Predictors of postpartum HIV care engagement for women enrolled in prevention of mother-to-child transmission (PMTCT) programs in Tanzania

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Abstract

Prevention of mother-to-child transmission of HIV (PMTCT) is a foundational component of a comprehensive HIV treatment program. In addition to preventing vertical transmission to children, PMTCT is an important catch-point for universal test-and-treat strategies that can reduce community viral load and slow the epidemic. However, systematic reviews suggest that care engagement in PMTCT programs is sub-optimal. This study enrolled a cohort of 200 women initiating PMTCT in Kilimanjaro, Tanzania, and followed them to assess HIV care engagement and associated factors. Six months after delivery, 42/200 (21%) of participants were identified as having poor care engagement, defined as HIV RNA >200 copies/mL or, if viral load was unavailable, being lost-to-follow-up in the clinical records or self-reporting being out of care. In a multivariable risk factor analysis, younger women were more likely to have poor postpartum care engagement; with each year of age, women were 7% less likely to have poor care engagement (aRR: 0.93; 95% CI: 0.89, 0.98). Additionally, women who had told at least one person about their HIV status were 47% less likely to have poor care engagement (aRR: .53; 95% CI: 0.29, 0.97). Among women who entered antenatal care with an established HIV diagnosis, those who were pregnant for the first time had increased risk of poor care engagement (aRR 4.16; 95% CI 1.53, 11.28). The findings suggest that care engagement remains a concern in PMTCT programs, and must be addressed to realize the goals of PMTCT. Comprehensive counseling on HIV disclosure, along with community-based stigma reduction programs to provide a supportive environment for people living with HIV, are crucial to address barriers to care engagement and support long-term treatment. Women presenting to antenatal care with an established HIV status require support for care engagement during the crucial period surrounding childbirth, particularly those pregnant for the first time.

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Keywords

Tanzania; HIV; prevention of mother-to-child transmission of HIV (PMTCT); pregnancy; care engagement

Introduction

Over the past 20 years, the scale-up and integration of services for the prevention of mother-to-child transmission of HIV (PMTCT) have been at the forefront of HIV treatment and prevention efforts in low- and middle-income countries (LMICs) (World Health Organization, 2010). PMTCT programs reduce new HIV infections among children, improve long-term health outcomes for women living with HIV, and prevent the forward transmission of HIV to sexual partners (Nachega et al., 2012; UNAIDS, 2016). The antenatal care setting is a key entry point for HIV testing (Chandisarewa et al., 2007) and initiation of lifetime antiretroviral therapy (ART) under the recommended Option B+ guidelines (World Health Organization, 2016).

Although delivery of ART to HIV-infected pregnant and breastfeeding women has improved dramatically, suboptimal retention in HIV care and adherence to ART among pregnant and postpartum women threaten to weaken the potential impact of PMTCT. Retention rates among women enrolled in PMTCT under Option B+ are lower than those among the general adult population receiving HIV care (Knettel et al., 2018). Loss-to-follow up (LTFU) in PMTCT programs may be explained by the added complexity and vulnerability of women's lives during pregnancy, including the demands of new motherhood, pressure to begin treatment before one feels ready, poor coordination between PMTCT and other HIV services, and inadequate counseling and support (Colvin et al., 2014; Gourlay, Birdthistle, Mburu, Iorpenda, & Wringe, 2013; Matheson et al., 2015; Ngarina, Popenoe, Kilewo, Biberfeld, & Ekstrom, 2013).

To address shortcomings in PMTCT retention and implement systems to improve care engagement, it is imperative to put effective monitoring and quality improvement processes in place. Previous studies assessing HIV care engagement demonstrate a substantial degree of heterogeneity in the measurement of care engagement, and have typically relied only on one method of measurement, most commonly retrospective medical chart review of HIV clinic visit compliance or patient self-report of care engagement (Knettel et al., 2018; Mugavero et al., 2012; Mugavero, Davila, Nevin, & Giordano, 2010). Such methods have notable flaws that may lead to misclassifications; for example, studies commonly fail to track patients who silently transfer to another clinic, miss patients who were diagnosed with HIV but never initiated ART, and fail to recognize the role of medication adherence along with clinic attendance (Mugavero et al., 2012; Risher et al., 2017; Rollins et al., 2014; Yehia et al., 2012). In addition, medical records, particularly in under-resourced settings, may contain inaccurate or missing information, leading to unreliable results (Pirkle, Dumont, & Zunzunegui, 2012). Few studies on PMTCT in sub-Saharan Africa have triangulated care engagement data using multiple methods, or used a clinical biomarker to support care engagement outcomes (Knettel et al., 2018; Mugavero et al., 2012; Risher et al., 2017;

Rollins et al., 2014). Triangulation of data can strengthen the accuracy and reliability of the reported care engagement measures used to inform PMTCT policy and intervention strategies.

