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### Authors

Nutor, Jerry John  
Slaughter-Acey, Jaime C  
Afulani, Patience A  
[et al.](#)

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## THE RELATIONSHIP BETWEEN COUNSELING AND ADHERENCE TO ANTIRETROVIRAL THERAPY AMONG PREGNANT AND BREASTFEEDING WOMEN ENROLLED IN OPTION B+

Jerry John Nutor, Jaime C. Slaughter-Acey, Patience A. Afulani,  
Moses M. Obimbo, and Sanyu A. Mojola

The aim of the study was to investigate the relationship between counseling prior to starting antiretroviral treatment (ART) and adherence to treatment among women enrolled in Option B+ in Zambia. Using convenience sampling, 150 HIV+ women enrolled in an Option B+ treatment regimen in rural and urban districts were recruited. Four generalized Poisson regression models were built to assess the association between counseling and adherence to ART. In all, 75% of the participants reported adherence in the past 7 days. In adjusted analyses, there was a significant positive relationship between counseling and adherence in the rural district (prevalence ratio [PR] 2.52, 95% CI [1.19, 5.35],  $n = 81$ ) but not in the urban district (PR = 0.77, 95% CI [0.15, 3.91],  $n = 69$ ). Offering counseling prior to initiating antiretroviral treatment to HIV+ women is particularly important for promoting medication adherence in rural settings of low resourced countries.

*Keywords:* adherence, antiretrovirals, HIV, Option B+, counseling, Zambia

Vertical transmission (VT) of HIV has been identified as the major source of HIV infection among children worldwide (Wang et al., 2016; World Health Organization, 2018). Pregnant women living with HIV can transmit the infection to their babies in

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Jerry John Nutor, PhD, RN, is affiliated with the Department of Family Health Care Nursing, School of Nursing, University of California, San Francisco, California. Jaime C. Slaughter-Acey, PhD, MPH, is affiliated with the Division of Epidemiology and Community Health, School of Public Health, University of Minnesota. Patience A. Afulani, MBChB, MPH, PhD, is an assistant professor in the Departments Epidemiology & Biostatistics and Obstetrics, Gynecology, & Reproductive Sciences, University of California, San Francisco. Moses M. Obimbo, MD, PhD, is affiliated with the Departments of Human Anatomy and Obstetrics and Gynecology, University of Nairobi, Nairobi, Kenya. Sanyu A. Mojola, PhD, is affiliated with the Department of Sociology, Woodrow Wilson School of Public and International Affairs, and Office of Population Research, Princeton University, Princeton, New Jersey.

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Address correspondence to Jerry John Nutor, PhD, RN, Department of Family Health Care Nursing, School of Nursing, University of California, San Francisco, 2 Koret Way, Ste. N431G, San Francisco, CA 94143. E-mail: Jerry.Nutor@ucsf.edu

utero, during delivery or through breastfeeding (World Health Organization, 2019). The World Health Organization (WHO) has implemented different strategies aimed at reducing vertical transmission of HIV. These include the provision of antiretroviral drugs via the targeted programs, such as Option A, Option B, Option B+, and most recently, Treatment for All.

Implemented in 2003, Option A offered HIV+ pregnant women antiretroviral prophylaxis prenatally (starting as early as 14 weeks gestation) and during the onset of labor, followed by a 1-week postpartum antiretroviral regimen to decrease the risk of drug resistance (WHO, 2015). Option B presented a simpler clinical flow in which all HIV+ pregnant and breastfeeding mothers were offered triple antiretroviral medications as soon as diagnosis or as early as 14 weeks gestation and ending after childbirth, if not breastfeeding; otherwise antiretroviral medications continued until cessation of breastfeeding (WHO, 2010). If a mother's CD4 count fell to fewer than 350 cells/mm<sup>3</sup>, ART was restarted. However developing countries, especially those in sub-Saharan Africa and Southeast Asia, have experienced significant barriers in monitoring mothers' CD4 count. These include limited access to health care facilities, a limited number of trained staff, and a limited supply of testing equipment (WHO, 2010, 2019).

