Proportion and Determinants of Adherence to Antiretroviral Therapy among HIV Positive People Registered Under ART Center in South India

Abstract

Background: Antiretroviral therapy (ART) significantly delays the progression from HIV to AIDS. Adherence to ART is the second strongest predictor of progression to AIDS and death, after CD4 count. A very high level of adherence (≥95%) is required for ART to be effective on a long term and to prevent the emergence of resistant viral strains and prevent comorbidities. Methods: A case series study was undertaken at an ART center for a period of 6 months. Non-probability purposive sampling was adapted to select HIV-positive subjects aged >15 years on ART for more than 6 months. A predesigned semi-structured questionnaire was used to obtain the data. Treatment compliance was assessed by self-reported 1-week recall method. Results: A total of 536 HIV-positive people were interviewed, among which 315 (58.8%) of them were males and 214 (39.9%) were females. Nearly two third of the participants (359, 67.0%) reported ≥95% adherence to treatment. Personal commitments (51, 28.8%) and working time inconvenience (42, 23.7%) were the common reasons for less adherence. On bivariate analysis, married people (OR: 1.586, CI: 1.097-2.929), participants residing in rural area (OR: 1.628, CI: 1.130-2.345), participants not having side effects of drugs (OR: 5.324, CI: 3.491-8.181), participants equipped with better knowledge about ART (OR: 2.019, CI: 1.377-2.961), and participants having support of friends and family members (OR: 1.612, CI: 1.019-2.540) showed a higher level of adherence to ART. Conclusions: Demographic factors such as marital status, residing in rural area, and other personal factors like having good knowledge about ART, without side effects to drugs, and having support of friends and family members were found to show a high level of adherence to ART.

Keywords: Acquired immunodeficiency syndrome, adherence, antiretroviral therapy, human immunodeficiency virus

Introduction

India has the third highest adult-HIV burden with a prevalence of 0.26%.[1] Advent of antiretroviral drugs for HIV has been an important milestone in the history of HIV/AIDS and not only has changed the way of life for people living with HIV (PLHIV) by adding duration of survival but also has improved quality of life. Antiretroviral therapy (ART) has consistently helped in the prevention of opportunistic infections, hence progression from HIV to AIDS. These drugs have been available in the developed countries since 1990, unfortunately as in many resource-poor areas; access to this treatment was limited in India. However, in India, free ART was started in the year 2004, by adopting technical guidelines from the World Health Organization.[2] Since 2007, there is a consistent decline in AIDS-related mortality by 54% annually; this coincides with rapid access to ART.[3]

Among PLHIV on antiretroviral drugs, adherence to treatment is the second strongest predictor of progression to AIDS and death, after CD4 count.[3] Adherence is the term used to describe the patient’s behavior of taking drugs correctly in the right dose, with the right frequency, and at the right time.[2]

A very high level of adherence is also an important determinant of virologic and immunologic outcome, AIDS-related morbidity, mortality, hospitalizations, and to be effective on a long term to prevent the emergence of resistant viral strains.[3-7] The goal of the National AIDS Control Programme is to attain ≥95% individual drug adherence rate.[8] So, the success of the program depends on the sustainable high rates of adherence to medication regimen. Non-adherence risks the development of drug resistance and failure of therapy.

Access this article online
Website: www.ijpvmjournal.net/www.ijpm.ir
DOI: 10.4103/ijpvm.IJPVM_7_18

How to cite this article: Hiregoudar V, Bellara R, Goud TG. Proportion and determinants of adherence to antiretroviral therapy among HIV positive people registered under ART center in South India. Int J Prev Med 2019;10:206.
In India, even though there is free availability of ART, individual’s perspective toward treatment, their immediate surroundings, and sociocultural factors plays a major role in compliance to therapy. Hence, this study was started with the objective to know the adherence level to ART and to find out its determining factors.

**Methods**

A case series study was undertaken at an ART center attached to a medical college from June 1, 2012, to May 31, 2013. The study was approved by the ethical review committee of the institute. A written informed consent was taken from all study participants and confidentiality was maintained throughout the study.

HIV-positive people aged >15 years and who are on ART for minimum period of 6 months were included. A non-probability purposive sampling was adopted to select the study participants and a predesigned semi-structured questionnaire was used to obtain data after explaining the purpose of the study and obtaining written informed consent.

