Retention in HIV Care During Pregnancy and the Postpartum Period in the Option B+ Era: Systematic Review and Meta-Analysis of Studies in Africa

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Background: Under Option B+ guidelines for prevention of mother-to-child transmission of HIV, pregnant and breastfeeding women initiate antiretroviral therapy for lifelong use. The objectives of this study were: (1) to synthesize data on retention in care over time in option B+ programs in Africa, and (2) to identify factors associated with retention in care.

Methods: PubMed, EMBASE, and African Index Medicus were systematically searched from January 2012 to June 2017. Pooled estimates of the proportion of women retained were generated and factors associated with retention were analyzed thematically.

Results: Thirty-five articles were included in the final review; 22 reported retention rates (n = 60,890) and 25 reported factors associated with retention. Pooled estimates of retention were 72.9% (95% confidence interval: 66.4% to 78.9%) at 6 months for studies reporting <12 months of follow-up and 76.4% (95% confidence interval: 69.0% to 83.1%) at 12 months for studies reporting ≥12 months of follow-up. Data on undocumented clinic transfers were largely absent. Risk factors for poor retention included younger age, initiating antiretroviral therapy on the same day as diagnosis, initiating during pregnancy versus breastfeeding, and initiating late in the pregnancy. Retention was compromised by stigma, fear of disclosure, and lack of social support.

Conclusions: Retention rates in prevention of mother-to-child transmission under option B+ were below those of the general adult population, necessitating interventions targeting the complex circumstances of women initiating care under option B+. Improved and standardized procedures to track and report retention are needed to accurately represent care engagement and capture undocumented transfers within the health system.

Key Words: antiretroviral therapy (ART), HIV/AIDS, loss to follow-up, option B+, prevention of mother-to-child transmission (PMTCT), retention in care

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Since the United Nations Millennium Declaration in 2000, great gains have been made in addressing the global HIV pandemic. Coordinated scale-up of antiretroviral medications worldwide has contributed to increases in life expectancy and declines in AIDS-related deaths.[1,2] One important area of progress in the fight against HIV is the widespread reduction in vertical transmission from mothers to children, contributing to a 58% decline globally in new pediatric infections and a 40% reduction in childhood HIV mortality between 2002 and 2013.[3]

A key development in the prevention of mother-to-child transmission (PMTCT) has been the implementation of option B+, a World Health Organization–supported protocol aimed at providing access to lifelong antiretroviral therapy (ART) for all HIV-positive pregnant and breastfeeding women.[4,5] Because of historical barriers in access to ART and lack of evidence demonstrating their long-term safety, previous iterations of PMTCT guidelines known as Option A and Option B offered temporary ART during pregnancy with additional eligibility based on CD4 count.[6] However, once the evidence for treatment-as-prevention was established and ART became more consistently available in areas of high HIV prevalence, option B+ has become a preferred choice. The Option B+ approach was first initiated in Malawi in 2011 and has since expanded to most of Sub-Saharan Africa.[5,7]

Option B+ programs hold great promise for preventing transmission of HIV and moving toward an "AIDS-free generation."[8] At the same time, there have been concerns about implementation challenges, particularly with retention in care and adherence to ART in the prenatal and postpartum periods.[9–12] The periods before and after childbirth are a crucial window for ART retention when women may disengage from care and drop off the HIV treatment cascade, contributing to disease progression, increased risk of transmission, and potential drug resistance.[13–15]

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Retention in HIV care is a concern for all people living with HIV; multiple studies have documented a complex combination of social, practical, and intrapersonal stressors affecting retention rates.[16–19] These include challenges in accessing care, anticipated or enacted stigma, conflicts with other responsibilities, and dissatisfaction with care.[18,19] For pregnant women, these same stressors are further complicated by the unique challenges associated with pregnancy, childbirth, and caring for a young child.[15,20] The defining characteristic of option B+ is starting and maintaining all pregnant and postpartum women on lifelong ART, which is intended to simplify treatment frameworks and eliminate inequities in treatment. However, concerns have been raised that this "one size fits all" approach removes decision-making about care from the patient. Perceived inflexibility in treatment options and timing may cause those who are not ready to start lifelong medication to drop out of care.[21,22] Studies examining women's initiation and retention in care both before and after the rollout of option B+ have validated these concerns, showing lower rates of initiation and retention after B+ was implemented.[11,23,24] Thus, there is an urgent need to understand the implementation and maintenance of lifelong ART in low-resource settings and to identify opportunities to improve women's care engagement in the pregnancy and postpartum periods.

The goal of this systematic review was to identify, systematize, and summarize the existing data on initiation and retention in care after starting lifelong ART (option B+) for pregnant and postpartum women in Africa. Specifically, the review was guided by 2 study aims: (1) to summarize the proportion of HIV-infected pregnant women initiating and retained in HIV care and option B+ programs at various time points after starting lifelong ART, and (2) to identify the factors associated with retention in HIV care and loss to follow-up under option B+.

METHODS

The review was conducted following Preferred Reporting Items for Systematic Reviews guidelines.[25] For aim 1, studies were included if they reported patient-level data on retention in care among pregnant or postpartum women who received care under the clinical conditions of option B+ (ie, lifetime initiation of ART during pregnancy or breastfeeding) in an African country. Studies using modeling estimates as opposed to actual patient data were excluded. For aim 2, studies were included if they explored factors associated with retention under the clinical conditions of option B+, including both quantitative and qualitative study designs.

Given the timeline of the implementation of option B+ (first adopted by Malawi in late 2011), only studies published after January 2012 were included. Studies published after this date using data collected both before and after the implementation of option B+ were included only if data were stratified and described estimates of retention both before and after implementation. Where multiple articles described a single cohort, only the article with the most complete data or longest follow-up period was included. Studies were excluded if participants were recruited specifically from high-risk or "key" populations (eg, injection drug users, prisoners, sex workers, and cohorts with low CD4 counts). For studies describing an intervention aimed specifically at improving retention, only data from the comparison or "standard of care" group were included in analyses. The review is registered in the International Prospective Register of Systematic Reviews (PROSPERO; CRD42017058961).[26]

Search Strategy

The search strategy was designed in consultation with information specialists from the Duke University Libraries and completed through an iterative process to assess the inclusiveness of the search and the relevancy of the articles being retrieved. We used 3 databases: PubMed, EMBASE, and the African Index Medicus (AIM), which were searched on February 15, 2017, and June 15, 2017. We used standardized search terms and key words related to the constructs of (1) HIV or AIDS, (2) option B+, universal "test and treat," or lifelong ART, (3) pregnancy or the postpartum period, and (4) Africa or any African nation. When available, controlled vocabulary was used to capture broader categories related to the search terms, indexed by the databases (eg, PubMed Medical Subject Headings, or MeSH). The specific search terms used for the PubMed database are detailed in Supplemental Digital Content Appendix A, http://links.lww.com/QAI/B103. and were similar for the other included databases.

