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Durability of HIV Viral Load Suppression among Postpartum Women in 13 Countries in Sub-Saharan Africa

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By

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Bachelor of Science
Duke University
2021

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Abstract

Durability of HIV Viral Load Suppression among Postpartum Women in 13 Countries in Sub-Saharan Africa

By Meghan Peel

Achieving and retaining HIV viral load suppression (VLS) in the postpartum period is especially difficult for mothers, despite the implementation of Option B+ and other high coverage and long-lasting HIV treatment options. This has important implications for their health and the health of their children and partners. In this study, we analyzed data from the Population-Based HIV Impact Assessment (PHIA) to determine the durability of VLS in the first three years postpartum. We identified VLS by three different cutoffs: <1000 copies/mL (epidemiologically suppressed), <200 copies/mL (low-level viremia, previous standard for undetectable), and <50 copies/mL (new standard for undetectable). We used HIV testing weights pooled across all 13 countries to estimate the percentage of viral suppression and log-binomial regression to estimate crude prevalence ratios at each of the VLS cutoffs. We also utilized logistic regression to incorporate demographic and behavioral factors into our estimates. In all analyses, there was a demonstrated drop-off from year 1 postpartum to year 2, and further drop-offs by year 3. Even when accounting for confounding factors, the trend remained the same for all levels of VLS. There were no differences in VLS outcomes by breastfeeding status, parity, or awareness of HIV status at the time of pregnancy. These findings demonstrate the need for additional support and care for women in the postpartum period, especially after the first year postpartum. Resources should be applied to all mothers, regardless of demographic or reproductive factors, and should be used to support mothers no matter how recently they delivered. However, because the reduction in VLS continues over time, additional support may be necessary later in the postpartum period.

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Introduction

Prevention of mother-to-child transmission of HIV is key to reducing the HIV burden in children under age 15. In West and Central Africa in 2021, there were an estimated 54,000 new HIV infections and 38,000 deaths due to AIDS in children, with an estimated 420,000 children living with HIV. There were also approximately 2.9 million women over the age of 15 living with HIV in this region, with 88,000 new infections in 2021. The burden in Eastern and Southern Africa is even more significant, with around 1 million children living with HIV, 78,000 new infections, and 45,000 deaths from AIDS in children under 15. There were also nearly 12.6 million women living with HIV, and 390,000 new HIV infections in women in 2021. Of the countries included in this analysis (most of which are in Eastern and Southern Africa), there is variation in antiretroviral therapy (ART) coverage of pregnant women and the vertical transmission rate (including during breastfeeding). Cameroon and Ethiopia have the highest vertical transmission rates, while Eswatini and Namibia have the lowest. Cameroon and Ethiopia also have the lowest percent ART coverage of pregnant women, while Eswatini, Namibia, and Uganda have the highest (AIDSInfo).

To address this burden, the WHO's Option B+ program began rolling out in Malawi in 2011, and by 2013 was becoming established in a number of other sub-Saharan African countries. Option B+ allows pregnant women to start antiretroviral therapy (ART) regardless of their CD4 count and encourages lifelong HIV treatment (*Impact of an Innovative Approach to Prevent Mother-to-Child Transmission of HIV — Malawi, July 2011–September 2012*, 2013). Treatment adherence and resulting viral load suppression significantly reduces the risk of the mother transmitting HIV to her child through pregnancy, delivery, or breastfeeding (Chi et al., 2013, Chaka et al., 2019). Further, lifelong treatment after her pregnancy protects the mother's

health, prevents transmission to seronegative sexual partners, and protects against HIV transmission in any future pregnancies (Chaka et al., 2019). Though Option B+ is generally accepted by pregnant women living with HIV in these settings, not all pregnant and breastfeeding women are able to achieve viral suppression (Chadambuka et al., 2018, Yotebieng et al., 2019). Adherence to ARTs throughout pregnancy can be very challenging, but it is particularly difficult in the postpartum period, where adherence tends to be lower than during pregnancy (Nachega et al., 2016). This has important consequences for the prevention of mother-to-child transmission of HIV during pregnancy and while breastfeeding in the postpartum period.