Hence, in 2012, WHO recommended Option B+ (provision of triple antiretrovirals drugs, nevirapine, zidovudine and lamivudine, to be continued for life regardless of CD4 count or viral load). This was after a successful trial in Malawi that called for the provision of antiretroviral treatment (ART) starting as soon as a mother was diagnosed, and lifetime treatment regardless of CD4 count (WHO, 2013). Option B+ was then the standard of care until a new treatment guideline for all people living with HIV Treatment for All was introduced in 2015. Treatment for All, expands Option B+ to all HIV+ persons (WHO, 2013). While Option B+ has contributed to significant improvement in the number of women enrolled, some researchers question the effectiveness of Option B+ due to low adherence and retention in HIV care (Coutsoudis et al., 2013; Matheson et al., 2015; Schouten, Jahn, Chimbandira, Harries, & Van Damme, 2013).

Adherence to ART among HIV+ pregnant women is essential to preventing HIV re-infection, eliminating vertical transmission and improving their general wellbeing by helping manage symptoms of HIV (Schnack et al., 2016; Tobin & Aldrovandi, 2013). The vertical transmission rate of HIV infection without medical treatment or non-adherence ranges between 15% and 45% (Endalamaw, Demsie, Eshetie, & Habtewold, 2018; Ngwende et al., 2013). However, with appropriate, timely medical intervention and adherence to treatment, the rate of the infant's infection can be reduced substantially, to as low as 1% (Townsend et al., 2014).

Barriers to adherence to HIV treatment regimens differ across settings and individuals (Ebuy, Yebyo, & Alemayehu, 2015; Kohler et al., 2012). For example, one of the major factors that prevents patients from achieving optimal adherence to their medications is the side effects associated with ART (Al-Dakkak et al., 2013; Shubber et al., 2016). Previous studies have reported that patients taking ART commonly report feeling sick and weak and experiencing a decreased quality of life (Al-Dakkak et al., 2013; Bezabhe et al., 2015; Maiese et al., 2016; Sanjobo, Frich, & Fretheim, 2008; Tadesse, Mekonnen, Tesfaye, & Tadesse, 2014). These side effects were reported to be more common in developing countries and may be related to the high rate of non-adherence to the ART (Mills et al., 2006). Side effects may be more commonly experienced among pregnant and breastfeeding women given the physiological changes that occur during pregnancy and lactation (Ford et al., 2013; Polle, 2016).

Therefore, WHO recommends that health care providers counsel people living with HIV about the side effects and importance of adherence prior to initiating ART (WHO, 2014). These guidelines extend to pre-exposure prophylaxis for HIV (WHO, 2015), as well as Option B+. It is recommended that counseling is done by a health care provider (e.g., nurse, midwife or physician). The counseling session is required to inform the patient about the dosage, mechanism of action, expected side effects and contraindications of antiretroviral drugs.

HIV-specific health literacy among women is crucial to adherence and continuous stay in treatment. Lack of knowledge about ART is associated with non-adherence (Ebuy et al., 2015) and retention (Tenthani et al., 2014). Similarly, sufficient knowledge of vertical transmission (VT) of HIV could facilitate women's adherence to ART (Boateng, Kwapong, & Agyei-Baffour, 2013; Tymejczyk et al., 2016). For example, Boateng and colleagues found that a majority of women in their study had high levels of HIV knowledge (e.g., routes of transmission, importance of antiretroviral drugs). However, participants with inadequate knowledge on VT and ART regimens were significantly more likely to be non-adherent and were lost to follow-up as compared to those with adequate knowledge on VT and ART. Because HIV+ women enrolled in Option B+ are expected to be on ART for the rest of their lives, it is important to explore the role and possible limitations of counseling in facilitating ART adherence.

The study was conducted in Zambia because it has one of the highest prevalence rates of HIV among pregnant women, with estimated 120,000 pregnant women currently living with HIV (WHO, 2018). In 2017, more than 80% of HIV+ pregnant women in Zambia were enrolled in HIV care (WHO, 2019). However, since the implementation of the Option B+ by the Ministry of Health of Zambia in 2013, no study has been conducted to examine how HIV transmission knowledge and other factors promote or impede adherence. Therefore, this study investigates the relationship between counseling on side effects of antiretroviral drugs and adherence among HIV+ women enrolled in Option B+ in Zambia. We hypothesized that women who received counseling prior to initiating ART would have a higher rate of adherence compared to those who did not receive counseling.