Similar to a previous review on retention in HIV care,[16] we also screened abstracts from the International AIDS Society Conference and the Conference on Retroviruses and Opportunistic Infection during the study period of 2012–2017. Conference abstracts related to retention in option B+ were compared with results from the database searches to ensure that relevant published articles derived from the abstracts had been captured. Because this review summarized an observed proportion of women retained and not a specific intervention outcome, we believe the potential for publication bias to be low because authors were likely to publish full articles for cohorts with either high or low retention. Therefore, we chose to exclude the gray literature from the review to maintain the quality control achieved by journals' peer review process.

Study Selection and Data Abstraction

Titles and abstracts of studies retrieved were screened independently by 2 review authors using the Covidence online platform[27] to identify studies that potentially met inclusion criteria. The full text of positively screened studies was then reviewed and independently assessed for final eligibility by 2 individuals. Disagreement between reviewers on the initial screening or final eligibility of studies was resolved through discussion with a third individual. To record data from eligible studies, a standardized data abstraction form was developed and 2 individuals independently extracted the data for the primary research questions. Extracted information also included the study setting, population, participant demographics, study design and methodology, definitions of key variables, and timing of measurement.

Data Analysis

Aim 1: Estimates of Retention in Care

Data for aim 1 included the proportion of participants retained in HIV care for each study and, when available, the proportion of participants who were lost to follow-up (LTFU), died, known to have transferred, or known to have stopped treatment at each time point. Patients who were noted as attending appointments (or meeting other, study-defined criteria for retention in care) but not adhering to some other aspect of their care (eg, taking medication) were considered retained. Participants who were documented as having transferred care were considered retained in care.

We reviewed articles for retention and abstracted data at every time point reported in each study, rounded to the nearest 3-month interval. In this manner, the studies included retention rates at the first PMTCT follow-up appointment (which was used as a measure of care initiation) and 3, 6, 9, 12, 24, 36, and 48 months after ART initiation. In instances where retention was reported at multiple time points, but data on deaths or transfers were included only for the final time point, these numbers were imputed linearly to earlier time points. In all the included studies, time points for retention were measured from the date of initiation on ART, not from the date of childbirth.

Retention data were synthesized in a meta-analysis stratified by the final time reported in the original studies ($<$12 months and $\geq$12 months) to assess the impact of the duration of follow-up time on reported retention.[16] The data were first transformed using the Freeman and Tukey arcsine transformation,[28] and then pooled estimates of retention were generated using a random-effects regression to account for the large heterogeneity across included studies.[16] Each estimate of retention and its 95% confidence interval (CI) is presented on a forest plot along with the overall pooled estimate for retention; the I^2 statistic is presented to describe heterogeneity.

Finally, we use a lifetable analysis to present cumulative retention estimates across time for individuals who remained in care after the first appointment. Individuals were censored at the time of transfer or termination of study and were considered to have the event of interest if they died or were LTFU. A combined outcome of LTFU and/or death was used because these 2 events may be related; it is possible that those who died during follow-up had lower rates of care engagement and subsequent progression of disease. Overall, death was infrequent (n = 582) compared with LTFU (n = 15,794). Individuals were categorized as LTFU if they were reported in the original study to be LTFU or known to have stopped ART. Unavailable data were linearly interpolated. No CIs are reported for the lifetable analysis because the sample size would generate inappropriately small intervals based on several large studies.

Aim 2: Factors Associated With Retention

For aim 2, we abstracted variables that were found to significantly predict retention or loss to follow-up in HIV care. For qualitative results, we abstracted themes related to risk or protective factors for retention in care. Using the abstracted results of all studies that examined factors associated with retention, we used thematic analysis to synthesize the data and identify common themes in the findings.[29] We present a narrative review of both the quantitative and qualitative data.

RESULTS

Search Results

The first search was conducted on February 15, 2017, and yielded 441 results from PubMed, 288 from Embase, and 43 from AIM. We removed all studies published before 2012 and all redundant results (ie, studies found in more than one database) to obtain our initial list of 404 studies to be screened. On completion of the initial review, we re-ran the searches on June 15, 2017, and obtained 91 new studies not included in the initial search (45 from PubMed, 38 from Embase, and 8 from AIM), nearly all of which were newly published. In total, 495 studies were screened for inclusion.

Study Screening and Data Abstraction

Of the 495 articles screened using the title and abstract, 79 were retained for full-text review (Fig. 1). The most common reasons for exclusion at this stage were: no measure of retention in care, data collected before the implementation of option B+, and study site outside Africa. Among the 79 full-text articles reviewed, 35 were ultimately retained. Of these, 22 studies contained data for aim 1 (rates of retention), and 25 contained data for aim 2 (factors associated with retention). Twelve studies contributed data to both aims. Forty-four studies were excluded at this stage. Reasons for exclusion included inadequate data, conference abstracts or incomplete research articles, data collected before option B+ was implemented, and articles that did not include original data (eg, modeling articles and study protocols).

Aim 1: Estimates of Retention in Care

The 22 included studies for aim 1 included 60,890 women and were conducted in 8 African nations: Malawi (11), Zimbabwe (3), Mozambique (2), Uganda (2), Cameroon, Ethiopia, Nigeria, and South Africa. Sample sizes varied widely, from 50 in a small pilot study to 29,313 in one large database review. The earliest study began data collection in Malawi in late 2011 and the most recent finished data collection in late 2016. Studies conducted in the same nation were typically geographically distinct from one another, although 3 studies used national databases in Malawi (2) and Mozambique. Twelve studies included women enrolled in option B+ during both pregnancy and breastfeeding, whereas 10 enrolled only pregnant women. Definitions of retention in care were largely consistent, requiring patients to have attended a clinic appointment within the last 90 days, although a small number of studies used longer or shorter windows or did not include a definition. Several studies included data only for the participants retained and/or LTFU

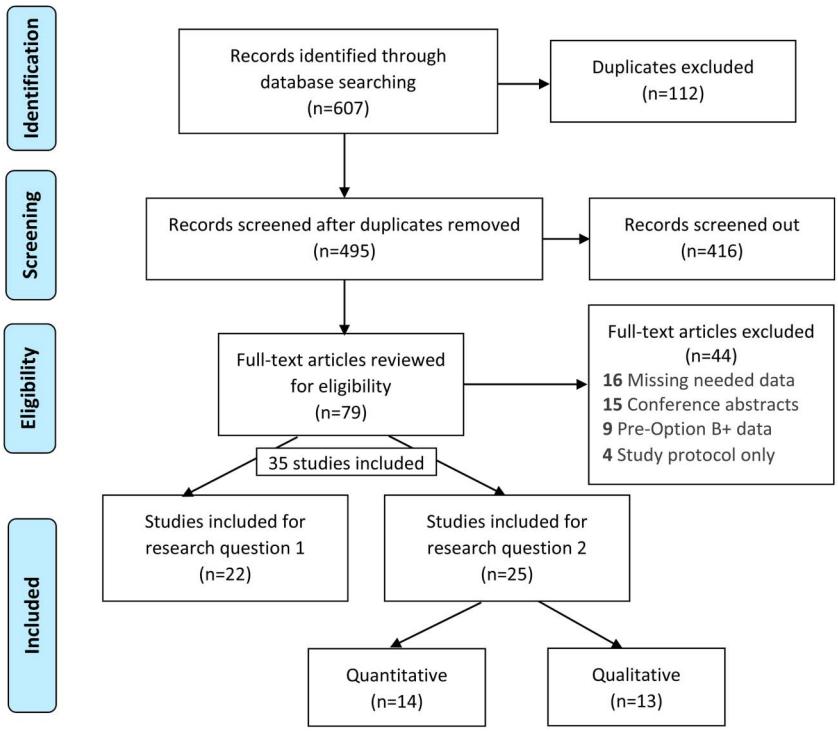


FIGURE 1. Study flowchart.

and did not provide information on those who had died or were known to have transferred their care to another facility.

