Levels of option B+ ART drugs adherence and associated factors among pregnant women following ART services at public health facilities of East Shawa Zone, Oromia, Ethiopia

Mihretu Tarekegn[a,*], Ararso Baru[b], Assefa Seme[c]

[a] Oromia Regional Health Bureau, Addis Ababa, Ethiopia
[b] Arbaminch University College of Health Science, Slums and Rural Health Initiative Network (SRHIN), Arbaminch, Ethiopia
[c] Addis Ababa University School of Public Health, Addis Ababa, Ethiopia

ARTICLE INFO

ABSTRACT

Background: Anti-retroviral therapy has led to a significant reduction in morbidity and mortality related to HIV/AIDS. However, this cannot be fully realized without addressing the barriers related to retention in care and medication adherence.

Methods: A cross-sectional study design was implemented to select 293 pregnant women on option B+ anti-retroviral treatment (ART). The collected data was cleaned and entered into Epidata version 3.1 and exported to SPSS Version 21 for analysis. Multiple logistic regression models were used to indicate the association between variables.

Results: The overall drug adherence of pregnant women on ART medications was 82.6%. The study showed that participants educational status, AOR 4.54(95% CI; 1.72–11.95), participants status disclosure 2.61(95% CI; 1.01–6.71), social and financial support to the participants AOR 2.76(95% CI; 1.17–6.51), counseling on the benefit AOR 2.9(95% CI; 1.27–6.63), were all positive and significantly associated with adherence to option B+ treatment, while experience of drug side effect AOR 0.24(95% CI; 0.1–0.6), and fear of stigma and discrimination AOR 15.79(95% CI; 4.64–53.67), were negatively associated with adherence to option B+ treatment.

Conclusion: Educational status, counseling on the health benefit of treatment for the fetus and the mothers, social and financial support favors adherence while fear of stigma and discrimination and drug side effects negatively affect adherence to option B+. The study calls for collaborative work among patients, healthcare professionals, and the public to enhance ART adherence.

Background

Since the start of the epidemic, about 78 million people have become infected with HIV while 35 million people have died from AIDS-related illnesses [1]. In 2013 there were 35 million people living with HIV. Sub-Saharan Africa shared about 24.7 million of the world HIV positive people and 58% of them were women [2]. In 2015, 77% [69–86%] of pregnant women living with HIV had access to anti-retroviral medicines to prevent transmission of HIV to their babies [1].

Anti-retroviral therapy has led to a significant reduction in morbidity and mortality related to HIV/AIDS [3]. Since 2010, new infection of HIV was declined by 50% due to applications of Option A, Option B, and Option B+ protocols [4].

According to option A, pregnant women start ART prophylaxis as early as 14 weeks of gestation during pregnancy and as soon as possible after labour, the infant will continue to take prophylaxis throughout breastfeeding. Under option B, the women start ARV during pregnancy and continuing to take it throughout breastfeeding. On the other hand, the third approach, option B+, recommend the use of lifelong ARV drugs for all pregnant women regardless of their CD42 count [5,6].

Option B+ was first conceived and implemented in Malawi in 2011 [7]. In 2013, the Ethiopian government launched the implementation of option B+ with aims to eliminate new HIV infection to children in 2015 and to improve mothers' wellbeing [8]. Since its implementation, the number of women on ART has increased in Ethiopia [9].

Even though ART decrease morbidity and mortality related to HIV/AIDS, it cannot be fully realized without addressing barriers related to retention in care and medication adherence [3]. Non-adherence to highly active anti-retroviral therapy (HAART) is associated with an increased tendency to vertical transmission of HIV, the progression of mothers' HIV to AIDS, raised a number of orphaned children, economic impact and potential development of drug-resistant virus [10–13]. Therefore, retention during care is a crucial factor to bring the desired effect [14].

There are several anticipated fear related option B+ adherences. Firstly, Option B+ doesn't consider the CD4 status and recommends all pregnant including women who feel healthy to start lifelong ART which can affect their adherence [15]. Secondly, option B+ recommends initiation of lifelong ART without considering gestational age which increases the probability of non-adherence due to long-time exposure to treatment [16].

