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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

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Abstract

Background—Under Option B+ guidelines for prevention of mother-to-child transmission of HIV (PMTCT), pregnant and breastfeeding women initiate antiretroviral therapy (ART) 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; factors associated with retention were analyzed thematically.

Results—35 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% CI: 66.4%, 78.9%) at 6 months for studies reporting <12 months of follow up and 76.4% (95% CI: 69.0%, 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 ART 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 PMTCT 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.

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Keywords

antiretroviral therapy (ART); HIV/AIDS; loss to follow up; Option B+; prevention of mother-to-child transmission (PMTCT); retention in care

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 WHO-supported protocol aimed at providing access to lifelong antiretroviral therapy (ART) for all HIV-positive pregnant and breastfeeding women.[4,5] Due to 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 towards 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]

Retention in HIV care is a concern for all PLHIV; 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 post-partum women in Africa. Specifically, the review was guided by two 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 (PRISMA) guidelines.[25] For aim one, 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+ (i.e., 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 two, 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 manuscripts described a single cohort, only the manuscript 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 (e.g., injection drug users, prisoners, sex workers, 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 three databases: PubMed, EMBASE, and the African Index Medicus (AIM), which were searched on February 15 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 (e.g., PubMed Medical Subject Headings, or MeSH). The

specific search terms used for the PubMed database are detailed in Appendix A and were similar for the other included databases.

Following the search protocol from 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 to 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 believed the potential for publication bias to be low, as authors were likely to publish full manuscripts for cohorts with either high or low retention. Therefore, we chose to exclude the grey 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 two 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 two 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 two 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, 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 (e.g., taking medication) were considered retained. Participants who were documented as having transferred care were considered retained in care.

We reviewed manuscripts 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 following 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 of 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, ≥ 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 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 lost to follow up (LTFU). A combined outcome of LTFU and/or death was utilized as these two 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 to 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 confidence intervals are reported for the lifetable analysis as the sample size would generate inappropriately small intervals based upon 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 African Index Medicus. We removed all studies published prior to 2012 and all redundant results (i.e., studies found in more than one database) to obtain our initial list of 404 studies to be screened. Upon 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 African Index Medicus), 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 (see Figure 1). The most common reasons for exclusion at this stage were: no measure of retention in care, data collected prior to the implementation of Option B+, and study site outside of 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 papers that did not include original data (e.g., modeling papers 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 eight 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 three studies used national databases in Malawi (2) and Mozambique. Twelve studies included women enrolled in Option B+ during both pregnancy and breastfeeding, while ten 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 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 months and 12 months following 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, a majority of studies reported significant LTFU within the first six months after initiation ART, including immediately after the first appointment. Retention ranged from 56–97% after the first visit and from 47–88% six 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%, 78.9%) at 6 months for studies reporting < 12 months of follow up and 76.4% (95% CI: 69.0%, 83.1%) at 12 months for studies reporting ≥ 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, while 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 for 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 three 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 of 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 a majority 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 eight 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 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 as 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 appear to be challenges retaining women in care across the PMTCT care cascade, with a majority of 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 Figure 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- 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 utilized 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, see 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 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] While early initiation has important implications for preventing vertical transmission, pressure from providers to start ART immediately may alienate newly diagnosed women who feel that they need time to consider their options or consult with others prior to 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 multi-level 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] While 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 the present study included data on attendance at the first follow-up appointment. Since 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 five 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 (e.g., 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, i.e., 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 upon 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. On the other hand, prospective studies may over-estimate retention as follow up with cohort participants may, in and of itself, facilitate retention.[49]

Almost all of 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 post-partum 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.

