**Research Article**

# TREATMENT ADHERENCE AND FACTORS INFLUENCING ADHERENCE TO ANTIRETROVIRAL THERAPY: A SYSTEMATIC REVIEW AND META-ANALYSIS

## Surbhi A. Kaklottar* and Siddaram Sarate

ManikakaTopawla Institute of Nursing, CHARUSAT

**A R T I C L E   I N F O**

**A B S T R A C T**

**Background:** HIV/AIDS remains one of the world's most significant public health challenges. The goal of ART is to achieve maximal and durable suppression of virus replication. Adherence plays a very important role in success of antiretroviral therapy.**Objective:** to systematically assess the data of adherence and its influencing factors to antiretroviral therapy (if any) in HIV/AIDS patients. **Design:** systematic review and meta-analysis. **Material and methods:** PubMed/Medline and global health library database were used to search the literature. The major study characteristics were extracted i.e. study design, sample size, location and setting, adherence rate, etc. **Results:** There were ten cross-sectional studies enrolling 3657 participants. Treatment adherence found equal {OR:1.04(95% CI[0.875-1.246])} in both male and female and 0.6 times more {OR:0.67[95% CI(0.558-0.806)]} in age group less than 40 years as compare to age group more than 40 years. 54% {OR:0.56(95%CI[0.494-0.634])} of treatment adherence was found in the absence of most prevalent factors. **Discussion:** This systematic review and meta-analysis to summarize the data of ART adherence and factors influencing treatment adherence. **Conclusion:** Patients on ART face multiple barriers to adherence.Range of reasons for nonadherence to ART, including alcoholism, drug side-effects, long distance to travel to hospital, forgetfulness, etc.

## INTRODUCTION

HIV/AIDS remains one of the world's most significant public health challenges, particularly in low- and middle-income countries.[1] HIV is a virus that attacks the immune system, AIDS is not a virus but a set of symptoms (or syndrome) caused by the HIV virus. This is the last stage of HIV and if left untreated will lead to death.[2]

Globally, an estimated 36.7 million (34.0–39.8 million) people were living with HIV in 2015. An estimated 2.1 million (1.8–2.4 million) people were newly infected with HIV in 2015. An estimated 35 million people have died from HIV-related causes so far, including 1.1 million (940 000–1.3 million) in 2015. In mid-2017, 20.9 million people living with HIV were receiving antiretroviral therapy (ART) globally. Between 2000 and 2016, new HIV infections fell by 39%, and HIV-related deaths fell by one third while13.1 million lives were saved due to ART in the same period.[3] Achieving optimal therapeutic outcomes such as reduced viral load, reduction of drug resistance, and improved survival requires strict adherence to ART regimens.[4] There is significant amount of research about the reasons behind poor adherence to antiretroviral therapy.

---

*Corresponding author:* **Surbhi A. Kaklottar**
ManikakaTopawla Institute of Nursing, CHARUSAT

Adherence is a multidimensional concept that includes contextual, intrapersonal and behavioural factors. Recent research has found several barriers affecting adherence to ART.[5]

## METHOD

### LITERATURE SEARCH

A systematic literature search was performed in the following electronic bibliographic databases: PubMed/ MEDLINE and the Global Health Library for all publications up to March 2018. Search terms composed of combined text: "Adherence," "Patient Compliance," "antiretroviral therapy," "HIV," "AIDS", "contributory factors" for all years. No restriction based on year of publication, study design or language was applied. Given the comprehensive approach of the search, references were not checked, except those from a recent global systematic review.

### Inclusion criteria

Studies that given the quantitative data for adherence factors included. Review articles, policy documents and adherence training manuals were excluded.