Previous studies conducted in different regions of the world reported that adherence to Option B+ ART medications among pregnant women can be affected by various factors. These factors can be related to patient, drug, socio-economic and health care system [15–30]. Despite the fact that several studies have assessed ART adherence levels and factors affecting adherence in different regions of Ethiopia, data on Option B+ ART adherence among HIV positive pregnant women in Oromia regional state is still limited. So, this study aims at assessing the level of ART adherence and associated factors among pregnant women on option B+ prevention of mother to child transmission (PMTCT) program in the East Shawa zone of Oromia regional state, Ethiopia.

Methods and materials

Study area and study period

This study was conducted in public health facilities (hospitals and health centers) of the East Shawa zone, which is one of the twenty-zones in Oromia regional state. The zone has four public hospitals namely Adama Referral Hospital, Bishoftu General Hospital, Welenchit District Hospital and Batu District Hospital. Moreover, the zone has seventy health centers. All of the public hospitals and sixty-one of the health centers in the zone provide PMTCT services. The study was conducted in all four public hospitals and eighteen health centers. The duration of the study was from January 2 to March 20, 2017.

Study design

A health facility based cross-sectional study was used to assess the level of adherence to option B+ treatment and associated factors among pregnant women on PMTCT follow up at selected public health facilities in East Shawa zone, Ethiopia.

Population

The source population was all pregnant women on PMTCT follow-up at public health facilities in East Shawa Zone.

The study population was all pregnant women on PMTCT follow-up at the selected public health facilities in East Shawa Zone.

Inclusion and exclusion criteria

Inclusion criteria: pregnant women who were on PMTCT follow-up for at least one month at the selected public health facilities in East Shawa zone were included to the study.

Exclusion criteria: pregnant women who were on PMTCT follow up but who was critically ill and unable to communicate during data collection period were excluded from the study.

Sample size

Sample size (n) was determined based on a single population proportion formula with the following assumptions; the level of confidence (α) was taken to be 0.05 (Z $(1 - \alpha/2)$ = 1.96); the margin of error was taken as 0.05. For the first specific objective, based on the study conducted at public hospitals of Tigray regional state, the levels of option B+ ART adherence was 87.1% [17]. For a second specific objective, based on a study conducted in Addis Ababa HIV disclosure status was 77.2% [18]. Accordingly, the calculated sample size was 172 and 304 respectively with 5% consideration for non-responses. Finally, the maximum sample size was taken (304).

Sampling procedure

Public healthcare facilities in the study area were classified as hospitals and health centers. All of the public hospitals in the zone were included tothe study. Since the zone has sixty-one public health centers that provide option B+ PMTCT services, we included only some of them due to financial constraint. We assumed that each health center was considered similar by their administration and quality of service they provides. So, 30% of the health centers were included to the study and they were randomly selected by the lottery method to get representative sample. A specific sample size was allocated to each health facility using proportion-to-size allocation. To select 304 pregnant women, the first women in each public health facilities was randomly selected by the lottery method. Then, the rest of the women were selected by systematic random sampling technique.

Data collection and instrument

To collect data from pregnant women, an interviewer-administered questionnaire was used. There was one data collector for each selected health facilities. The qualification of data collectors was a Bachelor of Science in Nursing. They were recruited based on their competence and data collection experience. In addition, they were not working at the selected public health facilities in which the study was conducted. Moreover, one supervisor for each hospital and one supervisor for every three health facilities were recruited. The data collectors and supervisors were trained on the data collection techniques by principal investigator before the data collection procedure.

Measurement

This study applied adherence measurement questions adapted from South Africa experiences, which was designed to measure adherence in the resource-constrained setting to collect data for outcome variables,with minor modification [19]. Another study conducted in Tigray regional state, Ethiopia, has also used the same tool to measure the level of adherence in the study area [17].

Data entry, processing, and analysis

Data were checked for completeness and inconsistencies as well as cleaned and coded. The collected data was entered into EpiData 3.1 (EpiData Association, Odense, Denmark) and then exported to SPSS version 21.0 for statistical analysis. The entered data were initially checked for normality and multicollinearity then considered for further analysis.