Though there have been previous studies focused on the ART adherence and prevalence of viral suppression in pregnant and breastfeeding mothers living with HIV, there are limited studies focused on the durability of viral load suppression (VLS) at undetectable levels or levels of low-level viremia during the postpartum period. This is particularly important, because mother-to-child transmission of HIV can still occur even at levels of low-level viremia, which is often associated with reduced adherence to ARTs and may be missed in studies that only include the epidemiologic definition of viral suppression (<1000 copies/mL) (Landes et al., 2019). In addition, this analysis has not been done at this scale. Thus, the goal of this study is to determine how durable viral suppression is postpartum in mothers living with HIV across 13 sub-Saharan African countries. We wish to explore whether this relationship is consistent when using low-level viremia or undetectable VLS levels, as there is a growing shift toward these measurements as a marker for controlled HIV infection.

Methods

Data for this study was provided by the Population-Based HIV Impact Assessment (PHIA) project. This project consists of a series of nationally representative cross-sectional

household surveys conducted in Cameroon, Cote d'Ivoire, Eswatini, Ethiopia, Kenya, Lesotho, Malawi, Namibia, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe. Trained interviewers collected household-based demographic, behavioral, and clinical information and conducted high-quality blood tests for HIV serostatus, CD4+ count, presence of ARVs, and viral load (Sachathep et al., 2021; Patel et al., 2021). HIV serostatus was determined with a combination of home-based rapid tests and confirmatory laboratory testing. Recency of HIV infection was also able to be determined using a combination of Limited Antigen Enzyme (LAg-Avidity) immunoassay, HIV viral load, and ARV test results (Population-based HIV Impact Assessment (PHIA) Data Use Manual, Voetsch et al, 2021). Viral load testing was done by plasma sample or dried blood spot (DBS), depending on the country (Schrubbe et al., 2023). Women who participated in the interviews were asked about their reproductive history, including detailed information on any pregnancies in the last 3 years. The interview asked questions about the mother's HIV status and their knowledge of that status, the antenatal care they received during their pregnancy, if any, and whether they breastfed their children. Data included in this study was collected between 2015 and 2019.

Those included in the study population were mothers who had tested positive for HIV, were between the ages of 15 and 49, and had delivered within the past 36 months at the time of the survey. Mothers without HIV testing weight (blood weight) data or unknown VLS status at <1000 copies/mL were removed from the final dataset (n = 3638). Characteristics of the study population can be found in the total column of Table 1.

Delivery times were defined by year, including those that delivered less than 12 months of the survey date, those that delivered between 12 and less than 24 months of the survey date, and those that delivered between 24 and 36 months of the survey date. These values were

calculated using the age in months of each mother's last live birth at the time of the interview. Other variables included in this analysis include whether a mother breastfed their last child, number of pregnancies, country, age group, wealth quintile, urbanicity, whether the mother accessed antenatal care during their last pregnancy, and whether they were aware of their HIV status at the time of their last pregnancy. A mother was considered as having breastfed their last child if they responded as either currently or previously breastfeeding their last child. Parity is the number of pregnancies a mother reported, including any current pregnancies. A mother was considered as living in an urban area if this was reported in the survey. Peri-urban and rural settings were not included in this value. Those who reported accessing antenatal care did so during their most recent pregnancy. A mother was considered aware of their HIV status at time of pregnancy if they either tested and got a result (positive or negative) during their pregnancy, or if they knew their HIV status before their pregnancy. Additional details on the questions asked during the survey and the answer choices provided for each country are available on the PHIA dataset website (https://phia-data.icap.columbia.edu/datasets).