## METHODS

### DESIGN AND SAMPLE

This is a cross sectional study of HIV+ pregnant and breastfeeding women enrolled in an Option B + ART treatment regimen in urban (Lusaka District) and rural (Sina-zongwe District) Zambia. Using convenience sampling, we recruited women who sought care at pre- or post-natal clinics in government hospitals/health centers in these districts. Data collection took place between July and September 2016. Women were eligible to participate in the study if they were at least 18 years of age, pregnant or breastfeeding and were enrolled in the Option B+ treatment for at least two months. We excluded from the study women who were critically ill (defined by having recent hospitalization), had intellectual impairment (e.g., developmental disability) as ascertained by medical records, or started ART prior to pregnancy.

At the respective clinics where women waited for their consultation, trained research assistants explained the purpose, benefits, and risks of the study as well as confidentiality of potential participants. Those who could read were given a copy of

the information sheet to help them understand the details of the study. For those who could not read, the research assistants explained the details on the information sheet to them in a language that they understood (Tonga and Nyanja). After addressing concerns and questions from the potential participants, they were asked to make a voluntary decision on whether to participate or not to participate. Potential participants who agreed to participate in the study signed a consent form. The protocol for the study was approved by Drexel University Institutional Review Board and two local institutional review boards; the ERES Converge Institutional Review Board and the Zambia National Health Research Authority.

## MEASURES

*Outcome Variable.* The dependent or main outcome variable was self-reported adherence to Option B+ ART. Adherence was measured by asking the women “Did you miss taking any of your ART drugs in the last seven (7) days?” (yes/no; Billoro, Mamo, & Jarso, 2018; Mitiku, Abdosh, & Teklemariam, 2013). Adherence to ART was when a woman responded no to missing prescribed doses in a week prior to the study. Non-adherence was when a woman responded yes to missing a dose (s) in the 7 days prior to the study.

*Independent Variable.* For our independent variable, all participants were asked “Did the health care provider counsel you on how to take the medication and its side effects? (yes/no).”

*Modifiers.* Place of residence was measured as urban/rural.

*Covariates.* Women’s knowledge of HIV transmission and VT was measured using a thirteen-item scale adopted from Ebuy and colleagues (2015). For each item, women responded true or false. Examples of items include: The HIV/AIDS virus is present in blood, semen, and vaginal fluid; HIV+ women can reduce the risk of HIV transmission to their babies if they take EMTCT drugs; A person can have HIV/AIDS and give it to other people even if the person does not look sick; and Adhering to antiretroviral drugs can reduce the risk of opportunistic infections. The HIV transmission and VT knowledge score can range from 0 to 13, with higher scores representing higher levels of HIV transmission and EMTCT knowledge. The instrument was reliable in the study (13 items; Cronbach’s  $\alpha = 0.75$ ). The scores were categorized into two groups: those who scored below the median and those who scored equal to or above the median.

Other covariates included as potential confounders are; age, marital status (in a relationship and living with partner vs. in a relationship, not living with partner), educational status (primary or no formal education, secondary and college or higher), employment (employed, housewife, and unskilled labor), monthly household income (below U.S. \$200 vs. U.S. \$200 and above).

## DATA COLLECTION

Self-administered questionnaires were distributed to participants who signed the consent form. For participants who could not read or write, the items in the questionnaire were read by a research assistant in the language they understood best and their responses were recorded. The interviews took place in a conference room at the clinics and lasted for about 30 minutes.

## DATA ANALYSIS

We used STATA version 13 (College Station, TX) for data analysis. Descriptive statistics were used to summarize the variables. To test the association between Option B+ adherence and each of the independent variables and covariates, bivariate analyses were conducted using Poisson regression models (with a robust variance estimate; Zou, 2004) to estimate the unadjusted prevalence ratio (PR) and associated 95% confidence interval (CI). In multivariate analyses for the full sample, models were built using a stepwise approach: Model 1 included the independent variable (whether counseled on side effects); Model 2 adjusted for place of residence (urban/rural district); Model 3 adjusted for age, marital status, education, monthly household income and occupation in addition to the variables in model 2; Model 4 controlled for women's knowledge of HIV transmission and VT in addition to all the variables in Model 3.