Table 1 summarizes reported retention in care from the time of ART initiation. Retention in care after the first appointment and at 6 and 12 months after initiation were the most commonly reported time periods. Across the individual studies, there was considerable variability in the timing and frequency with which retention was measured. Even so, most of the studies reported significant LTFU within the first 6 months after initiation of ART, including immediately after the first appointment. Retention ranged from 56% to 97% after the first visit and from 47% to 88% 6 months after ART initiation.

Results of the data synthesis and meta-analysis are presented in Figure 2. Pooled estimates of retention in care were 72.9% (95% CI: 66.4% to 78.9%) at 6 months for studies reporting $<$12 months of follow-up and 76.4% (95% CI: 69.0% to 83.1%) at 12 months for studies reporting $\geq$12 months of follow-up. The cohorts with longer follow-up times demonstrated higher retention at earlier time points, and the heterogeneity was significant across both set of studies ($I^2 > 97\%$).

Figure 3 displays the pooled retention estimates over time using lifetable analysis. Retention for those who remained in care after the first appointment (n = 59,427/60,890) was estimated to be 89.9%, 79.4%, 74.5%, and 69.3% at 3, 6, 12, and 24 months after ART initiation, respectively.

Aim 2: Factors Associated With Retention in Care

The geographic distribution of the 25 studies included for aim 2 were similar to aim 1, with Malawi the most represented (13 studies), followed by Uganda (4), Zimbabwe (3), Mozambique (2), Cameroon, Ethiopia, Rwanda, South Africa, and Tanzania. Of these studies, 15 enrolled participants during both pregnancy and breastfeeding, whereas 7 enrolled only pregnant women and 3 enrolled only breastfeeding women.

Among 14 studies with quantitative data, common risk factors for lower retention in care included lower age, which was observed in 9 studies, and time of ART initiation. Risk of lower retention was observed among women who initiated ART on the same day as diagnosis (6 studies), initiated during pregnancy versus breastfeeding (4 studies), and initiated late in the pregnancy (3 studies). Three studies identified lack of social support as a risk factor and 3 studies noted clinic-level factors, with lower retention at larger, urban, public hospitals as compared to smaller, rural, private facilities.

Among 13 studies with qualitative data, similar themes emerged. Nearly all the studies reported themes related to stigma, fear of disclosure or others learning about their status, and the impact of social discrimination. Several other themes were present in most of the studies, including patients' denial of their HIV status, fear of ART side effects, poor counseling leading to lack of HIV knowledge, and logistical barriers to care including finances, transportation, and time commitment. Several studies discussed barriers to care related to partner support, often including fear of violence or abandonment, feeling intimidated by the prospect of lifelong treatment, and negative experiences with treatment providers. In the 8 studies that included themes related to facilitators of care engagement, nearly all contained themes related to the desire to prevent transmission to the baby, desire to maintain one's own health, and benefitting from the support of others

TABLE 1. Rates of Retention in HIV Care Among Pregnant and Postpartum Women

			Percent Retained (%)							
Study	**Nation**	**N**	**1st Appt**	**3 mo**	**6 mo**	**9 mo**	**12 mo**	**24 mo**	**36 mo**	**48 mo**
Atanga et al[52]	Cameroon	277	92	88	85		77			
Auld et al[23]	Mozambique	14,397			69					
Chan et al[53]	Malawi	813	56	48	47					
Dzangare et al[34]	Zimbabwe	148	93		77					
Ford et al[48]	Zimbabwe	386	97	92	86		85			
Haas et al[54]	Malawi	29,313			83		79	74	74	
Hosseinipour et al[36,55]	Malawi	447	81		71		60	41		
Joseph et al[56]	Zimbabwe	547	96		69		63			
Kamuyango et al[57]	Malawi	190					97			
Kim et al[50]	Malawi	810			80					
Koole et al[24]	Malawi	586			85					
Koss et al[58]	Uganda	200								68
Landes et al[59]	Malawi	2955	87	85						
Llenas-Garcia et al[42]	Mozambique	308	60				42			
Mitiku et al[60]	Ethiopia	346	95		88		84	77		
Mwapasa et al[40]	Malawi	396					69			
Oyeledun et al[41]	Nigeria	247			68					
Price et al[61]	Malawi	63	67		60					
Schnack et al[62]	Uganda	124	64							
Schwartz et al[63]	South Africa	50					76			
Tenthani et al[11]	Malawi	5357			76					
Tweya et al[64]	Malawi	2930	91	87		83				

including clinic staff, partners, peers, and other women with HIV. Six studies also noted women's desire to reduce or prevent visible symptoms of HIV, often for fear that this would lead to labeling and stigma.

DISCUSSION

This systematic review is the first to synthesize the growing body of literature describing the PMTCT care cascade in the option B+ era in Africa. The results include quantitative estimates of retention in care in the months after ART initiation and highlight factors associated with improving or impeding long-term engagement in care. Our findings have implications for future studies assessing retention in PMTCT care, and provide valuable information for stakeholders to consider because they develop and evaluate interventions to support the implementation of option B+.

The synthesis and meta-analysis of quantitative studies revealed several important trends. First, there seem to be challenges retaining women in care across the PMTCT care cascade, with most of the studies reporting significant LTFU. Studies reporting high LTFU after the first visit demonstrate the challenges associated with the initial diagnosis, ART initiation, and/or enrollment in PMTCT programs. All studies reported increasing LTFU over time, highlighting the need to enhance long-term retention. The pooled estimates of retention (from Fig. 3) were 79.4% at 6 months and 74.5% at 12 months after ART initiation. In a similar review of adults receiving HIV care in low-income and middle-income countries, Fox and Rosen reported an 80.9% pooled estimate of retention in care at 12 months after ART initiation.[16] Lower retention in pregnant women may reflect the vulnerability of this population due to challenges associated with maintaining HIV care while pregnant and in the postpartum period, including the stresses of new motherhood, postpartum emotional challenges, and stigma related to HIV disclosure.[30–32]

We observed significant heterogeneity in the estimates of retention reported across studies ($I^2 > 97\%$). The heterogeneity likely reflects the inconsistency in methods used across the studies and may signal that estimates could shift as more studies become available, particularly with improved standardization of measurement across research. Third, we found that studies with longer follow-up periods reported higher retention rates, a finding consistent with earlier reviews.[16] This finding may be due to variance in resources, where research teams with the resources to support long follow-up periods may also dedicate greater resources to promoting retention.