HIV viral load suppression is defined as <1000 RNA copies/mL unless otherwise specified. Analysis of levels of viral load suppression were also included at the <200 copies/mL and <50 copies/mL cutoffs to represent low-level viremia and undetectable status, respectively. These values were chosen based on updated WHO guidelines, which suggested that viral loads suppressed below <1000 copies/mL were controlled infections, while those that were <50 copies/mL were considered undetectable (*HIV/AIDS)*. The U.S. CDC uses <200 copies/mL as its definition of viral suppression in its campaign to end the HIV epidemic (CDC). For comparability to other studies and the HIV status across different countries, all of these VLS definitions were included. For additional comparability if needed, analysis using <400 copies/mL

was also included supplementally. All results from this analysis are available in the supplemental tables section. Mothers were considered virally suppressed under these cutoffs if their blood test results were able to be classified as either <200 copies/mL or <50 copies/mL. Because of varying sensitivity in the viral load tests between countries, some viral load test results were unable to be categorized as virally suppressed or not under these cutoffs. In these cases, viral load suppression was considered unknown and was not included in the analysis for that level of VLS. However, these women were not removed from the study population.

The data used in this report was adjusted using survey weights based on the 2-stage cluster design used to conduct the surveys. The replicate blood weights provided in the PHIA data were pooled together across all 13 countries, creating an equal number of weights across all countries. Weights from Kenya and Rwanda were adjusted and scaled up to the full national population, rather than the study population alone. Survey weights accounted for survey design and participant non-response. Jackknife variance estimation was done with the survey package in R. For each level of viral suppression, all mothers who did not have viral load suppression data were removed from the analysis. Sample code for this process is available in the PHIA data use manual (Population-based HIV Impact Assessment (PHIA) Data Use Manual).

The weighted proportion of mothers who were virally suppressed was calculated using the different levels of viral suppression as described previously (<1000 copies/mL, <200 copies/mL, <50 copies/mL). The pooled survey weights were used to calculate these values. The proportions virally suppressed were calculated using the <1000 copies/mL cutoff for all confounding variables. Prevalence ratios were calculated using the survey package as well, and all mothers who did not have data for the variable of interest were removed from the analysis for that variable. The results of this analysis can be found in Table 2.

After performing baseline analysis on these variables, we performed logistic regression using delivery time as the multi-level exposure and viral load suppression as the outcome. Survey weights were used to scale the data appropriately in all analyses. Each model was run with the different VLS definitions as the outcome (<1000 copies/mL, <200 copies/mL, <50 copies/mL). Parity, breastfeeding status, and awareness of HIV status at the time of pregnancy were included as interaction terms. A confounding assessment was done including breastfeeding, parity, country, age group, urbanicity, antenatal care, awareness of HIV status at the time of pregnancy, and wealth quintile as confounders. Collinearity testing and an interaction assessment were done prior to the confounding assessment.

All data cleaning and analysis was done using the statistical software R (R Core Team, 2022).

Results

The percentage of mothers that were virally suppressed after calculation with the survey weights decreased over time when using all three of the VLS definitions. VLS ranged from 60-70%, 55-66%, and 49-59% for the VLS definitions of <1000 copies/mL, <200 copies/mL, and <50 copies/mL respectively. In all scenarios, VLS was highest within the first year of delivery and lowest within the third year of delivery. The decreases in VLS between the first and second year were greater than the decreases in VLS between the second and third year postpartum for all VLS definitions (Table 2).

In all three levels of viral suppression (<1000 copies/mL, <200 copies/mL, and <50 copies/mL), there is a drop-off in viral suppression after the first year postpartum. For example, when using a cutoff of <1000 copies/mL as the definition for viral suppression, there is a 13%

lower prevalence of viral load suppression within 2 years post-delivery, and a 14% lower prevalence of VLS with 3 years post-delivery. The measures for the other VLS cutoffs are similar and can be found in Table 2. All decreases in VLS are statistically significant with the exception of 2 years post-delivery using <50 copies/mL as the cutoff for VLS. VLS also decreased over time when using <400 copies/mL as the definition for VLS, and these results are available in Supplemental Table 2.