Effect modification was examined by stratifying regression models by place of residence. In the stratified analysis, similar sets of three generalized Poisson regression models were built: Model 1 included the exposure; Model 2 adjusted for age, marital status, education, monthly household income and occupation; Model 3 included all the variables in Model 2 in addition to women's knowledge of HIV transmission and VT.

## RESULTS

### DESCRIPTIVE RESULTS

A total of 150 women, 81 (54%) from the urban district and 69 (46%) from the rural district, were included in the study. Table 1 presents sample characteristics of the women in the overall and stratified samples. Women in the overall sample were relatively young ( $M = 29 \pm 6.20$ ): 38.7% were between age 26 and 30 years. The majority (90%) were in a relationship and living with their partner (90%). Women had diverse socioeconomic statuses (SES); 85% lived in households earning below the median monthly income (\$200) and 55% had only primary education or no formal education. The characteristics of the women in the district-stratified sample differs slightly; in the urban district, the majority of the women were married and living with their partner 56% ( $n = 56$ ), 68% received secondary education ( $n = 38$ ), 61% were employed ( $n = 25$ ), and 70% had income of \$200 and above ( $n = 16$ ). In the rural district, the majority of the women had primary or no formal education, 53% ( $n = 44$ ), were involved in unskilled labor, 75% ( $n = 30$ ) and earned below the median monthly income, 50% ( $n = 62$ ). The women were similarly aged in both urban and rural districts.

### BIVARIATE RESULTS

Table 2 presents the bivariate analysis that examined the association between counseling and adherence to ART in the overall and district-stratified sample. Of the 150 study participants, 112 (75%) reported adherence while the remaining 38 (25%) were non-adherent. ART adherence was significantly associated with receiving counseling prior to initiating treatment ( $p < .01$ ). The majority (80%) of the sample reported that they received counseling. Of those who were non-adherent, more than

TABLE 1. Sample Characteristics Stratified by Urban Rural Residence

	Overall (N = 150)	Urban (n = 81)	Rural (n = 69)
Characteristics	n (%)	n (%)	n (%)
<b>District</b>			
Lusaka (Urban)	81 (54)		
Sinazongwe (Rural)	69 (46)		
<b>Age</b>			
18–25	34 (22.7)	21 (62)	13 (38)
26–30	58 (38.7)	36 (62)	22 (38)
31–35	34 (22.7)	14 (41)	20 (59)
Above 35	24 (16.0)	10 (42)	14 (58)
<b>Marital Status</b>			
In a relationship	135 (90)	75 (56)	60 (44)
In a relationship, not living with partner	15 (10)	6 (40)	9 (60)
<b>Educational Status</b>			
Primary and no formal education	83 (55.3)	39 (47)	44 (53)
Secondary	56 (37.3)	38 (68)	18 (3)
Higher/college	11 (7.3)	4 (36)	7 (64)
<b>Occupation</b>			
Employed	41 (27.3)	25 (61)	16 (39)
Housewife	69 (46)	46 (67)	23 (33)
Unskilled labor	40 (26.7)	10 (25)	30 (75)
<b>Household Monthly Income</b>			
Below \$200	125 (8)	63 (50.4)	62 (49.6)
\$200 and above	23 (15)	16 (70)	7 (30)
<b>Knowledge on HIV/AIDS and EMTCT</b>			
Below median	112 (75)	55 (49)	57 (51)
Median and above	38 (25)	26 (68)	12 (32)
<b>Received Counseling</b>			
No	30 (20)	9 (30)	21 (70)
Yes	120 (80)	72 (60)	48 (40)
<b>Adherence</b>			
Adherent	112 (75)	64 (57)	48 (43)
Non-adherent	38 (25)	17 (46)	21 (54)

half received counseling (56.8%). There were no significant bivariate associations between receiving counseling and women's age, marital status, or household income.

Overall, place of residence was not significantly associated with adherence ( $p = .24$ ). However, among women in the rural district, counseling was significantly associated with adherence. Among women who were non-adherent in the rural district, the majority (67%) reported that they did not receive counseling prior to starting the antiretroviral drugs. Women's occupation was the only covariate that was found to be significantly associated with adherence in both rural ( $p = .01$ ) and urban ( $p = .08$ ) districts. Among rural women, 93% of those who are unskilled laborers were adherent, compared to 50% of housewives and 56% of employed women.