A total of 536 participants were interviewed during the study period. Relevant data on sociodemographic profile were collected by interviewing the participants and clinical profile was noted from the respective ART register. An arbitrary scoring method was adopted to assess the knowledge and attitude toward ART, where a person answering three questions correctly out of five questions with respect to both knowledge and attitude separately was considered to have adequate knowledge or positive attitude.

The treatment adherence level was assessed by 1-week recall method:

\[
\text{Adherence level over 7 days} = \frac{\text{Expected no. of doses to be taken} - \text{No. of missed doses} \times 100}{\text{Expected no. of doses to be taken}}
\]

A database was created in MS Excel and analysis was done using SPSS version 20, IBM, New York, USA. Descriptive statistics such as proportion and percentage were used to analyze the findings and to draw the inferences. Chi-square was used to test for statistical significance, a \(P\) value of <0.05 was considered as statistically significant. Bivariate analysis was performed, and variables found to be statistically significant on bivariate analysis were included in multiple logistic regression analysis.

**Results**

A total of 536 HIV-positive people were included in this study, out of which 58.8% of them were males, 42.9% were from the 25 to 34 year age group, and 32.8% were between 35 and 44 years. Majority of the study participants (79.1%) were Hindu; 62.7% were married, 60% had studied up to high school, and 57.1% were unskilled laborers. More than one third of the study participants were from upper lower class (39.6%) followed by 31.0% from the lower middle class. A higher proportion of the study participants (59.9%) lived in urban areas while 40.1% were from rural areas [Table 1].

Among 536 participants, majority were on ZLN (zidovudine/lamivudine/nevirapine) regimen (76.7%) followed by 14.8% on SLN (stavudine/lamivudine/nevirapine) regimen and 4.1% on ZLE (zidovudine, lamivudine, efavirenz) regimen. Nearly two third of

| Table 1: Association between socio-demographic profile and ART adherence |
|-----------------------------|-----------------|-----------------|--------|
| **Socio-demographic profile** | **Adherence to ART** | **P** |
|                             | **High ≥95%** \(n\%\) | **Low <95%** \(n\%\) |
| **1.Age in years**           |                 |                 |
| 15 to 24                     | 21 (55.3)       | 17 (44.7)       | 0.272 |
| 25 to 34                     | 163 (70.9)      | 67 (29.1)       |     |
| 35 to 44                     | 117 (66.5)      | 59 (33.5)       |     |
| 45 to 54                     | 44 (61.1)       | 28 (38.9)       |     |
| >55                          | 14 (70.0)       | 6 (30.0)        |     |
| **2.Gender**                 |                 |                 |
| Male                         | 209 (66.3)      | 106 (33.7)      | 0.336 |
| Female                       | 147 (68.7)      | 67 (31.3)       |     |
| Transgender                  | 3 (42.9)        | 4 (57.1)        |     |
| **3.Religion**               |                 |                 |
| Hindu                        | 290 (68.4)      | 134 (31.6)      | 0.353 |
| Muslim                       | 54 (62.8)       | 32 (37.2)       |     |
| Others                       | 15 (57.7)       | 11 (42.3)       |     |
| **4.Martial status**         |                 |                 |
| Married                      | 238 (70.8)      | 98 (29.2)       | 0.009 |
| Not married                  | 33 (51.6)       | 31 (48.4)       |     |
| Separated/Widowed            | 88 (66.7)       | 48 (33.3)       |     |
| **5.Education**              |                 |                 |
| Illiterate                   | 27 (69.2)       | 12 (30.8)       | 0.016 |
| Primary School               | 35 (52.2)       | 32 (47.8)       |     |
| High School                  | 217 (66.4)      | 110 (33.0)      |     |
| Preuniversity                | 70 (76.9)       | 21 (23.1)       |     |
| Graduation                   | 10 (83.3)       | 2 (16.7)        |     |
| **6.Occupation**             |                 |                 |
| Unemployed                   | 106 (70.7)      | 44 (29.3)       | 0.607 |
| Unskilled                    | 197 (64.4)      | 109 (35.6)      |     |
| Semiskilled                  | 44 (68.8)       | 20 (31.2)       |     |
| Skilled                      | 4 (66.7)        | 2 (33.3)        |     |
| Professional                 | 8 (80.0)        | 2 (20.0)        |     |
| **7.Socio-economic status**  |                 |                 |
| Upper                        | 10 (83.3)       | 2 (16.7)        | 0.098 |
| Upper middle                 | 72 (66.5)       | 38 (34.5)       |     |
| Lower middle                 | 103 (62.0)      | 63 (38.0)       |     |
| Upper lower                  | 144 (67.9)      | 68 (32.1)       |     |
| Lower                        | 30 (83.3)       | 6 (16.7)        |     |
| **8.Area of residence**      |                 |                 |
| Rural                        | 229 (71.3)      | 92 (28.7)       | 0.009 |
| Urban                        | 130 (60.5)      | 85 (39.5)       |
the participants (67.0%) reported ≥95% adherence to treatment and remaining 33.0% of the study participants reported <95% adherence. Personal work such as attending family functions (28.8%), working time inconveniences to come to the ART center for collection of drugs (23.7%), and difficulty to remember the treatment (23.5%) were the commonest reasons for less adherence.