Though parity, breastfeeding status, and awareness of HIV status at the time of pregnancy were included as interaction terms, an interaction assessment determined that there was no interaction between these variables and delivery time. When conducting a confounding assessment, only the age group changed the outcome of the model substantially, though all confounding variables were retained in the model because of their value in answering the research question. The drop-off in viral load suppression remained after adjusting for all confounding variables in all VLS cutoff scenarios. The fully adjusted model included all confounding variables listed previously, but it did not include the interaction terms tested because they were not significant. The results from this model are presented in Table 3, which provides the odds ratios for these VLS cutoffs without accounting for any interaction or confounding factors (crude model) in addition to the fully adjusted model that is discussed here.

Discussion

We analyzed the PHIA HIV viral load suppression data from 13 countries at three different definitions of VLS (<1000 copies/mL, <200 copies/mL, and <50 copies/mL) in the first three years after delivery in mothers living with HIV. Viral load suppression decreased over time regardless of the definition used for VLS. Prior research has shown that this is a common trend, especially in the postpartum period, as adherence to ARTs is more difficult in the postpartum

period than during pregnancy (Nachega et al., 2016). VLS is especially important in this population, as a reduction in viral load to undetectable levels can protect the health of the mother by preventing the progression from HIV into more advanced stages of the disease. Reduced viral loads can also prevent vertical transmission to any children the mother has (present or future) through delivery or breastfeeding and prevent transmission to seronegative partners (Chi et al., 2013, Chaka et al., 2019). Our findings demonstrate that this is a widespread problem in this region of the world, and that despite implementation of Option B+ and other HIV interventions, there is still substantial need for improvement in access and adherence to ARTs in postpartum women, no matter the VLS standard used for measurement.

Not only did VLS decrease over time regardless of the VLS definition, but there was also a more substantial decrease in VLS between the first and second years postpartum as opposed to between the second and third years. Other studies have also found that adherence to ARTs is much lower in the postpartum period as opposed to the antenatal period, and that loss-to-follow up is a substantial issue in longitudinal studies focused on VLS and ART adherence in the postpartum period (Nachega et al., 2016, Akama et al., 2019). However, there is limited evidence prior to this study of the importance of the period after the first year postpartum on successful HIV treatment. This study suggests that there is a larger drop-off in the women enrolled in HIV treatment programs and effectively using ARTs after the first year postpartum than after the second year. This is important for future program planning, as it may be important to focus resources on retaining mothers in care more during this critical period.

The drop-off in VLS over time did not differ based on parity, breastfeeding history, or knowledge of HIV-positive status. Known positivity at the time of pregnancy (as opposed to those who are diagnosed at the time of pregnancy) has previously been found to not have a

significant impact on VLS; however, there is a difference in the percentage of those who remained in care at an approximately 1.5-year postpartum follow-up between these two groups (Akama et al., 2019). This has important implications for delivery of services to postpartum mothers. Resources and additional support in the postpartum period should be extended no matter the number of children they have had, whether they breastfed their last child, or whether they knew their HIV status at the time of pregnancy.

VLS also consistently declined after the first year postpartum when accounting for breastfeeding status, parity, country, age group, urbanicity, wealth quintile, whether a mother accessed antenatal care, and whether the mother's HIV status was known at the time of pregnancy. Other studies have found that age tends to have a significant impact on VLS in pregnant in breastfeeding women, as older women tend to be more likely to be virally suppressed (Yotebieng et al., 2019). Though age group had the greatest impact on the results of the logistic regression when investigating individual variables, this difference did not change the trend in VLS after the first year postpartum for any of the levels of VLS included in this analysis. Even though there is the possibility of great variation in the factors included in this analysis across countries and settings, it is important to note that adjusting for these differences still produced a similar trend in VLS. Because of this, it is likely that there is a widespread need for improved support for postpartum mothers across multiple settings and countries.