### Study selection and data extraction

Initially, 98 studies were searched on the basis of title and then after reviewing all the studies independently final 10 studies

were selected as per the inclusion criteria [figure 1]. Initial search was 98 studies and then 49 studies were excluded based on criteria i.e. not given the quantitative data about the adherence to the Anti-retroviral therapy. After the reviewing the titles of the study 49 studies were retrieved. In the 49 retrieved articles, twenty-four studies were removed (seven duplicated studies; eight review article and nine abstracts).The final retrieved articles were twenty-five, in that 15 studies were excluded after full review of the studies.
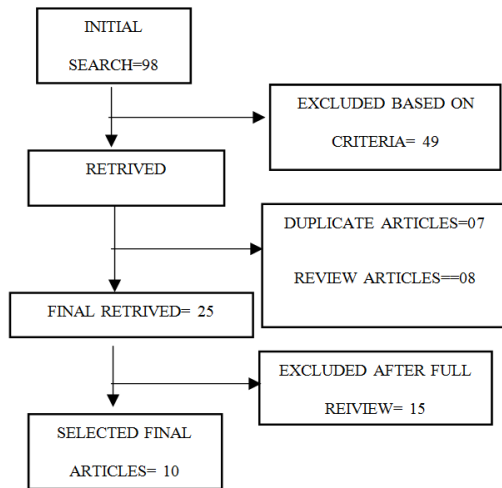


**Figure** 1 Flow-chart

Final selection of 10 studies and for the data extraction full review of the articles were done. Data were extracted on study design, sample size, study setting, adherence rate, non-adherence rate and non-adherence factors, etc. The metaanalysis was done by using IBM SPSS Statistic 20 software. For the purpose of meta analysis, collected the proportion data and quantity data.

## RESULTS

### Identification of studies

The following flow chart showing the systematic selection process of the studies. Through the initial search 98studies were identified, then 49 studies were excluded according to the inclusion criteria. After the 49 studies were retrieved, in that 8 studies were duplicate; 7 studies were review based articles and 9 studies were abstracts. Accordingly, 10 studies met the inclusion criteria and were included in the systematic review.

### Characteristics of included studies

The characteristics of the selected studies are shown in table 1. The total 10 studies enrolled total 3657 participants (1815 males and 1842 females).The average sample size was 350.25. the mean age was 37.05+-14.5 years.These ten studies followed cross sectional method of the research design.

**Table 1** Study characteristics & Treatment adherence

| Author | Study conducted year | Location & Setting | Study Design | Sample Size | Mode of Information collected | Adherence Rate | Non-adherence Rate | Odd ratio [calculated for meta-analysis] |
|---|---|---|---|---|---|---|---|---|
| Shukla et al[6] | | ART center of two tertiary care hospitals in Uttar Pradesh, India | cross-sectional, analytical study. | 322 | Pill count method, pretested and structured questionnaire and Becks Depression Inventory (Hindi) | 89.1% | 10.9% | **Age:** 0.92 [95% CI (0.452-1.866)] **Gender:** 1.66 [95% CI (0.821-3.364)] |
| Gokarn, et al[7] | November 2007 and September 2009 | Aurangabad, India | cross sectional observational study | 300 | Morisky Medication Adherence Scale (MMAS) | 96.60% | 3.40% | **Age:** 2.342 [95% CI (1.008-5.441)] **Gender:** 0.72 [95% CI (0.408-1.282)] |
| Saha, et al[8] | 2011 | ART centre of a tertiary care hospital in West Bengal, India | observational, analytical, cross-sectional epidemiological study | 370 | the Adult AIDS Clinical Trial Group adherence questionnaire | 87.60% | 12.40% | **Age:** 6.17 [95% CI (1.461-26.092)] **Gender:** 1.33 [95% CI (0.72-2.478)] |
| Banagi Yathiraj, et al[9] | April 2014 to April 2015 | tertiary care hospitals, at Mangalore, Karnataka,India | cross-sectional study | 409 | pretested semi structured questionnaire | 70.40% | 29.60% | **Age:** 1.18 [95% CI (0.770-1.822)] **Gender:** 0.47 [95% CI (0.293-0.750)] |
| Aye, et al[10] | 2016 | an HIV outpatient clinic, Mon state, Myanmar | cross-sectional study | 300 | Structured interview questionnaire And visual analogue scale | 84% | 16% | **Age:** 1.28 [95% CI (0.689-2.377)] **Gender:** 0.60 [95% CI (0.324-1.125)] |
| Kim MH et al[11] | 2012 | HIV clinics in central and south-eastern Malawi. | cross-sectional study | 519 | Structured interview questionnaire | 55% | 45% | **Gender:** 1.1 [95% CI (0.751-1.609)] |
| Abera et al[12] | 2015 | JUTH, located in Jimma town, Oromia | cross-sectional study | 221 | Structured closed ended questionnaire | 63.8% | 36.19% | **Age:** 0.62 [95% CI (0.342-1.105)] **Gender:** 0.78 [95% CI (0.434-1.394)] |
| Mitiku et al[13] | 2010 | Ehiopia | cross-sectional study | 239 | standard interview questionnaire | 87% | 13% | **Age:** 0.56 [95% CI (0.253-1.219)] **Gender:** 0.86 [95% CI (0.372-1.976)] |
| Letta et al[14] | | Harar and Dire Dawa towns, Ethiopia | cross-sectional study | 620 | structured questionnaire with a face-to-face interview | 85% | 15% | **Age:** 0.91 [95% CI (0.583-1.428)] |
| Alagaw et al[15] | 2012 | Wolaita Soddo Hospital, Southern Ethiopia | cross sectional study | 357 | Self- report | 74.4% | 25.6% | **Age:** 1.23 [95% CI (0.599-2.42)] **Gender:** 1.61 [95% CI (0.843-3.092)] |