Married participants showed a higher level of adherence to ART (70.8%) than single (51.6%) and separated or widowed participants (66.7%, P = 0.009). Participants who had studied up to graduation (83.3%) and pre-university (76.9%) were better adherent to treatment compared with illiterates (69.2%, P = 0.016). A higher proportion of participants residing in rural areas (71.3%) were better adherent than from urban areas (60.5%, P = 0.009) [Table 1].

It was evident that the participants who did not have the habit of tobacco usage (71.7%) were better adherent to treatment than the participants with the habit of using tobacco (60.4%) (P = 0.008). Participants who had friends and family members who were supporting them personally and helping them to take care of themselves by reminding about the drugs were better adherent to treatment (68.9%) compared with others who were not having support of friends and family members (57.9%) (P = 0.039). Not having any of the side effects such as uneasiness, vomiting, and so on to ART drugs showed a high level of adherence (76.3%) compared with participants having any one of the side effects to drugs (37.5%) (P < 0.005), and having good knowledge about ART showed better adherence (71.8%) than having poor knowledge about ART (55.8%) (P < 0.005) [Table 2].

On bivariate analysis, married participants (OR: 1.586, CI: 1.097–2.292) and participants residing in rural areas (OR: 1.628, CI: 1.130–2.345) were better adherent to treatment compared with unmarried, widowed, and participants from urban area, respectively. A higher level of adherence was also seen among participants with support of friends and family members (OR: 1.612, CI: 1.019–2.540) and without tobacco consumption (OR: 0.611, CI: 0.424–0.879) compared with participants without anybody’s support and having a habit of tobacco consumption, respectively [Table 3].

After logistic regression, the determining factors for adherence to ART were being married (AOR: 1.695, CI: 1.113–2.579), residing in rural area (AOR: 1.863, CI: 1.225–2.834), not consuming tobacco (AOR: 0.529, CI: 0.351–0.798), having no side effects to drugs (OR: 11.843, CI: 6.212–22.579), having support of friends and family members (AOR: 2.805, CI: 1.385–5.682), and having good knowledge regarding ART (AOR: 2.437, CI: 1.582–3.753) [Table 4].

### Table 2: Association between personal and ART profile with adherence to ART

| I-Personal profile | Adherence to ART | p |
|--------------------|------------------|---|
|                     | High ≥95% | Low <95% |      |
| 1. Tobacco consumption |          |            |      |
| Yes                 | 139 (60.7) | 90 (39.3) | 0.008 |
| No                  | 220 (71.7) | 87 (22.3) |      |
| 2. Alcohol consumption |        |            |      |
| Yes                 | 97 (61.4)  | 61 (38.6)  | 0.076 |
| No                  | 262 (69.3) | 116 (30.7) |      |
| 3. Support of family and friends | | |      |
| Present             | 304 (68.9) | 137 (31.1) | 0.039 |
| Absent              | 55 (57.9)  | 40 (42.1)  |      |
| 4. Side effects to ART drugs | | |      |
| Absent              | 311 (76.2) | 97 (23.8)  | <0.005 |
| Present             | 48 (37.5)  | 80 (62.5)  |      |
| 5. Knowledge regarding ART | | |      |
| Better knowledge    | 268 (71.8) | 105 (28.2) | <0.005 |
| Poor knowledge      | 91 (55.8)  | 72 (44.2)  |      |
| 6. Attitude towards ART |       |            |      |
| Positive attitude   | 318 (68.1) | 149 (31.9) | 0.154 |
| Negative attitude   | 41 (59.4)  | 28 (40.6)  |      |