There were several limitations of the study and the use of cross-sectional data. The primary limitation is that by using cross-sectional data, the temporality of all the events recorded in the surveys, such as HIV testing, pregnancy outcomes, and awareness of HIV status, are not always able to be determined. This could be addressed with future cohort or other longitudinal studies. There is also the potential for recall bias or information bias, as many of these

reproductive factors were self-reported. However, in the PHIA protocol, many of these factors were later confirmed with further interview questions and laboratory testing, when possible, to try to avoid misclassification. There may also be cultural differences in how reproductive and sexual health is discussed, especially among women, which could impact their answers to some of the survey questions. This could result in differences in how a question was perceived or answered in different settings.

This analysis was also done across all 13 countries at once, and there are significant differences in HIV prevalence, care, and other factors among and within countries. Though many of these factors were taken into account through the use of survey weights in the analysis, the results should be interpreted broadly. Further studies may also be needed to apply this analysis or any of its results to specific countries or locations within countries. However, the benefit of using a cluster household survey design with survey weights is that the data used in this study is relatively representative of the populations as a whole for each of the countries included. Though the clusters chosen may not be exactly representative of the population, survey weight adjustments considered demographic factors of the study population and the country population, in addition to participant non-response, to generate more representative estimates.

Overall, we recommend greater focus on ensuring mothers stay adherent to their ARTs postpartum, whether that be through more consistent check-ins, policy changes, or greater awareness of this issue during routine medical examinations. This is especially important the more time has passed since delivery, as VLS was lower at year three postpartum than year two postpartum in all scenarios. Because this relationship held even at levels of low-viremia or undetectability, we recommend a more general approach to improving access and adherence in the first few years postpartum to ensure mothers are able to remain virally suppressed long-term.

This could even potentially be combined with other postpartum or women's healthcare services, though future studies would be needed to determine the effectiveness of this method in these settings.

The postpartum period is an especially vulnerable time for mothers, and their ability to remain virally suppressed has significant implications for their health and the health of their children and partners. Based on the results of this study, there is a substantial need for increased monitoring and treatment postpartum to ensure greater adherence to ARTs in this setting. This is especially important after the first year postpartum. Both new and existing HIV prevention and treatment programs in sub-Saharan Africa should put forth renewed effort and funding to target mothers in the postpartum period and ensure sufficient support to allow mothers to achieve and retain viral suppression in the long-term. Healthcare providers in this context should also be aware of this issue and incorporate this knowledge into their care of postpartum mothers and infants whenever possible.

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Tables

Table 1: Unweighted characteristics of 3,648 HIV+ mothers who delivered in the 36 months prior to survey date in 13 countries in sub-Saharan Africa as part of the PHIA surveys, 2015-2019.

Months Since Delivery at time of Interview	**Virally Suppressed**	**Not Virally Suppressed**	**Total (%)**	**% Virally Suppressed (Unweighted)**
	n=2518	n=1120	N=3638	69%
VLS <1000 copies/mL				
<12 months	984	326	1312 (36%)	75%
12-<24 months	815	399	1218 (33%)	67%
24-36 months	719	395	1118 (31%)	64%
All time intervals	2518	1120	3638 (100%)	69%
VLS <200 copies/mL				
<12 months	929	367	1296 (36%)	71%
12-<24 months	761	443	1204 (33%)	62%
24-36 months	665	440	1105 (30%)	59%
All time intervals	2355	1250	3605 (99%)*	65%
VLS <50 copies/mL				
<12 months	842	454	1296 (36%)	65%

