or implemented. Our results should not replace other acceptability assessments within specific populations prior to intervention implementation.

Long-term engagement in HIV care is a challenge for pregnant and postpartum women in South Africa and throughout the region. Interventions that specifically target this population are urgently needed. Our findings highlight the acceptability of interventions that both involve patients at the individual level, and improve clinic flow and data management at the facility and health systems levels. We recommend combining interventions, as prioritized by women, at multiple levels in order to achieve maximum acceptability. This formative research to identify and address the concerns and preferences of this unique patient population is a vital step in the development of new interventions. We found high acceptability for many proposed interventions, with noted concerns about individual responsibility, privacy, and logistics. Respondents were particularly enthusiastic about proposed innovations that provide additional health education or improve linkage to and communication with the health facility. It is unlikely that a single intervention will provide a panacea; providing choices for women within the intervention toolbox may be the key to reaching optimal engagement in HIV care.

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Compliance with Ethical Standards

Conflict of interest The authors declare no conflicts of interest.

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