### Discussion

Among HIV-positive people, ART can significantly delay the progression from HIV to AIDS and has transferred the miserable lives of HIV-positive people to chronic manageable disease. A very high level of adherence (≥95%) is required for ART to be effective on long term and to prevent the emergence of resistant viral strains and prevent comorbidities like opportunistic infections.

A self-reported adherence level by 1-week recall method was adopted, which has shown high sensitivity. A high level of adherence (≥95%) to treatment was seen among 67.0% of study participants and 33.0% showed lower level of adherence. Similar cutoff level of >95% adherence was considered in the studies done by Achappa et al., Shah et al., and Bello that reported a level of adherence of 63.7%, 73%, and 73.3%, respectively. A little higher level of adherence observed in other studies may be because of the methodology adopted of self-reporting by 4-day recall method, random self-reporting, geographical difference leading to cultural differences, and taboo associated with HIV in study population. A cutoff level of adherence was varying; studies with a higher cutoff level showed lower level of adherence and consequently studies with lower cutoff levels showed a higher level of adherence. In studies done by Naik et al. and Sharma et al. with absolute 100% cutoff level, 57% and 59% of people were adherent to therapy, respectively, and in a study done Sarna et al.
Table 3: Association between socio‑demographic, personal and ART profile and adherence to ART among PLHIV by bivariate analysis

| Variables                      | ≥95% (ART Adherence) | ≤95% (ART Adherence) | Odds Ratio | 95% CI        | P    |
|--------------------------------|----------------------|----------------------|------------|---------------|------|
| Age <45 years                  | 184 (68.4%)          | 85 (31.6%)           | 1.138      | 0.794-1.632   | 0.482|
| Age >45 years                  | 175 (65.5%)          | 92 (34.5%)           | 1.366      | 0.949-1.966   | 0.093|
| Religion Hindu                 | 290 (68.4%)          | 134 (31.6%)          | 1.348      | 0.810-2.075   | 0.174|
| Religion Others (Females & Transgender) | 147 (68.7%)          | 67 (31.3%)           | 1.069      | 0.687-1.654   | 0.843|
| Marital status Married         | 238 (70.8%)          | 98 (29.2%)           | 1.586      | 1.097-2.929   | 0.014|
| Marital status Others          | 121 (60.5%)          | 79 (39.5%)           | 1.118      | 0.552-2.263   | 0.756|
| Education Illiterate           | 27 (69.2%)           | 12 (30.8%)           | 1.118      | 0.552-2.263   | 0.756|
| Education Literate             | 332 (66.8%)          | 165 (33.2%)          | 1.266      | 0.842-1.918   | 0.258|
| Monthly family income <5000    | 194 (66.0%)          | 100 (34.0%)          | 0.905      | 0.630-1.301   | 0.591|
| Monthly family income >5000    | 165 (68.2%)          | 77 (31.8%)           | 0.905      | 0.630-1.301   | 0.591|
| Area of residence Rural        | 229 (71.3%)          | 92 (28.7%)           | 1.628      | 1.130-2.345   | 0.009|
| Area of residence Urban        | 130 (60.5%)          | 85 (39.5%)           | 0.905      | 0.630-1.301   | 0.591|
| Tobacco Users                  | 139 (60.7%)          | 90 (39.3%)           | 0.611      | 0.424-0.879   | 0.008|
| Tobacco Non users              | 220 (71.7%)          | 87 (28.3%)           | 0.611      | 0.424-0.879   | 0.008|
| Alcohol Users                  | 97 (61.4%)           | 61 (38.6%)           | 0.704      | 0.478-1.038   | 0.076|
| Alcohol Non users              | 262 (69.3%)          | 116 (30.7%)          | 0.704      | 0.478-1.038   | 0.076|
| Support of friends & family    | Present              | 304 (68.9%)          | 137 (31.1%)| 1.612          | 0.04 |
| Support of friends & family    | Absent               | 35 (57.9%)           | 26 (42.1%) |               |      |
| Side effects to ART drugs No   | 311 (76.2%)          | 97 (23.8%)           | 5.324      | 3.491-8.181   | <0.005|
| Side effects to ART drugs Yes  | 48 (75.0%)           | 17 (25.0%)           |            |               |      |
| Knowledge regarding ART Good   | 268 (71.8%)          | 105 (28.2%)          | 2.019      | 1.377-2.961   | <0.005|
| Knowledge regarding ART Poor   | 91 (55.8%)           | 72 (44.2%)           | 2.019      | 1.377-2.961   | <0.005|
| Attitude towards ART Positive  | 318 (68.1%)          | 149 (31.9%)          | 1.458      | 0.868-2.448   | 0.154|
| Attitude towards ART Negative  | 41 (59.4%)           | 28 (40.6%)           | 1.458      | 0.868-2.448   | 0.154|