TABLE 2. Bivariate Analysis of Variables With Adherence Stratified by Urban and Rural Samples (N = 150)

	Over all			Urban			Rural		
	Adherent	Non-adherent	<i>p</i>	Adherent	Non-adherent	<i>p</i>	Adherent	Non-adherent	<i>p</i>
	<i>n</i> (%)	<i>n</i> (%)		<i>n</i> (%)	<i>n</i> (%)		<i>n</i> (%)	<i>n</i> (%)	
Total Adherence	112 (75)	38 (25)	.04						
District			.24						
Lusaka (Urban)	64 (57)	17 (46)							
Sinazongwe (Rural)	48 (43)	21 (54)							
Received Counseling			< .01			.92			< .00
No	14 (13)	16 (43)		7 (78)	2 (22)		7 (33)	14 (67)	
Yes	98 (87)	22 (57)		57 (79)	15 (21)		41 (87)	7 (23)	
Age			.45			.49			.11
18–25	26 (23.2)	8 (21.6)		15 (71.4)	6 (28.6)		11 (84.6)	2 (15.4)	
26–30	39 (34.8)	18 (48.7)		28 (77.8)	8 (22.2)		11 (52.4)	10 (47.6)	
31–35	27 (24.1)	7 (18.9)		13 (92.9)	1 (7.4)		14 (70.0)	6 (30.0)	
Above 35	20 (17.9)	25 (10.8)		8 (80.0)	2 (20.0)		12 (85.8)	3 (15.3)	
Marital Status			.28			.19			.61
In a relationship, not living with partner	13 (11.6)	3 (6.0)		6 (100)	0 (0.0)		7 (77.0)	2 (23.0)	
In a relationship	99 (88.4)	35 (94.0)		58 (77.3)	17 (22.7)		41 (69.5)	18 (30.5)	
Educational Status			.98			.54			.71
Primary and no formal education	62 (55.4)	20 (54.1)		31 (79.5)	8 (20.5)		31 (72.1)	12 (27.9)	
Secondary	42 (37.5)	15 (37.8)		29 (76.3)	9 (23.7)		13 (72.2)	6 (27.8)	
Higher/college	8 (7.1)	3 (8.1)		4 (100)	0 (0.0)		4 (57.1)	3 (42.9)	
Occupation			.11			.08			.01
Employed	32 (28.6)	9 (24.3)		23 (92.0)	2 (8.0)		9 (56.3)	7 (43.7)	
Housewife	46 (41.1)	22 (59.5)		35 (76.1)	11 (23.9)		11 (50.0)	12 (50.0)	
Unskilled labor	34 (30.4)	6 (16.2)		6 (60.0)	4 (40.0)		28 (93.3)	2 (6.7)	
Household Monthly Income			.39			.12			.41
Below \$200	92 (82.9)	33 (88.9)		48 (76.2)	15 (23.8)		44 (72.1)	18 (27.9)	
\$200 and above	19 (17.1)	4 (11.1)		15 (93.8)	1 (6.2)		4 (57.1)	3 (42.86)	
Knowledge on HIV/AIDS and EMTCT			.53			.79			.071
Median and above	82 (73.2)	29 (78.4)		43 (78.2)	12 (21.8)		39 (69.4)	17 (30.4)	
Below the median	30 (26.8)	9 (21.6)		21 (80.8)	5 (19.2)		9 (75)	4 (25)	

## MULTIVARIATE RESULTS

*Relationship Between Adherence and Counseling in the Overall Sample.* Table 3 presents a multivariate analysis of the relationship between counselling and adherence to antiretroviral drugs among Zambian women in the overall sample. In the unadjusted analysis (Model 1), counseling was significantly associated with adherence (PR 3.02, 95% CI [1.57, 5.79]). Counseling was also significantly associated with adherence in all adjusted analyses (Models 2–4), including model 4 where all

the covariates were controlled (PR 2.52, 95% CI [1.19, 5.35]). None of the covariates (age, marital status, educational status, occupation, monthly income, or HIV knowledge) was significant in any of the models.