In order to support the implementation of PMTCT programs, it is necessary to assemble robust data on care engagement among pregnant and postpartum women. The goal of this prospective study of women initiating PMTCT care in Tanzania was to: 1) describe HIV care engagement outcomes at 6-months post-partum through triangulation of data via viral load measurements, retrospective medical chart review and self-report, and 2) assess the intrapersonal, interpersonal, and facility-level risk factors that are associated with poor care engagement outcomes.

Methods

Study setting and participants

This prospective cohort study enrolled 200 HIV-infected women from nine PMTCT clinics in the Kilimanjaro Region of Tanzania. The study sites included two referral hospitals and seven local clinics, including three clinics from the major city in Kilimanjaro (Moshi) and four clinics from surrounding peri-urban and rural areas. At the time of the study, all facilities were following the national protocol for PMTCT care (The United Republic of Tanzania Ministry of Health and Social Welfare, 2013), which is based on the Option B+ guidelines and the integration of HIV services within antenatal and postpartum care for the mother and child up until 18 months after delivery.

Women were eligible to enroll if they were enrolled in PMTCT care from one of the nine study clinics, had been in PMTCT care for at least one month, were at least 16 weeks or greater gestational age, were at least 18 years of age, and were able to provide informed consent. Clinic staff introduced the study to patients and referred them to a member of the research staff for additional information. If women were referred to the study before meeting eligibility criteria and were interested in participating, their contact information was recorded and they were scheduled for enrollment at a later date. The cohort was restricted to women who had been in care for one month in order to not overburden women on the day of an HIV diagnosis and to allow for baseline assessment of factors such as HIV disclosure and perceptions of care.

At the conclusion of the enrollment period, the ANC registries of the nine study clinics were reviewed to capture all HIV-infected women who attended ANC during the enrollment period, in order to compare the cohort to HIV-infected pregnant women who were not enrolled in the cohort. A medical record review was conducted of patient records who were over 18 and had either reached gestational age of 24 weeks or been on ART for at least one month by the close of enrollment. Information was extracted on whether they initiated ART at the clinic (and would have been eligible for study enrollment), whether they returned to PMTCT after the first visit, and whether they remained in care at 6 months postpartum.

Study procedures

Following informed consent, participants completed the baseline assessment, an interviewer-administered structured survey that took approximately 60 minutes. Participants provided contact information to facilitate study retention. Three additional follow-up assessments were conducted: within one month of the birth of the child, three months postpartum, and six months postpartum. Participants were reminded of study visits via phone call, text message, or in person when they returned to the clinic; home visits were made to participants who were otherwise unreachable, if permission for home visits had been provided at enrollment. In the event that a participant was unable or unwilling to return to the clinic but still wanted to participate, an abbreviated version of the follow-up survey was conducted by phone. At each study visit, participants were reimbursed for their travel expenses to and from the study appointment, including those participants who had moved out of the Kilimanjaro Region.

At the six-month assessment, participants provided a blood sample to measure HIV RNA. Samples were processed using an Abbott Real Time HIV-1 PCR Machine at the Kilimanjaro Clinical Research Institute biotechnology laboratory, which has Virology Quality Assurance certification. If participants did not complete a six-month assessment, postpartum HIV RNA data was abstracted from the medical record, if available. Participants were considered to have an elevated viral load if the HIV RNA was >200 copies/mL. A threshold of >200 copies/mL is defined as virologic failure by the AIDS Clinical Trials Group (ACTG) and the U.S. Department of Health and Human Services guidelines, and accounts for low level viremia due to isolated virologic blips or assay variability (Ribaudo, Lennox, & Currier, 2009). Following the six-month visit, medical records were reviewed at the site of enrollment to assess for participants' PMTCT care engagement. Data were extracted on dates of PMTCT visits, ART medication received at each visit, and notations of transfer to another clinic.

Primary outcome

The primary outcome was HIV care engagement at six months postpartum. Care engagement was characterized based upon the composition of three types of data: HIV RNA or viral load data, self-reported survey data, and medical record abstraction. Participants were defined to have poor care engagement, if they met one of two criteria: (1) HIV RNA was >200 copies/mL; or, if HIV RNA data was unavailable, (2) the participant self-reported to be out of care or not taking ARVs or the participant was lost to follow up (LTFU) by medical record review (i.e. at six months postpartum the participant had not attended clinic for >90 days and was not noted to have transferred to another clinic).

Covariates

The survey included participant self-report measures reflecting individual, inter-personal and facility constructs, and informed by prior research (Knettel et al., 2018). All measures were translated from English to Swahili, back-translated to English, and discussed to reach consensus on appropriate translations. The covariates used in this study were all measured at the baseline (pregnancy) time point.

