Outcome expectancies toward adherence to antiretroviral therapy for pregnant and postpartum women with HIV

Florence M Momplaisir¹, Kathryn Fortune², Hervette Nkwihoze³, Allison K Groves³, Erika Aaron⁴ and John B Jemmott III⁵,⁶

Abstract

Objectives: Adherence to antiretroviral therapy and retention in care significantly drop for women with HIV during the postpartum period. We have a limited understanding of how outcome expectancies influence maternal adherence and retention in care.

Methods: Women with HIV from an urban academic clinic completed in-depth interviews in the third trimester and at 3 to 9 months postpartum to evaluate outcome expectancies, facilitators, and barriers to antiretroviral therapy adherence and retention in care. Interviews were audio-recorded and analyzed for content. A codebook was created using deductive (based on the theory of reasoned action approach) and inductive (based on emergent themes) codes.

Results: We conducted 21 interviews with 12 women during pregnancy and 9 women during postpartum period. Participants had a mean age of 31 (standard deviation = 5.7) and most were African American (75%). Outcome expectancies centered mostly around pediatric health to prevent perinatal transmission of HIV and to be healthy to raise their children. Other outcome expectancies included preventing transmission of HIV to their partners. Social support from partners served as a strong facilitator as they helped routinize pill-taking behaviors, provided reminders, and decreased social isolation. Barriers to antiretroviral therapy adherence included depression, the disruption of scheduling routines, and the physical demands associated with the postpartum period. These barriers were accentuated for women with multiple children.

Conclusion: Women’s commitment to pediatric health was the primary motive for antiretroviral therapy adherence. Partners also served an important role. These findings suggest that interventions linking pediatric and maternal health, and partner support can improve maternal HIV treatment in the postpartum period.

Keywords
antiretroviral therapy, HIV/AIDS, maternal health, medication adherence, postpartum period, retention in care
Introduction

Antiretroviral therapy (ART) and guidelines to prevent perinatal transmission of HIV contributed to a rate decline in perinatal transmission to <1%,1 a major achievement in combating the HIV epidemic. During pregnancy, women with HIV adhere to most prenatal visits.2 In contrast to the prenatal period, postnataally, a significant proportion of women with HIV do not reengage in HIV care.2 Consequently, they experience viral rebound postpartum, which can lead to disease progression, viral resistance, sexual transmission to partners, and increased maternal morbidity.3,4 Preserving maternal immune function is crucial to sustaining maternal and infant health before and after delivery.

While there is substantial literature on individual-level5–8 and structural-level9,10 factors influencing women’s HIV care continuum outcomes, we have a limited understanding of how facilitators and barriers influence women’s intention and their ability to remain engaged in care and adhere to ART within the context of pregnancy and the postpartum period. We were specifically interested in understanding how women’s perceived consequences, either positive or negative, of medication adherence and care retention affected their health behaviors. The anticipated consequences of engaging in a behavior, such as taking HIV medications, are termed outcome expectancy. In this study, we used the reasoned action approach11 to assess women’s outcome expectancies, facilitators, and barriers vis-à-vis ART adherence and retention in care, first during pregnancy and then during the postpartum period. The study’s prospective nature allowed us to describe how themes related to these theoretical constructs evolved for women as they transitioned from pregnancy to the postpartum period.

Methods

Setting and study participants

This was a qualitative study conducted at a co-located comprehensive HIV and prenatal care clinic in Philadelphia, Pennsylvania. The inclusion criteria were as follows: women diagnosed with HIV, in their second or third trimester of pregnancy, and in care at the clinic. Institutional Review Board approval from Drexel College of Medicine (IRB number 1608004793) was obtained before the start of the study.

Study procedures

After obtaining informed written consent, participants completed a Research Electronic Data Capture (REDCap) questionnaire inquiring about demographic information, pregnancy history, substance use, mental health history, adherence to ART, disclosure of HIV status to their partner, and awareness of their partner’s HIV status. Following the completion of the questionnaire, we conducted in-depth semi-structured interviews and repeated the interviews at 3 to 9 months postpartum. The interview script (refer to supplemental material) included open-ended questions about perinatal care, plans for postpartum care, outcome expectancies, individual and structural facilitators, and barriers vis-à-vis adherence to ART and retention in care during pregnancy and postpartum. The interviews, typically lasting 45 to 60 min, were conducted individually in a private room in English or Spanish. Interview audio recordings and transcripts will be stored for 7 years.