The study by Shukla *et al* used unique data collection instruments designed by their respective study groups and used and Becks Depression Inventory (Hindi) for method of data collection.[6] The study by Gokarn *et al* used Morisky Medication Adherence Scale (MMAS) and self-designed questionnaire for data collection.[7] The study by Saha *et al* used the Adult AIDS Clinical Trial Group adherence questionnaire while Banagi Yathiraj *et al,* Aye *et al,* Kim AH *et al,* Abera *et al* and Letta *et al* used data collection instruments designed by their respective study groups whereas the study by Mitiku *et al* used the standard interview questionnaire and Alagaw *et al* used self-report from patient as data collection instrument.[8-15]

All the studies reported the adherence and non-adherence rate.

The seventy percentage of studies (7/10) reported the range of ART. The seventy percentage of studies (7/10) reported the recall period for the data collection while Only one (1/10) study reported First line and second line ART regimen and other studieshad not reported the specific ART regimen. Hundred percentage of studies reported the qualitative and quantitative data related to factor influencing the treatment adherence while eighty percentage of studies (8/10) percentage of the studies reported the definition of adherence in own words.

### Reasons for non-adherence

The reasons for non-adherence to ART across the included studies are summarized in Table 2.

**Table 2** Treatment Adherence & contributory factors

| Study | Definition of adherence | Treatment regimen | Range of ART [calculated Odd ratio for metaanalysis] | Recall period | Adherent participant N (%) | Reasons for non-adherence (most 3 prevalent) |
|---|---|---|---|---|---|---|
| Shukla *et al*[6] | a patient's ability to follow a treatment plan, take medications at prescribed times and frequencies, and follow restrictions regarding food and other medications. | Antiretroviral therapy (specific regimen not reported) | 6 months OR: 10.26 [95%CI (4.793-21.975)] | Not reported | 287 (89.1%) | 1.busy with other work 2. felt sick or ill 3. Don't have money to visit ART center |
| Gokarn, *et al*[7] | the ability to take prescribed drugs in the recommended dosages and schedules and following any special instructions e.g. empty stomach, after meals etc. >95 %. | Antiretroviral therapy (specific regimen not reported) | 6 months | Not reported | 290 (96.60%) | 1.Were out of home/were traveling 2.Too busy in other work 3. side effects of medication |
| Saha, *et al*[8] | a self-report of not missing a single dose of medication over the previous four days. | Antiretroviral therapy (specific regimen not reported) | 6 months OR: 1.15 [95% CI (1.102-1.19)] | Four days | 370 (87.60%) | 1.forgetting to take medicine 2.being away from home 3. busy with other things |
| Banagi Yathiraj, *et al*[9] | Not reported | Antiretroviral therapy (specific regimen not reported) | Not reported | 30 days | 288 (70.40%) | 1.forgetfulness to take ART 2.Alcohol intake |
| Aye, *et al*[10] | Adherence is the extent to which a person is taking the medicine as prescribed by physician and according to medical recommendations, inclusive of timing, dosing and consistency and correctly taking the drugs in terms of right doses, right times and following the dietary recommemdations | Antiretroviral therapy (specific regimen not reported) | 1 month OR: 0.86 [95% CI (0.461-10596)] | 30 days | 252 (84%) | 1.busy with other things 2.away from home 3.forgetfulness |
