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Outcomes After Loss to Follow-Up for Pregnant and Postpartum Women Living With HIV and Their Children in Kenya: A Prospective Cohort Study

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Background: Many prevention of vertical transmission (PVT) studies assess outcomes within 12 months postpartum and exclude those lost to follow-up (LTFU), potentially biasing outcomes toward those retained in care.

Setting: Five public facilities in western Kenya.

Methods: We recruited women living with HIV (WLH) ≥18 years enrolled in antenatal clinic (ANC). WLH retained in care (RW) were recruited during pregnancy and followed with their children through 6 months postpartum; WLH LTFU (LW, last visit >90 days) after ANC enrollment and ≤6 months postpartum were recruited through community tracing. Recontact at 3 years was attempted for all participants. Primary outcomes were retention and child HIV-free survival. Generalized linear regression was used to estimated risk ratios (RRs) for associations with becoming LTFU by 6 months postpartum, adjusting for age, education, facility, travel time to facility, gravidity, income, and new vs. known HIV positive at ANC enrollment.

Results: Three hundred thirty-three WLH (222 RW, 111 LW) were recruited from 2018 to 2019. More LW versus RW were newly diagnosed with HIV at ANC enrollment (49.6% vs. 23.9%) and not virally suppressed at study enrollment (40.9% vs. 7.7%). 6-month HIV-free survival was lower for children of LW (87.9%) versus RW (98.7%). At 3 years, 230 WLH were retained in care (including 51 previously LTFU before 6 months), 30 transferred, 70 LTFU, and 3 deceased. 3-year child HIV-free survival was 81.9% (92.0% for children of RW, 58.6% for LW), 3.7% were living with HIV, 3.7% deceased, and 10.8% had unknown HIV/vital status. Being newly diagnosed with HIV at ANC enrollment was the only factor associated with becoming LTFU (aRR 1.21, 95% CI: 1.11 to 1.31).

Conclusions: Outcomes among those LTFU were worse than those retained in care, underscoring the importance of retention in PVT services. Some, but not all, LW re-engaged in care by 3 years, suggesting the need for PVT services must better address the barriers and transitions women experience during pregnancy and postpartum.

Key Words: vertical transmission, prevention of mother-to-child transmission, pregnant, postpartum, retention in care, viral suppression

(*J Acquir Immune Defic Syndr* 2024;97:242–252)

INTRODUCTION

Retention in care and viral suppression are programmatic priorities for the 1.2 million women living with HIV (WLH) who become pregnant each year.[1] In Eastern and Southern Africa, nearly a third of WLH who initiate

Received for publication February 20, 2024; accepted June 24, 2024.

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This research was presented at the following conferences: 1. Humphrey J, Kipchumba B, Alera M, Pfeiffer EJ, Songok J, Mwangi W, Kosgei W, Musick B, Yiannoutsos C, Wachira J, Wools-Kaloustian K. Barriers and enhancers to retention in integrated HIV and maternal and child health care: the IeDEA-Kenya PMTCT cohort. 23rd International AIDS Conference, July 6–10, 2020; (virtual meeting). 2. Humphrey J, Musick B, Songok J, Kipchumba B, Kosgei W, Mwangi W, Yiannoutsos C, Wools-Kaloustian K. A comparison of the outcomes of women retained versus lost during the prevention of mother to child HIV transmission (PMTCT) cascade: the IeDEA-Kenya PMTCT cohort. International Workshop on HIV Pediatrics 2020, November 16–17, 2020; (virtual meeting). 3. Humphrey J, Kipchumba B, Sang E, Alera M, Musick B, Muli L, Kipsang J, Songok J, Yiannoutsos C, Wools-Kaloustian K. Long-term outcomes after loss to follow-up from PMTCT services for women and children in Kenya. Poster session to be presented at: Conference on Retroviruses and Opportunistic Infections, March 3–6, 2024; Denver, CO.

The East Africa International Epidemiology Databases to Evaluate AIDS (IeDEA) is supported by the US National Institutes of Health's National Institute of Allergy and Infectious Diseases, the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD), the National Cancer Institute, the National Institute of Mental Health, the National Institute on Drug Abuse, the National Heart, Lung, and Blood Institute, the National Institute on Alcohol Abuse and Alcoholism, the National Institute of Diabetes and Digestive and Kidney Diseases, the Fogarty International Center, and the National Library of Medicine (#U01AI069911). This work was also supported by the Moi Teaching and Referral Hospital Intramural Research Fund. Dr. Humphrey's effort was supported by the NICHD (K23HD105495). The authors declare no conflicts of interest.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.jaids.com).

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antiretroviral therapy (ART) during pregnancy become lost to follow-up (LTFU) in the subsequent year and do not maintain viral suppression throughout the postpartum period.[2–6] HIV viremia for WLH during pregnancy and breastfeeding is associated with increased maternal morbidity and vertical HIV transmission.[7–9] Understanding loss to follow-up and maternal viremia is necessary to identify strategies to improve prevention of vertical transmission (PVT) outcomes.

Loss to follow-up from PVT services is associated with factors including younger age, ART initiation during pregnancy, stigma, poverty, and transport barriers.[2,10–13] However, these factors are largely based on analyses lacking outcomes for individuals who transferred out or became LTFU. In reality, those who become LTFU may be deceased, retained at a different facility or disengaged from care entirely, and maybe maintained or not maintained on ART. Studies utilizing active tracing of women LTFU from PVT services have shown that 30%–37% of women have evidence of HIV care at another facility, often referred to as "silent transfers."[14–17] In Uganda, community tracing of pregnant women who became LTFU revealed that only 39% were virally suppressed, compared with 89% of women retained in care.[15]

These studies demonstrate the utility of community tracing to determine the outcomes of WLH who became LTFU within 12 months postpartum.[18] However, women's outcomes after this period are less well understood. In many settings, routine HIV services are integrated within maternal-child health (MCH) clinics requiring that WLH transition to HIV clinics after completion of PVT follow-up, usually after 18–24 months postpartum.[19] Data to understand the outcomes of women and children after this transition are limited, especially for those who had become LTFU or transferred out during the early postpartum period. Determining the outcomes of those individuals can help guide retention interventions and enhance the models used by national HIV programs and UNAIDS to track the HIV epidemic.[20] The objective of this study is to determine the early and long-term outcomes of women and children who are retained in care and LTFU from PVT services in Kenya.

