

Factors Associated with Non-Adherence to Antiretroviral Treatment Eight Years After Free of Charge Access to ARV in the Region of Kayes, Mali

Modibo Keita^{1*}, YI Coulibaly² and Abdoulaye MT³

¹Infectious Diseases Ward (IDW) at Point G Teaching Hospital, Bamako, Mali

²International Center for Excellence in Research, Bamako, Mali

³Infectious Diseases Ward, Point G University Teaching Hospital, Bamako Mali

* Corresponding Author

Modibo Keita, Infectious Diseases Ward (IDW) at Point G Teaching Hospital, Bamako, Mali, Tel: +22366722238, E-mail: modibomozart@yahoo.fr

Citation

Modibo Keita, YI Coulibaly, Abdoulaye MT (2021) Factors Associated with Non-Adherence to Antiretroviral Treatment Eight Years After Free of Charge Access to ARV in the Region of Kayes, Mali. World J Immunol and Respir Med 1:1-9

Publication Dates

Received date: August 29, 2021

Accepted date: September 29, 2021

Published date: October 01, 2021

Abstract

HIV is present in Mali despite its very low National prevalence with nearly 1%. Since years ago the ARV is available free of charge for those diagnosed cases. However, the adherence to treatment remains challenging in some extent. Therefore, this cross sectional study was initiated to study the factors associated with none adherence to anti-retroviral treatment in the region of Kayes in Mali. A total of 130 patients aged of at least 18 years old and under ARV treatment in the regional Fousseyni Daou hospital have been included in the investigation.

The none adherence has been define as an uptake of ARV drugs less than 95 % of prescribed doses of ARV during the last 7 days prior to the interview of patient. The data were collected using the tally sheet of the hospital pharmacy, patient's medical record and the interview questionnaire of the study participants.

The logistic regression was used to identify the associated factors to none adherence to ARV treatment. Consequently, the study reported 20 months as the median time under ARV treatment and 19.2 % (25/130) of the participants were none adherents to ARV treatment. The main factors associated with none adherence to ARV treatment was the unawareness of the risks related to irregular uptake of the drug by patient [adjusted OR=6.44 IC 95% (1.90 -21.85)]

In conclusion, in Mali and particularly in Kayes regions the strengthening of communication and the decentralization of HIV management centers may improve the adherence of the persons living with HIV to ARV treatment.

Keywords: HIV, Anti-Retroviral, Adherence, Mali

Introduction

At the end of 2010, the estimated number of person living HIV (PLHIV) was 34 million and 68% of them were living in sub-Saharan Africa [1]. According to ONUSIDA, since 2006, at least 6 millions of PLHIV with 4.1 million in sub-Saharan Africa were suffering of an opportunistic disease associated with HIV at advanced stage and having the need of anti retroviral treatment [2].

In 2004, the commitment of Malian authorities conducted to the establishment of national policy against HIV/AIDS. This policy is about making ARV free of charge for all people living with HIV and having the need of treatment with any discrimination [3]. In Mali the prevalence of HIV decreased from 1.7 in 2001 to 1.3 in 2006 [4]. The number of patients put in ARV treatment is growing, from 6815 subjects under ARV treatment in 2005 to 41925 in 2011[5,6]. This supports the fact that the treatment and care are improved particularly in favour of antiretroviral (ARV) treatment.

Kayes is the first administrative region of Mali with a population of 1, 9993,615 inhabitants among them 40.3% are between 15 and 49 years old [7]. with the prevalence of 0.7% [4], a total of 2,358 were put under ARV treatment at the end of 2011 in the region of Kayes [6].

The health professional in charge of those patient have been quickly faced many difficulties as the adverse reactions, the noncompliance to treatment and the treatment failure. Despite the fact that noticeable progress has been made in the treatment of HI, some barriers are still present for the long term success [8].