*Relationship Between Adherence and Counseling by Zambian Districts.* Table 4 provides the multivariate results of the district stratified analysis of the relationship between counseling and adherence to antiretroviral drugs. In both adjusted and unadjusted models, counselling was not significantly associated with adherences to ARTs in the urban district. In the rural district, however, counselling was significantly associated with adherence in both unadjusted (PR 5.22, 95% CI [1.20, 13.59]) and unadjusted models (PR 3.31, 95% CI [1.10, 9.96]).

**TABLE 3. Multiple Regression Models for Association Between Counseling and Adherence in Full Sample (N = 150)**

	Model 1		Model 2		Model 3		Model 4	
	PR [95% CI]	<i>p</i>	PR [95% CI]	<i>p</i>	PR [95% CI]	<i>p</i>	PR [95% CI]	<i>p</i>
<b>Received Counseling</b>								
Yes	Referent		Referent		Referent		Referent	
No	3.02 [1.57, 5.79]	.001	2.97 [1.50, 5.87]	.002	2.54 [1.20, 5.37]	.01	2.52 [1.19, 5.35]	.02
<b>District</b>								
Urban			Referent		Referent		Referent	
Rural			1.06 [0.54, 2.09]	.86	1.33 [0.61, 2.91]	.47	1.29 [0.59, 2.85]	.52
<b>Age</b>								
18–25					Referent		Referent	
26–30					1.44 [0.57, 3.59]	.44	1.47 [0.58, 3.68]	.52
31–35					0.97 [0.31, 3.03]	.96	0.95 [0.30, 2.96]	.93
Above 35					0.85 [0.24, 3.01]	.8	0.85 [0.23, 3.01]	.79
<b>Marital Status</b>								
In a relationship					Referent		Referent	
In a relationship, not living with partner					0.57 [0.13, 2.57]	.49	0.54 [0.12, 2.46]	.43
<b>Educational Status</b>								
Higher/college					Referent		Referent	
Primary and no formal education					0.73 [0.17, 3.09]	.67	0.63 [0.14, 2.84]	.55
Secondary					0.86 [0.22, 3.39]	.83	0.75 [0.18, 3.11]	.69
<b>Occupation</b>								
Employed					Referent		Referent	
Housewife					1.16 [0.46, 2.91]	.75	1.15 [0.46, 2.90]	.77
Unskilled labor					0.67 [0.20, 2.21]	.51	0.67 [0.20, 2.23]	.52
<b>Household Monthly Income</b>								
\$200 and above					Referent		Referent	
Below \$200					1.78 [0.54, 5.57]	.34	1.76 [0.54, 5.71]	.35
<b>Knowledge on HIV/AIDS and EMTCT</b>								
Median and above							Referent	
Below the median							1.36 [0.56, 3.34]	.49

TABLE 4. Multiple Regression Models for Association Between Counseling and Adherence Stratified by District