Data analysis

Descriptive statistics including means, standard deviations (SDs), and percentages were calculated for demographic and clinical variables, including age, race, income, mental health disorders, and substance use among others.

Interviews were conducted by the primary investigator and two other interviewers trained in qualitative research methods and issues surrounding perinatal HIV care. Interviews were audio-recorded, transcribed verbatim with personal identifiers removed, and analyzed for content. A codebook was created using deductive codes and after thoroughly reviewing interview transcripts using inductive codes. As the analysis progressed, new themes emerged, and the codebook was refined and extended. We extensively reviewed data and analyzed them through the following steps:12,13 (1) Coding: We categorized our data by developing and applying inductive and deductive codes to all transcripts using Dedoose software.14 Deductive codes were based on our theoretical framework, the reasoned action approach.11 Inductive codes were derived through team meetings to capture emergent themes. (2) Matrices: We used matrices to further analyze and organize the qualitative data by themes as they emerged in the interviews and as a way to facilitate comparisons across different types of participants (e.g. women with or without perinatal acquisition of HIV, or women with or without multiple children).

Results

Population

We conducted 21 interviews with 12 women during pregnancy and 9 of 12 women during the postpartum period (3 women were lost to follow-up). Interviews took place between February 2017 and January 2020. Table 1 presents the demographic and clinical characteristics of participants. The majority of participants were African American (75.0%), never married (66.7%), unemployed (75.0%), and had a combined yearly income of less than $10,000 (66.7%). A quarter of women acquired HIV perinatally; most reported having either comorbid depression (58.3%) or anxiety (41.7%).
Outcome expectancies toward HIV treatment during the prenatal and postpartum periods

Preventing perinatal HIV transmission. Nearly all women expressed the outcome expectancy that consistently adhering to ART and being retained in care would prevent perinatal HIV transmission, which explains their success in sustaining viral suppression in the prenatal period. One woman said,

I think the fact that I’m pregnant and all and knowing that I don’t want my son to go through what I went through is my most, like biggest motivation . . . truthfully it is more about him than it is about me. (. . .) I’m more like, “this is for you, I’m doing this for you.” . . . I’m more worried about, like the baby. In my opinion, just the fact that I’m pregnant, it’s the biggest motivation for me.

Women who perinatally acquired HIV highlighted the link between maternal ART adherence and reduced HIV transmission risk and seemed particularly motivated to prevent infection to their baby: “Like I got contracted [HIV infected] because my mother wasn’t doing what she was supposed to do and knowing what I went through, I will never ever, ever want to put my baby through that.” All women strongly believed that staying in care during pregnancy would significantly reduce the risk of HIV transmission to their baby.

Ability to care for children during the postpartum period and beyond. During the postpartum period, another outcome expectancy emerged: women’s motivation to stay in care and adhere to ART shifted from wanting to prevent perinatal transmission to wanting to be able to care for their children. One participant explained that even though she had been struggling in the postpartum period, she was motivated to stay on her medication and go to her appointments: “Because I gotta stay alive and stay healthy for the kids because they need their mother. I don’t know anyone who can take care of them and got the patience to take care of them.” Women expressed the desire to be healthy so that they could raise and provide for their children despite significant challenges in their lives, including homelessness: “I go without so she can have, which is what a good mother would do, but you know, it’s hard because I have to make sure I have somewhere to go.”

Maintaining their own health. Another salient outcome expectancy regarding adherence to HIV treatment was women’s physical health. For instance, a participant who was perinatally infected and had struggled with adherence her whole life shared that her adherence improved because she did not want to feel sick or look ill:

When I was getting sick and my face and skin started getting messed up, it was visible. When I wasn’t taking it at first, nothing was wrong. Nothing was showing or anything. It got to the point where things started appearing, and I don’t like that.

Preventing sexual transmission to partners. Preventing sexual transmission of HIV to partners was an outcome expectancy for some women. Women with HIV-negative partners were motivated to protect them, as one woman described:

Right now, my whole motivation for taking my medicine is that I’m dating someone that’s negative and of course I can’t make them positive. I need to be zero, zero. And the only way for me to be that is to take the medication. So that’s the motivation.

