

Determinants of Defaulting from Antiretroviral Therapy Treatment in Nekemte Hospital, Eastern Wollega Zone, Western Ethiopia

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Abstract Background: The prognosis of patients with HIV in Sub-Africa has improved with the widespread use of antiretroviral therapy. Despite this success, defaulting from antiretroviral therapy is one of the major challenges in resource-limited settings. There are limited data on determinants of defaulting from antiretroviral therapy in Ethiopia. Therefore the aim of this study is to assess determinants of defaulting from antiretroviral treatment in Nekemte Hospital, West Ethiopia. **Method:** A case control study was used. The study covered 118 cases and 118 controls. Cases were individuals who had missed two or more clinical appointments (i.e. had not been seen for the last 2 months); controls were individuals who were rated as excellent adherers by the providers. Data were collected from patient records, and by telephone call and home visit to identify the factors associated with for defaulting. The logistic regression model was fitted by using back ward elimination technique to identify independent predictors of antiretroviral treatment defaulting. **Result:** After controlling for possible confounders, living far from the facility (out of the town) (AOR=4.1; 95%CI 1.86 to 9.42), dependent patients for source of food [AOR=13.9; 95%CI 4.23 to 45.99], patients with mental status not at ease [AOR=4.7; 95%CI 1.65 to 13.35], patients whose partners were HIV negative [AOR=5.1; 95%CI 1.59 to 16.63], patients whose partners HIV status were unknown or not tested [AOR=2.8; 95%CI 1.23 to 6.50] and patients that fear stigma [AOR=8.3; 95%CI 2.88 to 23.83] were statistically significant association. **Conclusion:** In this study, those who were living out of the town or far from the facility, whose partner's HIV status was negative or unknown, who were stigmatized and mental ill had a higher chance of defaulting from ART treatment. So, efforts to reduce defaulting from ART should focus on addressing these risk factors.

Keywords Defaulting, Antiretroviral treatment, Nekemte hospital

1. Introduction

Sub-Saharan Africa remains the region most heavily affected by HIV, and accounted for 68% of all people living with the virus and for 72% of AIDS deaths in 2009[1]. The HIV/AIDS epidemic in Ethiopia continues to pose a threat to the lives of people. It is estimated that 977,394 people live with the virus resulting in 71,902 HIV related deaths in 2007. The national prevalence of HIV in 2007 is estimated to be 2.1%[2].

Provision of Antiretroviral Therapy (ART) has reduced mortality and also improved the quality of life of people living with HIV and AIDS (PLWHA)[3]. In 2009 alone, 1.2 million people received ART for the first time worldwide[1]. By the end of 2009, there were more than five million people on ART in middle and low income countries. In Sub-Saharan

Africa, nearly 37% of people eligible for treatment were able to access ART in 2009[1]. In Ethiopia provision of ART was started in 2003. At the end of June 2008, there were only 110,611 patients (75%) who were alive and on ART out of the 150,136 patients who had been started ART since 2003[4].

Despite this success, poor adherence to ART and defaulting from ART are two major challenges in resource-limited settings[5]. Defaulting reduces the immunological benefit of ART and increases AIDS related morbidity, mortality and hospitalizations[6]. Poor adherence and defaulting from ART treatment increase the risk of drug resistance and treatment failure[5, 7- 8]. A systematic review of 33 patient cohorts from 13 African countries reported that only between 46% and 85% of patients remained in care at 2 years[9]. Studies done in Ethiopia and South Africa had reported, the overall rate of defaulting treatment were 13.6% and 12.8/100 person years respectively[5, 10].

Different studies reported that defaulting from ART are influenced by distance from facility[10--16], transportation cost[12, 14, 16], drug abuse[10, 17], being bed ridden[10],

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having HIV negative partner[10], depression[18], stigma[16, 18-20], CD4 count[16], food insecurity[21], adherence support services and food rations at HIV care clinics[22].

Previous studies conducted in Ethiopia addressed adherence to ART and associated factors. However, the broader aspects of defaulter and associated factors were not well studied in Ethiopia especially in the zonal hospital. There is only one study that is conducted on this issue and it was conducted in tertiary hospital[10]. Thus this is the first by its kind in zonal hospital in Ethiopia. Besides, the defaulter rate in Nekemte hospital was 21.7% which was the highest (from 2837 ever started 616 patients were defaulters) when compared with the study on Jimma specialized hospital(13.6%)[10]. Therefore the aim of this study was to assess determinants of defaulting from antiretroviral therapy in Nekemte Hospital, West Ethiopia.