12-<24 months	699	505	1204 (33%)	58%
24-36 months	606	499	1105 (30%)	55%
All time intervals	2147	1458	3605 (99%)*	60%
Breastfed Last	2340	1045	3385 (93%)	69%
Child				
Parity				
1 child	269	221	490 (13%)	55%
2 children	507	257	764 (21%)	66%
3 children	532	221	753 (21%)	71%
4 children	464	168	632 (17%)	73%
5+ children	646	253	899 (25%)	72%
Country				
Cameroon	57	80	137 (4%)	42%
Cote d'Ivoire	16	29	45 (1%)	36%
Eswatini	326	93	419 (12%)	78%
Ethiopia	37	8	45 (1%)	82%
Kenya	150	48	198 (5%)	76%
Lesotho	283	118	401 (11%)	71%
Malawi	281	88	369 (10%)	76%
Namibia	297	70	367 (10%)	81%
Rwanda	99	26	125 (3%)	79%
Tanzania	185	128	313 (9%)	59%
Uganda	202	122	324 (9%)	62%

Zambia	257	155	412 (11%)	62%
Zimbabwe	328	155	483 (13%)	68%
Age				
15-19	45	79	124 (3%)	36%
20-24	386	276	662 (18%)	58%
25-29	597	310	907 (25%)	66%
30-34	735	254	989 (27%)	74%
35-39	543	156	699 (19%)	78%
40-44	186	39	225 (6%)	83%
45-49	26	6	32 (1%)	81%
Urban	942	463	1405 (39%)	67%
Antenatal Care	2472	1073	3545 (97%)	70%
Wealth Quintile				
Lowest	606	264	870 (24%)	70%
Second	502	197	699 (19%)	72%
Middle	530	249	779 (21%)	68%
Fourth	474	246	720 (20%)	66%
Highest	403	164	567 (16%)	71%
Aware of Status at Time of Pregnancy	2363	934	3297 (91%)	72%

***** These values are slightly lower than the sample size due to difference in viral load testing sensitivity between countries. Those who did not have a reported viral load that could definitively be categorized at VLS <200 copies/mL or <50 copies/mL were not included in analysis at that level of VLS, but were not removed from the study population

Some percentages in the total column may not add up to 100% due to missing data.

Table 2: Weighted proportion (95% CI) of those who were virally suppressed, using survey blood weights. Prevalence ratios (PRs) and 95% confidence intervals (CIs) are also included using these weighted proportions.

Months Since Delivery at time of Interview	**Weighted Percentage Virally Suppressed**	**Prevalence Ratio (PR)**	**95% Confidence Interval (CI)**
VLS <1000 copies/mL			
<12 months	70%	1.0	---
12-<24 months	61%	0.87	(0.81, 0.95)
24-36 months	60%	0.86	(0.79, 0.93)
All time intervals	64%	---	---
VLS <200 copies/mL			
<12 months	66%	1.0	---
12-<24 months	57%	0.87	(0.79, 0.95)
24-36 months	55%	0.83	(0.76, 0.91)
All time intervals	60%	---	---
VLS <50 copies/mL			

<12 months	59%	1.0	---
12-<24 months	53%	0.90	(0.81, 1.00)
24-36 months	49%	0.83	(0.75, 0.92)
All time intervals	54%	---	---
Breastfed Last	63%	0.90	(0.80, 1.01)
Child			
Parity			
1 child	50%	1.0	---
2 children	61%	1.23	(1.06, 1.42)
3 children	63%	1.27	(1.10, 1.47)
4 children	66%	1.33	(1.14, 1.55)
Country			
Cameroon	43%	1.23	(0.72, 2.11)
Cote d'Ivoire	35%	1.0	---
Eswatini	77%	2.21	(1.36, 3.59)
Ethiopia	79%	2.26	(1.35, 3.80)
Kenya	75%	2.16	(1.32, 3.54)
Lesotho	70%	2.02	(1.24, 3.29)
Malawi	76%	2.18	(1.33, 3.57)
Namibia	82%	2.36	(1.45, 3.85)
Rwanda	79%	2.27	(1.38, 3.73)
Tanzania	63%	1.80	(1.08, 2.99)
Uganda	62%	1.78	(1.09, 2.91)