The role of social support in establishing norms around ART adherence

Social support and norms around HIV treatment. Women who disclosed and received social support from their partners maintained care-seeking behaviors, even with the disruption created by the postpartum period. Their partners reminded them to take ART:

He’s been so supportive. I’ll tell you he helped me get back on my medication. (. . .) He’ll wake up in the middle of the night, and he’ll like “yo take your medication,” and
he’ll give it to me, like literally take them out and give it to me.

Among women who disclosed their HIV diagnosis to their partner, 80% reported that their partner was supportive of them attending medical visits for HIV care and 25% said that their partner actively helped them remain engaged in care, which helped routinize their care-seeking behaviors.

**Lack of social support.** One-third of women (33.3%) did not disclose their status to their partner, often due to perceived stigma, which limited their ability to adhere to ART postpartum. The lack of disclosure to partners caused anxiety around labor and delivery when the mother and the baby had to receive zidovudine, possibly raising questions about the mother’s HIV status. This concern made the birthing experience less rewarding. Women without a partner tried to seek support from trusted family or friends but often held back from disclosing because of stigma. Some women temporarily moved to a family member’s house after delivery for instrumental support with their newborn, which required changing their habits around pill-taking to prevent people from knowing their status. Lack of social support impeded their ability to establish consistent behaviors around HIV treatment and care.

**Barriers to ART adherence and retention in care during the prenatal and postpartum periods**

**Anxiety and depression.** During the prenatal and postpartum periods, challenges associated with anxiety or depression presented significant barriers to ART adherence. As shown in Table 1, depression and anxiety were prevalent, and women often struggled to receive treatment for depression. In the postpartum period, barriers to treatment access were more pronounced because some women had the additional burden of postpartum depression. For some women, the anticipation of developing postpartum depression created additional anxiety: “[during pregnancy] Honestly, I refuse to get depressed, I refuse to stop my (HIV) medication because how am I gonna raise my baby, and not even that just me, myself, I don’t like being that way.” This woman successfully took her ART while remaining out of medical treatment for her depression during pregnancy. Following delivery, she struggled to reengage in care and adhere to ART, in part because she was anxious about the negative impact of postpartum depression on her role as a new mother: “I had the worries of becoming a mother and not being able to succeed and not being able to do things the right way and that kinda spiraled. . . .”

**Barriers specific to pregnancy.** Pregnancy-specific barriers included morning sickness and physical discomfort. One woman said, Well in the beginning of the pregnancy, I would have really bad morning sickness, so even with taking the medicine I was still throwing up too, so I was letting them [the medical team] know that I don’t know if I’m throwing my pill back up too . . .

Another participant mentioned that as her pregnancy progressed, it became harder to attend her medical appointments because of the physical discomfort of being pregnant:

. . . now that I am in my third trimester, it’s getting harder because of the pressure of the baby. I believe his head is down in my pelvis area like he is trying to come down. And now it’s hard for me to walk . . .

**Barriers specific to the postpartum period.** Barriers specific to the postpartum period included change in routine and the demands of caring for a new baby. Women saw their daily routine disrupted by the demands of infant care, and this, mixed with fatigue and sleep deprivation, caused them to miss ART doses:

I’m too tired to get up. Like if I’m already in bed, I’m like “ohh I’m tired, I’m just going to go to sleep,” and then I just go to sleep. I could do better. I was taking them (my medications) every day when I was pregnant.

Some women described not being able to think clearly because of physical and emotional fatigue, as indicated by this quote: “Just because my head hasn’t been in the same space, so I’ve been having some trouble keeping up with it [taking my medication].”

Women with multiple children or children with special needs particularly struggled with keeping a routine and self-care. One woman who had a son with attention-deficit/hyperactivity disorder (ADHD) described how difficult it was to handle a new baby. She spent her time and energy going to pediatric appointments and attending to her son’s needs, leaving little time to keep her HIV appointments. She stated, “My older son (has) ADHD and trying to keep up appointments, myself and both of the kids, you know, but with their appointments, I been doing good, but with myself, it been kind of like a stressful situation.”

**Other barriers.** Other barriers that affected adherence and retention in care included competing demands, forgetfulness, stigma, and social determinants, such as financial challenges and homelessness (Table 2).