Finally, it is possible that a small amount of data were duplicated in this review, as three 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 five categories of retention: retained, lost to follow up, 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 over 60,000 African women initiating ART under Option B+ demonstrated estimated retention in HIV care among pregnant and postpartum women to be 79.4% six 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 (e.g., difficulty accepting diagnosis), social (fear of disclosure due to stigma), clinical (quality of counseling and clinical care), and practical (transportation, 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+.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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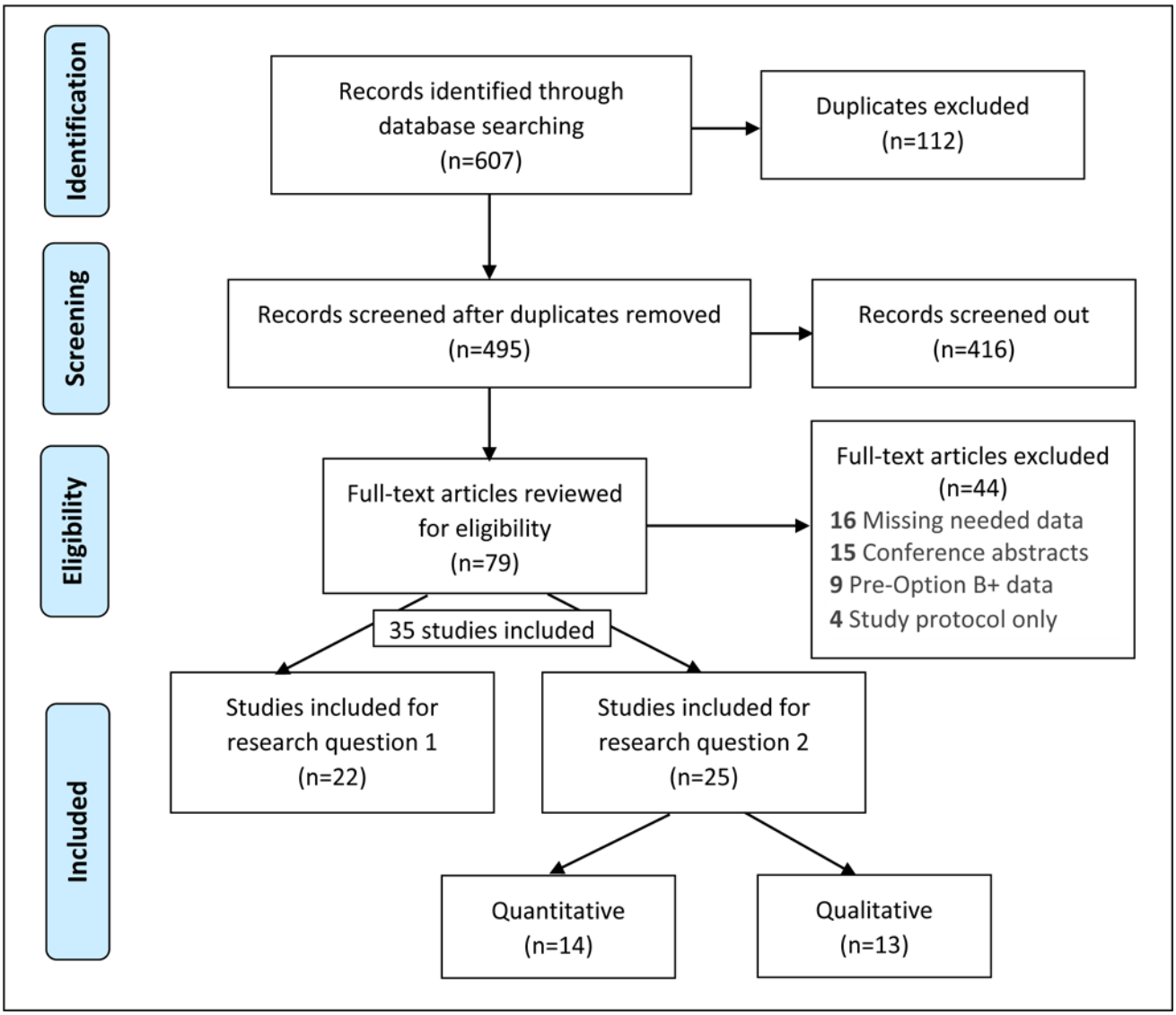