Table 4: Determining factors of ART adherence among PLHIV by multiple logistic regression

| Variables                | ART Adherence | Odds Ratio | 95% CI | P    |
|--------------------------|---------------|------------|--------|------|
| Marital status Married   | 238 (70.8%)   | 1.695      | 1.113-2.579 | 0.014|
| Marital status Others    | 121 (60.5%)   | 1.863      | 1.225-2.834 | 0.004|
| Area of residence Rural  | 229 (71.3%)   | 0.529      | 0.351-0.798 | 0.002|
| Area of residence Urban  | 130 (60.5%)   | 0.529      | 0.351-0.798 | 0.002|
| Tobacco Users             | 139 (60.7%)   | 2.805      | 1.385-5.682 | 0.004|
| Tobacco Non users         | 220 (71.7%)   | 2.805      | 1.385-5.682 | 0.004|
| Support of friends & family Present | 311 (76.2%) | 2.805 | 1.385-5.682 | 0.004|
| Support of friends & family Absent     | 48 (75.0%)   |            |       |      |
| Side effects to ART drugs No | 311 (68.7%)   | 11.843     | 6.212-22.579 | <0.005|
| Side effects to ART drugs Yes   | 48 (57.8%)   | 35 (42.2%) |       |      |
| Knowledge regarding ART Good  | 268 (71.8%)   | 2.437      | 1.582-3.753 | <0.005|
| Knowledge regarding ART Poor  | 91 (55.8%)   | 2.437      | 1.582-3.753 | <0.005|

with lower cutoff level of 90%, a higher proportion of 94% people were adherent to treatment. A meta-analysis showed a adherence level of 77% in Africa and 55% in North America with a cutoff level of 95%[16] whereas in India, adherence level was 70% with different definitions of adherence.[17] 

The most common reasons for non‑adherence among the less adherent group were personal work (28.8%), that is, being away from home for attending wedding, funerals, religious places, and not able to carry drugs with them because of stigma attached to HIV; difficult to remember (23.7%); and work time inconvenient.
especially because of night shifts (23.5%). Similar reasons were found by Achappa et al.\cite{10} and Bello.\cite{12} The cost of the treatment was the main barrier to adherence in some of the studies done such as Achappa et al.\cite{10} and Kumarsamy et al.\cite{18} However, a study done by Sarna et al.\cite{13} reported that people paying out of their pockets showed a higher level of adherence compared with free ART. As our study was done in a government hospital with the availability of free investigations, ART, and travel allowance to patients, we did not consider cost as a factor for lower adherence.

It was evident from this study that there was no much difference among different age groups and adherence to therapy, and similar results were observed by studies Achappa et al.\cite{10} Cauldbeck et al.\cite{19} and Olowookere et al.\cite{20} However, a study done by Wasti et al.\cite{21} revealed that participants older than 35 years were more adherent to treatment (90.3%); this difference may be attributed to strict adherence counselling sessions conducted pre and post ART. Some studies\cite{22,23,24} have reported that men were more likely to adhere to ART than women. However, in this study, there was no much difference in adherence levels between males and females. One very important finding was that transgender group was very poor in adherence levels. Married participants were better adherent to treatment (70.8%) may be because of the support they receive from their spouses. A contrasting finding was showed by Olowookere et al.\cite{20} in which married participants showed a lowest level of adherence compared with others which may be because of the difference in the sociocultural factors.