**Discussion**

Adherence to ART is critical for maternal well-being, particularly in the postpartum period, when women are vulnerable to ART discontinuation. Because many women are susceptible to disengagement in care during this time,
understanding facilitators and barriers for maintenance of ART adherence in the context of the perinatal period is essential, particularly when providing adherence counseling. For example, practitioners can capitalize on the fact that women are highly motivated to care for their infants and keep them healthy. Adherence counseling conversations can capitalize on this motivator for women with HIV by educating the mother that adhering to their HIV medications and staying healthy themselves will, in turn, keep their baby healthy. We found that outcome expectancies centered around women’s children, to prevent perinatal transmission of HIV or maintain pediatric health following delivery, were significant contributors to increased ART adherence. Other outcome expectancies included the desire to maintain women’s health and protect sexual partners from HIV infection. Major barriers to ART adherence in the postpartum period included untreated depression, the disruption of scheduling routines, and the physical demands associated with the postpartum period. These barriers seemed accentuated for women with multiple children. For some women, support from their partners was a facilitator of adherence and care engagement both during pregnancy and in the postpartum period.

Previous research has identified the desire to prevent perinatal HIV transmission as a strong motive for ART adherence during pregnancy.\textsuperscript{16-18} Here, we found that women’s commitment to pediatric health continued to be the primary motive for ART adherence in the postpartum period. These findings suggest that interventions linking pediatric and maternal health might show promise in improving ART adherence. Such work is needed in the United States in light of critical reviews of research indicating that trials of interventions to improve ART adherence and retention in care postpartum have been implemented in low-resource countries but are lacking in high-resource countries.\textsuperscript{19,20} A strategy to improve postpartum adherence to treatment are peers, or women with HIV who were able to overcome barriers to ART adherence and retention in care during pregnancy and postpartum. Peers are trained to provide education and social support to newly pregnant women with HIV.\textsuperscript{21-23} A study testing the efficacy of peer support in improving ART adherence and retention in care across different geographic locations in the United States is currently ongoing.\textsuperscript{24} A study in the Southern United States showed that the use of a multidisciplinary perinatal care coordination team to facilitate timely transition to HIV care postpartum helped improve viral suppression at 6 months after the delivery.\textsuperscript{25} The team met monthly to identify and address psychosocial and structural barriers to ART adherence and facilitated co-location of pediatric and maternal care. Viral suppression at 6 months postpartum improved from 43% to 59% post-program.\textsuperscript{26}

Our finding that women reported the outcome expectancy that adherence would prevent sexual transmission to partners is consistent with emerging literature showing that the Undetectable = Untransmittable (“U = U”) message can reinforce ART adherence and contribute to viral suppression.\textsuperscript{27} U = U signifies that individuals with HIV who adhere to their ART regimen achieve and maintain viral suppression, and do not sexually transmit HIV to their partners.\textsuperscript{28} In a large survey (N = 2389) conducted in 25 countries, people with HIV who had U = U discussions with their health care providers were less likely to have suboptimal adherence and were more likely to be virally suppressed than people with HIV unaware of the U = U

\begin{table}[h]
\centering
\begin{tabular}{|l|l|}
\hline
\textbf{Theme} & \textbf{Representative Quote} \\
\hline
Competing demands & “I can’t do anything without holding him . . . and it’s just really hard. When he’s napping, I’m cooking, cleaning, doing homework, trying to have interactions with the other kids, trying to do anything. Sometimes just trying to take a bath and relax my own self but I don’t sleep. Literally last night, I went to bed at 5 in the morning, and I got back up at 7.” \\
Forgetfulness & “It’s a struggle, it’s a struggle. Like I forget or if I go out, which I don’t, but if I’m drinking, I’ll go to sleep or that’s about it. Or I’m too tired to get up. Like if I’m already in bed I’m like ‘ohh I’m tired, I’m just going to go to sleep’ and then I just go to sleep.” \\
Stigma & “So, only person in my family who knows (HIV status) is my mom. My grandma don’t know, my dad don’t know. My dad can’t know. So when I’m around them I actually try not to take my medicine in their face. But I go through extra . . . I don’t want people to find my medicine and research it. Or to even just figure out what’s going on in my own life. I don’t want people to know that about me. I do notice that people judge you different when they know.” \\
Financial challenges & “My mind was so consumed on other things and how I was going to pay my bills that I just put that [taking my ART] on the bottom of the list instead of it being at the top of the list.” \\
Homelessness & “I was homeless when I found out (HIV status), I was in a very bad spot, I didn’t really have family support . . . I was very depressed and I went through that for a few years but after my homeless spell and I got on my feet and I had a job and stuff, I just took more interest in coming to the doctor.” \\
\hline
\end{tabular}
\caption{Other barriers to ART adherence and retention in care reported during qualitative interviews of pregnant and postpartum women.}
\end{table}
messaging. For pregnant women with HIV, reinforcing the U=U concept might motivate maintaining adherence in the postpartum period, particularly for women in serodiscordant relationships.