Figure 1.
Study flowchart

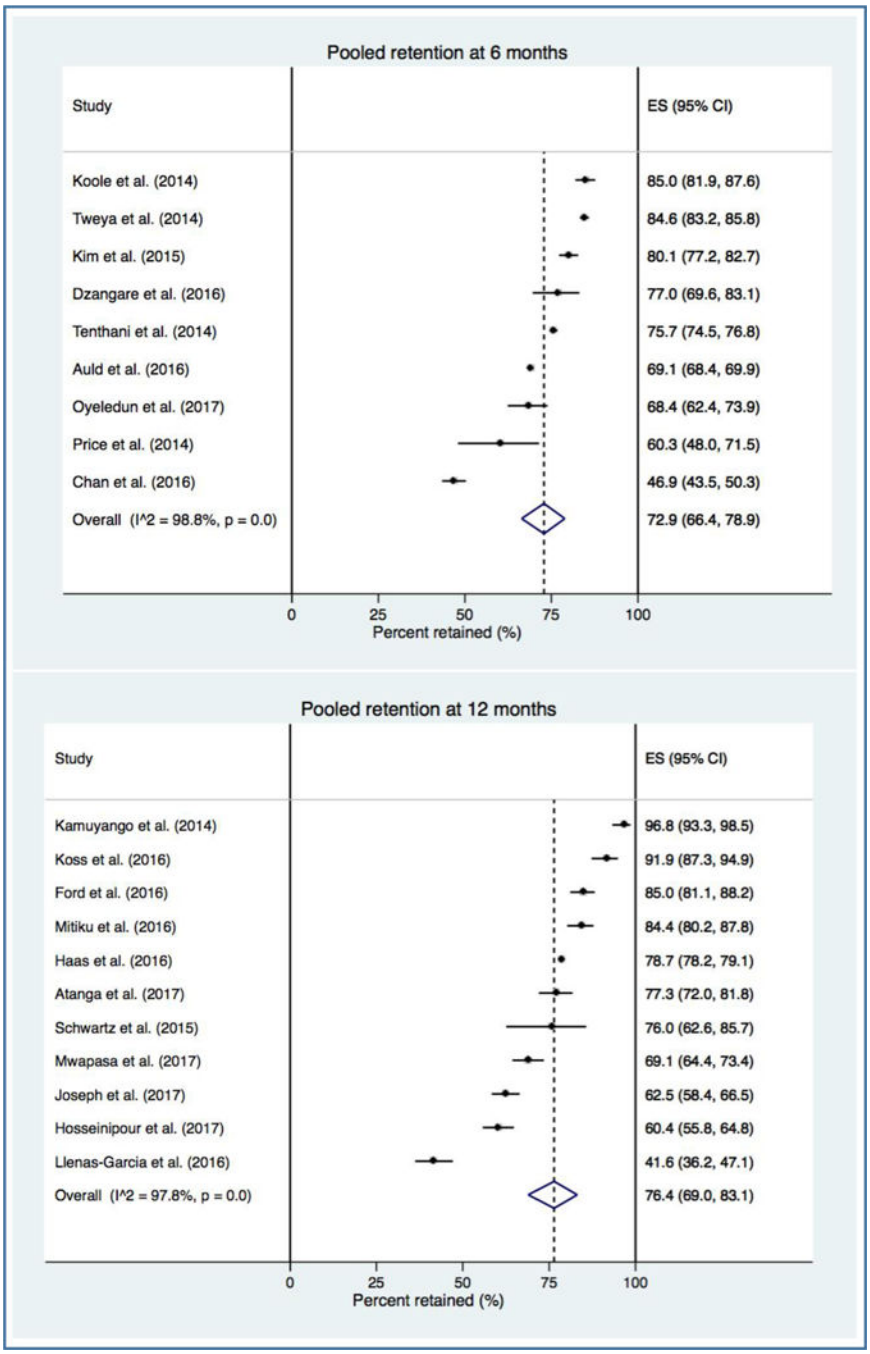
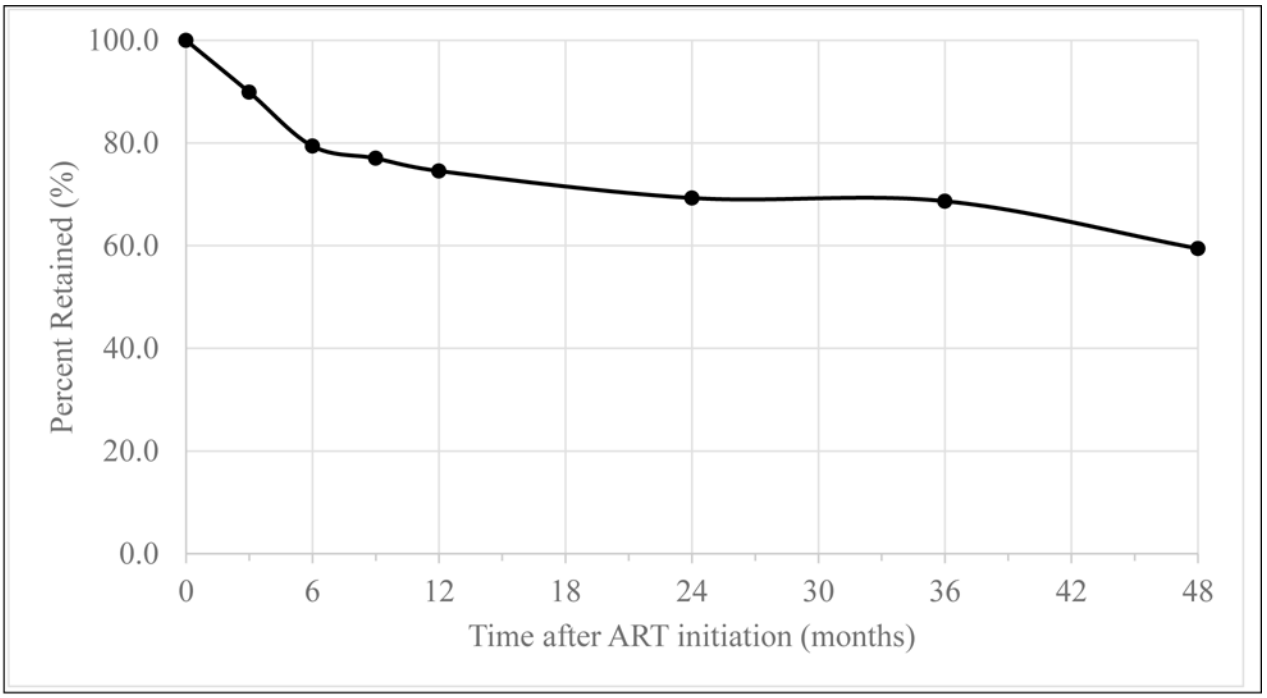