| Kim MH *et al*[11] | Self-efficacy for antiretroviral adherence is one's sense of being able to adhere to ART as prescribed | First line and second line ART regimen | Not reported | 7 days, 30 days and 6 months | 366 (55%) | 1.forgetting 2.travel from home 3.busy with other things |
| Abera *et al*[12] | The extent to which the patient continues the agreed upon mode of treatment under limited supervision when faced with conflicting demands as distinguished from compliance or maintenance | Antiretroviral therapy (specific regimen not reported) | Not reported | Not reported | 141 (63.8%) | 1.forgetting 2.traveling 3.being busy |
| Mitiku *et al*[13] | Not reported | Antiretroviral therapy (specific regimen not reported) | 1 month OR: 1.28 [95% CI (0.352-4.696)] | 7 days | 208 (87%) | 1.forgetting 2.some due to travelling 3.few due to being busy |
| Letta *et al*[14] | ART adherence was defined as taking all pills in correctly prescribed doses at right time (no dose missed or delayed for greater than or equal to 90 min) | Antiretroviral therapy (specific regimen not reported) | 3 months | 7 days | 527 (85%) | 1.forgetting 2.being away from home 3.being busy with different activities |
| Alagaw *et al*[15] | Adherence was measured by dose adherence; adhered were those who took greater than or equal to 95% of the prescribed drugs | Antiretroviral therapy (specific regimen not reported) | 1 month | 7 days | 312 (74.4%) | 1.forgetting 2.Stock finished 3.lack of transport cost, |

Eighty percentage (8/10) studies showed that being busy with other works and simply forget to take medicine were the most prevalent reasons for non-adherence to ART. Other common obstacles for non-adherence was away from home showed in forty percentage (4/10) studies. The studies also reported travelling cost, feeling sick, medicine not available at centre, substance abuse were the factors that affect the adherence to the treatment.In Table 2 odd ratio for ART regimen calculated for individual study, finding revealed that adherence seen in long time duration treatment. In table 1 odd ratio for age and gender were calculated, the findings revealed in most of study treatment adherence seen in less than 40 years of age group and more in men than females.

## DISSCUSSION

This systematic review and meta-analysis to summarize the data of ART adherence. By the literature reviewing, found the various studies that helped to understand the adherence to the ART regimen as well as the non-adherence factors also. The Average adherence rate was 79.29% among all studies.Treatment adherence among age less than 40 years was 0.6 times more as compare to age group more than 40 years while treatment adherence is equal in both female and male among all these studies.Pooled analysis of all studies pooled estimate treatment adherence found equal {OR:1.04(95% CI[0.875-1.246])} in both male and female and 0.6 times more {OR:0.67[95% CI(0.558-0.806)]} in age group less than 40 years as compare to age group more than 40 years. 54% {OR:0.56(95%CI[0.494-0.634])} of treatment adherence was found in the absence of most prevalent factors. If the patients were disclosed their condition it lead more adherence of treatment (OR 1.6[95% CI (0.671-4.205)]).