Intrapersonal—At the intrapersonal level, demographic, pregnancy, HIV and mental health risk factors, and knowledge of PMTCT were assessed. Demographics included age, education level, and relationship status. Women reported history of prior pregnancy and the gestational age at which they first presented to antenatal care. Attitude toward the pregnancy was measured using eight items (e.g., "I feel happy about being pregnant"; α=0.91) (Speizer, Santelli, Afable-Munsuz, & Kendall, 2004). The timing of women's HIV diagnosis was dichotomized as either being a new diagnosis (i.e., the participant learned her HIV status during the index pregnancy) or being an established diagnosis (i.e., the participant knew her HIV status prior to presenting to ANC). Acceptance of one's HIV status was measured using the acceptance subscale of the Illness Cognition Questionnaire (ICQ; α=835) (Evers et al., 2001), and attitude toward ART was measured using the Beliefs About Medicines Questionnaire (BMQ; α=0.68) (Horne, Weinman, & Hankins, 1999). Depressive symptoms were measured with the Edinburgh Postnatal Depression Scale (EPDS; α=0.88) (Cox, Holden, & Sagovsky, 1987), and internalized feelings of shame and stigma regarding one's HIV status were measured using Scale A of the HIV and Abuse Related Shame Inventory (HARSI; α=0.86) (Neufeld, Sikkema, Lee, Kochman, & Hansen, 2012). To assess knowledge of PMTCT, women were asked seven questions that focused on: the length of time women should be on ART, the use and duration of prophylactic Nevirapine for the exposed child, and recommended breastfeeding practices.

Interpersonal level factors—Interpersonal factors included the partner's HIV status, HIV disclosure, two measures of perceived support, and experienced violence. Women self-reported their partner's HIV status and whether or not they had ever disclosed their HIV status to a person outside of the heath care workers directly involved in their antenatal and PMTCT care. Social support was measured using the Perceived Availability of Support Scale (PAS; α=0.82) (O'Brien, Wortman, Kessler, & Joseph, 1993), and support specifically from the father of the child was measured with the Norbeck Social Support Questionnaire (NSSQ; α=0.96) (Norbeck, Lindsey, & Carrieri, 1981). Additionally, women were asked whether or not they had ever experienced verbal, physical or sexual violence as an adult.

Facility related factors—Women reported where they initiated antenatal care (local clinic or hospital), the amount of time it typically took to travel to the clinic, and perceptions of quality of care. Perceived quality of care was measured using a version of the Patient-Provider Relationship Scale (PPRS; α=0.87), adapted for length and cultural context (Barry et al., 2012).

Data analysis

Descriptions of each risk factor of interest were presented using frequencies and proportions for binary variables or medians and interquartile ranges for continuous variables. Scaled measures were summed and analyzed as continuous variables; missing data were imputed with the mean of completed questions when the measure was at least 75% completed. The relative risk of the primary outcome was assessed for each risk factor using a log-binomial regression. In instances where this regression failed to converge, a Poisson regression with robust variance was used to approximate a log-binomial regression and the relative risk. A multivariable model was constructed using any variable that had a p-value   .10 in univariate

analysis; additionally, several variables were selected *a priori* based upon previous studies, including age, education, relationships status, and timing of HIV diagnosis (i.e., new vs. established diagnosis). As a secondary analysis, we examined stratified models, separating women who were diagnosed with HIV during the index pregnancy from those who were known to be living with HIV when they presented for ANC.

Results

Figure 1 illustrates the flowchart of study enrollment and follow-up. During the period of enrollment, 436 HIV-infected pregnant women attended ANC at the nine study clinics. Of note, of the 173 women who were not included in the cohort, 46 (26.6%) did not initiate ART and would not have been eligible for the study, and 42 (24.2%) became lost to follow-up (LTFU) from the clinic prior to 6 months postpartum.

For the 200 women enrolled in the cohort, six-month follow up was completed for 188 (94.0%), with 179 of these surveys completed in person and 9 done via an abbreviated phone survey. Viral load results were available from 181 participants, with most (n=124) taken by the study staff and 57 abstracted from the medical records. Medical record review was completed for all 200 participants.

Participants had a median age of 30 years, and the majority (58%) did not have education beyond primary school (Table 1). Most participants (69%) lived with a partner, and most (78%) reported that this was their first pregnancy. The sample was fairly evenly split between women who were newly diagnosed during the index pregnancy (n=94) and women who entered ANC already knowing their HIV status (n=106).

Six months after delivery, 42/200 (21%) of participants were considered to have poor care engagement. Of the 182 participants with measured viral loads, 107 (59%) had undetectable viral load, 47 (26%) had HIV RNA levels < 200, 6 (3%) had HIV RNA levels between 200 and 1000, and 22 (12%) had HIV RNA levels > 1,000. For the 18 participants without HIV RNA data, 14 (78%) were considered LTFU in the medical record review and/or reported to the study team that they had stopped attending their HIV appointments or stopped taking their ART. Disaggregated outcomes for HIV RNA, medical record review, and self-reported care engagement at 6 months are presented in Supplemental Table 1.