METHODS

Setting

This prospective cohort study was conducted at the Academic Model Providing Access to Healthcare (AMPATH) in western Kenya. AMPATH is a USAID-funded HIV care and treatment program currently serving over 122,000 people living with HIV on ART at Ministry of Health facilities that provide HIV treatment services based on national guidelines.[21] AMPATH is a participating program in the East Africa International Epidemiology Databases to Evaluate AIDS consortium.[22]

In Kenya, routine HIV services have been integrated within public MCH clinics since 2015. In this integrated model, women are given monthly appointments during pregnancy and through at least 12 months postpartum with their children. This is typically followed by appointment spacing every 2–3 months during the period from 12 to 18 months postpartum, which is when after cessation of breastfeeding the child's final HIV test is done, per recommendation of the national guidelines.[23] Following this period, women transition from the MCH clinic to a HIV Care and Treatment clinic; their children without HIV are discharged from PVT follow-up, and children with HIV continue HIV care at a dedicated HIV clinic.

Study Population

We recruited WLH age ≥18 years in antenatal clinic (ANC) at Busia County Referral Hospital, Huruma Sub-County Hospital, Kitale County Referral Hospital, Moi Teaching and Referral Hospital, and Uasin Gishu County Hospital (see Figure S1, Supplemental Digital Content, http://links.lww.com/QAI/C329). Pregnant WLH retained in care (RW) and ≥28 weeks gestation were consecutively recruited by a research assistant following a routine ANC visit if their last clinic visit was ≤90 days prior. WLH who had become LTFU (LW) after ANC enrollment were defined as having not returned to the facility for >90 days since their last attended visit after ANC enrollment through 6 months postpartum.

To recruit LW, paper medical files at each facility were reviewed to identify all women who had enrolled in ANC but had not returned for >90 days, were presumed still pregnant or within 6 months postpartum by their estimated delivery date in relation to the date of file review, and not documented as deceased or transferred out. Given that standard care consisted of monthly appointments, a gap of >90 days since the last attended appointment meant that at least 2 routinely scheduled appointments had been missed.

Potentially eligible LW were recruited through community tracing. To do this, LW were contacted by phone by a member of the clinical staff to confirm their personal details and willingness to be approached. LW willing to be approached, as well as LW who could not be reached by phone after ≥3 attempts, were traced in the community using the locator information in their files. Tracing was conducted by a facility outreach team member or a community health worker following routine AMPATH protocols, and these individuals were accompanied by one of the study's research assistants. Although community outreach is routinely performed by AMPATH-affiliated facilities, funds are often insufficient to conduct tracing of all patients who become LTFU. Therefore, the research team contributed funds to ensure the availability of transport for routine outreach during the study. Individuals conducting the outreach used unmarked vehicles or public transport and were trained to avoid disclosure of participants' HIV status by identifying themselves as MCH clinic representatives. Once the woman's identity was established, the interaction was moved to a setting where confidentiality could be maintained.

Study Procedures

After enrollment, participants were administered a survey by the research assistant capturing clinical data for the

mother and child. LW were asked additional questions about their reasons for leaving the facility where they had originally enrolled in ANC. The survey was administered in English or Kiswahili using the REDCap mobile app.[24] Dried blood spots (DBS) were collected from all women at study enrollment for VL testing. A follow-up study encounter was conducted at the facility for all RW and their infants at 4–10 weeks postpartum, following their routine postnatal clinic (PNC) visit. At this encounter, DBS were collected from women and their infants for repeat VL and HIV DNA PCR testing, respectively. For LW who were postpartum at study enrollment, DBS were also collected from their infants for HIV DNA PCR testing.

Loss to follow-up (>90 days since the last visit) at any time during pregnancy through 6 months postpartum was the primary outcome. Once a participant became LTFU, she was categorized as LW for the analysis. This is because the study team provided counseling on the importance of retention and ART adherence to LW and communicated women's contact information and VL results to the clinical staff, which may have influenced subsequent reengagement in care. Therefore, to align the observation period for RW with that of LW, we also tracked the clinic attendance through 6 months postpartum for all RW through real-time file review. If any RW became LTFU before 6 months, they were traced in the community using the same procedures used to enroll LW, and they were considered LW in the analysis.

To determine long-term outcomes of participants after completion of PVT follow-up, we attempted prospective follow-up of all participants at 3 years postpartum. To do this, we reviewed participants' records to determine whether they were LTFU once they were within 33–39 months postpartum. Given that AMPATH HIV clinics routinely offered 3 to 6-monthly HIV clinic appointments to clients enrolled in differentiated services, and to align with a prior study, loss to follow-up at 3 years postpartum was defined as >60 days since the last missed scheduled visit.[16] The study team made ≥3 phone call attempts to contact each participant. Participants reached by phone were administered a survey like that administered at study enrollment. Women who were LTFU at 3 years postpartum were traced in the community as previously described. Those LTFU who could not be traced were considered to have unknown retention status. For women missing a routine VL within the past 90 days or whose infants were missing an HIV test result after breastfeeding cessation, in-person encounters were arranged for maternal VL and child HIV DNA PCR. However, the 3-year follow-up overlapped with the onset of the COVID-19 pandemic in which in-person encounters were restricted for safety reasons, so most data were collected by phone and specimen collection could not be undertaken.