The study by Shukla *et al* revealed no difference in male and female treatment adherence. According to the results persons who were busy with other works were non-adherence (40.0%) to antiretroviral therapy. Apart of thesemost prevalent factors for non-adherence were forget to take medicine and being away from home.[6] The study by Gokarn *et al* Adherence rate of >95% was reported by 290 (97%) patients. On MMAS scale 78% of the patients were found adherent to the treatment. On multivariate analysis factors such as age, addictions, difficulty in remembering treatment, finding treatment to be difficult, taking traditional medicines and having no one to remind about medicines were found to be associated with non-adherence. The most common reason for non-adherence were missing pills while travelling or being out of home.[7] The study by Saha *et al*total of 87.6% of patients were found to be adherent to HAART. Principal causes of non-adherence were forgetting to take medicine (70.2%), being away from home (65.2%), and busyness with other things (64.7%). Multivariate logistic regression analysis revealed that non-adherence was significantly associated with a positive family history of HIV/AIDS (odds ratio [OR] 16; 95% confidence interval [CI] 2.2–114.3; p = 0.01), occurrence of side effects with HAART (OR 9.81; 95% CI 1.9–51.7; p = 0.01) and employment (OR 5.93; 95% CI 1.5–23.2; p = 0.01).[8] The study by Banagi Yathiraj *et al*among 409 PLHIV, 70.4% showed adherence to ART (>95%). Univariate analysis yielded many factor associated with adherence (P < 0.05). However, on multivariate analysis, PLHIV who do not forget to take ART and not consuming alcohol were the factors consistent with adherence to ART (P < 0.05).[9] The study by Aye *et al* Among

300 patients (male 37.7% and female 62.3%, with a mean age of 41.3 years, standard deviation 8.7), 84% reported ≥95% adherence to ART in the past month. Among 16% of those reporting non-adherence, major reasons for skipping the medication were being busy (23%), being away from home (17.7%) and being forgetful (12.3%). In multivariable logistic rgeression, low behavioural skills on ART adherence (OR = 0.31, 95% CI: 0.10-0.94), tobacco use (OR = 3.22, 95% CI:1.28-8.12), having disclosed their HIV status (OR = 0.07, 95% CI: 0.01-0.69), having a partner who was not on ART (OR = 4.25, 95% CI: 1.70-10.64) and among men, having erectile dysfunction (OR = 15.14, 95% CI: 1.41-162.66) were significant associated with ART non-adherence.[10] The study by Kim H *et al* The mean age of participants (SD) was 14.5 (2) years and 290 (56%) were female. Of the 519 participants, 153 (30%) reported having missed ART doses within the past week, and 234 (45%) in the past month. Commonly reported barriers to adherence included forgetting (39%), travel from home (14%), busy with other things (11%), feeling depressed/overwhelmed (6%), feeling stigmatized by people outside (5%) and within the home (3%). Factors found to be independently associated with missing a dose in the past week were drinking alcohol in the past month (OR 4.96, 95% CI [1.41–17.4]), missed clinic appointment in the past 6 months (OR 2.23, 95% CI [1.43–3.49]), witnessed or experienced violence in the home (OR 1.86, 95% CI [1.08–3.21]), and poor treatment self-efficacy (OR 1.55 95% CI [1.02–2.34]). Sex and age were not associated with adherence.[11] The study by Abera *et al* pooled analysedthe total 221 participants more than half 153 (69%) were greater than 30 years, 144 (65.15%) were females, 167 (75.56%) were urban dwellers, 169 (76.43%) were Oromo ethnic group. Overall from the study participants 80 (36.19%) had poor adherence and 141 (63.8%) had good adherence to their ART treatment. Factors like educational status, residence, occupation and alcohol addiction are significantly associated with the level of adherence to ART treatment.[12]The study by Mituku *et al* depicted the result that among the 239 study participants, the magnitude of adherence to ART in the week before interview was 87%.The main reasons for non-adherence were forgetting (47.2%), traveling (18.9%), and being busy doing other things (15.1%). There was not any independent predicator identified for adherence to ART.[13]The study by Letta *et al* revealed The level of ART adherence was 85 %. Adherence was more likely among patients of 35–44 years (AOR=2.39; 95 % CI=1.15–5.01), had monthly income of 501.00–999.00 Ethiopian Birr (ETB) (AOR=6.73; 95 % CI=2.71–16.75), no history of opportunistic infection (AOR=2.81; 95 % CI=1.47–5.36), and had good family support (AOR=2.61; 95 % CI=1.45–4.72). However, those who did not disclose their sero-status (AOR=0.45; 95 % CI=0.21–0.97) and did experience depression (AOR=0.36; 95 % CI=0.21–0.61) were less likely adherent than their counter parts.[14] The study by Alegaw *et al* used Multi-method adherence assessment consisting of self-report, monthly dispense schedule and dietary requirements, were used to measure adherence and the average adherence rate was 74.4%. Multivariate logistic regression analysis showed that, with whom a subject lives (Adjusted Odds Ratios (AOR)=4.943,1,(2.168-11.270)), depression (AOR=2.221,1,(1.093-4.515)), and having inadequate diet to take with ART (AOR=2.229,1,(1.034-4.807)), were independent predictors of dose adherence.[15]