In assessing the factors affecting retention in PMTCT care, we observed several key themes across studies. In quantitative studies, participants who were younger (typically under the age of 25, Table 2), initiated on the same day as diagnosis, and initiated during pregnancy (versus during breastfeeding) were at higher risk for LTFU. These results point to the need to support younger ART initiates during pregnancy, potentially through targeted interventions or peer support models.[33,34] For example, recent trials from the INSPIRE collaboration have demonstrated that

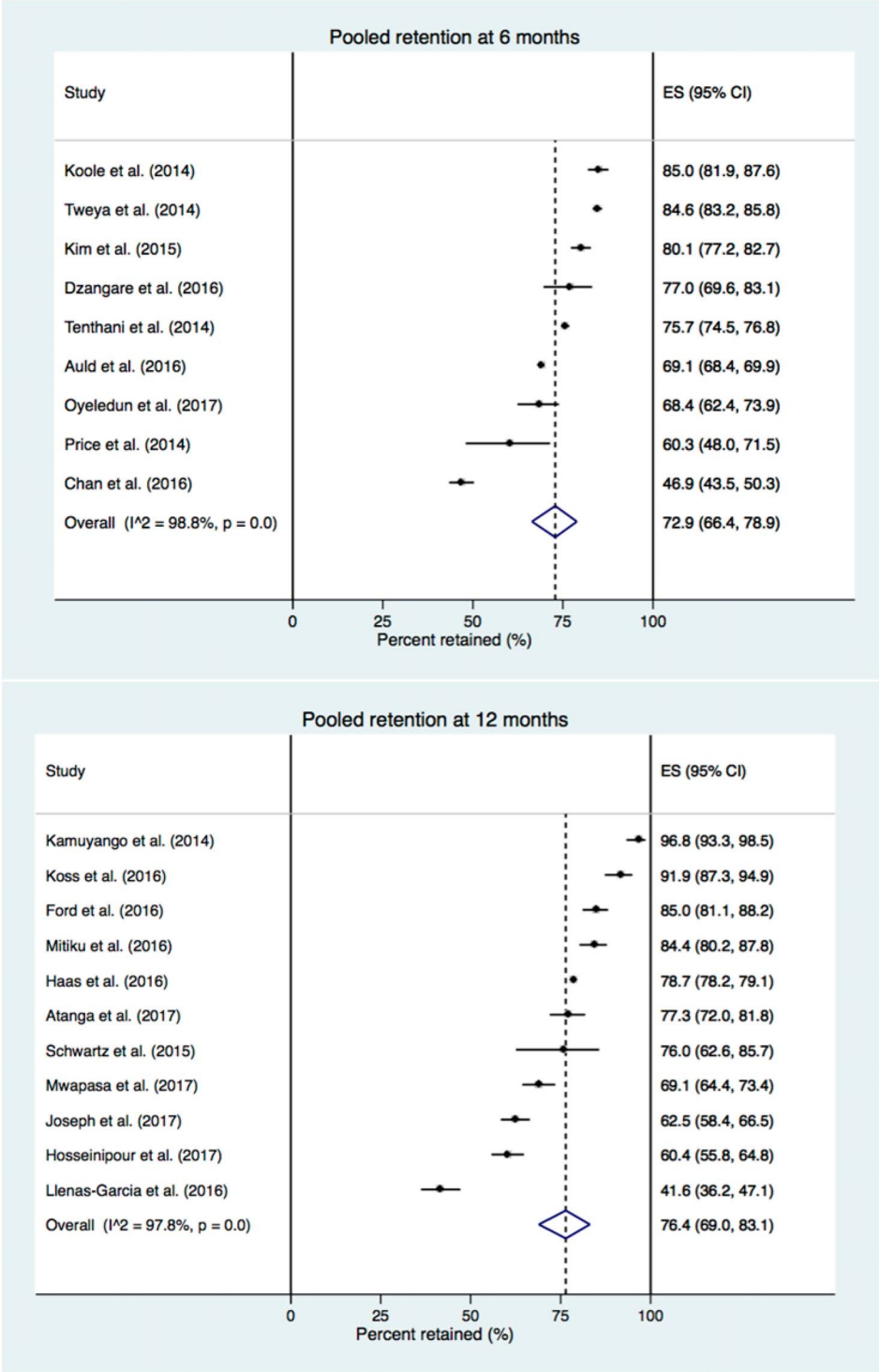
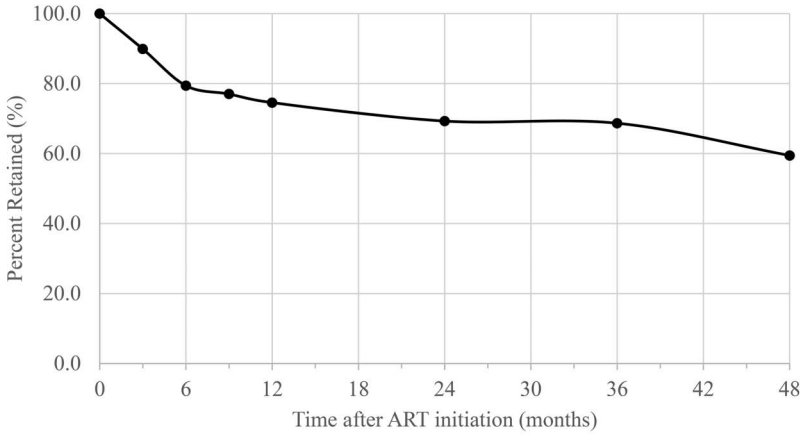


FIGURE 2. Forest plots of 6 and 12 months (same figure, top and bottom).

peer support interventions can improve retention in PMTCT, including mentor mother programs in Nigeria,[35] community-based peer support in Malawi,[36] and clinic-based support groups in Zimbabwe.[37,38] By contrast, trials in the current review examining integrated CD4 testing,[39] text messaging interventions,[40] and clinic quality improvement[41] showed no effect at improving retention in care.

In considering new intervention models, attention should also be paid to assessing the readiness of participants to initiate treatment immediately after diagnosis.[11,42] Although early initiation has important implications for preventing vertical transmission, pressure from providers to start ART immediately may alienate newly diagnosed women who believe that they need time to consider their options or



	Baseline - 3m	3 -6 m	6 - 9m	9 - 12m	12- 24m	24 - 36m	36 - 48m
Number at risk	59427	50053	27560	23974	21419	18597	151
Cumulative % retained	89.9	79.4	77.0	74.5	69.3	68.7	59.4

FIGURE 3. Cumulative probability of retention in care.

consult with others before initiating treatment.[11,43] By acknowledging and addressing such ambivalence, providers may see improved retention in the longer term.