2. Methods and Materials

A case control study was conducted in Nekemte Hospital from March 2011 to April 2011. Nekemte town is located 331 Kilometers West of Addis Ababa, the capital city of Ethiopia.

Cases were ART treatment defaulters. ART treatment defaulters in this study are defined as an HIV positive patient who had been on ART treatment and missed two or more monthly clinical appointments[10], and age 15 years and above. Controls were individuals who had been on ART at least for one year and were rated as excellent adherers by the providers[10] and age 15 years and above. For each case, a control that was enrolled in the same month was selected. If more than one control enrolled in the same month, the closest date of enrolment determined selection. Patients attend the ART clinic each month to refill the ART drugs.

The sample size was calculated using Epi-info version 6.0.4 software. As estimated from study done in Jimma, proportion of patients living far (distance) from the facility among the cases and controls being 44.1% and 26.0% respectively[10]. At 95% CI and 80% power and case to control 1:1, the total sample size required were 238 (119 cases and 119 controls). The hospital record was used as sampling frame. An electronic pharmacy record was used to generate lists of patients who have failed to pick up medication (defaulters). From lists of defaulter, 119 patients (cases) were randomly selected from the eligible.

Using semi-structured questionnaires (a case note extraction), socio-demographic and behavioral information, and clinical factors that could potentially be associated with defaulting (which were recorded at the time treatment started) were retrieved from patient records and cards. The patient card and other forms included questions on socio-demographic information, past medical status, mental health status, and concerns for adherence. The retrieval was conducted by a data clerk in the hospital. Data were also gathered on telephone calls through their addresses recorded at the beginning of ART where possible. In occasions where telephone interview was not feasible five trained peer

counselors were used to trace and interview defaulters at home. The interview was conducted at hospital for controls during follow-up visit. The questionnaire was first prepared in English language, then translated to a local language and retranslated to English to check for consistency. Data collectors and supervisors were trained for two day on the methods, objectives and data collection tool before the data collection.

Data were entered, processed and analyzed using SPSS software version 16. Data analysis was started by describing each variables involved. Bivariate analysis was done for each explanatory variable separately; to identify those associated to ART treatment defaulting. Variables with p-value less than 0.20 in the bivariate analysis were considered as candidate to be entered in the multivariable logistic regression model. The logistic regression model was fitted by using back ward elimination technique. Log likelihood ratio test was used to assess the goodness of fitness of the final model.

The ethical clearance was obtained from Jimma University. Written informed consent was also obtained from each respondent.

3. Result

Table 1. Sociodemographic characteristics of study participants, Nekemte Hospital, 2011

Characteristics	Cases (n=118)	Controls n(n=118)
	N ^o (%)	N ^o (%)
Sex		
Male	50(42.4)	48(40.7)
Female	68(57.6)	70 (59.3)
Age		
15-24	19(16.1)	9(7.6)
25-34	53(44.9)	60(50.8)
≥35	46(39.0)	49(41.5)
Place of residence		
In Nekemte town	57 (48.3)	87(73.7)
Out of Nekemte town	61 (51.7)	31(26.3)
Ethnicity		
Amahara	18(15.3)	8 (6.8)
Oromo	83(70.3)	101(85.6)
Others	17 (14.4)	9 (7.6)
Religion		
Muslim	8 (6.8)	20(16.9)
Christian	98(83.1)	110(93.2)
Marital status		
Single	31(26.3)	25(21.2)
Married	45(38.1)	54(45.8)
Divorced	18(15.3)	12(10.2)
Widowed	24(20.3)	27(22.9)
Educational status		
Illiterate	28(23.7)	8(6.8)
1-8 th	46(39.0)	64(54.2)
9-12 th	33(28.0)	38(32.2)
>12 th (college & university)	11(9.3)	8 (6.8)
Family monthly income		
Had no income(dependent)	47(39.8)	7 (5.9)
≤ 500 E. Birr	20(16.9)	39(33.1)
501-999	42(35.6)	62(52.5)
≥1000	9 (7.6)	10(8.5)

A total of 236 individuals were interviewed, having the response rate of 99.2%. From the total of study participants, about a two-fifth of both cases and control were male (42.4% for case and 40.7% for control group). Fifty three (44.9%) of case and 60(50.8%) of control were in age group of 25-34 years. Patients who live in the town were 57(48.3%) and

87(73.7%) of cases and controls respectively. Concerning educational status of participants, 28(23.7%) of case and 8(6.8%) of control group were illiterate. Forty seven (39.8%) of case and 7(5.9%) of control had no monthly income and were dependent on others (table1).