Data and Specimen Management

We extracted clinical data from paper medical files and the AMPATH electronic medical record for women and their infants and linked these data to the REDCap data.[25] DBS specimens were dried immediately after collection and transported to the AMPATH Reference Laboratory for storage at −80°C until HIV VL and DNA PCR testing. The lower limit of detection for the VL assay was 550 copies/mL.

Statistical Analysis

We first compared the characteristics of enrolled women and children at study enrollment, overall and delineated by retention status (RW vs. LW) at 6 months postpartum, using the Fisher exact test to compare percentages of categorical variables and Wilcoxon rank-sum test to compare medians of continuous variables. As described above, women who became LTFU at any point from enrollment in ANC through 6 months postpartum were classified as LW, and those not LTFU were classified as RW. As the mother's and child's appointment schedules were routinely synchronized, we considered the mother's retention status as a surrogate for the child's status in the analysis.

Next, we compared the characteristics and reasons for not returning to the ANC of enrolled reported by LW who were disengaged from care (last visit to any facility >90 days) to LW who reported "silently transferring" to another facility and were in care (last visit to the new facility ≤90 days based on self-report and verified by review of the woman's appointment card). The characteristics of women and children were also summarized at 3 years postpartum overall and by retention status at 6 months postpartum. Applying the retention data acquired through community tracing, we constructed a Sankey diagram to illustrate the flow of participants between various states of retention over time, from enrollment in ANC through 6 months and 3 years postpartum.[26] In this diagram, the height of each column is proportional to the number participants in each retention category and the colors represent various states of retention in care, thus creating an illustration of patient churn at a detail not otherwise attainable using routine program data.

We used generalized linear regression with a log link and a binomial distribution to estimate unadjusted and adjusted risk ratios (aRR) for associations with loss to follow-up through 6 months postpartum (primary outcome). The primary analysis adopted a clinic perspective, defined as LW versus RW, in which the care engagement status of those LTFU from the clinic was unknown. A secondary analysis adopted a community perspective, informed by our community tracing data, in which LW who were silently transferred were considered retained rather than disengaged from care. Both analyses used independent variables measured at ANC enrollment (age, education, facility, travel time to facility, gravidity, income, and new vs. known HIV positive). We used multinomial logistic regression to determine associations with the retention status at 3 years postpartum, defined as retained, disengaged, or unknown status, with retained as the reference. Independent variables in this analysis included those measured at ANC enrollment as well as the retention status at 6 months (RW vs. LW). We hypothesized that being newly diagnosed with HIV would be associated with retention in all models.[27]

Ethics Approval

The study was approved by the Moi University/Moi Teaching and Referral Hospital Institutional Research and Ethics Committee in Kenya and the Indiana University Institutional Review Board in the United States. A research permit was granted by the Kenya National Commission for Science, Technology and Innovation. All women provided written informed consent for their own and their children's participation. For cases in which an eligible or enrolled woman was traced in the community and discovered to be deceased or no longer with the child, written informed consent was obtained from the father or other caregiver to permit the child's participation. A recontacting provision in the initial consent was signed by all participants which enabled the three-year follow-up. After each study encounter before 6 months and at 3 years postpartum, participants who were disengaged from care were encouraged to reengage in care and their retention status and contact information were provided to the clinic staff. HIV VL and DNA PCR results were also provided to women and the clinic staff when available, typically 1–2 months after collection. The data were coded for analysis using study identification numbers assigned to each participant so that the data could not be linked to participants except by using a linkage log.

RESULTS

Characteristics of Women and Pregnancy Outcomes

From March 2018 through January 2019, 239 WLH were consecutively recruited following their routine ANC visit and enrolled in the study as RW (Fig. 1). None of those approached declined to participate. To recruit LW, we reviewed the charts of 1387 WLH enrolled in care at all sites who were pregnant or ≤6 months postpartum based on their estimated delivery date. Among them, 176 (12.7%) were eligible for recruitment as LW. Seventy-two women could not be traced, 14 (19.4%) were contacted by phone, and 58 (80.6%) were not. Upon tracing of the remaining 104 women, 4 (3.8%) declined to participate and one was deceased. Thus, 99 LW were enrolled through the record review process. In addition, among those who were retained at recruitment, 17 (7.1%) became LTFU before 6 months postpartum, 12 (70.6%) of whom were traced and reclassified as LW, and 5 (29.4%) of whom could not be traced and were excluded from the analysis. Thus, the analysis at 6 months postpartum included 222 RW and 111 LW.

Among 111 LW, 30 (27.0%) were pregnant and 81 (73.0%) postpartum at study enrollment, while by design, all RW were pregnant at study enrollment (Table 1). LW were enrolled at a median of 122 days after their last attended visit at the study facility, compared with 32 days for RW. Postpartum LW were enrolled a median of 10 weeks after delivery. Among the 81 LW who were postpartum at study enrollment, 63 (77.8%) became LTFU after their last attending the clinic during pregnancy and 18 (22.2%) after last attending clinic at a median of 6 weeks postpartum. Compared with RW, LW were younger, less likely to be married/cohabitating, and more likely to be primigravida and newly diagnosed with HIV. More LW compared with RW had not disclosed their HIV status to their partner. Viral suppression at enrollment was higher among RW (92.3%) than LW (59.1%).

Pregnancy outcomes were missing for 2 LW who enrolled in the study during pregnancy and were LTFU from the study and facility and not reencountered after delivery, resulting in 331 women with a known pregnancy outcome (Table 2). Miscarriage/spontaneous abortion was higher among LW (11.0%) compared with RW (0.5%). All of the LW who experienced a miscarriage/spontaneous abortion became LTFU after last attending clinic during pregnancy.