There are a range of reasons for failing to adhere to ART, including drinking alcohol, having drug side-effects, long distance to travel to hospital, being illiterate, non-disclosure of HIV status, being female, lack of knowledge and negative perceptions towardsART. The key reason for skipping ART given was travel fare problems presumably in order to collect ART, followed by pill running out and wanting to avoid the side-effects.

## CONCLUSION

It is mandatory to achieve hundred percentage adherence to antiretroviral therapy by following the treatment regimen strictly. For adherence, it is necessary to timely detection of patient behaviour as well as the physical condition of the patient. Reduce the factors that can affect the treatment adherence to antiretroviral therapy. Adherence is a process, not a single event, and adherence support must, therefore, be integrated into regular clinical follow-up. This systematic review concludes that most prevalent factors for non-adherence were being busy with other works, forgetfulness, away from home, feeling sick, etc. These could be minimizing by the health care members as well as patients and family members.

### *Implication to nursing practice*

The primary goal of treatment with ART is to prevent HIV-related morbidity and mortality. Many studies have shown a strong correlation between adherence and clinical outcomes and/or laboratory markers (notably CD4 count). Non-adherence has been found to diminish the immunological benefit of ART and increase AIDS-related morbidity, mortality, and hospitalizations. Treatment adherence is generally regarded as an important factor in achieving optimal outcomes across many disease states; in the treatment of HIV, poor adherence to treatment has the potential to impact outcomes on multiple levels. Poor adherence to antiretroviral therapy (ART) is associated with less effective viral suppression, which risks the immediate health of the patient, but also risks creating permanent treatment resistance to that particular agent or group of agents within a given combination therapy regimen. This may have downstream effects on treatment costs as well as therapeutic options. The causes of poor adherence to ART are extremely diverse, and include complexity of therapeutic regimens (eg, pill burden and dosing frequency), treatment side effects, poor health literacy, poor patient-physician relationship, and limited access to ART as a result of formulary restrictions or copayment costs. Treatment approaches, such as the use of fixed-dose combinations of ART agents to reduce dosing complexity, as well as educational interventions, such as medication therapy management initiatives, have been shown to improve adherence to therapy in HIV. It is important that all members of the healthcare team address potential barriers to adherence in order to achieve viral suppression and optimize outcomes in patients with HIV. Priorities should be given to improving adherence by providing regular follow-up, increasing patients' awareness of the ART treatment, including its benefits and side-effects, eliminating problems of access and alleviating the impact of cost.