Table 2. Bivariate analysis of factors related to ART treatment defaulting, Nekemte Hospital, 2011

Characteristics	Cases(n=118)	Controls(n=118)	COR (95% CI)
	N ^a (%)	N ^a (%)	
Sex			
Male	50(42.4)	48(40.7)	1
Female	68(57.6)	70 (59.3)	0.93(0.56-1.56)
Age			
15-24	19(16.1)	9(7.6)	1
25-34	53(44.9)	60(50.8)	0.42(0.17-1.00)
≥35	46(39.0)	49(41.5)	0.45(0.18-1.08)
Place of residence			
In Nekemte town	57 (48.3)	87(73.7)	1
Out of Nekemte town	61 (51.7)	31(26.3)	3.00(1.74-5.17)*
Ethnicity			
Amahara	18(15.3)	8 (6.8)	1
Oromo	83(70.3)	101(85.6)	0.37(0.15-0.88)
Others	17 (14.4)	9 (7.6)	0.84(0.26-2.68)
Religion			
Muslim	8 (6.8)	20(16.9)	1
Christian	98(83.1)	110(93.2)	0.36(0.15-2.85)
Marital status			
Single	31(26.3)	25(21.2)	1
Married	45(38.1)	54(45.8)	1.40(0.65-2.99)
Divorced	18(15.3)	12(10.2)	0.94(0.48-1.85)
Widowed	24(20.3)	27(22.9)	1.69(0.68-4.21)
Educational status			
Illiterate	28(23.7)	8(6.8)	2.55(0.77-8.48)
1-8 th	46(39.0)	64(54.2)	0.52(0.20-1.40)
9-12 th	33(28.0)	38(32.2)	0.63(0.23-1.76)
>12 th (college & university)	11(9.3)	8 (6.8)	1
Family monthly income			
Had no income(dependent)	47(39.8)	7 (5.9)	7.46(2.25-24.79)
≤ 500 E. Birr	20(16.9)	39(33.1)	0.57(0.20-1.63)
501-999	42(35.6)	62(52.5)	0.75(0.28-2.01)
≥1000	9 (7.6)	10(8.5)	1
Meal per day			
Three	101(85.6)	109(92.4)	1
Two	17(14.4)	9(7.6)	2.04(0.87-4.78)
Source of food			
Independent	68(57.6)	111(94.1)	1
Dependent	50(42.4)	7(5.9)	11.66(5.00-27.19)*
Develop side effect/toxicity			
Yes	10(8.5)	6 (5.1)	1.73(0.61-4.92)
No	108(91.5)	112(94.9)	1
Stigma			
Yes	44(37.3)	8(6.8)	8.18(3.64-18.36)*
No	74(62.7)	110(93.2)	1
Attending traditional healers/holly water			
Yes	21(17.8)	6(5.1)	4.04(1.57-10.42)*
No	97(82.2)	112(94.9)	1
Seriously sick/bed ridden			
Yes	19 (16.1)	8(6.8)	2.64(1.11-6.30)*
No	99(83.9)	110(93.2)	1
Were you on TB treatment			
Yes	24(20.3)	31(26.3)	0.72(0.39-1.32)
No	94(79.7)	87(73.7)	1
If yes, Complete d[@]			
Yes	14(11.9)	23(19.5)	1