Figure 2.
Forest plots of 6 & 12 months (same figure, top & bottom)



	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

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. (2017)[52]	Cameroon	277	92	88	85		77			
Auld et al. (2016)[23]	Mozambique	14397			69					
Chan et al. (2016)[53]	Malawi	813	56	48	47					
Dzangare et al. (2016)[34]	Zimbabwe	148	93		77					
Ford et al. (2016)[48]	Zimbabwe	386	97	92	86		85			
Haas et al. (2016)[54]	Malawi	29313			83		79	74	74	
Hosseinipour et al. (2017)[36,55]	Malawi	447	81		71		60	41		
Joseph et al. (2017)[56]	Zimbabwe	547	96		69		63			
Kamuyango et al. (2014)[57]	Malawi	190					97			
Kim et al. (2015)[50]	Malawi	810			80					
Koole et al. (2014)[24]	Malawi	586			85					
Koss et al. (2016)[58]	Uganda	200								68
Landes et al. (2016)[59]	Malawi	2955	87	85						
Llenas-Garcia et al. (2016)[42]	Mozambique	308	60				42			
Mitiku et al. (2016)[60]	Ethiopia	346	95		88		84	77		
Mwapasa et al. (2017)[40]	Malawi	396					69			
Oyeledun et al. (2017)[41]	Nigeria	247			68					
Price et al. (2014)[61]	Malawi	63	67		60					
Schnack et al. (2016)[62]	Uganda	124	64							
Schwartz et al. (2015)[63]	South Africa	50					76			
Tenthani et al. (2014)[11]	Malawi	5357			76					
Tweya et al. (2014)[64]	Malawi	2930	91	87		83				

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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. (2017)[52]	Cameroon	277	-Lower Age (<25) -Small clinic, high staff turnover	
Chan et al. (2016)[53]	Malawi	813	-Initiated ART on day of diagnosis	-Integrated testing, counseling, ART
Dzangare et al. (2016)[34]	Zimbabwe	148	-Lower age -Higher gravida status	
Erlwanger et al. (2017)[39]	Zimbabwe	1150	-Lower age -First pregnancy -Don't know partner's status -Initiated late in pregnancy -Newly diagnosed	
Ford et al. (2016)[48]	Zimbabwe	386	Lower age	
Hoffman et al. (2017)[65]	Malawi	203	-Lower age (<26) -No disclosure to partner -Less education -Lack of ART counseling -Low social support -Initiated late in pregnancy -Logistical: money, time, transport -ART side effects -Mistreatment by study staff	-Economic or career support (e.g., help growing food) -More HIV/ART counseling and education -Partner support -Support group participation
Landes et al. (2016)[59]	Malawi	2955	-Lower age (<30) -Initiated during pregnancy (vs. breastfeeding) -More advanced disease stage	
Llenas-Garcia et al. (2016)[42]	Mozambique	308	-Initiated during pregnancy (vs. breastfeeding)	
Mitiku et al. (2016)[60]	Ethiopia	346	-Lower age (<25) -Hospital (vs. health center) -Initiated ART on day of diagnosis -Lack of CD4 testing	
Musomba et al. (2017)[66]	Uganda	856	-Lower age -Newly diagnosed	
Mwapasa et al. (2017)[40]	Malawi	396	-Lower age -Newly diagnosed -Initiated late in pregnancy	
Schnack et al. (2016)[62]	Uganda	124	Less education -Newly diagnosed -Lack of disclosure	
Tenthani et al. (2014)[11]	Malawi	5357	Urban facility -Public facility (vs. private) -Large facility -Initiated during pregnancy (vs. breastfeeding)	-Adherence counseling above and beyond guidelines
Tweya et al. (2014)[64]	Malawi	2930	Lower age (<25) -Initiated during pregnancy (vs. breastfeeding) -Unemployed	
Qualitative Studies				
Citation	**Nation**	**Sample Size**	**Retention Barriers**	**Retention Facilitators**