In a multivariable risk factor analysis for the full cohort of 200 women, age and disclosure of HIV status were independently associated with postpartum care engagement (Table 2). When controlling for other factors, younger women were more likely to have poor postpartum care engagement; with each year of increased age, women were 7% less likely to have poor care engagement (aRR: 0.93; 95% CI: 0.89, 0.97). Additionally, women who had told at least one person about their HIV status were 47% less likely to have poor care engagement (aRR: .53; 95% CI: 0.29, 0.97). Reporting higher levels of social support from a partner was associated with less likelihood of poor care engagement in univariate analysis (cRR: 0.96; 95% CI: 0.93, 0.99), but was no longer a significant predictor in multivariate analysis (aRR: 0.98; 95% CI: 0.94, 1.02).

For women who were known to be living with HIV at the time they became pregnant, those who were pregnant for the first time had 4.16 times the risk of poor care engagement (aRR: 4.16; 95% CI: 1.53, 11.28) (Table 3). For women with a new diagnosis of HIV, age was the only independent predictor of care engagement. Similar to the full cohort, women who were younger were more likely to have poor care engagement; women were 8% less likely to have poor care engagement with each year of increased age (aRR: 0.92; 95% CI: 0.86, 0.98).

Discussion

This prospective cohort study of 200 HIV-infected pregnant women receiving PMTCT services in the Kilimanjaro region of Tanzania found that about one-fifth of patients had indicators of poor HIV care engagement by six months after delivery. Women who were younger and had not disclosed their HIV status were more likely to have poor care engagement. Among women entering PMTCT with established HIV diagnoses, those presenting during their first pregnancy were at higher risk for poor care engagement than those who had been pregnant previously.

The findings of postpartum care engagement in this study are consistent with previous findings from a meta-analysis of PMTCT studies during the Option B+ era, which found that among women who attended PMTCT beyond the first appointment, 20.6% of participants were LTFU by six months (Knettel et al., 2018). While most previous studies relied on medical record review alone, and were thus limited by the quality of the record keeping, this study used a biological marker of viral load combined with self-report and medical record data. The use of a biomarker also provides an indicator of adherence to medication. Future studies should consider adding biological markers of medication adherence using dried blood spot or hair samples (Alcaide et al., 2017); currently, this technology is not available in most LMICs, but its successful use in research may lead to future uptake in health systems to monitor adherence.

The levels of care engagement found in this study should be considered in context of the UNAIDS 90-90-90 goal, which sets a target that 90% of individuals on ART be virally suppressed (UNAIDS, 2014). In this cohort, among women who had a viral load measurement, 85% were virally suppressed (HIV RNA 200). While pregnant and postpartum women face unique challenges to HIV care engagement, they also share characteristics with individuals who initiate ART in a test-and-treat framework; namely, they are typically tested and enrolled in lifelong HIV treatment soon after diagnosis, without experiencing symptoms, and with varying degrees of autonomy and voice about whether they can refuse treatment. As a result, women may have little time to accept the weight of their HIV diagnosis and make a personal, values-driven commitment to long-term treatment. As Tanzania rolls out its new policy for universal test-and-treat for all individuals diagnosed with HIV (National AIDS Control Programme, 2017), consideration should be given for sharing lessons and implementation strategies from the PMTCT setting to support ART initiation and retention in the general population, and vice versa. Supporting long-term care engagement requires differentiated models of care that identify individuals at elevated risk of poor care engagement and target services and support to those individuals (Grimsrud et al., 2016).

Consistent with previous research, younger age was a significant risk factor for poor care engagement (Erlwanger et al., 2017; Mitiku, Arefayne, Mesfin, & Gizaw, 2016; Musomba et al., 2017; Tweya et al., 2014). Contextually, in Tanzania and the Kilimanjaro region specifically, young pregnant women who are new mothers typically have significant involvement from their partner's family (Urassa, Pembe, & Sunguya, 2009). This level of oversight by in-laws may provide additional support to a woman, but at the same time may make it difficult for her to discretely engage with PMTCT services and receive HIV care without disclosing her serostatus. Qualitative research has identified additional barriers to PMTCT care engagement that may be more common with younger age, including instability in romantic relationships (Buregyeya et al., 2017; Cataldo et al., 2017; Napúa et al., 2016), difficulty in accepting one's HIV status (Atanga et al., 2017; Clouse et al., 2014; Flax et al., 2017; Katirayi et al., 2016; McLean et al., 2017), and fear of beginning a lifelong treatment regimen (Buregyeya et al., 2017; Gill et al., 2017; Katirayi et al., 2016). This may be explained in part by greater feelings of shame and perceived stigma among younger individuals living with HIV (Enane, Vreeman, & Foster, 2018; Hosek, Harper, & Domanico, 2005). Efforts to support younger women in PMTCT care engagement should consider ways to strength their social support networks, either by engaging their existing supporters in HIV care or by adding external peer supporters, such as other young women with HIV who are living healthy lives and fulfilling their social and familial roles.