Descriptive statistics were used to summarize the data. Bivariate logistic regression was used to find an association of each independent variable with the dependent variable. Variable with p-value of < 0.25

were considered for multivariate logistic regression to control the effect of potential confounders. Then, the significance level was set at P < 0.05.

Ethical consideration

Ethical clearance was secured from Research Ethics Committee (REC) of the School of Public Health as mandated by Addis Ababa University. Letter of permission was obtained from Oromia Regional Health Bureau, zonal health, and district officials. Informed consent was obtained from all pregnant women prior to proceeding data collection from them. This was done after the clear description of the objectives of the study and of its procedures. Then, each respondent was asked to check whether the information provided for the purpose of the study has been adequately understood or not. Confidentiality of the information obtained from each participant was maintained.

Operational definitions

Good adherence: a woman was considered good adherence if she responded 'No' to all (four) question prepared to assess the adherence level. These questions are; (1) Do you sometimes find it difficult to remember to take your medication? (2) When you feel better, do you sometimes take a break from your medication? (3) Many patients have trouble with taking their ARV doses as prescribed; did you miss any ARV doses in the last 3 days? (4) Sometimes if you feel worse when you take the medicine, do you stop taking it? [17,19].

Poor adherence: A woman was considered as poor adherence if she responded 'Yes' to at least one of the above questions [17,19].

Result

Socio-demographic characteristics of respondents

A total of 293 pregnant women on option B+ ART drug were interviewed about ART drug adherence.

Concerning the age category of respondents 95 (32.4%) of them belongs to the age group of 30 to 34 while 85 (29%) of them belong to the age group 25–29 years. The mean age ± SD of the participants were 29.2 ± 4.6 years. Two hundred and twenty-five (76.8%) of the respondents were urban residents. A vast majority of the study participants were Ethiopian orthodox Christianity followers which accounted for 202(68.9%) of the respondents followed by protestant 55(18.8%). Regarding educational status, one hundred and fifty-three (52.2%) of the respondents have a primary education while 83(28.3%) of them can't read and write (Table 1).

Two hundred and forty-nine (85%) participants were married, and 27(9.2%) of the respondents divorced while widowed constituted 10(3.6%) of the respondents. Regarding their occupation, more than half 161(54.9%) of the respondents were housewives. Three-fourths of the respondents, 223(76.1%) were living with their husbands/partners while 25(8.5%) of them live alone at the time of the study (Table 1).

ART adherence level and health care system related characteristics of respondents

Majority of the respondents, 184(62.8%) were attending their ART follow-up at health centers. Two hundred and twenty-six (77.1%) of the study participants spent less than an hour walking on foot to reach healthcare facilities for the follow-up services. Regarding the time of HIV status diagnosis, majority of the study participants 180(61.4%) knew their HIV status before being pregnant. More than half of the respondents, 158(53.9%), started ART drugs during the second trimester (13–28 weeks) of the current pregnancy (Table 2).

Concerning pregnancy type, 213(72.7%) of the participants had intended pregnancy. With regard to disclosure status, 249(83.3%) of

Table 1

Socio-demographic characteristics of pregnant women on option B+ ART drugs at East Shawa Zone, Oromia, Ethiopia January 2 to March 20, 2017.

Variables	Categories	Frequency	Percentage
Residence	Urban	225	76.8
	Rural	68	23.2
Religion	Muslim	32	10.9
	Christian Orthodox	202	68.9
	Protestant	55	18.8
	Others[1]	4	1.4
Marital status	Married	242	82.6
	Divorced	27	9.2
	Widowed	17	5.8
	Others[2]	7	2.4
Age	< 25	62	21.2
	25–29	85	29
	30–34	95	32.4
	≥ 35	51	17.4
Educational status	Can't read and write	83	28.3
	Primary (1–8)	153	52.2
	Secondary and above	57	19.5
Occupational status	Own work	70	23.9
	House Wife	161	54.9
	Private employee	43	14.7
	Government employee	9	3.1
	Others[3]	9	3.1
Monthly income	< 650	58	19.8
	650–1400	134	45.7
	> 1400	101	34.5
Person they live with	Partner	223	76.1
	Extended family	45	15.4
	Alone	25	8.5