Quantitative Studies				
Citation	**Nation**	**Sample Size**	**Retention Risk Factors**	**Retention Protective Factors**
Atanga et al. (2017)[52]	Cameroon	36 short answer – all defaulted	-Denial of HIV status, stigma -Religious beliefs -Transportation issues	
Buregyeya et al. (2017)[67]	Uganda	57 IDI, current patients – 18 pregnant, 39 postpartum	-Lack of counseling -Fear of being seen at clinic -Lack of disclosure, fear of abandonment or abuse -Size of pills -Intimidated by lifelong treatment -ART side effects -Logistical: transport, time	-Desire to have a healthy baby -Desire to maintain health, meet responsibilities -Support of health worker or others with HIV -Worry that visible symptoms would make status known
Cataldo et al. (2016)[68]	Malawi	24 IDI, Newly initiating	-Distance to clinic -Lack of privacy in care -Lack of readiness -Stigma, social discrimination -Stigma in health system -Fear of partner leaving -Lack of partner support -Lack of counseling	
Clouse et al. (2014)[69]	South Africa	50 IDI, ART eligible, before and after birth 1 FGD	-Lack of money -Work conflicts -Poor treatment by clinic staff -Denial of status -Lack of disclosure -Long lines, limited clinic hours	
Elwell (2016)[70]	Malawi	25 IDI – 13 defaulted, 12 current patients 7 FGD (n=53)	-Fear of disclosure -Stigma, shame -Poor interactions with health care workers -Fear of being seen at clinic	-Improved survival of people on ART -Desire to prevent transmission to baby -Desire to stay healthy for children
Flax et al. (2017)[71]	Malawi	64 IDI – 32 defaulted, 32 current patients	-Lack counseling, knowledge -Denial of status -Fear unwanted disclosure, stigma -Lack of support -Logistical, transportation -ART side effects -Long lines and slow service -Negative experience with provider	-Desire to prevent transmission to baby -Desire to stay healthy -Support from family members and others
Gill et al. (2017)[72]	Rwanda	112 IDI, ART eligible, 0–24 months postpartum	-ART side effects -Intimidated by lifelong ART -Fear unwanted disclosure, stigma -Lack of social support	-Desire to stay healthy, maintain appearance, keep status hidden -Desire to prevent transmission to baby -Support from clinic staff -Support from family and friends -Support from others with HIV
Katirayi et al. (2016)[73]	Malawi	39 IDI, ART eligible – 19 pregnant 20 postpartum 16 FGD (n=93)	-Intimidated by lifelong ART -Lack of readiness -Denial of status -Fear of disclosure -Lack of counseling, education	-Desire to stay healthy, maintain appearance, reduce symptoms, prolong life -Desire to prevent transmission to baby
Kim et al. (2016)[74]	Malawi	65 IDI, ART eligible – 10 refused, 26 defaulted, 29 current patients	-Concerns about partner support -Feeling healthy without ART -Denial of status -ART side effects	-Desire to prevent transmission to baby -Desire to stay healthy -Encouragement from health worker of others
McLean et al. (2017)[75]	Malawi, Tanzania, Uganda	22 IDI, ART eligible	-Denial of status -Lack of partner support -Stigma -Mistreatment at clinic -Lack of counseling	-Desire to prevent transmission to baby -Partner support -Disclosure to partner and knowledge of partner's status

Quantitative Studies				
Citation	**Nation**	**Sample Size**	**Retention Risk Factors**	**Retention Protective Factors**
Napua et al. (2016)[76]	Mozambique	6 FGD (n=51), ART eligible	-Stigma -Lack of partner support, 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, short consultation	-Participation in peer support groups
Price et al. (2014)[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. (2014)[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	