In qualitative studies, retention was undermined by stigma and fear of disclosure, lack of support from one's partner and others, denial of one's status, lack of knowledge or poor HIV counseling, logistical barriers to care, side effects associated with treatment, and negative experiences with care providers. This complex array of factors impacting care engagement has been modeled by McMahon and colleagues,[44] and points to the importance of multilevel intervention models that address personal, social, clinical, and practical conditions that impact decisions related to initiating and maintaining HIV care.[45,46]

There are several limitations to note in the current retention literature that impacted this synthesis, and which have implications for future researchers seeking to limit heterogeneity of measurement in retention studies. This includes the need for common definitions of retention in cross-study comparison.[47] Although most studies in the current review defined LTFU as a period of more than 90 days without attending an appointment, some studies used other definitions or did not explicitly state which definition was used.

Studies should also distinguish between initiation and retention in care. This is best addressed by including data on the number of participants who either refused treatment at the initial appointment or never returned for a follow-up appointment. Only 12 of 22 studies in this study included data on attendance at the first follow-up appointment. Because these data represent the very onset of care, they have important implications for intervention models aimed at improving overall care engagement.

Another concern in the included studies was the variability in the categories of retention outcomes reported across studies. Authors typically used some combination of the following 5 categories: retained, LTFU, transferred, died, or known to have stopped ART. Not all studies used the same categories or classified participants in the same way (eg, transfers were sometimes included in retained, LTFU, or simply not reported), creating challenges for interpretability and generalizability. Notably, all studies were limited in their ability to capture undocumented transfers, that is, women who shifted to another clinic without informing clinic or study staff.[48] For this reason, it is impossible to know among the LTFU, how many had dropped out of care, versus enrolled in another clinic.

Approximately two-thirds of the included studies were retrospective in nature and relied on medical record abstraction or large national HIV databases. Estimates of retention were subsequently limited by the quality of the data and the capacity of the health care system to document outcomes such as transfers and deaths. However, prospective studies may overestimate retention because follow-up with cohort participants may, in and of itself, facilitate retention.[49]

Almost all the included studies began measuring retention in care from the date of the first antenatal appointment and did not record or examine retention in relation to the date of childbirth, which is likely a crucial event for HIV care retention.[15] Furthermore, the structure and delivery of PMTCT and HIV services change dramatically between the pregnancy and postpartum periods. Without demarcating whether or not women are LTFU during pregnancy, at the time of birth, or during the postpartum period, stakeholders are limited in their ability to appropriately target interventions within the PMTCT continuum.[50]

Nearly half of the studies in the synthesis originated from Malawi, which was the first nation to implement option B+, and home to a large-scale monitoring and evaluation program in collaboration with international partners.[51] Retention data should be revisited once new studies become available from other countries and settings.

TABLE 2. Summary of Results for Aim 2: Barriers and Facilitators for Care

Quantitative Studies

Citation	Nation	Sample Size	Retention Risk Factors	Retention Protective Factors
Atanga et al[52]	Cameroon	277	Lower age (<25)	
			Small clinic and high staff turnover	
Chan et al[53]	Malawi	813	Initiated ART on d of diagnosis	Integrated testing, counseling, and ART
Dzangare et al[34]	Zimbabwe	148	Lower age	
			Higher gravida status	
Erlwanger et al[39]	Zimbabwe	1150	Lower age	
			First pregnancy	
			Do not know partner's status	
			Initiated late in pregnancy	
			Newly diagnosed	
Ford et al[48]	Zimbabwe	386	Lower age	
Hoffman et al[65]	Malawi	203	Lower age (<26)	Economic or career support (eg, help growing food)
			No disclosure to partner	More HIV/ART counseling and education
			Less education	Partner support
			Lack of ART counseling	Support group participation
			Low social support	
			Initiated late in pregnancy	
			Logistical: money, time, and transport	
			ART side effects	
			Mistreatment by study staff	
Landes et al[59]	Malawi	2955	Lower age (<30)	
			Initiated during pregnancy (vs. breastfeeding)	
			More advanced disease stage	
Llenas-Garcia et al[42]	Mozambique	308	Initiated during pregnancy (vs. breastfeeding)	
Mitiku et al[60]	Ethiopia	346	Lower age (<25)	
			Hospital (vs. health center)	
			Initiated ART on d of diagnosis	
			Lack of CD4 testing	
Musomba et al[66]	Uganda	856	Lower age	
			Newly diagnosed	
Mwapasa et al[40]	Malawi	396	Lower age	
			Newly diagnosed	
			Initiated late in pregnancy	
Schnack et al[62]	Uganda	124	Less education	
			Newly diagnosed	
			Lack of disclosure	
Tenthani et al[11]	Malawi	5357	Urban facility	Adherence counseling above and beyond guidelines
			Public facility (vs. private)	
			Large facility	
			Initiated during pregnancy (vs. breastfeeding)	
Tweya et al[64]	Malawi	2930	Lower age (<25)	
			Initiated during pregnancy (vs. breastfeeding)	
			Unemployed	

Qualitative Studies

Citation	Nation	Sample Size	Retention Barriers	Retention Facilitators
Atanga et al[52]	Cameroon	36 short answer—all defaulted	Denial of HIV status and stigma	
			Religious beliefs	
			Transportation issues	
Buregyeya et al[67]	Uganda	57 IDI, current patients—18 pregnant and 39 postpartum	Lack of counseling	Desire to have a healthy baby

TABLE 2. (*Continued*) Summary of Results for Aim 2: Barriers and Facilitators for Care

Qualitative Studies				
Citation	**Nation**	**Sample Size**	**Retention Barriers**	**Retention Facilitators**
			Fear of being seen at clinic	Desire to maintain health and meet responsibilities
			Lack of disclosure and fear of abandonment or abuse	
			Size of pills	Support of health worker or others with HIV
			Intimidated by lifelong treatment	
			ART side effects	Worry that visible symptoms would make status known
			Logistical: transport and time	
Cataldo et al[68]	Malawi	24 IDI, newly initiating	Distance to clinic	
			Lack of privacy in care	
			Lack of readiness	
			Stigma and social discrimination	
			Stigma in health system	
			Fear of partner leaving	
			Lack of partner support	
			Lack of counseling	
Clouse et al[69]	South Africa	50 IDI, ART eligible, before and after birth	Lack of money	
			Work conflicts	
			Poor treatment by clinic staff	
			Denial of status	
			Lack of disclosure	
			Long lines and limited clinic hours	
		1 FGD		
Elwell[70]	Malawi	25 IDI—13 defaulted and 12 current patients	Fear of disclosure	Improved survival of people on ART
			Stigma and shame	Desire to prevent transmission to baby
			Poor interactions with health care workers	Desire to stay healthy for children
			Fear of being seen at clinic	
		7 FGD (n = 53)		
Flax et al[71]	Malawi	64 IDI—32 defaulted and 32 current patients	Lack of counseling and knowledge	Desire to prevent transmission to baby
			Denial of status	Desire to stay healthy
			Fear unwanted disclosure and stigma	Support from family members and others
			Lack of support	
			Logistical, transportation	
			ART side effects	
			Long lines and slow service	
			Negative experience with provider	
Gill et al[72]	Rwanda	112 IDI, ART eligible, 0–24 mo postpartum	ART side effects	Desire to stay healthy, maintain appearance, and keep status hidden
			Intimidated by lifelong ART	Desire to prevent transmission to baby
			Fear unwanted disclosure and stigma	Support from clinic staff
			Lack of social support	Support from family and friends
				Support from others with HIV
Katirayi et al[73]	Malawi	39 IDI, ART eligible—19 pregnant and 20 postpartum	Intimidated by lifelong ART	Desire to stay healthy, maintain appearance, reduce symptoms, and prolong life
			Lack of readiness	Desire to prevent transmission to baby
			Denial of status	
			Fear of disclosure	
			Lack of counseling and education	
		16 FGD (n = 93)		