A study conducted in Bamako (Mali) during the first year of free of charge of ARV in 2004 reported 70 % of patients' adherence to ARV [9]. One year later, 58.5% of non-adherence to treatment has been registered in the patients followed at the University hospital of Point G in Bamako [10]. This lack of non-adherence was also observed in Burkina Faso in 2005 (70%) and in Côte d'Ivoire (76%) [11, 12]. Most of these studies were from the first years of access to free of charge of ARV. Cambiano et al. in 2010 reported that the median time limit of adhesion less or equal to 60% was 4 years starting from the beginning of ARV treatment [13].

Many factors are associated to treatment adherence. Some of those factors were investigated in Morocco notably the

difficulty related to the changes of work time or resting, involuntary omission [14]. Others factors including the marital status, the economic level and social support have been investigated in Uganda [15]. In these studies, the estimation of adherence rates was only based on the information giving by the patients. Since 1976, Sackett et Haynes in their theoretical module categorized the non-adherence factors in 3 groups (the factors related to treatment, to patients and to the health services [16].

Therefore, the investigation of these factors will allow strengthening the treatment follow up strategies, to avoid the emergence of drug resistance and to the reduction of economic cost of ARV treatment. This study was initiated to study the factors associated to non-adherence to ARV treatment 8 years after the access to free of charge ARV in the region of Kayes in Mali.

Methods

Study design and population

This study was a cross sectional study conducted among the patients under ARV treatment in the hospital Fousseyni DAOU of Kayes in 2012. The patients included were aged of at least 18 years old and infected by the HIV1 and /or the HIV2 and their ARV treatment initiated in the hospital Fousseyni DAOU for at least 6 months. The patients affected by TB or any other disease which lead to long term treatment and capable of interacting with ARV treatment were excluded from the study.

Sampling

With the prevalence of 68% of ARV treatment adherence reported in the literature and the confidence interval of 95% and a precision of 0.08, 130 participants has been included in this study by using the sample calculation method of Schwartz [15, 17]. Using the eligible patients register, a simple random sampling was performed to recruit the participants.

Calculation of the adherence rate

The adherence has been defined as the uptake of 95% of the prescribed doses by the patient during the last 7 days prior to the interview of the patient. This definition has been inspired from the work done by Knobel *et al* (2002) and Laniece *et al* (2003) which work was subject of a large consensus in matter of treatment measure in the person living with HIV [18,19].

The adherence rate in percentage has been calculated by the following formula:

$$\text{Adhesion rate} = \left[\frac{\text{No} - \text{Nm}}{\text{No}} \right] \times 100$$

No = Number of tablets which may be swallowed normally in the 7 days prior to this survey.

Nm = Number of tablets none swallowed in the 7 days prior to this survey.

The patient was classified non adherent to ARV treatment if the adherence rate was strictly inferior to 95 %.

Data collection

The data was collected at 3 levels:

1. Patient : by direct interview, here the socio demographic, cultural, and economic (sex, age, marital status, education level, profession, monthly income, time to hospital access and disease perception) information have been collected;
2. At the drug store, here duration the drug delivery, some factors related to the treatment were collected (treatment regimen, the number of tablets lost, the reason of none drug uptake, treatment duration and the sides effect. This step also helps to verify the information from the patient during the direct interview;
3. During the medical consultation: here the factors like co morbidities, baseline CD4 rate, the most recent CD4 rates and the clinical signs of the patient have been collected.

The quality control of the collected data was certified by two supervisors from the start to the end of the data collection

Data analysis

The data was analysed using the R version 2.12.2 software. The dependent variable was the adherence to ARV with two modalities (adherent and none adherent). The explicative variables were grouped in personal factors, factors linked to health services, clinical and biological factors and factors associated to ARV treatment. The bi variate analysis between the adherence to ARV and the others categorical explicative variables were conducted regarding the conditions of Pearson and Yates corrected Chi2 application and the Fisher exact test.

The variables with P values less than 0.20 have been included in the multivariate analysis [20]. In the first step, a backward analysis was conducted to perform logistic regression. The models were compared using the likelihood Ratio test. The Akaike criteria the most lower have been used to choose the final model for each group of variables. In second step, a forward analysis was conducted for the variables of concern in model of the grouped factors with the objective to come with a final model. The adequation of this final model and the intermediate models was verified using the test of Hosmer et Lemeshow [21]

Ethical considerations

All the participants signed the informed consent before their inclusion in the study.