Characteristics of Infants

There were 325 liveborn infants, 226 born to RW, and 99 to LW (Table 3). HIV-free survival (the proportion of HIV-exposed infants alive and HIV uninfected) through 6 months was 95.4% overall and was lower among infants of LW (87.9%) compared with RW (98.7%). All 8 of the infants who tested HIV positive, including 7 infants of LW and 1 of RW, had mothers who were not virally suppressed at study enrollment.

Reasons for Leaving the Facility

Among 111 LW, 32 (28.8%) reported silently transferring to a new facility and were in care (defined by <90 days since their last visit to the new facility) and 79 (71.2%) were disengaged from care when they were first encountered as LW (Fig. 2 and Table S1, Supplemental Digital Content, http://links.lww.com/QAI/C329). The most frequently self-reported reasons for not returning to the study facility included transport cost/difficulty, poor service quality, and risk of HIV stigma or status disclosure. Transport cost/difficulty and change of residence were more frequently reported by silently transferred compared with disengaged women.

Outcomes at Three Years

Among all women, 3 (0.9%) died, including one RW who died at one month postpartum because of preeclampsia and 2 LW who died at 13 months postpartum, one of tuberculosis and the other of an unknown illness (Table 4). A total of 230 (69.1%) women were retained in care at the ANC or enrollment by 3 years postpartum, including 179 (80.6%) and 51 (45.9%) of women previously classified as RW and LW, respectively. Thirty women (9.0%) had a documented transfer to another facility, of which 28 (93.3%) were retained in care at the new facility. Among 70 (21.0%) women classified as LTFU at 3 years, 8 (11.4%) had silently transferred to a new facility, 19 (27.1%) were disengaged from care, and 43 (61.4%) were untraceable and thus classified as unknown retention status. Overall, among the 333 women, 266 (79.9%) were retained in care at any facility, 19 (5.7%) were disengaged from care, 3 (0.9%) were deceased, and the retention and vital status could not be

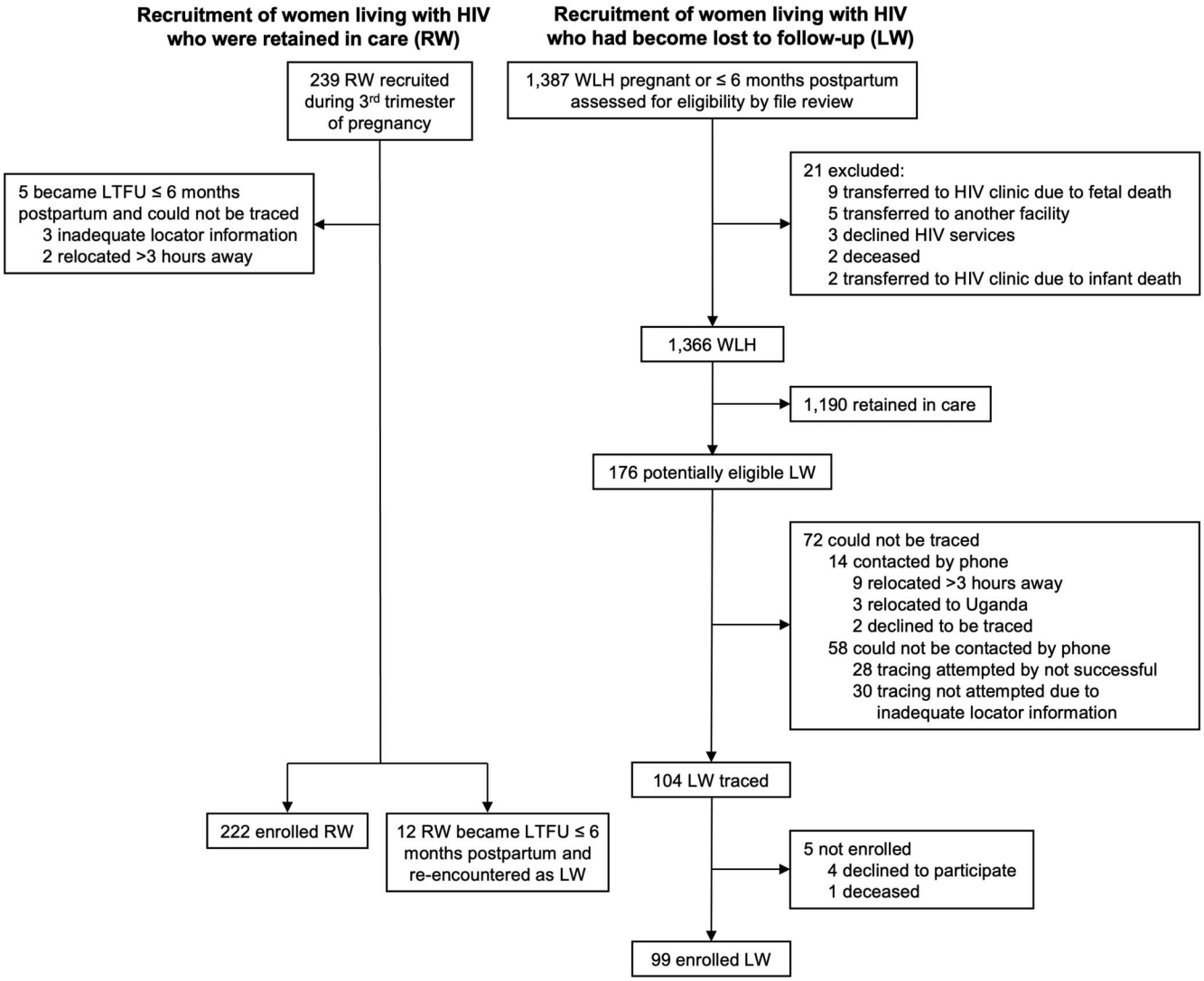

FIGURE 1. Identification and recruitment of participants. The left figure shows the recruitment of RW who were consecutively recruited following their routine ANC visit at ≥28 weeks gestation. The right figure shows the process of medical file review to identify LW eligible for recruitment through community tracing. In this figure, the 1190 retained in care include the RW in the left figure.

determined for 45 (13.5%) women (Fig. 3). Child HIV-free survival at 3 years was 266 of 325 (81.8%); 12 (3.7%) were living with HIV, 12 (3.7%) were deceased, and 35 (10.8%) had unknown vital and HIV status (Table 5).