We found that partners provided social support for ART adherence by helping to routinize treatment-related behaviors, providing reminders, assisting women in remaining in care, and decreasing social isolation. These findings are consistent with studies in Sub-Saharan Africa showing the benefits of male-partner involvement in the care of pregnant or postpartum women with HIV. For example, data from large studies tie male-partner participation to reduced depressive symptoms and increased ART uptake; moreover, male antenatal-clinic involvement improved infant HIV-free survival. Although involving partners may enhance women and their infants’ health, the literature also suggests the need to overcome low male-involvement rates and address possible adverse effects of gender-power imbalances, particularly in male-dominated partnerships.

Our participants faced a variety of barriers that challenged their ability to remain on ART. Depression was the most widely mentioned barrier to care during the prenatal and postpartum periods. At least in the short term, some women with depression in our study successfully maintained ART adherence because of their commitment to their children. The effect of depression on ART adherence and retention in care in the prenatal and postpartum periods has been mixed with some studies showing a negative effect and others showing no effect. However, depression is clearly a contributor to poor birth outcomes and maternal morbidity, regardless of HIV status. Given the elevated prevalence of depression in women with HIV, integrated care models need to be implemented, where mental health support and HIV care are provided to women in a family-centered way during pregnancy and the postpartum period.

Our study has several limitations worth noting. First, we relied on a small sample, and three women were lost to care postpartum, making it impossible to incorporate their perspectives into our data analysis. Therefore, barriers identified for women in the postpartum period were limited to those we were able to reach for the postpartum interviews. Women were recruited at an academic health center; hence, we lack the perspectives of women in care in a different setting (i.e. community clinics). Despite the small sample, we quickly achieved saturation of themes, particularly for outcome expectancies, barriers, and facilitators associated with ART adherence in our sample.

**Conclusion**

The focus on pediatric health strongly influenced women’s treatment-seeking behaviors during pregnancy and the postpartum period. When informed of the women’s HIV diagnosis, social support from partners also served as a strong facilitator. Women’s ability to overcome psychosocial challenges to maintain pediatric health speaks of their resiliency. Our findings can help inform efforts to improve women’s and their infants’ outcomes and raise the possibility that involving women’s support system, including their partner, family members, or friends, might be an efficacious strategy to achieve such results.

**Acknowledgements**

We thank Gregg Alleyne and the clinical perinatal team at Drexel College of Medicine who cared for the patients we interviewed. We thank the participants for the time invested in the interviews.

**Author contributions**

F.M.M. led all aspects of the study, including defining the research question, finalizing the methodology, overseeing recruitment efforts, conducting interviews, leading the data analysis, and writing the manuscript. K.F. transcribed and coded interviews, analyzed and interpreted data, and contributed to writing of manuscript. H.N. led the recruitment efforts, conducted the interviews, and contributed to the data analysis and writing of manuscript. A.K.G. and E.A. contributed to the survey instruments, conducted interviews, attended ongoing study meetings, and contributed to the write-up of the manuscript. J.B.J. contributed to the design of the study, the interpretation of the data, and the revision of the manuscript for important intellectual content, and provided final approval for publication.

**Declaration of conflicting interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Funding**

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by the Harold Amos Medical Faculty Development Program of the Robert Wood Johnson Foundation.

**ORCID iD**

Kathryn Fortune https://orcid.org/0000-0003-4564-4304

**Supplemental material**

Supplemental material for this article is available online.

**References**

1. Nesheim SR, FitzHarris LF, Mahle Gray K, et al. Epidemiology of perinatal HIV transmission in the United States in the era of its elimination. *Pediatr Infect Dis J* 2019; 38(6): 611–616.