Results

Personal factors

From the 130 patients included, the sex ratio was in favour of men with 1.7(83/47). And the mean age of the participants was 39.31 years old with the range of 18 and 63 years. The majority of the patient was not educated (69.2%). Among those patients, 36.9% were from polygamy couple and more than the half of patients (70%) had very low monthly income (< \$ US 45 per month) for the family of 4 member as a mean.

Clinical and biological factors

According to world health Organization (WHO) clinical classification, 68.5% (89/130) of the patients were in stage III. The buccal lesion was observed in 23.1%(30/130) of the cases. All the infections was due to HIV1excluding one case due to HIV2. The median of CD4 level at the beginning of the treatment was 105.5 CD4/mm3 with the range of 4 to 1,050 CD4/mm3 were noticed.

Factors associated to health services and ARV treatment

In total, 60 % (78/130) of the patients had their combined tritherapy in a single tablet et with a median duration under ARV treatment of 20 months and a range of 6 to 72 months. Only 15.4% (20/130) of the patients was attending the meeting helping for treatment observance. The knowledge of ARV treatment by the patients was relatively acceptable, because 90% (117/130) the patients thought that the ARV treatment

improve their health status, 82.3% (107/130) of the patients reported that the ARV treatment slowed the progress of the infection, 47.7% (62/130) of the patients knew that the ARV do not eliminate the virus in the blood and 51.5% (67/130) said that ARV drugs may produce sides effect even if they were swallowed correctly. To reach the health center, 38.5% (50/160) of the patients had more than one hour. The discretion of health buildings where the patients were take care was satisfactory according to 82. 3 % (107/130) of the patients and 87.7 % (114/130) were satisfied for the disponibility of the physician.

None adhesion to ARV treatment

During this study, 24.6% (32/130) of the patient had lost one dose of their ARV treatment 7 days before the survey. The most common reasons listed were the feeling of being in depression, [31.3%(10/32)], the sides effects of ARV [12.5%(4/32)], inadequate timeframe of ARV uptake[6.3%(2/32)] and the difficulty to swallow the tablets [3.1%(1/32)].among those patients 19.2%(25/130) were classified as non adherents with the overall adhesion rate less than 95%. The table I

shows the comparison of patient's proportion adherents and none adherents regarding personal, clinical, biological factors associated to health services and those associated to ARV treatment. The models of multivariate analysis are presented in the table II. In model 1 adjusted for personal factors, the age group of 35-42 years old were retrieve to be factors for non-adhesion [Adjusted OR = 3.02 CI 95% (1.03 – 8.81)]. The time used to reach the health centre higher than 1 hour and the none discrete room of patient management according to patient judgement were associated to a high risk of non adhesion to ARV in model II adjusted for personal factors and to the factors associated to health services with respectively [Adjusted OR = 2.74 CI 95% (1.04 – 7. 17)] et [Adjusted OR = 3. 45 CI 95% (1.16 – 10.22)]. By adjusting the model 2 according to clinical and biological factors, the factors associated to health services remained associated to the none adhesion and the level of CD4 < 75/mm³ was highly associated to none adhesion [Adjusted OR= 4.59 CI 95% (1.35-15.57)]. In the final model adjusted for all the group of factors (personal, health services, clinical, biological, ARV treatment), the patients do not knowing the risk of incorrect uptake of ARV drugs had 6 times more risk of being none adherent to ARV treatment [Adjusted OR= 6.44 CI 95% (1.90-21.85)]