Note:
[1] Waqefata, Adventist and Catholic.
[2] Cohabitant, separated.
[3] Farmers, Commercial Sex Workers.

the respondents disclosed about HIV status to husband, sexual partner, family, friends and/or other significant person. The majority of respondents 204(69.6%) have received financial and social support from either partner, family, relatives, governmental or non-governmental organizations, while 173(59%) of the respondents ever participated on HIV positive mother to mother discussion program about ART drug adherence. Sixty-five (22.2%) participant developed side effect to the ART drugs during the current pregnancy (Table 2).

The overall adherence level to antiretroviral medication was 82.6%, which was achieved by 242 of the study participants (Table 2).

Factors associated with option B+ ART adherence

Educational status was significantly associated with adherence status. Women who attended at least primary school level were almost 5 times more likely to have good adherence than those unable to read and write, [AOR 4.54 (95% CI; 1.72–11.95)] (Table 3).

The analysis also revealed that antiretroviral drug adherence was strongly associated with the drug side effect. Unsurprisingly, women who developed drug side effect during current pregnancy were 76% less likely to have good adherence than their counterparts, [AOR 0.24(95% CI; 0.1–0.6)] (Table 3).

The respondents who were counseled on the health benefit of HIV/AIDS treatment for mother and fetus were nearly three times more likely to be adherent than those never counseled, [AOR 2.9(95% CI; 1.27–6.63)]. Moreover, ART drug adherence has a strong association with fear of stigma and discrimination. Accordingly, the respondents who were not scared of stigma and discrimination were about sixteen times more likely to have good adherence than those who reported fear of stigma and discrimination during the current pregnancy, [AOR 15.79(95% CI; 4.64–53.67)] (Table 3).

The study also showed that respondents who received social and

Table 2
HIV, ART, and health care system related characteristics of pregnant Women on option B+ ART drugs at East Shawa Zone, Oromia, Ethiopia January 2 to March 20, 2017.

Variables	Categories	Frequency	Percentage
Types of Health Care Facilities	Health Center	184	62.8
	Hospital	109	37.2
Time needed by patient to reach healthcare facilities	< 1 h	226	77.1
	≥1 h	67	22.9
Gestational age at the moment of ART initiation	≤12 Weeks	105	35.8
	13–28 Weeks	158	53.9
	≥ 28 Weeks	30	10.2
Moment of HIV Status diagnosis	Before being pregnant	180	61.4
	After being pregnant	113	38.6
Pregnancy Type	Intended	213	72.7
	Unintended	80	27.3
HIV Disclosure Status	Disclosed	249	83.3
	Not Disclosed	49	16.7
Frequency of Counseling on ART adherence by Healthcare provider	Always	198	67.6
	Some times	73	24.9
	At initiation of treatment only	22	7.5
Developed ART drug side effect on current pregnancy	Yes	65	22.2
	NO	228	77.8
Received social and financial support	Yes	204	69.6
	No	89	30.4
Participated on HIV positive mother to mother discussion about ART adherence	YES	173	59
	NO	120	41
Relationship with healthcare provider	Good	264	90.1
	Poor	29	9.9
Reported fear of stigma and discrimination on current pregnancy	Yes	51	17.4
	No	242	82.6
Level of ART Adherence	Good	242	82.6
	Poor	51	17.4

financial support from partner, family, friends, relatives, government or non-governmental organizations were nearly 3 times more likely to have good adherence than their counterparts, [AOR 2.76(95%CI; 1.17–6.51)]. Furthermore, the respondents who had a poor relationship with health care providers were 78% less likely adherent to their medication than those reported having a good relationship with health care providers, [AOR 0.22 (95% CI; 0.08–0.62)] (Table 3).