	Urban District (n = 81)				Rural District (n = 69)							
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
	PR [95% CI]	p	PR [95% CI]	p	PR [95% CI]	p	PR [95% CI]	p	PR [95% CI]	p	PR [95% CI]	p
Received Counseling												
Yes	Referent		Referent		Referent		Referent		Referent		Referent	
No	1.07 [0.24, 4.66]	.93	0.82 [0.17, 3.98]	.81	0.77 [0.15, 3.91]	.75	5.22 [1.20, 13.59]	.001	3.56 [1.21, 10.42]	.02	3.31 [1.10, 9.96]	.03
Age												
18–25			Referent		Referent		Referent		Referent		Referent	
26–30			1.12 [0.34, 3.73]	.85	1.11 [0.33, 3.74]	.86			2.00 [0.39, 10.18]	.41	2.26 [0.41, 12.37]	.35
31–35			0.49 [0.05, 4.69]	.53	0.49 [0.05, 4.67]	.53			1.65 [0.30, 9.06]	.57	1.60 [0.29, 8.74]	.59
Above 35			1.25 [0.22, 7.09]	.79	1.33 [0.23, 7.62]	.75			1.06 [0.14, 8.27]	.96	1.04 [0.13, 8.35]	.97
Marital Status												
In a relationship			Referent		Referent		Referent		Referent		Referent	
In a relationship, not living with partner			1.12 [0.61, 2.05]	.9	0.96 [0.53, 1.80]	.95			0.86 [0.15, 4.97]	.87	0.77 [0.13, 4.60]	.77
Educational Status												
Higher/college			Referent		Referent		Referent		Referent		Referent	
Primary and no formal education			0.98 [0.53, 1.80]	.96	0.98 [0.50, 1.89]	.97			1.26 [0.18, 8.95]	.82	1.08 [0.15, 8.16]	.94
Secondary			1.02 [0.68, 1.56]	.98	1.05 [0.70, 1.61]	.98			0.89 [0.15, 5.16]	.89	0.79 [0.13, 4.60]	.79
Occupation												
Employed			Referent		Referent		Referent		Referent		Referent	
Housewife			1.67 [0.35, 8.04]	.52	1.70 [0.35, 8.22]	.51			0.75 [0.19, 2.98]	.68	0.64 [0.15, 2.83]	.56
Unskilled labor			3.34 [0.56, 19.79]	.18	3.51 [0.58, 21.25]	.17			0.21 [0.04, 1.19]	.07	0.19 [0.33, 1.14]	.07
Household Monthly Income												
\$200 and above			Referent		Referent		Referent		Referent		Referent	
Below \$200			3.35 [0.40, 27.83]	.26	3.13 [0.37, 26.49]	.29			0.95 [0.16, 5.61]	.96	0.94 [0.16, 5.57]	.94
Knowledge on HIV/AIDS and EM/TCT												
Median and above			Referent		Referent		Referent		Referent		Referent	
Below the median			1.39 [0.40, 4.79]	.59							1.69 [0.35, 8.09]	.51

## DISCUSSION

We explored the relationship between receiving counseling prior to initiation of ART and self-reported adherence to Option B+, among HIV+ pregnant women in Zambia, a low resource country. We found that 75% of HIV+ women reported being adherent to Option B+. Further, women who received counseling prior to initiating ART were significantly more likely to report medication adherence compared to those who did not receive counseling. We also found that place of residence was not significantly associated with adherence; rather, the association between counseling and adherence was only significant in the rural district.

Our findings confirm the result of previous studies in Malawi (Haas et al., 2016) and Brazil (Vaz et al., 2007), which concluded that HIV+ women during their pre and postpartum periods have greater adherence with ART. A possible explanation for this is that women at the pre and postpartum periods are not only concerned about their health but also the health of their unborn baby or infant and they might be willing to do everything possible to prevent their unborn baby or infant from contracting the virus. In addition, health seeking behavior during pregnancy appears to promote adherence to antiretroviral drugs among HIV+ women. Medical appointments occur more often during antenatal and early postnatal periods than during routine HIV care, which likely create an opportunity for the women to adhere to their antiretroviral drugs. Further studies are necessary to explain women's decision-making process regarding antiretroviral drugs use, especially given the likelihood of vertical transmission.

In our district-stratified analysis, we found a significant association between counseling and adherence in the rural district but not in the urban district. This association remained significant even after controlling for all the sociodemographic variables. Fewer participants who lived in the rural district were counseled, compared to the urban district. However, rural participants who were counseled were less likely to miss taking ART. There are three possible explanations for this finding. First, like most sub-Saharan African countries, there is a shortage of nurses and midwives working in the rural areas in Zambia as compared to the urban areas (Ferreiro, Siziya, Goma, & Dussault, 2011; Zambia Demographic Health Survey, 2014). Therefore, the few nurses and other health care workers in the rural areas are often stressed to the point that they are not able to perform all of their duties including counseling their clients on the side effects of antiretroviral drugs. Also, in instances where there is availability of health care workers, rural women do not receive all the needed care because of preferential treatment provided by the health care workers; women with high socioeconomic status may receive better quality of care because of where they live (Afulani, 2015; Afulani, Sayi, & Montagu, 2018; Tekelab, Chojenta, Smith, & Loxton, 2019). Rural women may thus not be offered certain services such as counseling because of their social class.