Table 1: Distribution of factors by adherent and non-adherent patients

Personal factors	Patients adherent (n=105)	Patients non adherent (n=25)	P value
Sexe			
Female	64 (61.0%)	19 (76.0%)	p=0.15*
Male	41 (39.0%)	6 (24.0%)	
Group Age			
18 – 34 years	39 (37.1%)	7 (28%)	p=0.04*
35 – 42 years	28 (26.7%)	13 (52%)	
43 – 63 years	38 (36.2%)	5 (20%)	
Marital status			
Monogamous	38 (36.2%)	7 (28%)	p=0.54***
Polygamous	37 (35.2%)	11 (44%)	
Single	12 (11.4%)	2 (8%)	
Divorced	6 (5.7%)	0 (0%)	
Widow	12 (11.4%)	5 (20%)	
Level of education			
None	73 (69.5%)	17 (68%)	p=0.70***
Primary	23 (21.9%)	7 (28%)	
Secondary	9 (8.6%)	1 (4%)	
Average monthly income			
Less than 25 000 FCFA	68 (64.8%)	23 (92.0%)	p<0.01*
25 000 FCFA and more	37 (35.2%)	2 (8.0%)	
Clinical and biological factors			
WHO stage at the start of ARV treatment			
Stage I	5 (4.8%)	2 (8%)	p=0.66***
Stage II	12 (11.4%)	4 (16%)	

Personal factors	Patients adherent (n=105)	Patients non adherent (n=25)	P value
Stage III	74 (70.5%)	15 (60%)	
Stage IV	14 (13.3%)	4 (16%)	
CD4 count at start of ARV treatment			
< 250 CD4/mm ³	94 (89.5%)	17 (68%)	p=0.01 **
≥ 250 CD4/mm ³	11 (10.5%)	8 (32%)	
CD4 count at time of data gathering			
< 75 CD4/mm ³	11 (10.5%)	8 (32%)	p=0.01 **
≥ 75 CD4/mm ³	94 (89.5%)	17 (68%)	
Facility-related factors			
Patient-specific location of care			
Discrete	92 (87.6%)	15 (60%)	p<0.01 **
Non-discrete	13 (12.4%)	10 (40%)	
Physician availability according to patient			
Yes	94 (89.5%)	20 (80%)	p=0.19 **
No	11 (10.5%)	5 (20%)	
Time to arrive at the hospital			
≤ 1 hour	70 (66.7%)	10 (40%)	p=0.02*
> 1 hour	35 (33.3%)	15 (60%)	
Attendance at adherence club			
Yes	17 (16.2%)	3 (12%)	p=0.76 **
No	88 (83.8%)	22 (88%)	
Factors related to ARV treatment			
Single product combination therapy			
Yes	62 (59%)	16 (64%)	p=0.64*
No	43 (41%)	9 (36%)	
Duration of ARV treatment			
< 55 months	87 (82.9%)	16 (64%)	p=0.03*
≥ 55 months	18 (17.1%)	9 (36%)	
Factors related to knowledge about ARV treatment			
Cure of the disease by ARVs			
Yes	9 (8.6%)	1 (4.0%)	p=0.39***
No	96 (91.4%)	24 (96.0%)	
Regression of the disease by ARVs			
Yes	91 (86.7%)	16 (64.0%)	p=0.01 **
No	14 (13.3%)	9 (36%)	
Improvement of health by ARVs			
Yes	99 (94.3%)	18 (72.0%)	p<0.01***
No	6 (5.7%)	7 (28.0%)	
Possibility of discomfort even with correct use of ARVs			
Yes	60 (57.1%)	7 (28.0%)	p<0.01*
No	45 (42.9%)	18 (72.0%)	
Knowledge of the risks of taking ARVs incorrectly			
Yes	94 (89.5%)	13 (52.0%)	p<0.01 **
No	11 (10.5%)	12 (48.0%)	

* Pearson's Chi-square, ** Yates' corrected chi-square, *** Fischer test exact de