Zambia	61%	1.76	(1.07, 2.88)
Zimbabwe	66%	1.89	(1.16, 3.09)
Age			
15-19	32%	0.47	(0.33, 0.67)
20-24	55%	0.80	(0.71, 0.89)
25-29	59%	0.85	(0.77, 0.93)
30-34	69%	1.0	---
35-39	75%	1.09	(1.00, 1.19)
40-44	80%	1.15	(1.04, 1.27)
45-49	74%	1.08	(0.79, 1.47)
Urban	64%	0.99	(0.93, 1.07)
Antenatal Care	64%	1.51	(1.10, 2.08)
Wealth Quintile			
Lowest	61%	1.0	---
Second	68%	1.12	(1.01, 1.23)
Middle	62%	1.01	(0.91, 1.11)
Fourth	61%	0.99	(0.89, 1.10)
Highest	69%	1.12	(1.00, 1.25)
Aware of Status at	67%	2.03	(1.67, 2.47)
Time of Pregnancy			

Table 3: Crude/unadjusted odds ratios and fully adjusted odds ratios using logistic regression.

	Crude Odds Ratio (OR)	Crude 95% Confidence Interval (CI)	Fully Adjusted Odds Ratio (OR)	Fully Adjusted 95% Confidence Interval (CI)
VLS <1000 copies/mL				
<12 months	1.0	---	1.0	---
12-<24 months	0.68	(0.53, 0.86)	0.59	(0.45, 0.76)
24-36 months	0.64	(0.50, 0.82)	0.52	(0.40, 0.69)
VLS <200 copies/mL				
<12 months	1.0	---	1.0	---
12-<24 months	0.69	(0.55, 0.88)	0.61	(0.47, 0.79)
24-36 months	0.63	(0.50, 0.79)	0.51	(0.40, 0.66)
VLS <50 copies/mL				
<12 months	1.0	---	1.0	---
12-<24 months	0.78	(0.61, 1.00)	0.71	(0.54, 0.92)
24-36 months	0.68	(0.54, 0.84)	0.58	(0.46, 0.73)

Supplemental Tables

Supplemental Table 1: Characteristics of the study population for <400 copies/mL as the VLS cutoff.

VLS <400 copies/mL	Virally Suppressed	Not Virally Suppressed	Total (%)	% Virally Suppressed (Unweighted)
<12 months	951	346	1297 (36%)	73%
12-<24 months	784	421	1205 (33%)	65%
24-36 months	688	418	1106 (30%)	62%
All time intervals	2423	1185	3608 (99%)*	67%

***** This value is slightly lower than the sample size due to difference in viral load testing sensitivity between countries. Those who did not have a reported viral load that could definitively be categorized at VLS <400 copies/mL were not included in analysis at that level of VLS, but were not removed from the study population.

Supplemental Table 2: Weighted proportion (95% CI) of those who were virally suppressed for a definition of viral suppression of <400 copies/mL, using survey blood weights. Prevalence ratios (PRs) and 95% confidence intervals (CIs) are also included using these weighted proportions.

VLS <400 copies/mL	Weighted Percentage Virally Suppressed	Prevalence Ratio (PR)	95% Confidence Interval (CI)
<12 months	68%	1.0	---
12-<24 months	59%	0.87	(0.80, 0.94)
24-36 months	57%	0.85	(0.78, 0.92)
All time intervals	62%	---	---

Supplemental Table 3: Crude/unadjusted odds ratios and fully adjusted odds ratios using logistic regression.

	Crude Odds Ratio (OR)	Crude 95% Confidence Interval (CI)	Fully Adjusted Odds Ratio (OR)	Fully Adjusted 95% Confidence Interval (CI)
VLS <400 copies/mL				
<12 months	1.0	---	1.0	---
12-<24 months	0.67	(0.53, 0.86)	0.58	(0.45, 0.75)
24-36 months	0.64	(0.50, 0.81)	0.52	(0.40, 0.68)