Secondly, misconceptions about HIV transmission and ART are more common among women living in rural areas (Sano et al., 2016). For example, some women receiving ART in rural Malawi believe that they can stop taking their medication when they feel better and restart whenever they begin to feel ill (Kim et al., 2016). Further, fear of being stigmatized or discriminated against might lead to women living with HIV feeling reluctant to seek help to clarify misconceptions if not addressed by their health care worker during counseling. These misconceptions could lead to non-adherence among rural dwellers (Boateng et al., 2013; Kohler et al., 2012; Peterson, et al., 2015; Sano et al., 2016). However, there is a need for further study

to explore the prevalence of misconceptions in rural areas in Zambia and how these misconceptions might affect adherence to the ART.

Finally, most rural dwellers have low socioeconomic status and typically have low education, household income and knowledge about the transmission of HIV. However, the socioeconomic status of the women in urban areas varies greatly. Some households in urban settings have very high SES, some are extremely poor, while others fall within the middle-class range (Nutor et al., 2017; Zambia Demographic Health Survey, 2014). Therefore, the findings associated with the measures of adherence by district likely reflect unmeasured SES. This finding supports previous studies which reported that socioeconomic status and place of residence influence adherence to ART (Knettel et al., 2018; Nutor, Slaughter-Acey, Marquez & Opong, 2019).

Our research findings underscore the importance of ensuring access to counseling prior to ART, especially in rural areas, as WHO, health care providers and other stakeholders scale up the implementation of Option B+ and now the Treatment for All policy. Counseling should include information about the medication dosage, mechanism of action, expected side effects and contraindications. Health care providers must also make an effort to provide regular ongoing adherence support and quality care and services especially in rural communities. This is very important to achieve the goals of the Treatment for All policy, which aims at ending the HIV/AIDS epidemic by 2030. Health care providers should be encouraged to provide adherence assessment among women enrolled in Option B+ treatment regimen. Educational material including flyers with pictures describing the common side effects of the ART and how to treat or avoid them should be made available to women enrolled on the ART especially in rural areas. Special radio and television educational programs in various local languages focusing on transmission of HIV, the importance of adherence to ART and treatment of the common side effects of ART is also recommended.

### LIMITATIONS

This study has several limitations that could inform the design of future studies. First, assessment of treatment of adherence based on self-report may be subject to recall and social desirability bias that may result in under-reporting of the number of pills missed. Therefore, the study may have overestimated adherence. However, there is sufficient evidence that self-report adherence questionnaires provide a sensitive measure of non-adherence and can reliably predict a viral rebound (Petersen, et al., 2015; Usitalo et al., 2014). Also, this self-report measurement is cost effective and a quick method to use in conducting research in resource limited countries and achieving baseline data. In our future work, hair drug level and viral load will be used to corroborate our findings.

Furthermore, recruiting clients from clinics and hospitals might introduce some bias since most women who attend pre- and postnatal clinics are those who are mostly conscious about their health and the health of their baby. However, this influence may be limited since there is no significant difference between the sociodemographic and health characteristics of the women we included and other studies using random sampling method (Zambia Demographic Health Survey, 2014).

In addition, the rather small sample size of the study especially when stratifying the sample is a limitation. Nonetheless, due to the limited number of studies on adherence to ART especially Option B+, our findings are highly relevant for improving implementation. Future, additional large-scale studies assessing adherence to ART are needed however.

Finally, our study only measured whether women received counseling or not but did not examine the quality of counseling. We acknowledge that measuring quality of the counseling received by the women would have strengthened the utility of our results, however we believe that the current findings have the potential to contribute to the scarce studies on counseling and adherence to ART among pregnant and breastfeeding. We have plans to measure how quality of counseling influences adherence to the ART in our future study.

## CONCLUSION

The results of this study confirm previous reports that pregnant and breastfeeding women who received counseling on adherence and side effects of antiretroviral drugs are more likely to adhere to ART than those who were not counseled. We also found that women who reside in rural areas are less likely to be counseled, but when counseled, they are less likely to miss taking ART. Our results suggest the need to encourage health care providers to adequately prepare pregnant and breastfeeding women through adherence counselling prior to initiating treatment. There is also a need for provision of regular ongoing adherence support and high quality care and services—especially in rural communities.

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