HIV disclosure has been identified in the literature as a persistent determinant of long-term HIV care engagement, which was confirmed by our data. Non-disclosure of HIV to partners, family members, and close friends can create or perpetuate substantial barriers to attending the clinic, and can make it difficult to take pills consistently and on time (Bernier et al., 2018; King et al., 2008). Decisions not to disclose are often driven by legitimate fears of violence, abandonment, and stigma, especially from an intimate partner (Lugalla, Yoder, Sigalla, & Madihi, 2012; Shamu, Zarowsky, Shefer, Temmerman, & Abrahams, 2014). However, women who do disclose their status typically report improved care engagement and a variety of other positive outcomes, including improvements in mental health and reductions in sexual risk behaviors. To support HIV disclosures, there is a need for evidence-based and culturally-informed interventions that assist pregnant women in making decisions about HIV disclosures (Naigino et al., 2017; Spangler, Onono, Bukusi, Cohen, & Turan, 2014). These may include models that utilize peer support or couples HIV testing and counseling to improve communication about HIV and facilitate healthy disclosures (Turan et al., 2018). Additionally, interventions should seek to address HIV stigma, both in the form of improving HIV acceptance among infected women and reducing broader community misunderstanding and mistreatment of people living with HIV.

As test-and-treat programs become the standard of care in HIV, women are increasingly entering antenatal care knowing their HIV status and already initiated on ART. Pregnancy, and the entry into PMTCT, can provide an opportunity to reassess and support HIV care engagement. Among women entering care with an established HIV diagnosis, being pregnant for the first time was a risk factor for poor care engagement. Pregnancy, childbirth, and the experience of being a new mother all introduce new and unique challenges to HIV care engagement which must be reconciled, even with a known HIV status (Cichowitz, Watt, & Mmbaga, 2018; Psaros, Remmert, Bangsberg, Safren, & Smit, 2015).

The strengths of this study include the prospective design, triangulation of multiple sources of data, and excellent follow-up with study participants, with all 200 cohort women retained in the final analysis. At the same time, the close tracking methods used to retain our cohort, including reminder calls and home visits if necessary, likely contributed to improved retention in care over time. Further, the study was limited in that it enrolled women only after they had been prescribed ART for over one month. Women who did not initiate PMTCT were excluded from participation, and the women who did not return to the clinic after being prescribed ART were unlikely to be enrolled. This recruitment strategy over-estimated the true postpartum care engagement at the study clinics and was not able to identify factors associated with failure to initiate PMTCT. Additionally, the study may have been under-powered to detect differences in outcomes, particularly in the stratified analysis, and may have led to overfitting of the final models. Finally, it is possible that using a viral load measure as a marker of care engagement may have misclassified participants, as the presence of resistant strains of HIV (either through acquired or transmitted drug resistance) may lead to a suboptimal response to ART, even when taken as prescribed, and subsequent virologic failure. Despite these limitations, HIV viral load is considered the most important indicator of response to ART, and is the preferred monitoring approach to diagnose and confirm treatment failure. Given the limitations of self-report and medical record data, using viral load as a proxy for treatment adherence and retention in care is considered standard practice (HIV Surrogate Marker Collaborative Group, 2000).

A comprehensive PMTCT program is an essential component of achieving the goal of an AIDS-free generation (Fauci & Folkers, 2012). PMTCT programs should have effective monitoring, including regular viral load measurement, and support for long-term care engagement with appropriate clinic support. Differentiated models of care that recognize and respond to the unique needs of women with new and established diagnoses, first time mothers, and young women, are essential components of a PMTCT program. Quality counseling that is based on a patient-centered care framework (Epstein & Street, 2011) is essential to help women make decisions about HIV disclosure and identify and address the barriers to long-term care engagement that they may face during pregnancy, breastfeeding, and beyond the postpartum period.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