## References

1. World health organization. 10 fact of HIV/AIDS. Available from: http://www.who.int/features/factfiles/hiv/en/.
2. AVERT. Global information and education on HIV and AIDS. Available from: https://www.avert.org/about-hiv-aids/what-hiv-aids.
3. World health organization. Factsheet about HIV/AIDS. Available from: http://www.who.int/mediacentre/factsheets/fs360/en/.
4. Jan D. Hirsch *et al*. Antiretroviral Therapy Adherence, Medication Use,and Health Care Costs During 3 Years of a CommunityPharmacy Medication Therapy Management Program forMedi-Cal Beneficiaries with HIV/AIDS*JMCP Journal of Managed Care Pharmacy* Vol. 17, No. 3. April 2011.
5. Wasti SP, Simkhada P, Randall J, Freeman JV, van Teijlingen E (2012) Factors Influencing Adherence to Antiretroviral Treatment in Nepal: A Mixed Methods Study. PLoS ONE 7(5): e35547. doi:10.1371/journal.pone.0035547
6. Shukla M, Agarwal M, Singh JV, Tripathi AK, Srivastava AK, Singh VK. Nonadherence to antiretroviral therapy among people living with HIV/AIDS attending two tertiary care hospitals in district of northern India. *Indian J Community Med* 2016;41:55-61.
7. Anant Gokarn, Meenakshi Gangadhar Narkhede, Geeta Shrikar Pardeshi, Mohan Kondiba Doibale. Adherence to Antiretroviral Therapy. Japi. December 2012. vol. 60. 16-20.
8. Rajib Saha, Indranil Saha, Aditya Prasad Sarkar, Dilip Kumar Das, Raghunath Misra, Krishnadas Bhattacharya, Rabindra Nath Roy, Abantika Bhattacharya. Adherence to highly active antiretroviral therapy in a tertiary care hospital in West Bengal, India. *Singapore Med J* 2014; 55(2): 92-98.
9. Arjun Banagi Yathiraj, Bhaskaran Unnikrishnan, John T. Ramapuram, Nithin Kumar, Prasanna Mithra, Vaman Kulkarni, Ramesh Holla, Darshan B. and Rekha Thapar. Factors Influencing Adherence to Antiretroviral Therapy among People Living with HIV in Coastal South India. *Journal of the International Association of Providers of AIDS Care* 2016, Vol. 15(6) 529–533.
10. Aye *et al*. Non-adherence to anti-retroviral therapy among HIV infected adults in Mon State of Myanmar. *BMC Public Health* (2017) 17:391.
11. Kim MH *et al*. High self-reported non-adherence to antiretroviral therapy amongst adolescents living with HIV in Malawi: barriers and associated factors. *Journal of the International AIDS Society* 2017, 20:21437.
12. Abera A, Fenti B, Tesfaye T, Balcha F (2015) Factors Influencing Adherence to Antiretroviral Therapy among People Living With HIV/AIDS at ART Clinic in Jimma University Teaching Hospital, Southwest Ethiopia. *J Pharma Reports* 1: 101.
13. Habtamu Mitiku, Tekabe Abdosh, and Zelalem Teklemariam. Factors Affecting Adherence to Antiretroviral Treatment in Harari National Regional State, Eastern Ethiopia. *ISRNAIDS* Volume2013.
14. Letta *et al*. Factors associated with adherence to Antiretroviral Therapy (ART) among adult people living with HIV and attending their clinical care, Eastern Ethiopia. *BMC International Health and Human Rights* (2015) 15:33.
15. Alagaw A, Godana W, Taha M, Dejene T (2013) Factors Associated with Antiretroviral Treatment Adherence among Adult Patients in Wolaita Soddo Hospital. *J Trop Dis* 1: 125.

*******