Associations With Loss to Follow-Up

Being newly diagnosed with HIV at ANC enrollment was the only factor associated with loss to follow-up in the adjusted primary (aRR 1.21, 95% CI: 1.11 to 1.31) and secondary (aRR 1.18, 95% CI: 1.08 to 1.28) analyses (see Table S2, Supplemental Digital Content, http://links.lww.com/QAI/C329). At 3 years, being newly diagnosed with HIV was associated with being disengaged from care (aRR 3.72, 95% CI: 1.24 to 11.17) and having unknown retention status (aRR 5.98, 95% CI: 2.38 to 15.05) (see Table S3, Supplemental Digital Content, http://links.lww.com/QAI/C329). Having unknown retention status was also associated with being primigravida (aRR 3.81) and LTFU at 6 months (aRR 5.14).

DISCUSSION

Our study generates important insights concerning the dynamic nature of retention for PVT clients and differential outcomes between those retained and LTFU. A notable finding is that 40.9% of women identified as LTFU were untraceable, mostly because of inadequately documented locator information. PVT studies in eSwatini, Malawi, and Uganda have reported similarly low tracing success ranging from 40% to 55%.[15,28–30] In contrast, tracing success for nonpregnant adults often exceeds 80%.[31–33] Differences in

TABLE 1. Characteristics of Women at Study Enrollment, Overall and Delineated by Retention Status by 6 Months Postpartum

Characteristic	Total N = 333, n (%)	RW N = 222, n (%)	LW N = 111, n (%)	*P*
Age at ANC enrollment, median years (IQR)	31 (24–34)	32 (26–35)	28 (23–33)	<0.01
Weeks gestation at ANC enrollment, median (IQR)	23 (18–27)	22 (17–27)	23 (22–26)	0.12
Weeks gestation at study enrollment, median (IQR)*	33 (31–37)	34 (31–37)	33 (31–37)	0.52
Weeks postpartum at study enrollment, median (IQR)†	n/a	n/a	10 (5–16)	n/a
Facility				
Busia District Hospital	63 (18.9)	45 (20.3)	18 (16.2)	0.52
Huruma District Hospital	46 (13.8)	27 (12.2)	19 (17.1)	
Kitale District Hospital	68 (20.4)	48 (21.6)	20 (18.0)	
Moi Teaching and Referral Hospital	102 (30.6)	69 (31.1)	33 (29.7)	
Uasin Gishu District Hospital	54 (16.2)	33 (14.9)	21 (18.9)	
Educational attainment				
None	43 (12.9)	28 (12.6)	15 (13.5)	0.95
Primary	144 (43.2)	95 (42.8)	49 (44.1)	
Secondary	105 (31.5)	70 (31.5)	35 (31.5)	
Tertiary or higher	41 (12.3)	29 (13.1)	12 (10.8)	
Married/cohabitating	249 (74.8)	175 (78.8)	74 (66.7)	0.02
Unemployed	138 (41.4)	83 (37.4)	55 (49.6)	0.05
Family income (Ksh/month)				
<1000	79 (23.7)	45 (20.3)	34 (30.6)	0.05
1001–10,000	184 (55.3)	124 (55.9)	60 (54.1)	
>10,000	70 (21.0)	53 (23.9)	17 (15.3)	
Owns mobile phone	290 (85.8)	201 (90.5)	85 (76.6)	<0.01
Travel time to facility, median minutes (IQR)	30 (20–60)	30 (20–60)	30 (30–60)	0.03
Primigravida	59 (17.7)	31 (14.0)	28 (25.2)	0.02
No. of other children, median (IQR)‡	2 (1–3)	2 (2–3)	2 (1–3)	0.21
Has other children living with HIV§	41 (16.1)	28 (15.9)	13 (16.7)	0.86
Delivery location preference				
Facility	323 (97.0)	221 (99.6)	102 (91.9)	<0.01
Home	10 (3.0)	1 (0.5)	9 (8.1)	
HIV status not disclosed to anyone	41 (12.3)	22 (9.9)	19 (17.1)	0.08
HIV status not disclosed to partner	89 (26.7)	51 (23.0)	38 (34.2)	0.04
Partner HIV status				
Positive	122 (36.6)	87 (39.2)	35 (31.5)	<0.01
Negative	82 (24.6)	70 (31.5)	12 (10.8)	
Unknown	129 (38.7)	65 (29.3)	64 (57.7)	
Partner taking ART‖				
Yes	97 (79.5)	73 (83.9)	24 (68.6)	0.14
No	17 (13.9)	9 (10.3)	8 (22.9)	
Do not know	8 (6.6)	5 (5.6)	3 (8.6)	
Partner taking PrEP¶				
Yes	7 (8.5)	6 (8.6)	1 (8.3)	0.03
No	66 (80.5)	59 (84.3)	7 (58.3)	
Do not know	9 (11.0)	5 (7.1)	4 (33.3)	
Newly diagnosed with HIV during pregnancy	120 (36.0)	59 (26.6)	61 (55.0)	<0.01
Years on ART at ANC enrollment, median (IQR)	1.7 (0–5.5)	2.4 (0–6.0)	0 (0–3.7)	<0.01
WHO stage at ART initiation#				
Stage 1 or 2	202 (60.7)	147 (66.2)	55 (49.6)	0.01
Stage 3 or 4	35 (10.5)	22 (9.9)	13 (11.7)	
Missing	96 (28.8)	53 (23.9)	43 (38.7)	
Antiretroviral base				
Efavirenz or nevirapine	298 (89.5)	199 (89.6)	99 (89.2)	0.03
Lopinavir or atazanavir	12 (3.6)	9 (4.1)	3 (2.7)	
Dolutegravir	14 (4.2)	9 (4.1)	5 (4.5)	