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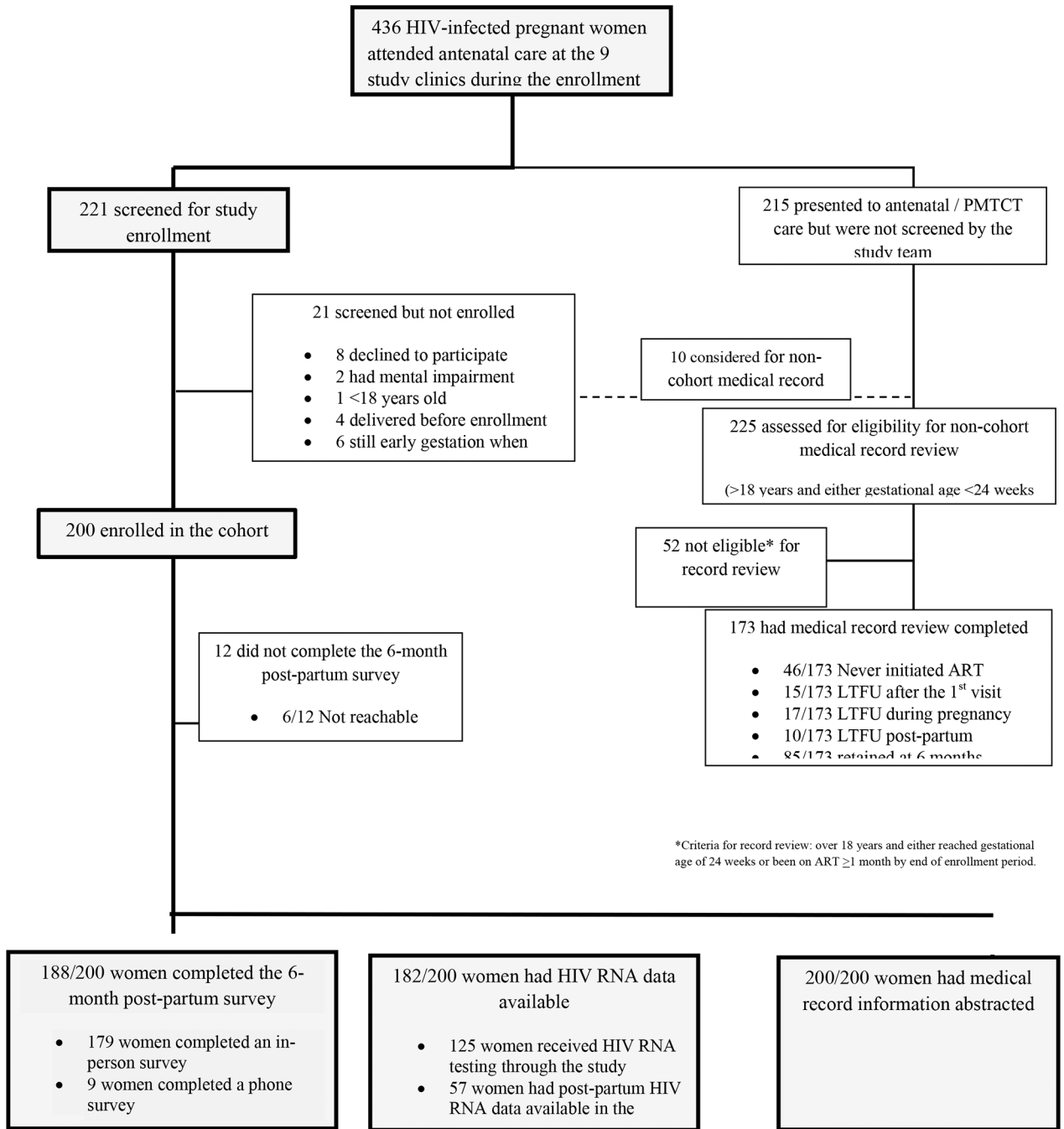
Figure 1:
Study enrollment

Table 1:

Baseline Participant characteristics

Intrapersonal factors	Good care engagement (n = 157)	Poor care engagement (n = 43)	Total (n = 200)
	Median (Q1, Q3) or # (%)		
Demographics			
Age	31.0 (26.0, 36.0)	28.0 (23.0, 32.0)	30.0 (25.0, 35.0)
Education - started secondary or higher	65 (41%)	18 (43%)	83 (42%)
Relationship - lives alone or no partner	46 (29%)	16 (38%)	62 (31%)
Pregnancy			
First pregnancy	30 (19%)	14 (33%)	44 (22%)
Gestational age > 24 weeks at initiation of ANC	29 (18%)	8 (19%)	37 (19%)
Attitude toward pregnancy scale [range: 0–24; high score ~ better attitudes]	16.0 (11.0, 19.0)	16.0 (12.0, 19.0)	16.0 (11.7, 19.0)
HIV			
Diagnosed with HIV during index pregnancy	71 (45%)	23 (55%)	94 (47%)
Acceptance of HIV - ICQ scale [range: 6–24; high score ~ more acceptance]	18.0 (15.0, 20.0)	18.0 (15.0, 20.0)	18.0 (15.0, 20.0)
Attitude toward ART - BMQ scale [range: 10 – 50; high score ~ better attitude]	34.0 (32.0, 36.0)	36.0 (33.0, 37.0)	34.0 (32.0, 37.0)
Knowledge of Option B+ [range 0–5; high score ~ less knowledge]	2.0 (0.0, 2.0)	1.0 (0.0, 2.0)	2.0 (0.0, 2.0)
Mental Health			
Depression - EPDS scale [range 0–30; high score ~ more depression]	5.0 (2.0, 9.0)	5.5 (2.0, 10.0)	5.0 (2.0, 9.5)
Shame – HARSI [range: 0–52; high score ~ more shame]	16.0 (12.0, 24.0)	16.5 (15.0, 30.0)	16.0 (12.0, 25.0)
Interpersonal factors			
Partner is HIV-infected	53 (34%)	8 (19%)	61 (30%)
HIV Disclosure - has told someone	131 (83%)	28 (67%)	159 (80%)
Experienced interpersonal violence as an adult	32 (20%)	10 (24%)	42 (21%)
Perceived social support - PAS Scale [range: 8–40; high score ~ more support]	29.0 (24.0, 34.0)	28.0 (24.0, 34.0)	29.0 (24.0, 34.0)
Partner support - NSSQ Scale [range: 7–35; high score ~ more support]	25.0 (18.0, 30.0)	21.0 (10.0, 27.0)	24.0 (16.0, 30.0)
Facility related factors			
Received care at a local clinic (vs. hospital)	100 (63%)	28 (67%)	128 (64%)
Travel time to clinic (minutes)	30.0 (30.0, 60.0)	30.0 (15.0, 60.0)	30.0 (30.0, 60.0)
Perceptions of quality of care – PPRS Scale [range: 12–48; high score ~ better quality]	37.0 (33.0, 41.0)	37.5 (33.0, 42.0)	37.0 (33.0, 41.0)

NOTE: Full data was available for all measures except: gestational age (1 response missing), NSSQ Scale (1 response missing), and PPRS Scale (2 responses missing).

Table 2:

Factors associated with poor PMTCT care engagement at six months postpartum (n = 198)

	Unadjusted relative risk (95% CI)	Adjusted relative risk (95% CI)
Intrapersonal		
Demographics		
Age	0.93 (0.89, 0.97) **	0.93 (0.89, 0.98) **
Education - started secondary or higher [ref: completed primary or less]	1.06 (0.61, 1.82)	0.76 (0.42, 1.38)
Relationship - lives alone or no partner [ref: lives with a partner]	1.37 (0.79, 2.36)	0.68 (0.34, 1.35)
Pregnancy		
First pregnancy [ref: prior pregnancy]	1.77 (1.03, 3.06) *	1.16 (0.55, 2.44)
Gestational age > 24 weeks at initiation of ANC [ref: <= 24 weeks]	1.03 (0.52, 2.04)	0.90 (0.45, 1.82)
Attitude toward pregnancy [range: 0–24; high score ~ better attitudes]	1.01 (0.96, 1.06)	
HIV		
Diagnosed with HIV index pregnancy [ref: established diagnosis]	1.37 (0.80, 2.34)	0.91 (0.50, 1.68)
Acceptance of HIV - ICQ scale [range: 6–24; high score ~ more acceptance]	1.03 (0.96, 1.12)	
Attitude toward ART - BMQ scale [range: 10 – 50; high score ~ better attitude]	1.05 (0.98, 1.12)	
Knowledge of Option B+ [range 0–5; high score ~ less knowledge]	1.03 (0.84, 1.27)	
Mental Health		
Depression - EPDS scale [range 0–30; high score ~ more depression]	1.00 (0.96, 1.05)	
Shame - HARSI [range: 0–52; high score ~ more shame]	1.02 (0.99, 1.04)	
Interpersonal		
Partner is HIV-infected [ref: partner negative or unknown]	0.54 (0.26, 1.09) ‡	0.80 (0.38, 1.71)
HIV Disclosure - has told someone [ref: has not told anyone]	0.52 (0.30, 0.89) *	0.53 (0.29, 0.97) *
Experienced any violence as an adult [ref: no violence experienced]	1.18 (0.63, 2.19)	
Perceived social support - PAS Scale [range: 8–40; high score ~ more support]	1.00 (0.96, 1.04)	
Partner support - NSSQ Scale [range: 7–35; high score ~ more support]	0.96 (0.93, 0.99) *	0.98 (0.94, 1.02)
Facility Related		
Local clinic [ref: hospital]	1.12 (0.63, 2.00)	
Travel time to clinic (minutes)	1.00 (1.00, 1.01)	
Perceptions of quality of care – PPRS Scale [range: 12–48; high score ~ better quality]	1.03 (0.97, 1.09)	

‡p<.10

*
p<.05

**
p<.01

***
p<.001

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Table 3:

Risk factors for poor care engagement, stratified by the timing of the HIV diagnosis