2. Adams JW, Brady KA, Michael YL, et al. Postpartum engagement in HIV care: an important predictor of long-term
retention in care and viral suppression. Clin Infect Dis 2015; 61(12): 1880–1887.
3. Swain C-A, Smith LC, Nash D, et al. Postpartum loss to HIV care and HIV viral suppression among previously diagnosed HIV-infected women with a live birth in New York State. PLoS ONE 2016; 11(8): e0160775.
4. Chen JS, Pence BW, Rahangdale L, et al. Postpartum HIV care continuum outcomes in the southeastern USA. AIDS 2019; 33(4): 637–644.
5. Turan B, Smith W, Cohen MH, et al. Mechanisms for the negative effects of internalized HIV-related stigma on antiretroviral therapy adherence in women: the mediating roles of social isolation and depression. J Acquir Immune Defic Syndr 2016; 72(2): 198–205.
6. Turan B, Rice WS, Crockett KB, et al. Longitudinal association between internalized HIV stigma and antiretroviral therapy adherence for women living with HIV: the mediating role of depression. AIDS 2019; 33(3): 571–576.
7. Crockett KB, Entler KJ, Brodie E, et al. Brief report: linking depressive symptoms to viral nonsuppression among women with HIV through adherence self-efficacy and ART adherence. J Acquir Immune Defic Syndr 2020; 83(4): 340–344.
8. Anderson JC, Campbell JC, Glass NE, et al. Impact of intimate partner violence on clinical attendance, viral suppression and CD4 cell count of women living with HIV in an urban clinic setting. AIDS Care 2018; 30(4): 399–408.
9. Riley ED, Vittinghoff E, Koss CA, et al. Housing first: unsuppressed viral load among women living with HIV in San Francisco. AIDS Behav 2019; 23(9): 2326–2336.
10. Kalichman SC and Kalichman MO. HIV-related stress and life chaos mediate the association between poverty and medication adherence among people living with HIV/AIDS. J Clin Psychol Med Settings 2016; 23(4): 420–430.
11. Fishbein M and Ajzen I. Predicting and changing behavior: the reasoned action approach. New York: Taylor & Francis Group, 2010.
12. Miles MB and Huberman AM. Qualitative data analysis: an expanded sourcebook. Thousand Oaks, CA: SAGE, 1994.
13. Bernard HR and Bernard HR. Social research methods: qualitative and quantitative approaches. Thousand Oaks, CA: SAGE, 2013.
14. Version D. 8.0. 35. Web application for managing, analyzing, and presenting qualitative and mixed method research data. Los Angeles, CA: SocioCultural Research Consultants, 2018.
15. Henegar CE, Westreich DJ, Maskew M, et al. The effect of pregnancy and the postpartum period on adherence to antiretroviral therapy among HIV-infected women established on treatment. J Acquir Immune Defic Syndr 2015; 68(4): 477–480.
16. Lytvyn L, Siemieniuk RA, Dilmitsis S, et al. Values and preferences of women living with HIV who are pregnant, postpartum or considering pregnancy on choice of antiretroviral therapy during pregnancy. BMJ Open 2017; 7(9): e019023.
17. Buregyeya E, Naigino R, Mukose A, et al. Facilitators and barriers to uptake and adherence to lifelong antiretroviral therapy among HIV infected pregnant women in Uganda: a qualitative study. BMC Pregnancy Childbirth 2017; 17(1): 94.
18. Mellins C, Chu C, Malec K, et al. Adherence to antiretroviral treatment among pregnant and postpartum HIV-infected women. AIDS Care 2008; 20(8): 958–968.
19. Momplaisir FM, Storm DS, Nkwioreze H, et al. Improving postpartum retention in care for women living with HIV in the United States. AIDS 2018; 32(2): 133–142.
20. Geldsetzer P, Yapa HMN, Vaikath M, et al. A systematic review of interventions to improve postpartum retention of women in PMTCT and ART care. J Int AIDS Soc 2016; 19(1): 20679.
21. Cataldo F, Sam-Agudu NA, Phiri S, et al. The roles of expert mothers engaged in Prevention of Mother-to-Child Transmission (PMTCT) Programs: a commentary on the INSPIRE studies in Malawi, Nigeria, and Zimbabwe. J Acquir Immune Defic Syndr 2017; 75: S224–S232.
22. McCarthy E, Joseph J, Foster G, et al. Modeling the impact of retention interventions on mother-to-child transmission of HIV: results from INSPIRE studies in Malawi, Nigeria, and Zimbabwe. J Acquir Immune Defic Syndr 2017; 75(2): S233–S239.
23. Phiri S, Tweya H, van Lettow M, et al. Impact of facility- and community-based peer support models on maternal uptake and retention in Malawi’s option B+ HIV prevention of mother-to-child transmission program: a 3-arm cluster randomized controlled trial (PURE Malawi). J Acquir Immune Defic Syndr 2017; 75: S140–S148.
24. A randomized controlled trial of Women Involved in Supporting Health (WISH). A peer-led intervention to improve postpartum retention in HIV care, https://clinicaltrials.gov/ct2/show/NCT04168008 (accessed 21 September 2020).
25. Hackett S, Badell ML, Meade CM, et al. Improved perinatal and postpartum human immunodeficiency virus outcomes after use of a perinatal care coordination team. Open Forum Infect Dis 2019; 6: ofz183.
26. Meade CM, Badell M, Hackett S, et al. HIV care continuum among postpartum women living with HIV in Atlanta. Infect Dis Obstet Gynecol 2019; 2019: 8161495.
27. Okoli C, Van de Velde N, Richman B, et al. Undetectable equals untransmissible (U = U): awareness and associations with health outcomes among people living with HIV in 25 countries. J Sex Transm Dis 2021; 97: 18–26.
28. Eisinger RW, Dieffenbach CW and Fauci AS. HIV viral load and transmissibility of HIV infection: undetectable equals untransmissible. JAMA 2019; 321(5): 451–452.
29. Peltzer K, Abbamonte JM, Mandell LN, et al. The effect of male involvement and a prevention of mother-to-child transmission (PMTCT) intervention on depressive symptoms in perinatal HIV-infected rural South African women. Arch Womens Ment Health 2020; 23(1): 101–111.
30. Vrako AC, Firth J, Amzel A, et al. Interventions to significantly improve service uptake and retention of HIV-positive pregnant women and HIV-exposed infants along the prevention of mother-to-child transmission continuum of care: systematic review. Trop Med Int Health 2018; 23(2): 136–148.
31. Dillabaugh LL, Lewis Kulzer J, Owoor K, et al. Towards elimination of mother-to-child transmission of HIV: the
impact of a rapid results initiative in Nyanza Province, Kenya. *AIDS Res Treat* 2012; 2012: 602120.