Discussion

In this study, good adherence was achieved by 242 respondents, which accounts 82.2% of the study participant (Table 2). This level of adherence was similar to the study conducted in Chongwe district of Zambia (82.5%) and Kisumu, Kenya (82%) [20,21]. On the hand, the overall adherence level of this study was slightly less than the finding reported by the study conducted in Tigray regional state of Ethiopia (87.1%), South Wollo Zone of Amhara regional state of Ethiopia (87.9%), the study in Western Kenya (89%), the study conducted in Bwaila Hospital, Malawi [16,22,23]. The study conducted in Tigray regional state of Ethiopia used a similar tool with this study to assess the level of adherence. However, the discrepancy might be due to; the study conducted in Tigray regional state used data from public hospitals only while this study used both hospitals and health centers. The women on follow up at primary health care facilities were less likely adherent to ART medications than those on follow up at hospitals [24].

In this study, educational status was strongly associated with ART adherence. The respondent who had educational status of at least primary school level were almost 5 times more likely to have good adherence than those unable to read and write, AOR 4.54(95% CI; 1.72–11.95) (Table 3). Similarly, educational status was strongly associated with adherence status as reported on previous studies from

Tanzania, Ghana and Kenya [16,25,26]. This might be due to better educated have access to information and are more likely to make better-informed decisions.

The study conducted in Zambia reported that women attended follow up at referral health facilities were more likely to be poorly adherent than those on follow up at rural health centers [20]. In contrary, a study conducted in Addis Ababa, Ethiopia, shows that the women on follow up at primary health care facilities were less likely to continue their follow up than those on follow up at hospitals [24]. However, in this study, type of health care facilities has no statistically significant association with ART drug adherence both on bivariate and multivariate analysis, COR 1.92(95%CI; 0.97–3.79) VS AOR 1.21(95% CI; 0.50–2.95) (Table 3).

Social and financial supports from partner, family, friends, governmental and non-governmental organization were associated with medication adherence. Accordingly, the respondent who obtained social and financial supports were 2.76 times more likely good adherent to ART medication than those didn't obtained support from others, AOR 2.76(1.17 6.51) (Table 3). The study conducted in Nigeria reported similar finding [27]. This might be due to the usual benefit of social and financial support for moral encouragement and healthcare assistance through transportation and reminders [3].

The respondents who were living with their sexual partner were six times more likely good adherent to ART medication than those living alone, AOR 6.1(95% CI; 1.22–30.4). Moreover, the respondents who were living with extended family were nearly five times more likely good adherent to their ART drug than those reported living alone, AOR 4.98(95% CI; 0.81–30.68) (Table 3). The study conducted in Ukraine agree with this study finding; poor adherence during pregnancy was more commonly reported among women living with their extended family and women not living with a partner [28].

HIV status disclosure to partner, family, friend, and significant others had a statistically significant association with ART adherence [25,27–30]. Similarly, in this study the respondents who disclosed their HIV status to others were 2.6 times more likely good adherent to their medication than those didn't disclosed their HIV status, AOR 2.61(95% CI; 1.01–6.71) (Table 3).

Good relationships with health care providers enable patients to have better information about the importance of adherence to their ART medications [31–33]. In this study, the respondent who reported a poor relationship with health care providers were 78% less likely good adherent to their medication when compared with their counterparts, AOR 0.22 (95% CI; 0.08–0.62) (Table 3).

Adherence to option B+ was strongly associated with drug side effects as reported by a study from Ukraine [28]. Likewise, the respondents who reported experience of drug side effect during the current pregnancy were 76% less likely to have good adherence than who didn't report any drug side effects, AOR 0.24(95% CI; 0.1–0.6) (Table 3).

The women who reported fear of stigma and discriminations were about 16 times more likely to have good adherence when compared with those didn't reported any fear of stigma and discriminations, AOR 15.79(95% CI; 4.64–53.67) (Table 3). This finding was consistent with previous studies conducted in India, Tanzania, and Nigeria [27,34,35].

The women who were counseled on health benefit of HIV/AIDS treatment for mother and fetus were 3 times more likely good adherent to ART medication than their counterparts, AOR 2.9(95% CI; 1.27–6.63) (Table 3).

Limitations

This study evaluated ART drug adherence using self-reports. Thus, the adherence estimate might be affected by some recall bias which might have a tendency to overestimate or underestimate adherence level.