	Established diagnosis (n = 105)	
	Unadjusted relative risk (95% CI)	Adjusted relative risk (95% CI)
Intrapersonal		
Demographics		
Age	0.92 (0.86, 0.98) *	0.98 (0.91, 1.05)
Education - started secondary or higher [ref: completed primary or less]	1.75 (0.78, 3.92)	1.12 (0.44, 2.84)
Relationship - lives alone or no partner [ref: lives with a partner]	1.76 (0.76, 4.11)	0.51 (0.16, 1.70)
Pregnancy		
First pregnancy [ref: prior pregnancy]	4.57 (2.24, 9.32) ***	4.16 (1.53, 11.28) **
Gestational age > 24 weeks at initiation of ANC [ref: <= 24 weeks]	0.91 (0.29, 2.79)	
Attitude toward pregnancy [range: 0–24; high score ~ better attitudes]	0.99 (0.92, 1.06)	
HIV		
Acceptance of HIV - ICQ scale [range: 6–24; high score ~ more acceptance]	1.01 (0.88, 1.16)	
Attitude toward ART - BMQ scale [range: 10 – 50; high score ~ better attitude]	1.06 (0.97, 1.17)	
Knowledge of Option B+ [range 0–5; high score ~ less knowledge]	1.15 (0.86, 1.55)	
Mental Health		
Depression - EPDS scale [range 0–30; high score ~ more depression]	1.01 (0.94, 1.07)	
Shame - HARSI [range: 0–52; high score ~ more shame]	1.01 (0.96, 1.05)	
Interpersonal		
Partner is HIV-infected [ref: partner negative or unknown]	0.48 (0.19, 1.25)	
HIV Disclosure - has told someone [ref: has not told anyone]	0.38 (0.14, 0.99) *	0.46 (0.17, 1.26)
Experienced any violence as an adult [ref: no violence experienced]	1.29 (0.52, 3.20)	
Perceived social support - PAS Scale [range: 8–40; high score ~ more support]	1.02 (0.96, 1.09)	
Partner support - NSSQ Scale [range: 7–35; high score ~ more support]	0.96 (0.91, 1.00) ‡	0.98 (0.93, 1.03)
Facility Level		
Local clinic [ref: hospital]	1.12 (0.48, 2.62)	
Travel time to clinic (minutes)	1.00 (0.98, 1.01)	
Perceptions of quality of care – PPRS Scale [range: 12–48; high score ~ better quality]	1.01 (0.92, 1.11)	

Diagnosed with HIV during index pregnancy (n = 93)

	Unadjusted relative risk (95% CI)	Adjusted relative risk (95% CI)
Intrapersonal		
Demographics		
Age	0.95 (0.88, 1.01)	0.92 (0.86, 0.98) *
Education - started secondary or higher [ref: completed primary or less]	0.64 (0.31, 1.34)	0.64 (0.31, 1.35)
Relationship - lives alone or no partner [ref: lives with a partner]	1.04 (0.51, 2.12)	1.11 (0.54, 2.30)
Pregnancy		
First pregnancy [ref: prior pregnancy]	0.85 (0.39, 1.85)	0.63 (0.26, 1.49)
Gestational age > 24 weeks at initiation of ANC [ref: <= 24 weeks]	1.10 (0.47, 2.57)	0.93 (0.39, 2.23)
Attitude toward pregnancy [range: 0–24; high score ~ better attitudes]	1.01 (0.94, 1.09)	
HIV		
Acceptance of HIV - ICQ scale [range: 6–24; high score ~ more acceptance]	1.06 (0.96, 1.17)	
Attitude toward ART - BMQ scale [range: 10 – 50; high score ~ better attitude]	1.04 (0.96, 1.13)	
Knowledge of Option B+ [range 0–5; high score ~ less knowledge]	0.94 (0.70, 1.25)	
Mental Health		
Depression - EPDS scale [range 0–30; high score ~ more depression]	1.00 (0.95, 1.06)	
Shame - HARSI [range: 0–52; high score ~ more shame]	1.02 (0.99, 1.06)	
Interpersonal		
Partner is HIV-infected [ref: partner negative or unknown]	0.73 (0.25, 2.17)	
HIV Disclosure - has told someone [ref: has not told anyone]	0.62 (0.31, 1.25)	
Experienced any violence as an adult [ref: no violence experienced]	1.10 (0.47, 2.57)	
Perceived social support - PAS Scale [range: 8–40; high score ~ more support]	0.99 (0.94, 1.03)	
Partner support - NSSQ Scale [range: 7–35; high score ~ more support]	0.97 (0.93, 1.01)	
Facility Level		
Local clinic [ref: hospital]	1.07 (0.49, 2.33)	
Travel time to clinic (minutes)	1.00 (1.00, 1.01)	
Perceptions of quality of care - PPRS Scale [range: 12–48; high score ~ better quality]	1.04 (0.96, 1.11)	

† p<.10

* p<.05

** p<.01

*** p<.001