(*continued on next page*)

TABLE 2. (*Continued*) Summary of Results for Aim 2: Barriers and Facilitators for Care

Qualitative Studies				
Citation	**Nation**	**Sample Size**	**Retention Barriers**	**Retention Facilitators**
Kim et al[74]	Malawi	65 IDI, ART eligible—10 refused, 26 defaulted, and 29 current patients	Concerns about partner support	Desire to prevent transmission to baby
			Feeling healthy without ART	Desire to stay healthy
			Denial of status	Encouragement from health worker of others
			ART side effects	
McLean et al[75]	Malawi, Tanzania, Uganda	22 IDI, ART eligible	Denial of status	Desire to prevent transmission to baby
			Lack of partner support	Partner support
			Stigma	Disclosure to partner and knowledge of partner's status
			Mistreatment at clinic	
			Lack of counseling	
Napua et al[76]	Mozambique	6 FGD (n = 51), ART eligible	Stigma	Participation in peer support groups
			Lack of partner support and fear of violence or abandonment	
			Lack of disclosure	
			Believes ART is dangerous	
			Lack of counseling	
			Lack of readiness	
			Desire to consult with partner	
			Denial of status	
			Long wait and short consultation	
Price et al[61]	Malawi	43 IDI, ART eligible	Fear of disclosure	
			Doubt about effectiveness of ART	
			Fear of side effects	
			Transportation	
			Lack of symptoms	
Tweya et al[64]	Malawi	111 short answer, all LTFU	Transportation	
			Financial stress	
			Lack of counseling	
			Too weak/sick to take ART	
			ART side effects	
			Lack of disclosure to partner	

FGD, focus group discussion; IDI, in-depth interview.

Finally, it is possible that a small amount of data were duplicated in this review because 3 studies reported using national data that may have included participants who were also enrolled in smaller regional projects.

The aforementioned concerns with the included studies likely had a substantial impact on the heterogeneity of the results we observed. For future studies measuring retention during the pregnancy and the postpartum period, we provide the following recommendations: (1) Use a common definition of retention, such as attendance at an HIV clinic appointment in the last 90 days; (2) Provide data on all 5 categories of retention: retained, LTFU, died, known to have stopped treatment, and transferred; (3) Note efforts to capture undocumented transfers and how these were categorized; (4) Include data on rates of initiation in care at baseline or first follow-up appointment; (5) Denote time of childbirth and associated changes in retention; and (6) Revisit rates of retention across the treatment cascade as new interventions and data from new nations become available.

CONCLUSION

Synthesized retention data representing more than 60,000 African women initiating ART under option B+ demonstrated estimated retention in HIV care among pregnant and postpartum women to be 79.4% 6 months after ART initiation and 74.5% 12 months after initiation. These rates fall short of UNAIDS 90-90-90 targets and threaten the success of option B+ goals to promote the health of women initiating ART and prevent vertical and forward transmission of HIV to children and partners. The myriad factors associated with LTFU occur at multiple levels, reflecting the complexities of personal and structural barriers that must be addressed to facilitate care engagement in PMTCT programs. Efforts to improve retention should ideally provide comprehensive solutions to address challenges at each of these levels: individual (eg, difficulty accepting diagnosis), social (fear of disclosure because of stigma), clinical (quality of counseling and clinical care), and practical (transportation and finances). Evidence from implementation research across multiple Sub-Saharan African countries suggests that peer support models may be particularly

promising in this regard (see July 2017 *JAIDS* supplement, Volume 75). Further research is necessary to evaluate the most cost-effective junctures for intervention, ensuring that women have access to an essential and lifesaving medication and receive the support they need to continue lifelong ART and realize the promise of option B+.