Table 2 : Multivariate Analysis

Associated factors	Model 1 OR [95 % CI]	Model 2 OR [95 % CI]	Model 3 OR [95 % CI]	Model 4 OR [95 % ICI]
Personal factors				
Group Age				
18 - 34 years	1	1	1	1
35 - 42 years	3.02 [1.03 – 8.81]	2.35 [0.74 – 7.48]	2.91 [0.83 – 0.13]	4.14 [0.97 – 17.56]
43 – 63 years	0.97 [0.26 – 3.56]	0.75 [0.19 – 2.93]	0.97 [0.23 – 4.12]	0.99 [0.18 – 5.20]
Sexe				
Male	1	1	1	1
Female	2.10 [0.72 – 6.10]	1.75 [0.56 – 5.50]	1.92 [0.55 – 6.63]	2.19 [0.53 – 8.95]
Facility-related factors				
Time to arrive at the hospital				
≤ 1 hour		1	1	1
> 1 hour		2.74 [1.04 – 7.17]	2.76 [1– 7.57]	2.46 [0.82 – 7.40]
Patient-specific location of care				
Discrete		1	1	1
Non-discrete		3.45 [1.16 – 10.22]	3.50 [1.12 – 10.94]	1.33 [0.33 – 5.35]
Clinical and biological factors				
CD4 count at time of data gathering				
≥ 75 CD4/mm ³			1	1
< 75 CD4/mm ³			4.59 [1.35 – 15.57]	4.50 [1.22 – 16.55]
Oral lesion				
Yes			1	1
No			0.49 [0.16 – 1.54]	0.52 [0.14 – 1.81]
Factors related to knowledge about ARV treatment				
Knowledge of the risks of taking ARVs incorrectly				
Yes				1
No				6.44 [1.90 – 21.85]
Duration of ARV treatment				
≤ 55 months				1
> 55 months				3.65 [0.97 – 13.79]

Model 1 : AIC=127.39, sensibility (Se)=52%, specificity (Sp)=73%, Aréa Under the Curve (AUC)=0.642, test d'Hosmer et Lemeshow (p=0.46)

Model 2 : AIC=120.49, Se=88%, Sp=51.4%, AUC=0.755, test d'Hosmer et Lemeshow (p=0.90)

Model 3 : AIC=117.34, Se=80,4%, Sp=72.4%, AUC=0.801, test d'Hosmer et Lemeshow (p=0.75)

Model 4 : AIC=108.45, Se=80%, Sp=81.9%, AUC=0.869, test d'Hosmer et Lemeshow (p=0.73)

Discussion

The objective of this study was to study the factors associated to none adherence to ARV treatment. During this study the evaluation of none adhesion from blood test of antiretroviral concentration in patient under ARV has not been conducted. This may led to the misunderstanding of some associated factors. But this method of none adhesion evaluation requires highly platform and high cost. Using the method of triangulation based on patient interview, his clinical status and the information obtained at the ARV drug store, the result showed that 19.2 % of the patient was none adherent to ARV treatment. Les main factors of none adhesion identified during this study include the time used to reach health center more than 1 hour, indiscreet room for patient management and the unawareness of patient regarding the incorrect uptake of his ARV treatment.

The unawareness of the patient regarding the risk of incorrect uptake of her ARV treatment has been also reported by the authors from Tunisia. They had showed that the perception of drug uptake importance by the patient is significantly linked to the observance [22]. The pre therapeutic advice should be reinforced and an important accent should regard the risk of incorrect uptake of ARV drugs regardless the therapeutic regimen. The knowledge of unwanted observance consequences can give more beneficial effect on the adhesion of patient to ARV compare to simplistic regimens. But in Benin, the complexity of regimen has not been an unwanted factor of adhesion [23]. Some studies conducted in 2002 in Ghana and Nepal had reported that the time used by the patients to reach health centres played a major obstacle to the adhesion to ARV treatment [24, 25]. Thus in Nepal, the displacement time to reach hospital more than 1 hour contributed to approximately 3 times the risk of being none adherent [25]. It is obvious that those patients even if they are engaged to take correctly their treatment become non adherent due to the difficulties to reach the management centre because of lack of adequate means of transport, to very distant place of residence and to the worsening of roads during the raining season.