Table 2. continue

Pill burden			
Yes	15(12.7)	14(11.9)	1.08(0.49-2.35)
No	103(87.3)	104(88.1)	1
Took OI treatment			
Yes	7(5.9)	7(5.9)	1.15(0.40-3.29)
No	111(94.1)	110(93.2)	1
Mental status			
Ease	92(78.0)	106 (89.8)	1
Not at ease	26 (22.0)	12 (10.2)	2.50(1.19-5.23)*
Tobacco use			
No	102(86.4)	106(89.8)	1
Yes	16 (13.6)	12(10.2)	1.39(0.63-3.07)*
Drinking Alcohol			
No	101(85.6)	108(91.5)	1
Yes	17(14.4)	10(8.5)	1.82(0.80-4.16)*
Baseline CD4 status			
≤ 50	35(29.7)	17(14.4)	2.51(1.31-4.79)*
>50	83(70.3)	101(85.6)	1
Partner's HIV status			
HIV positive	27(22.9)	65(55.1)	1
HIV negative	19(16.1)	10 (8.5)	4.57(1.88-11.11)*
Not known/not tested	46 (39.0)	32(27.1)	3.46(1.83-6.54)*

*significant for p-value <0.05

Table 3. Independent determinants of ART treatment defaulting in Nekemte hospital, 2011

Variables	Cases N ^a (%)	Controls N ^a (%)	Crude OR (95%CI)	Adjusted OR (95%CI)
Distance of the facility				
In Nekemte town	57 (48.3)	87(73.7)	1	1
Out of Nekemte town	61 (51.7)	31(26.3)	3.00(1.74-5.19)	4.19(1.86-9.42)*
Source of food				
Independents	68(57.6)	111(94.1)	1	1
Dependents	50(42.4)	7(5.9)	11.66(5.00-27.19)	13.95(4.23-45.98)*
Mental illness				
Ease	92(78.0)	106 (89.8)	1	1
Not at ease	26 (22.0)	12 (10.2)	2.50(1.19-5.23)	4.73(1.65-13.56)*
Partner HIV status				
HIV positive	27(22.9)	65(55.1)	1	1
HIV negative	19(16.1)	10 (8.5)	4.57(1.88-11.11)	5.14(1.59-16.63)*
Not tested/unknown	46 (39.0)	32(27.1)	3.46(1.83-6.54)	2.83(1.24-6.50)*
Stigma				
Yes	44(37.3)	8(6.8)	8.18(3.64-18.36)	8.28(2.88-23.82)*
No	74(62.7)	110(93.2)	1	1

Variables included in the adjusted model are educational status, attending traditional healer/ holly water, bed ridden, tobacco use, drinking alcohol, base line CD4 status, Tb treatment distance from facility, source of food, mental illness, partner's HIV status and stigma

* significant for p-value <0.05

Among the study participants, 10(8.5%) of cases and 6(5.1%) of controls complained the side effect of ART drugs. Patients that complained the fear of stigma were 44(37.3%) of cases and 8(6.8%) of controls. Twenty one (17.8%) of case and 6(5.1%) of controls were seeking help from traditional healers/holly water. Patients who were on TB treatment among cases and controls were 24(20.3%) and 31(26.3%) respectively.

At ART enrollment, 17(14.4%) of cases and 10(8.5%) of controls were smokers, 35(39.7%) of cases and 17(14.4%) of controls had CD4 count 50 and less. HIV status of partners of 46(39.0%) of cases and 32(27.1%) of controls were unknown/ not tested. All characteristics of patients at ART enrollment considered in this study were significantly associated with defaulting from ART treatment.

In bivariate analysis many factors were associated with ART defaulting (Table 2).

In the multiple logistic-regression model, only 5 factors were found to be independently associated with ART defaulting: living outside the town, dependent for source of food, mental illness not at ease, and having an HIV negative partner (or not tested/unknown HIV status), and complain stigma.

In this particular study, patients living far from the facility (out of the town) were more likely to default the treatment than patients living in the town (AOR=4.1; 95%CI 1.86 to 9.42). Dependent patients for source of food were more likely to default from ART treatment compared to independent patients for food [AOR=13.9; 95%CI 4.23 to 45.99]. Those patients with mental status not at ease were

4.19 times more likely to default from ART treatment compared to those with normal [AOR=4.7; 95%CI 1.65 to 13.35]. Compared to those whose partners were HIV positive, the risk of defaulting from ART treatments were 5.14 times higher among patients whose partners were HIV negative [AOR=5.1; 95%CI 1.59 to 16.63], and 2.83 times higher among patients whose partners HIV status were unknown or not tested [AOR=2.8; 95%CI 1.23 to 6.50]. The risk of defaulting from ART treatments among patients that fear stigma were higher compared to those without fear of stigma [AOR=8.3; 95%CI 2.88 to 23.83] (Table 3).