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REFERENCES

1. UNAIDS. *Prevention Gap Report*. Geneva, Switzerland: Joint United Nations Programme on HIV/AIDS; 2016.
2. UNAIDS. *90-90-90: An Ambitious Treatment Target to Help End the AIDS Epidemic*. Geneva, Switzerland: Joint United Nations Programme on HIV/AIDS; 2014.
3. Prendergast AJ, Essajee S, Penazzato M. HIV and the Millennium development goals. *Arch Dis Child.* 2015;100(suppl 1):S48–S52.
4. Helleringer S. Understanding the adolescent gap in HIV testing among clients of antenatal care services in west and central african countries. *AIDS Behav.* 2017;21:2760–2773.
5. WHO. *Consolidated Guidelines on the Use of Antiretroviral Drugs for Treating and Preventing HIV Infection: Recommendations for a Public Health Approach*. 2nd ed. Geneva, Switzerland: World Health Organization; 2016.
6. UNICEF. Options B and B+: key considerations for countries to implement an equity-focused approach. 2012. Available at: www.unicef.org/aids/files/hiv_Key_considerations_options_B.pdf. Accessed February 20, 2017.
7. Sibanda EL, Cowan FM. Good news for retention of women on option B + in Malawi. *Lancet HIV*. 2016;3:e151–152.
8. U.S. Department of State. *PEPFAR blueprint: creating an AIDS-free generation*. Washington, DC, Washington: U.S. Department of State; 2012.
9. Coutsoudis A, Goga A, Desmond C, et al. Is option B+ the best choice? *Lancet*. 2013;381:269–271.
10. Bateman C. Much ado over the new South African PMTCT guidelines. *S Afr Med J.* 2013;103:218–221.
11. Tenthani L, Haas AD, Tweya H, et al. Retention in care under universal antiretroviral therapy for HIV-infected pregnant and breastfeeding women ("option B+") in Malawi. *AIDS*. 2014;28:589–598.
12. Prevention CfDCa. Impact of an innovative approach to prevent mother-to-child transmission of HIV—Malawi, July 2011-September 2012. *MMWR Morb Mortal Wkly Rep.* 2013;62:148–151.
13. Gardner EM, McLees MP, Steiner JF, et al. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clin Infect Dis.* 2011;52:793–800.
14. Colvin CJ, Konopka S, Chalker JC, et al. A systematic review of health system barriers and enablers for antiretroviral therapy (ART) for HIV-infected pregnant and postpartum women. *PLoS One*. 2014;9:e108150.
15. Psaros C, Remmert JE, Bangsberg DR, et al. Adherence to HIV care after pregnancy among women in sub-Saharan Africa: falling off the cliff of the treatment cascade. *Curr HIV/AIDS Rep.* 2015;12:1–5.
16. Fox MP, Rosen S. Retention of adult patients on antiretroviral therapy in low- and middle-income countries: systematic review and meta-analysis 2008–2013. *J Acquir Immune Defic Syndr.* 2015;69:98–108.
17. Mills EJ, Nachega JB, Buchan I, et al. Adherence to antiretroviral therapy in sub-Saharan Africa and North America: a meta-analysis. *JAMA*. 2006; 296:679–690.
18. Merten S, Kenter E, McKenzie O, et al. Patient-reported barriers and drivers of adherence to antiretrovirals in sub-Saharan Africa: a meta-ethnography. *Trop Med Int Health*. 2010;15(suppl 1):16–33.
19. Ware NC, Wyatt MA, Geng EH, et al. Toward an understanding of disengagement from HIV treatment and care in sub-Saharan Africa: a qualitative study. *PLoS Med.* 2013;10:e1001369; discussion e1001369.
20. Geldsetzer P, Yapa HM, 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;19:20679.
21. Ahmed S, Kim MH, Abrams EJ. Risks and benefits of lifelong antiretroviral treatment for pregnant and breastfeeding women: a review of the evidence for the option B+ approach. *Curr Opin HIV AIDS*. 2013; 8:474–489.
22. Matheson R, Moses-Burton S, Hsieh AC, et al. Fundamental concerns of women living with HIV around the implementation of option B+. *J Int AIDS Soc.* 2015;18(suppl 5):20286.
23. Auld AF, Shiraishi RW, Couto A, et al. A decade of antiretroviral therapy scale-up in Mozambique: evaluation of outcome trends and new models of service delivery among more than 300,000 patients enrolled during 2004–2013. *J Acquir Immune Defic Syndr.* 2016;73:e11–22.
24. Koole O, Houben RM, Mzembe T, et al. Improved retention of patients starting antiretroviral treatment in Karonga District, northern Malawi, 2005-2012. *J Acquir Immune Defic Syndr.* 2014;67:e27–e33.
25. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med.* 2009;6:e1000097.
26. Watt MH, Knettel BA, Cichowitz C, et al. Retention in HIV care during pregnancy and the postpartum period in the option B+ era: a systematic review and meta-analysis of studies in Africa. *International Prospective Register of Systematic Reviews*. 2017. Available at: www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42017058961. Accessed March 9, 2017.
27. Innovation VH. Covidence systematic review software. Available at: www.covidence.org. Accessed March 21, 2017.
28. Freeman M, Tukey J. Transformations related to the angular and the square root. *Ann Inst Stat Mathematics*. 1950;21:607–611.
29. Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Med Res Methodol.* 2008;8:45.
30. Nel A, Kagee A. Common mental health problems and antiretroviral therapy adherence. *AIDS Care*. 2011;23:1360–1365.
31. Mahenge B, Stockl H, Likindikoki S, et al. The prevalence of mental health morbidity and its associated factors among women attending a prenatal clinic in Tanzania. *Int J Gynaecol Obstet.* 2015;130:261–265.
32. Ngarina M, Popenoe R, Kilewo C, et al. Reasons for poor adherence to antiretroviral therapy postnatally in HIV-1 infected women treated for their own health: experiences from the Mitra Plus study in Tanzania. *BMC Public Health*. 2013;13:450.
33. Dow DE, Turner EL, Shayo AM, et al. Evaluating mental health difficulties and associated outcomes among HIV-positive adolescents in Tanzania. *AIDS Care*. 2016;28:825–833.
34. Dzangare J, Takarinda KC, Harries AD, et al. HIV testing uptake and retention in care of HIV-infected pregnant and breastfeeding women initiated on "option B+" in rural Zimbabwe. *Trop Med Int Health*. 2016; 21:202–209.
35. Sam-Agudu NA, Ramadhani HO, Isah C, et al. The impact of structured mentor mother programs on 6-month postpartum retention and viral suppression among HIV-positive women in rural Nigeria: a Prospective Paired Cohort Study. *J Acquir Immune Defic Syndr.* 2017;75(suppl 2): S173–S181.
36. 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(suppl 2):S140–S148.
37. Orne-Gliemann J, Font H, Maphosa T, et al. Patterns of attendance at mother support groups in Zimbabwe. The EPAZ trial (2014–2016). *J Acquir Immune Defic Syndr.* 2017;75(suppl 2):S216–S223.
38. Foster G, Orne-Gliemann J, Font H, et al. Impact of facility-based mother support groups on retention in care and PMTCT outcomes in rural Zimbabwe: the EPAZ cluster-randomized controlled trial. *J Acquir Immune Defic Syndr.* 2017;75(suppl 2):S207–S215.
39. Erlwanger AS, Joseph J, Gotora T, et al. Patterns of HIV care clinic attendance and adherence to antiretroviral therapy among pregnant and breastfeeding women living with HIV in the context of option B+ in Zimbabwe. *J Acquir Immune Defic Syndr.* 2017;75(suppl 2):S198–S206.
40. Mwapasa V, Joseph J, Tchereni T, et al. Impact of mother-infant pair clinics and short-text messaging service (SMS) reminders on retention of HIV-infected women and HIV-exposed infants in eMTCT care in