(*continued on next page*)

TABLE 1. (*Continued*) Characteristics of Women at Study Enrollment, Overall and Delineated by Retention Status by 6 Months Postpartum

Characteristic	Total N = 333, n (%)	RW N = 222, n (%)	LW N = 111, n (%)	*P*
Other	5 (1.5)	5 (2.3)	0 (0)	
Not on ART	4 (1.2)	0 (0)	4 (3.6)	
Viral suppression**	270 (81.3)	205 (92.3)	65 (59.1)	<0.01

*222 RW and 31 LW enrolled in the study during pregnancy.
†81 LW enrolled in the study during the postpartum period.
‡Among 191 RW and 83 LW with a prior pregnancy.
§Among 176 RW and 78 LW with other children.
‖Among 87 RW and 35 LW who reported having a partner with HIV; 5 RW and 3 LW reported not knowing whether their partner was taking ART.
¶Among 70 RW and 12 LW who reported having a partner without HIV; 5 RW and 4 LW did not know whether their partner was taking pre-exposure prophylaxis.
#Defined as the maximum WHO stage before ART initiation, or if missing, first recorded WHO stage within 60 days after ART initiation.
**VL missing for 1 of the LW.
Ksh, Kenya shillings; PrEP, pre-exposure prophylaxis; WHO, World Health Organization.

HIV stigma and disclosure, patient mobility, ART experience, and outreach capacity within integrated MCH clinics may underly this disparity. Improving locator documentation and community tracing capacity in integrated MCH clinics could enhance tracing success for this population.

Thirty percent of LW had silently transferred to another facility by 6 months postpartum. This is similar to silent transfer rates in other PVT studies, which range from 30% to 37% before 12 months postpartum.[14–17] Transport cost/difficulty and change of residence were the most common self-reported reasons for silent transfers. These reasons may reflect the common practice of women returning to their households of origin for family support after delivery.[34] Clinic switching in PVT and non-PVT populations in Africa has been linked to factors such as employment, family relationships, and to avoid stigma.[28,29,35–37] Further research is needed to understand the risk of adverse outcomes related to clinic switching in PVT populations, as well as how to adapt PVT services to meet the needs of this population. Accurate documentation of patients' movements between clinics is also crucial to ensure that tracing resources are focused on those truly disengaged from care and not those who are in care elsewhere.

We found that nearly half of all LW at 6 months had reengaged in care at 3 years, including 51% of LW who were found to be disengaged from care at any clinic by 6 months and 34% who had silently transferred out and were engaged in care at another clinic by 6 months. This underscores the dynamic nature of retention for this population and the utility

TABLE 2. Pregnancy Outcomes Among Women, Overall and Delineated by Retention Status

Characteristic	Total N = 331, n (%)	RW N = 222, n (%)	LW N = 109, n (%)	*P*
Pregnancy outcome				
Live birth	318 (96.1)	221 (99.6)	97 (89.0)	<0.01
Miscarriage or spontaneous abortion	13 (3.9)	1 (0.5)	12 (11.0)	
Delivery location*				
Study facility	168 (52.8)	133 (60.2)	35 (36.1)	<0.01
Other facility	121 (38.1)	73 (33.0)	48 (49.5)	
Home	29 (9.1)	15 (6.8)	14 (14.4)	
Delivery mode*				
Vaginal	282 (88.7)	195 (88.2)	87 (89.7)	0.85
C-section	36 (11.3)	26 (11.8)	10 (10.3)	
No. of infants delivered*				
1	311 (97.8)	216 (97.7)	95 (97.9)	1.00
2	7 (2.2)	5 (2.3)	2 (2.1)	

*Excludes miscarriages.

TABLE 3. Characteristics of Liveborn Infants, Overall and Delineated by Maternal Retention Status

Characteristic	Total N = 325, n (%)	Infants of RW N = 226, n (%)	Infants of LW N = 99, n (%)	*P*
Age at study encounter, median weeks (IQR)	6.4 (6.1–8.4)	6.3 (6.0–6.6)	9.3 (6.4–14.6)	<0.01
Female	178 (55.6)	128 (56.9)	50 (52.6)	0.54
Birth weight, median kg (IQR)*	3.1 (2.8–3.5)	3.2 (2.8–3.6)	3.0 (2.7–3.4)	0.02
Feeding method at infant DNA PCR†				
Exclusive breastfeeding	298 (93.7)	216 (96.4)	82 (87.2)	<0.01
Mixed feeding	14 (4.4)	5 (2.2)	9 (9.6)	
Exclusive replacement feeding	6 (1.9)	3 (1.3)	3 (3.2)	
Vital status at 6 months of age				
Alive	318 (97.9)	224 (99.1)	94 (95.0)	0.03
Deceased	7 (2.2)	2 (0.9)	5 (5.0)	
HIV positive‡	8 (2.5)	1 (0.5)	7 (7.5)	<0.01
HIV-free survival	310 (95.4)	223 (98.7)	87 (87.9)	<0.01

*Birth weight was documented for 223 and 87 infants of RW and LW, respectively.
†Feeding method available for 224 and 94 infants of RW and LW, respectively.
‡Among infants alive through 6 months.