4. Discussion

This study intended to identify the determinants of defaulting from ART treatment. The study used analytic case control design. However, it might have some limitation such as: first, recall bias on some risk factors like drug side effect, toxicity and stigma. Second, distance from health facility was assessed by living in Nekemte town or outside the town, it would have been better in kilometers or hours it take to reach the facility. Distance in Kms or hrs were tried to obtain and majority of participants living outside the town did not respond. So the distance in this study should be interpreted cautiously. Third, using telephone interview for some defaulters may reduce the quality of information as compared to controls. This was used only for very few individual thus may not harm the validity of the study.

This study have identified important determinant factors of ART treatment defaulting. In this study living out of the town or far from the facility was significantly associated with ART treatment defaulting. Similar finding was reported by study done in Ethiopia, Kenya, Uganda and South Africa [10-13]. Distance to clinic and transportation are main factors for defaulting from care in a wide variety of settings developing countries [12-16]. This might be because people need to take time off from work to travel great distances to clinics and wait for the service all day. This may discourage patients to come back for ART treatment clinical appointments.

Among the socio-economic, patients who had no source of food (economically poor) and living dependently (on relatives, NGO, Government, etc) were 14 times more likely to default compared to patients who live independently. In Jimma zone of Ethiopia, 17.6% of patients who defaulted reported lack of food as a reason for absence from clinic [10].

Patients mental status were significantly associated with ART treatment defaulting. This had been reported by study done in Ethiopia and Nigeria [10, 18]. Depression and emotional adjustment to the HIV infections have been observed as other possible reasons why patients default from ART use [18].

Patients with a fear of stigma or Stigmatized patients were 8.3 times more likely to default than not stigmatized (had no fear of stigma). Similarly finding has been reported by study done in Botswana and Nigeria [18, 19]. Stigma is daily issues

facing people infected with HIV/AIDS especially in developing countries. Stigma was mentioned as one factor that constrained patients on antiretroviral therapy from sticking to agreed-to treatment plans. The issue of stigma has been a barrier to people living with AIDS disclosing their status and getting access to available support and care services [18].

Patient whose partner was an HIV-negative partner or unknown HIV status was more likely to default from treatment. Similar finding had been reported by study done in Ethiopia [10]. These may be HIV-infected individuals who had an HIV-positive partner who provided support and encouragement compared to those who had HIV-negative or unknown HIV status partner [10].

5. Conclusions

In Inclusion, PLWH who were living out of the town or far from the facility, whose partner's HIV status was negative or unknown, who were stigmatized and mental ill had a higher chance of defaulting from ART treatment. Besides, those who were dependent on other for food were more likely to default from the treatment. So it is recommended to make ART treatment available patients at the village. The staff should advise the patients and make them to bring their partner for HIV test. Linking patients to local social support or facilitating income generating activities for PLWHA to increase their income should be a priority issue. Effort should be made to decrease stigma. Intensifying counseling of patients before initiating and during treatment is importance so that PLWHA can adjust both psychologically and emotionally to the disease. Addressing stigma on an individual level and community level should be considered.

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Competing of Interests

The authors declare that they have no competing interests.

REFERENCES

- [1] UNAIDS & WHO: Global report. UNAIDS report on the global AIDS epidemic 2010. Geneva: UNAIDS & WHO; 2010:364.
- [2] Ministry of Health Ethiopia & Federal HIV/AIDS Prevention and Control Office: Single Point HIV prevalence estimate. Addis Ababa, Ethiopia 2007.