Table 3

Multivariate analysis result for factors associated with ART drug adherence among option B+ pregnant Women in public health facilities of East Shawa Zone, Ethiopia, January 2 to March 20, 2017.

Variables	Categories	Adherence Status		COR 95% CI	AOR95% CI
		Good	Poor		
Marital Status	Married	204	38	1.84(0.89–3.77)	2.3(0.41–12.96)
	Unmarried	38	13	1	1
Educational Status	Can't read and write	56	27	1	1
	Primary(1–8)	138	15	4.43(2.19–8.26))	4.54(1.72–11.95)**
	≥Secondary	48	9	2.57(1.10–6.00)	2.79(0.87–8.92)
Economic Status	< 650	45	13	1	1
	650–1400	118	16	2.13(0.94–4.78)	1.7(0.58–4.95)
	> 1400	79	22	1.04(0.48–2.26)	1.1(0.38–3.17)
Person they live with	Partner	191	32	4.69(1.96–11.24)	6.1(1.22–30.4)*
	Extended family	37	8	3.63(1.21–10.90)	4.98(0.81–30.68)*
	Alone	14	11	1	1
Type of health care facility	Hospital	96	13	1.92(0.97–3.79)	1.21(0.50–2.95)
	Health Center	146	38	1	1
Place of residence	Urban	190	35	1.67 (0.86–3.25)	2.17(0.59–8.00)
	Rural	52	16	1	1
Time needed to reach health care facility	< 1 h	191	35	1.71(0.88–3.33)	1.14(0.31–4.26)
	≥1 h	51	16	1	1
HIV status disclosure	Disclosed	211	37	2.57(01.25–5.30)	2.61(1.01–6.71)*
	Not Disclosed	31	14	1	
Fear of stigma and discrimination	Yes	38	13	1	1
	No	234	8	10(3.89–25.75)	15.79(4.64–53.67)***
Relationship with health care provider	Good	224	40	1	1
	Poor	18	11	0.29(0.13–0.66)	0.22 (0.08–0.62)**
Social and financial support	Yes	188	23	4.24(2.26–7.95)	2.76(1.17–6.51)*
	No	54	28	1	1
Any side effect of drug	Yes	48	17	0.49(0.25–0.96)	0.24(0.1–0.6)*
	No	194	34	1	1
Counselled on health benefit of treatment for mother and fetus	Yes	173	24	2.82(1.52–5.23)	2.9(1.27–6.63)*
	No	69	27	1	1

Note: *represents P < 0.05, **P ≤ 0.01, **P ≤ 0.001.

Conclusion and recommendation

A vast majority of respondents were adherent to their Option B+ ART drug regimens. However, nearly one-fifth of the respondents were not adhered to their drugs.

The finding of this study depicts that fear of stigma and discrimination, and drug side effects negatively affects Option B+ ART drugs adherence among pregnant women while appropriate counseling on health benefits of ART drugs for fetus and mothers, social and financial supports, patient-health care provider relationships, HIV status disclosures and educational status of the women positively affect Option B+ ART drugs adherence.

Based on the result of this study, we recommend collaborations of the patient, family, healthcare provider, a governmental and non-governmental organization to enhance Option B+ ART drugs adherence during pregnancy.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of Competing Interest

The authors declare that they have no competing interests.

Acknowledgements

Ethics approval and consent to participate

Before any attempt to collect data, ethical approval was obtained from Addis Ababa University College of Health Science. Letter of permission was obtained from administration officials of respective health centers and hospitals through Oromia regional state health bureau. Each client was informed about the purpose of the study, the right to refuse to participate in this study, and anonymity and confidentiality of the information gathered. They were assured that they will not be penalized for not participating if they wished not to participate and that their responses to the questions would have no effect on their care. Finally, a written Consent was obtained from each voluntary client.

Funding

Author's contribution

AB assisted with design, acquisition of data, analysis, interpretation, commenting, and drafting of the manuscript and critical review of the manuscript. AS assisted with the design, analysis, and interpretation of data, commenting, and the critical review of the manuscript drafts. MT made substantial contributions to conception, design, acquisition of data, analysis, interpretation of data, drafting of the manuscript and the critical review of the manuscript drafts. All authors read and approved the final draft of the manuscript.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.srhc.2019.100459.