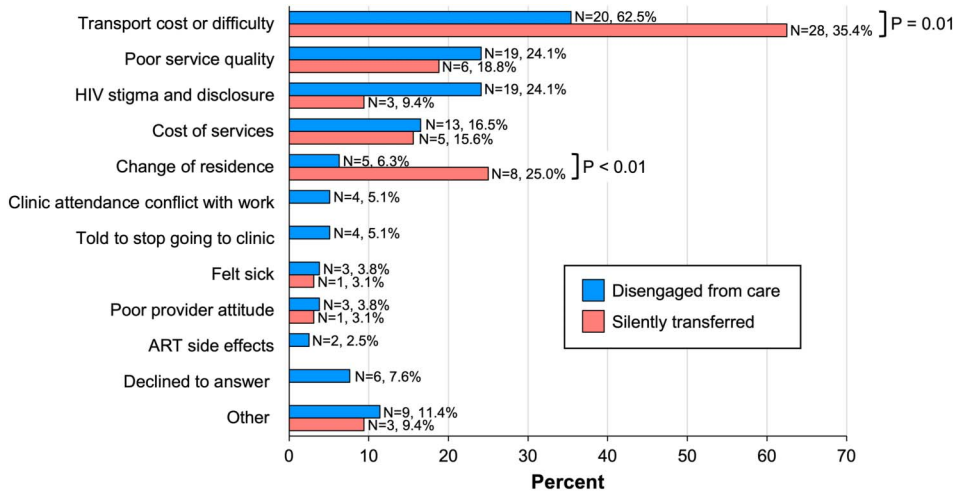

FIGURE 2. Self-reported reasons by LW for not returning to the facility at which they had enrolled in ANC. The Y-axis shows the reasons for not returning to the facility, ordered by frequency from highest to lowest. The X-axis shows the percentage of LW reporting each reason, stratified by LW who were disengaged from care (blue) versus silently transferred (red).

of longitudinal measures of patient churn. Being newly diagnosed with HIV at ANC enrollment remained associated with nonretention in all analyses, highlighting the importance of this characteristic as a predictor of adverse outcomes and the need to enhance services for this group.

HIV-free survival was lower among children of LW compared with RW at 6 months and 3 years. The three-year estimates are limited by missing data. However, missingness was more common among children of LW compared with RW, meaning that HIV-free survival is probably overestimated. For children of RW, the vertical transmission rate <1% is encouraging in the context of Kenya's national estimate of 9.7% in 2021 and goal to eliminate mother-to-child transmission.[38,39] As our study shows, mitigating loss to follow-up is critical to improving outcomes for pregnant and postpartum WLH and their children. However, research is needed to identify PVT service delivery models that are more responsive to the barriers and transitions that LW experience during the pregnancy-postpartum continuum.[40] Differentiated service delivery models can address this need but few have focused on PVT or how to enhance services for LW.[41]

Strengths of our study include its large sample size compared with other PVT tracing studies and ascertainment of outcomes after completion of PVT follow-up. Limitations

TABLE 4. Outcomes of Women at Three Years Postpartum, Delineated by Retention Status at 6 Months Postpartum

Characteristic	Total N = 333, n (%)	RW N = 222, n (%)	LW N = 111, n (%)	*P*
Months postpartum at follow-up, median (IQR)	34 (33–36)	34 (33–36)	35 (33–37)	0.04
Retained at study facility	230 (69.1)	179 (80.6)	51 (45.9)	<0.01
Documented transfer (n = 30)				
Retained at new facility	28 (8.4)	16 (7.2)	12 (10.8)	
Disengaged from new facility	0 (0)	0 (0)	0 (0)	
Unknown retention status	2 (0.6)	2 (0.9)	0 (0)	
LTFU (n = 70)				
Silent transfer after 6 months postpartum, retained at new facility	8 (2.4)	3 (1.4)	5 (4.5)	
Disengaged from study facility	19 (5.7)	11 (5.0)	8 (7.2)	
Unknown retention status*	43 (12.9)	10 (4.5)	33 (29.7)	
Deceased	3 (0.9)	1 (0.5)	2 (1.8)	
Overall retention in care†				
Total retained in care	266 (79.9)	198 (89.2)	68 (61.3)	<0.01
Total disengaged from care	19 (5.7)	11 (5.0)	8 (7.2)	
Unknown retention status	45 (13.5)	12 (5.4)	33 (29.7)	
Deceased	3 (0.9)	1 (0.4)	2 (1.8)	
Viral load				
<1000 copies/mL	184 (55.3)	150 (67.6)	34 (30.6)	<0.01
≥1000 copies/mL	10 (3.0)	6 (2.7)	4 (3.6)	
Missing	139 (41.7)	66 (29.7)	73 (65.8)	

*Includes 12 LW that had silently transferred out before 6 months postpartum.
†Excludes 3 women who were deceased.