These different risk factors identified in this study reveals in somehow the lack of health system in relation to the health facilities accessibility for HIV/AIDS management and the communication related to HIV treatment but other studies pointed out the role of played by the factors related to patient

by itself and to the ARV drugs [26,27, 28]. These studies had showed that the old persons are more likely to be adherent than young person in South Africa; the forgetfulness of the patient and feeling of wellbeing were the risk factors of none adhesion reported in Nigeria and the side effects were the main barriers to adhesion in Botswana [26, 27, 28]. It is difficult to reduce these risks related to personal characters of the patient or to the ARV drugs. On the other side, the factors related to health system in relation to the accessibility and the communication should be corrected easily to prevent the risk. The suitable access to ARV treatment could considerably change the life of the person living with HIV [29, 30]. In resource limited countries, the reinforcement of the decentralization of the access to ARV could improve the quality of care and provide a positive impact on the wellbeing of the patients. Many studies had demonstrated the effectiveness of communication (health professional –patient) in the adhesion to treatment [31, 32, 33]. The competence of the health agents involved in the management of HIV/AIDS should be reinforced in communication related to ARV treatment.

Conclusion

This study showed that a big proportion of patients under ARV in the region of Kayes in Mali are not adherents. The lack of supply notably the information of the patients in relation to the risks of none adhesion and the barriers to access to health services were identified as the risk factors of none adhesion au ARV treatment. Therefore, the communication and access to health services should be taken priority by the programmes to improve the adhesion of ARV treatment by the person living with HIV.

References

- WHO, UNAIDS, UNICEF. (2011) The Global Response to HIV / AIDS : An Update on the Epidemic and Health Sector Progress Towards Universal Access. Situation report, P28.
- Mali Ministry of Health, (2005) Sectorial Unit for the Fight against AIDS. Policy and protocols for antiretroviral treatment for HIV / AIDS. November P1-15
- Mali Ministry of Health, Statistical Planning Unit (2007) Fourth demographic and health survey of Mali in 2006 (EDS-IV). Chp 15, P250-62.
- UNAIDS (2009) Mali, country situation P2.
- High National Council for the Fight against AIDS of Mali. UNGASS 2012 National Report, period January 2010-December 2011, 20-32.
- National Institute of Statistics of Mali. General Census of Population and Housing. <http://instat.gov.ml> ; visited on 12/05/2012.
- Volberding PA, Deeks SG (1998) Antiretroviral Therapy for HIV Infection. Promises and Problems. JAMA 279: 1343-4.
- Aboubacrine S, Niamba P, Boileau C, Zunzunegui M, Machouf N, et al. (2007) Inadéquate adhésion to antiretroviral treatment and prevention in hospital and community sites in Burkina Faso and Mali : a study by the ATARAO group. Int J of STD & AIDS 18 : 741-7.
- Oumar AA, Dao S, Diamoutene A, Coulibaly S, Koumare B, et al. (2007) Factors associated with antiretroviral treatment observance at Point "G" hospital. Mali Med 22 : 18-21.
- Gill CJ, Hamer DH, Simon JL, Thea DM, Sabin LL (2005) No room for complacency about adherence to antiretroviral therapy in sub-Saharan Africa. AIDS 19 : 1243-9.
- Eholie SP, Tanon A, Polneau S, Ouiminga M, Djadji A, et al. (2007) Field adherence to highly active antiretroviral therapy in HIV-infected adults in Abidjan, Côte d'Ivoire. J Acquir Immune Defic Syndr 45 : 355-8.
- Cambiano V, Lampe FC, Rodger AJ, Smith CJ, Geretti AM, et al. (2010) Long-term trends in adherence to antiretroviral therapy from start of HAART. AIDS. 24 : 1153-62.
- Benjaber K, Rey JL, Himmich H (2005) Study on adherence to antiretroviral therapy in Casablanca (Morocco). Med. Wrong. Inf. 35 : 390-5.
- Byakika-Tusiime J, Oyugi JH, Tumwikirize WA, Katabira ET, Mugenyi PN, et al. (2005) Adherence to antiretroviral therapy in HIV+ Ugandan patients purchasing therapy. Int J of STD & AIDS. 16 : 38-41.
- Sackett. DL, Haynes BR (1976) Compliance with Therapeutic Regimens, Baltimore. USA. The Johns Hopkins University Press 293 p.
- Schwartz D (1969) Statistical methods for use by physicians and biologists. Edition Flammarion Médecins Sciences.
- Knobel HA, Alonso JB, Casado JLC, Collazos JD, Gonzalez JE, et al. (2002) Validation of a simplified medication adherence questionnaire in a large cohort of HIV-infected patients : the GEEMA Study. AIDS : 605-13.
- Laniece IA, Ciss MB, Desclaux AC, Diop KD, Mbodj FE, et al. (2003) Adherence to HAART and its principal determinants in a cohort of senegalese adults. AIDS, 17 : S103-8.
- Rothman KJ, Greenland S, Lash TL (2008) Modern epidemiology. 3rd ed. Philadelphia, PA : Lippincott Williams & Wilkins ; 2008.
- Hosmer DW, Lemeshow S (2007) Applied Logistic Regression. New York: Wiley-Interscience.
- A Gherissi, F Tinsa (2010) National survey on the art observance among people living with aids in Tunisia: major findings. Revue Tunisienne d'Infectiologie, Avril 4 : 66-73.
- Roux P, Rey JL, Sehonou J, Certain A (2004) The one-month compliance of AIDS patients included in the Beninese initiative for access to antiretrovirals. bull. Soc. Pharm. Bordeaux 143 : 19-30.
- Addo-Atuah J, Gourley D, Gourley G, White-Means SI, Womeodu RJ, et al. (2012) Accessibility of antiretroviral therapy in Ghana : Convenience of access. SAHARA J 9 : 74-87.
- Wasti SP, Simkhada P, Randall J, Freeman JV, Van TE (2012) Factor influencing adherence to antiretroviral treatment in Nepal: a mixed-methods study. PLoS One 7 : e35547.