References

[1] UNAIDS. How AIDS Changed Everything? 2016.

[2] UNAIDS. Global Fact sheet HIV/AIDS; 2014.

[3] Holtzman CW, Brady AK, Yehia RB. Retention in care and medication adherence: current challenges to antiretroviral therapy success. Dep Heal Hum Serv 2015;75(5):445–54.

[4] UNAIDS. The gap report: Beginning of the End of the AIDS Epidemic. J Int AIDS Soc; 2015.

[5] WHO. Antiretroviral drugs for treating pregnant women and preventing HIV infection in infants: recommendations for a public health approach. Geneva, Switzerland: WHO Press; 2010.

[6] WHO. Use of antiretroviral drugs for treating pregnant women and preventing HIV infection in infants: Programmatic update. Geneva, Switzerland; 2012.

[7] UNICIEF. Option B and B+: Key Considerations for Countries to Implement Equity Focused-Approach; 2012.

[8] FDRE/MOH. National comprehensive PMTCT/MNCH/RH training package reference manual; 2013.

[9] FDRE/MOH. Country Progress Report on the HIV. Addis Ababa, Ethiopia; 2014.

[10] Bhatti AB, Usman M, Kandi V. Current scenario of HIV/AIDS, treatment options, and major challenges with compliance to antiretroviral therapy the infection. Cureus 2016;8(3):1–12.

[11] Paredes R, Marconi VC, Lockman S, Abrams EJ, Kuhn L. Impact of antiretroviral drugs in pregnant women and their children in Africa: HIV resistance and treatment outcomes. J Infect Dis 2013;207(Suppl 2):93–100.

[12] Kalichman SC, Washington C, Grebler T, Hoyt G, Welles B, Kegler C, et al. Medication adherence and health outcomes of people living with HIV who are food insecure and prescribed antiretrovirals that should be taken with food. Clin Infect Dis 2015;79–91.

[13] Stover J, Korenromp EL, Blakley M, Komatsu R, Viisainen K. Long-term costs and health impact of continued global fund support for antiretroviral therapy. PLoS One 2011;6(6).

[14] Kieffer MP, Mattingly M, Giphart A, Van De Ven R, Chouraya C, Walakira M, et al. Lessons learned from early implementation of option B+: the Elizabeth Glaser Pediatric AIDS Foundation Experience in 11 African Countries. J. AIDS 2015;67:188–94.

[15] Kim MH, Zhou A, Mazenga A, Ahmed S, Markham C, Zomba G, et al. Why Did I Stop? Barriers and facilitators to uptake and adherence to ART in Option B+ HIV Care in Lilongwe Malawi. PLoS One 2016;11(2):1–16. e0149527.

[16] Ayuo P, Musick B, Liu H, Braitstein P, Nyandiko W, Otieno-nyunya B, et al. Frequency and factors associated with adherence to and completion of combination antiretroviral therapy for prevention of mother to child transmission in western Kenya. J Int AIDS Soc 2013;16(17994).

[17] Ebuy H, Yebyo H, Alemayehu M. Level of adherence and predictors of adherence to the Option B+ PMTCT programme in Tigray, northern Ethiopia. Int J Infect Dis 2015;33:123–9. https://doi.org/10.1016/j.ijid.2014.12.026.

[18] Mirkuzie AH, Hinderaker SG, Sisay MM, Moland KM, Mørkve O. Current status of medication adherence and infant follow up in the prevention of mother to child HIV transmission programme in Addis Ababa: a cohort study. J Int AIDS Soc 2011;14(1):50 http://www.jiasociety.org/content/14/1/50.

[19] Steel G, Joshi MP. Development of a multi-method tool to measure art adherence in resource-constrained settings: the South Africa experience. Management Sciences for Health, 4301 North Fairfax Drive, Suite 400. Arlington, VA 22203 USA: Rational Pharmaceutical Management Plus Program Center for Pharmaceutical Management; 2007.