32. Aluisio AR, Bosire R, Bourke B, et al. Male partner participation in antenatal clinic services is associated with improved HIV-free survival among infants in Nairobi, Kenya: a prospective cohort study. *J Acquir Immune Defic Syndr* 2016; 73(2): 169–176.

33. Rodriguez VJ, Parrish MS, Jones DL, et al. Factor structure of a male involvement index to increase the effectiveness of prevention of mother-to-child HIV transmission (PMTCT) programs: revised male involvement index. *AIDS Care* 2020; 32(10): 1304–1310.

34. Hampanda KM, Mweemba O, Ahmed Y, et al. Support or control? Qualitative interviews with Zambian women on male partner involvement in HIV care during and after pregnancy. *PLoS ONE* 2020; 15(8): e0238097.

35. Yotebieng KA, Fokong K and Yotebieng M. Depression, retention in care, and uptake of PMTCT service in Kinshasa, the Democratic Republic of Congo: a prospective cohort. *AIDS Care* 2017; 29(3): 285–289.

36. Surkan PJ, Patel SA and Rahman A. Preventing infant and child morbidity and mortality due to maternal depression. *Best Pract Res Clin Obstet Gynaecol* 2016; 36: 156–168.

37. Peltzer K, Rodriguez VJ, Lee TK, et al. Prevalence of prenatal and postpartum depression and associated factors among HIV-infected women in public primary care in rural South Africa: a longitudinal study. *AIDS Care* 2018; 30(11): 1372–1379.

38. Rubin LH, Cook JA, Grey DD, et al. Perinatal depressive symptoms in HIV-infected versus HIV-uninfected women: a prospective study from preconception to postpartum. *J Womens Health (Larchmt)* 2011; 20(9): 1287–1295.