25. Catherine O, David RB, Motasim B, Robin W (2003) Adherence is not a barrier to successful antiretroviral therapy in South Africa. *AIDS* 17 : 1369-75.
26. Olowookere SA, Fatiregun AA, Akinyemi JO, Bamgboye AE, Osagbemi GK (2008) Prevalence and determinants of non adherence to highly active antiretroviral therapy among people living with HIV/AIDS in Ibadan, Nigeria. *J Infect Dev Ctries* 2 : 369-72.
27. Weiser S, Wolfe W, Bangsberg D, Thior I, Gilbert P, et al. (2003) Barriers to antiretroviral adherence for patients living with HIV infection and AIDS in Botswana. *J Acquir Immune Defic Syndr* 34 : 281-8.
28. Boule A, Bock P, Osler M, Cohen K, Channing L, et al. (2008) Antiretroviral therapy and early mortality in South Africa. *Bull World Health Organ.* 86 : 678-87.
29. Bussmann H, Wester CW, Ndwapi N, Grundmann N, Gaolathe T, et al. (2008) Five-year outcomes of initial patients treated in Botswana's National Antiretroviral Treatment Program. *AIDS* 22 : 2303-11.
30. Bonmarchand M (2005) Placer le patient au cœur du choix thérapeutique : le secret d'une bonne adhésion au traitement. *Med Mal Inf* 35 : 8-10.
31. Garcia R, Lima MG, Gorender M, Badaró R (2005) The importance of the Doctor-Patient relationships in adherence to HIV/AIDS treatment: a case report. *Braz J Infect Dis* 9: 251-6.
32. Ahmed AA, Katlama C, Ghosn Guiguet M, Costagliola D (2005) Evaluation of compliance with antiretroviral treatment in a cohort of 200 patients in Djibouti, *East Mediterr Health J* 13: 1286-97.
33. Andre NN (2006) Stigma and adherence to antiretroviral therapy (ARV) in two populations of HIV-positive patients in Bamako and Ouagadougou. University of Montreal Thesis, Msc. in Community Health.