Malawi: a cluster randomized trial. *J Acquir Immune Defic Syndr*. 2017; 75(suppl 2):S123–S131.
41. Oyeledun B, Phillips A, Oronsaye F, et al. The effect of a continuous quality improvement intervention on retention-in-care at 6 months postpartum in a PMTCT program in northern Nigeria: results of a cluster randomized controlled study. *J Acquir Immune Defic Syndr*. 2017;75 (suppl 2):S156–S164.
42. Llenas-Garcia J, Wikman-Jorgensen P, Hobbins M, et al. Retention in care of HIV-infected pregnant and lactating women starting ART under option B+ in rural Mozambique. *Trop Med Int Health*. 2016;21:1003–1012.
43. Black S, Zulliger R, Marcus R, et al. Acceptability and challenges of rapid ART initiation among pregnant women in a pilot programme, Cape Town, South Africa. *AIDS Care*. 2014;26:736–741.
44. McMahon SA, Kennedy CE, Winch PJ, et al. Why women disengage from HIV care during and after pregnancy in morogoro region, Tanzania. *AIDS Behav*. 2017;21:317–329.
45. Gwadz M, Cleland CM, Applegate E, et al. Behavioral intervention improves treatment outcomes among HIV-infected individuals who have delayed, declined, or discontinued antiretroviral therapy: a randomized controlled trial of a novel intervention. *AIDS Behav*. 2015;19:1801–1817.
46. Haberer JE, Sabin L, Amico KR, et al. Improving antiretroviral therapy adherence in resource-limited settings at scale: a discussion of interventions and recommendations. *J Int AIDS Soc*. 2017;20:21371.
47. Mugavero MJ, Westfall AO, Zinski A, et al. Measuring retention in HIV care: the elusive gold standard. *J Acquir Immune Defic Syndr*. 2012;61: 574–580.
48. Ford D, Muzambi M, Nkhata MJ, et al. Implementation of antiretroviral therapy for life in pregnant/breastfeeding HIV+ women (option B+) alongside rollout and changing guidelines for ART initiation in rural Zimbabwe: the lablite project experience. *J Acquir Immune Defic Syndr*. 2017;74:508–516.
49. Menezes P, Miller WC, Wohl DA, et al. Does HAART efficacy translate to effectiveness? Evidence for a trial effect. *PLoS One*. 2011;6:e21824.
50. Kim MH, Ahmed S, Hosseinipour MC, et al. Implementation and operational research: the impact of option B+ on the antenatal PMTCT cascade in Lilongwe. *Malawi J Acquir Immune Defic Syndr*. 2015;68: e77–83.
51. Kalua T, Tippett Barr BA, van Oosterhout JJ, et al. Lessons learned from option B+ in the evolution toward "test and start" from Malawi, Cameroon, and the United Republic of Tanzania. *J Acquir Immune Defic Syndr*. 2017;75(suppl 1):S43–S50.
52. Atanga PN, Ndetan HT, Achidi EA, et al. Retention in care and reasons for discontinuation of lifelong antiretroviral therapy in a cohort of Cameroonian pregnant and breastfeeding HIV-positive women initiating "option B+" in the South West Region. *Trop Med Int Health*. 2017;22: 161–170.
53. Chan AK, Kanike E, Bedell R, et al. Same day HIV diagnosis and antiretroviral therapy initiation affects retention in option B+ prevention of mother-to-child transmission services at antenatal care in Zomba District. *Malawi J Int AIDS Soc*. 2016;19:20672.
54. Haas AD, Tenthani L, Msukwa MT, et al. Retention in care during the first 3 years of antiretroviral therapy for women in Malawi's option B+ programme: an observational cohort study. *Lancet HIV*. 2016;3:e175–182.
55. Hosseinipour M, Nelson JAE, Trapence C, et al. Viral suppression and HIV drug resistance at 6 Months among women in Malawi's option B plus program: results from the PURE Malawi study. *J Acquir Immune Defic Syndr*. 2017;75:S149–S155.
56. Joseph J, Gotora T, Erlwanger AS, et al. Impact of point-of-care CD4 testing on retention in care among HIV-positive pregnant and breastfeeding women in the context of option B+ in Zimbabwe: a cluster randomized controlled trial. *J Acquir Immune Defic Syndr*. 2017;75 (suppl 2):S190–S197.
57. Kamuyango AA, Hirschhorn LR, Wang W, et al. One-year outcomes of women started on antiretroviral therapy during pregnancy before and after the implementation of option B+ in Malawi: a retrospective chart review. *World J AIDS*. 2014;4:332–337.
58. Koss CA, Natureeba P, Kwarisiima D, et al. Viral suppression and retention in care up to 5 Years after initiation of lifelong ART during pregnancy (option B+) in rural Uganda. *J Acquir Immune Defic Syndr*. 2017;74:279–284.
59. Landes M, Sodhi S, Matengeni A, et al. Characteristics and outcomes of women initiating ART during pregnancy versus breastfeeding in option B+ in Malawi. *BMC Public Health*. 2016;15:713.
60. Mitiku I, Arefayne M, Mesfin Y, et al. Factors associated with loss to follow-up among women in option B+ PMTCT programme in northeast Ethiopia: a retrospective cohort study. *J Int AIDS Soc*. 2016;19:20662.
61. Price AJ, Kayange M, Zaba B, et al. Uptake of prevention of mother-to-child-transmission using option B+ in northern rural Malawi: a retrospective cohort study. *Sex Transm Infect*. 2014;90:309–314.
62. Schnack A, Rempis E, Decker S, et al. Prevention of mother-to-child transmission of HIV in option B+ era: uptake and adherence during pregnancy in Western Uganda. *AIDS Patient Care STDS*. 2016;30:110–118.
63. Schwartz SR, Clouse K, Yende N, et al. Acceptability and feasibility of a mobile phone-based case management intervention to retain mothers and infants from an option B+ program in postpartum HIV care. *Matern Child Health J*. 2015;19:2029–2037.
64. Tweya H, Gugsa S, Hosseinipour M, et al. Understanding factors, outcomes and reasons for loss to follow-up among women in option B+ PMTCT programme in Lilongwe, Malawi. *Trop Med Int Health*. 2014; 19:1360–1366.
65. Hoffman RM, Phiri K, Parent J, et al. Factors associated with retention in option B+ in Malawi: a case control study. *J Int AIDS Soc*. 2017;20: 21464.
66. Musomba R, Mubiru F, Nakalema S, et al. Describing point of entry into care and being lost to program in a cohort of HIV positive pregnant women in a large urban centre in Uganda. *AIDS Res Treat*. 2017;2017: 3527563.
67. 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;17:94.
68. Cataldo F, Chiwaula L, Nkhata M, et al. Exploring the experiences of women and health care workers in the context of PMTCT option B plus in Malawi. *J Acquir Immune Defic Syndr*. 2017;74:517–522.
69. Clouse K, Schwartz S, Van Rie A, et al. "What they wanted was to give birth; nothing else": barriers to retention in option B+ HIV care among postpartum women in South Africa. *J Acquir Immune Defic Syndr*. 2014; 67:e12–18.
70. Elwell K. Facilitators and barriers to treatment adherence within PMTCT programs in Malawi. *AIDS Care*. 2016;28:971–975.
71. Flax VL, Hamela G, Mofolo I, et al. Factors influencing postnatal option B+ participation and breastfeeding duration among HIV-positive women in Lilongwe District, Malawi: a qualitative study. *PLoS One*. 2017;12: e0175590.
72. Gill MM, Umutoni A, Hoffman HJ, et al. Understanding antiretroviral treatment adherence among HIV-positive women at four postpartum time intervals: qualitative results from the Kabeho study in Rwanda. *AIDS Patient Care STDS*. 2017;31:153–166.
73. Katirayi L, Namadingo H, Phiri M, et al. HIV-positive pregnant and postpartum women's perspectives about option B+ in Malawi: a qualitative study. *J Int AIDS Soc*. 2016;19:20919.
74. Kim MH, Zhou A, Mazenga A, et al. Why did I Stop? Barriers and facilitators to uptake and adherence to ART in option B+ HIV care in lilongwe, Malawi. *PLoS One*. 2016;11:e0149527.
75. McLean E, Renju J, Wamoyi J, et al. "I wanted to safeguard the baby": a qualitative study to understand the experiences of option B+ for pregnant women and the potential implications for 'test-and-treat' in four sub-Saharan African settings. *Sex Transm Infect*. 2017;93(suppl 3):1–5.
76. Napua M, Pfeiffer JT, Chale F, et al. Option B+ in Mozambique: formative research findings for the design of a facility-level clustered randomized controlled trial to improve ART retention in antenatal care. *J Acquir Immune Defic Syndr*. 2016;72(suppl 2):S181–S188.