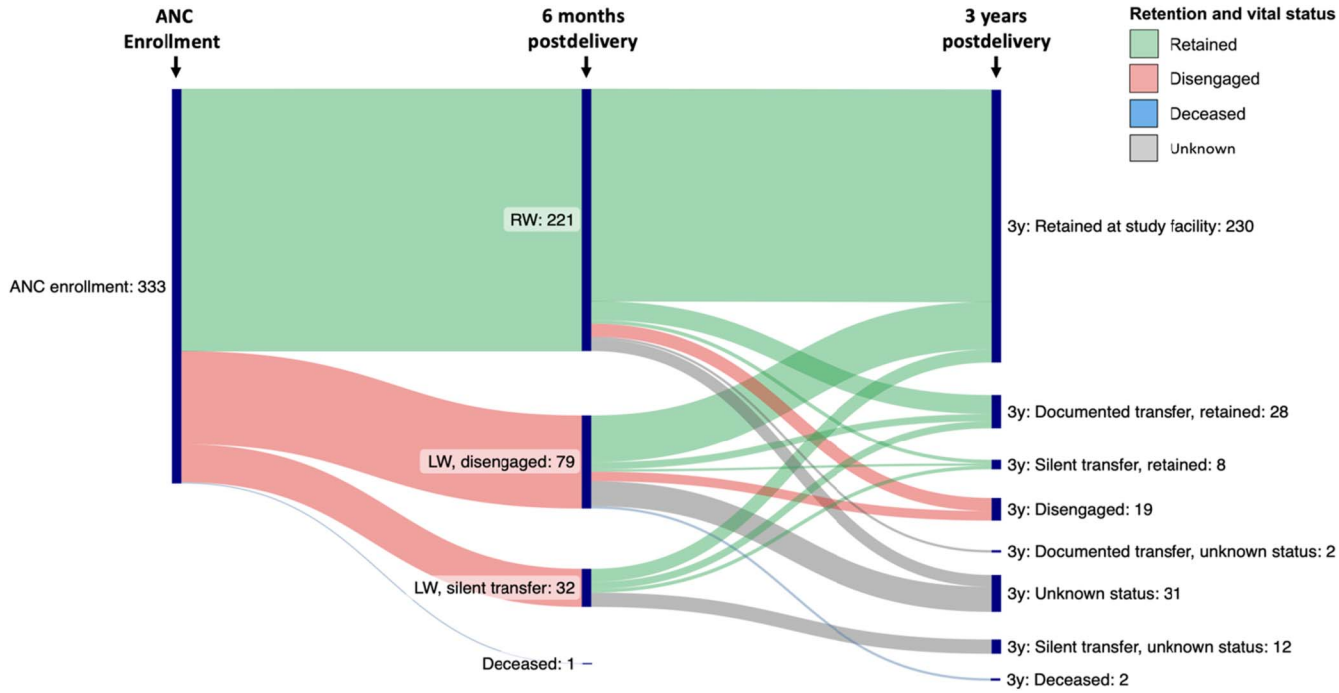

FIGURE 3. Retention status among women after enrollment in ANC, by 6 months and 3 years postpartum. The figure shows the flow of participants within different retention categories following enrollment in ANC through 6 months and 3 years postpartum. The heights of the paths represent the proportion of participants within each category, and the labels indicate the number of participants in each category. The colors of the paths correspond to the retention and vital status of women ascertained through prospective follow-up and community tracing: retained in care (green), disengaged from care (red), unknown retention status (gray), and deceased (blue). Path widths are not to scale. The left half of the figure shows the retention outcomes for full cohort (n = 333) by 6 months postpartum (center node), including those who remained retained in care through 6 months postpartum (RW, green path, n = 221), and those who became LTFU after ANC enrollment and before 6 months postpartum (LW, red paths, n = 111). LW are further segmented by those found to be disengaged from care (n = 32) versus silently transferred (n = 79). The right half shows the outcomes for the full cohort at 3 years postpartum (rightmost node), including those who remained retained at the study facility (≤60 days since the last missed scheduled visit at study facility; n = 230), documented transfer to another facility and were retained at the other facility (≤60 days since the last missed scheduled visit at other facility; n = 28), silently transferred to another facility and were retained at the other facility (n = 8), or disengaged from care (>60 days since last missed scheduled visit at any facility; n = 19). Also shown are those whose retention outcomes could not be verified (ie, unknown status), segmented by those who had evidence of documented transfer to another facility (n = 2), those without any evidence of transfer (unknown status, n = 31), and those found to have silently transferred out before 6 months whose status at 3 years could not be verified (silent transfer, unknown status; n = 12).

include the lack of clinical information on LW who could not be traced and missing data at the three-year mark, potentially limiting the generalizability of the study. We also did not collect data on treatment interruptions before pregnancy among women with known HIV before ANC enrollment, which could be predictive of later treatment during

TABLE 5. Characteristics of Children at Three Years After Birth, Overall and Delineated by Maternal Retention Status at 6 Months Postpartum

Characteristics at 3 Years Postpartum	Total N = 325, n (%)	Children of RW N = 226, n (%)	Children of LW N = 99, n (%)	*P*
Months postpartum at follow-up, median (IQR)	34 (33–36)	34 (33–36)	35 (34–37)	<0.01
Age at breastfeeding cessation, median months (IQR)*	12 (9–14)	12 (10–14)	12 (7–12)	0.07
HIV-free survival				
Alive and HIV negative	266 (81.8)	208 (92.0)	58 (58.6)	<0.01
Alive and HIV positive	12 (3.7)	1 (0.4)	11 (11.1)	
Deceased	12 (3.7)	5 (2.2)	7 (7.1)	
Unknown	35 (10.8)	12 (5.3)	24 (24.2)	

*Data available for 198 infants of RW and 58 infants of LW.

pregnancy/postpartum follow-up. Our findings also may not be generalizable to more rural settings.

CONCLUSIONS

Outcomes among women and children LTFU from PVT services were worse than among those retained in care, underscoring the importance of retention in care for this population. Some, but not all, LW were re-engaged in care by 3 years, highlighting the sustained risk of disengagement among those with previous interruptions in care and the need for PVT services to be more responsive to the barriers and transitions women experience during pregnancy and postpartum.

ACKNOWLEDGMENTS

The authors thank the clinical staff and community health workers at AMPATH for their collaboration with community tracing and in collecting the data that made this study possible.

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