- [3] Mannheimer SB, Matts J, Telzak E, Chesney M, Child C, Wu AW, Friedland G. Quality of life in HIV-infected individuals receiving antiretroviral therapy is related to adherence. *AIDS Care* 2005, 17(1):10-22.
- [4] Ethiopian Ministry of Health: Ethiopian monthly antiretroviral treatment report. Addis Ababa (Ethiopia): Ministry of Health 2008.
- [5] Kranzer K, Lewis JJ, Ford N, Zeinecker J, Orrell C, Lawn SD, *et al.* Treatment interruption in a primary care antiretroviral therapy programme in South Africa: cohort analysis of trends and risk factors. *Acquir Immune Defic Syndr*. 2010, 55(3): e17–e23.
- [6] Hogg RS, Heath K, Bangsberg D. Intermittent use of triple-combination therapy is predictive of mortality at baseline and after 1 year of follow-up. *AIDS*. 2002; 16, 1051–1058.
- [7] Adam BD, Maticka-Tyndale E, Cohen JJ. Adherence practices among people living with HIV. *AIDS Care*. 2003; 15: 2.
- [8] Malcolm SE, Rosen RK, Stone VE. An examination of HIV/AIDS patients who have excellent adherence to HAART. *AIDS Care* 2003, 15:251.
- [9] Rosen S, Fox MP, Gill CJ. Patient retention in antiretroviral therapy programs in sub-Saharan Africa: a systematic review. *PLoS Med* 2007, 4:e298.
- [10] Deribe K, Hailekiros F, Biadgilign S, Amberbir A, Kebede B. Defaulters from antiretroviral treatment in Jimma University Specialized Hospital, Southwest Ethiopia. *Trop Med Int Health* 2008, 13: 328–333.
- [11] Talam N, Gatongi P, Rotich J, Kimaiyo K. Factors affecting antiretroviral drug adherence among HIV/AIDS adult patients attending HIV/AIDS clinic at MOI teaching and referral hospital, Eldoret, Kenya. *East African Journal of Public Health*. 2008, 5(2):74-78.
- [12] Geng EH, Bangsberg DR, Musinguzi N. Understanding reasons for and outcomes of patients lost to follow-up in antiretroviral therapy programs in Africa through a sampling-based approach. *J Acquir Immune Defic Syndr* 2010, 53: 405–411.
- [13] Kagee A, Remien RH, Berkman A, Hoffman S, Campos L, Swartz L. “Structural barriers to ART adherence in Southern Africa: challenges and potential ways forward,” *Global Public Health* 2011, 6(1): 83–97.
- [14] Yu JK, Chen SC, Wang KY, Chang C, Makombe SD, Schoutenc EJ, *et al.* True outcomes for patients on antiretroviral therapy who are “lost to follow-up” in Malawi. *Bull World Health Organ* 2007; 85:550–554.
- [15] Raguenaud, M, Isaakidis, P, Vonthanak, S. Good ART patient outcomes and survival achieved in a six-year HIV/AIDS program in Cambodia. 5th IAS Conference on HIV Pathogenesis, Treatment, and Prevention; Cape Town, South Africa. July 19–22, 2009.
- [16] Geng E.H., Nash D. Kambugu A. Zhang Y. Braitstein P. Christopoulos K. A. *et al.* Retention in Care Among HIV-Infected Patients in Resource-Limited Settings: Emerging Insights and New Directions. *Curr HIV/AIDS Rep*. 2010; 7(4): 234–244
- [17] Gordillo V, del Amo J, Soreno V *et al.* (1999) Socio demographic and psychological variables influencing adherence to antiretro-viral therapy. *AIDS* 13, 1763–1769.
- [18] Daniel OJ, Oladapo OT, Ogundahunsi OA, Fagbenro S, Ogun SA, Odusoga OA. Default from Anti-Retroviral Treatment Programme in Sagamu, Nigeria. *African Journal of Biomedical Research*, Vol. 11 (2008); 221 – 224.(Short communication
- [19] Worley S. Development of a system for identifying and tracking of ART patients to minimize losses to follow-up in Eastern Cape, South Africa. Third South African AIDS Conference, 2007, Durban, abstract 672.
- [20] McGuire M, Muyenyembe T, Szumilin E, Heinzelmann A, Le Paih M, Bouithy N, *et al.* Vital status of pre-ART and ART patients defaulting from care in rural Malawi. *Trop Med Int Health* 2010;15:55–62.
- [21] Anema A, Zhang W, Wu Y, Elul B, Weiser SD, Elula B, Weisera SD, Hogg RS. *et al.* Availability of nutritional support services in HIV care and treatment sites in sub-Saharan African countries. *Public health nutrition*. 2012;15: 938–947
- [22] Lamb MR, El-Sadr WM, Geng E, Nash D. Association of Adherence Support and Outreach Services with Total Attrition, Loss to Follow-Up, and Death among ART Patients in Sub-Saharan Africa. *PLoS ONE*. 2012, 7(6): e38443.