[20] Okawa S, Chirwa M, Ishikawa N, Kapyata H, Msiska CY, Syakantu G, et al. Longitudinal adherence to antiretroviral drugs for preventing mother-to-child transmission of HIV in Zambia. BMC Pregnancy Childbirth 2015;15(258):1–10. https://doi.org/10.1186/s12884-015-0697-7.

[21] Thomas TK, Masaba R, Borkowf CB, Ndivo R, Zeh C, Otieno J, et al. Triple-antiretroviral prophylaxis to prevent mother-to- child HIV transmission through breastfeeding — The Kisumu Breastfeeding Study, Kenya: a clinical trial. Plos Med 2011;8(3).

[22] Tweya H. Loss to follow-up among women in Option B+ PMTCT programme in Lilongwe, Malawi: understanding outcomes and reasons. J Int AIDS Soc 2014.

[23] Tsegaye D, Deribe L, Wodajo S. Levels of adherence and factors associated with adherence to option B+ prevention of mother-to-child transmission among pregnant and lactating mothers in selected government health facilities of South Wollo Zone, Amhara Region, northeast. Epidemiol Health 2016;38(e2016043):1–7. https://doi.org/10.4178/epih.e2016043.

[24] Mitiku I, Arefayne M, Mesfin Y, Gizaw M. Factors associated with loss to follow-up among women in Option B â€™ PMTCT programme in northeast Ethiopia: a retrospective cohort study. J Int AIDS Soc 2016;19(20662):1–8.

[25] Kirsten I, Sewangi J, Kunz A, Dugange F, Ziske J, Jordan-harder B, et al. Adherence to combination prophylaxis for prevention of mother-to-child-transmission of HIV in Tanzania. PLoS ONE 2011;6(6).

[26] Boateng D, Kwapong GD, Agyei-baffour P. Knowledge, perception about antiretroviral therapy (ART) and prevention of mother-to-child- transmission (PMTCT) and adherence to ART among HIV positive women in the Ashanti Region, Ghana: a cross-sectional study. BMC Women's Health 2013;13(1):1.

[27] Ekama SO, Herbertson EC, Addeh EJ, Onwujekwe DI, Tayo F, Ezechi OC. Pattern and determinants of antiretroviral drug adherence among Nigerian pregnant women. J Pregnancy 2013;6.

[28] Bailey H, Thorne C, Malyuta R, Townsend CL, Semenenko I, Cortina-borja M. Adherence to antiretroviral therapy during pregnancy and the first year postpartum among HIV-positive women in Ukraine. BMC Public Health 2014;14(993):1–11.

[29] Igwegbe AO, Ugboaja JO, Nwajiaku LA. Prevalence and determinants of non-adherence to antiretroviral therapy among HIV- positive pregnant women in Nnewi, Nigeria. Int J Med Med Sci. 2010;2(August):238–45.

[30] Awiti OU, Mia AE. Reasoning and deciding PMTCT-adherence during pregnancy among women living with HIV in Kenya. Cult Health Sex 2011;13(7):829–40.

[31] Mbirimtengerenji ND, Jere G, Lengu S, Maluwa A. Factors that influence anti-retroviral therapy adherence among women in Lilongwe Urban Health. World J AIDS 2013;3:16–25.

[32] Starks H, Simoni J, Zhao H. Conceptualizing antiretroviral adherence in Beijing, China. AIDS Care 2008;20:607–14.

[33] Lewis MP, Colbert A, Erlen J, Meyers M. A qualitative study of persons who are 100% adherent to antiretroviral therapy. AIDS Care 2006;18:140–8.

[34] Ngarina M, Popenoe R, Kilewo C, Biberfeld G, Ekstrom AM. Reasons for poor adherence to antiretroviral therapy postnatally in HIV-1 infected women treated for their own health: experiences from the Mitra Plus study in Tanzania. BMC Public Health 2013;13(450:9):1–9.

[35] Rahangdale L, Banandur P, Sreenivas A, Turan JM, Washington R, Cohen CR. Stigma as experienced by women accessing prevention of parent-to-child transmission of HIV services in Karnataka, India. AIDS Care 2010;22:836–42.