Education does play an important role in participants being adherent to treatment: by facilitating a better communication between participants and health care provider, increasing understanding, retention of information provided by health workers, and thereby, enhancing adherence to ART medication. In this study, participants who studied more than pre-university or graduation showed a higher level of adherence and this association was statistically significant. A similar finding was observed in study done by Wasti et al.\cite{21} which may be attributed to similar a geographical and sociocultural background. However, on bivariate analysis, illiterates were better adherent to therapy compared with literates which was statistically not significant, likewise in some studies,\cite{10,19,20} illiterates were better adherent. There was much difference between employed and unemployed in being adherent to treatment, which is similar to the study done by Wasti et al.\cite{21} However, one of the reason for missing drugs was inconvenience caused because of work time and night shifts. Socioeconomic status was not associated with ART adherence, but in a study done by Cauldbeck et al.\cite{19} higher level of adherence was seen among people from low income family groups when compared with people from high income family groups in which the study was done in private sector where people had paid for their medication. Participants living in rural areas were showing better adherence levels; similar results were observed by Cauldbeck et al.\cite{19} This may be because participants from rural area followed instructions given by health care providers correctly.

Participants with better knowledge about ART showed a higher level of adherence. Similar results were shown by Olowookere et al.\cite{20} There was no association between attitude toward ART and adherence to treatment but having no side effects to drugs was not associated with a higher level of ART adherence, and contrasting results were observed by Wasti et al.\cite{21} Participants not having the habit of tobacco consumption showed a better level of adherence, and alcohol consumption was not associated with lower level of adherence. However, in a study done by Wasti et al.\cite{21} alcoholics showed lower level of adherence.

There was association between having support of friends and family members and high level of adherence which may be in the form of reminding the drugs to be taken or accompanying them to the ART center.

**Recommendations**

An extra effort should be put to counsel about benefits gained from adhering to ART to participants who are transgender, single, illiterate, less educated, and residing in urban areas. During every visit, attention should be paid to the side effects of drugs and family members should be counseled about helping by reminding about drugs and accompanying them to the ART center.

**Limitations**

A self-reported adherence was collected which may not give a clear picture of level of adherence, but, however, it is a better available method in resource limited settings. Non-probability sampling method was adopted in this study, which may not have provided an equal chance of selection of study participants.

**Conclusions**

In this study, 67.0% of the participants showed ≥95% adherence to ART. Sociodemographic factors such as education, marital status, hailing from rural area, not consuming tobacco, not having side effects to ART drugs, and other personal factors such as having support of friends and family members and having good knowledge about ART were associated with high level of adherence to ART.

**Financial support and sponsorship**

None.

**Conflicts of interest**

There are no conflicts of interest.

**Received:** 11 Jan 18 **Accepted:** 05 Jul 18 **Published:** 10 Dec 19
Hiregoudar, et al.: Proportion and determinants of adherence to antiretroviral therapy

References

1. National AIDS Control Organisation, Ministry of Health and Family Welfare, Government of India. Annual Report 2016-17. New Delhi: ABS publication; 2017.
2. Park K. Park’s textbook of preventive and social medicine. 22nd ed. India: Banarsidas Bhanot Publishers; 2013. p. 166-405.
3. Hogg RS, Heath K, Bangsberg D, Yip B, Press N, O’Shaughnessy MV, et al. Intermittent use of triple-combination therapy is predictive of mortality at baseline and after 1 year of follow-up. AIDS 2002;16:1051-8.
4. Nachega JB, Hislop M, Dowdy DW, Lo M, Omer SB, Regensberg L, et al. Adherence to highly active antiretroviral therapy assessed by pharmacy claims predicts survival in HIV-infected South African adults. J Acquir Immune Defic Syndr 2006;43:1-7.
5. Berg KM, Demas PA, Howard AA, Schoenbaum EE, Gourevitch MN, Arnsten JH. Gender differences in factors associated with adherence to antiretroviral therapy. J Gen Intern Med 2004;19:1111-7.
6. Bangsberg DR, Perry S, Charlebois ED, Clark RA, Roberston M, Zolopa AR, et al. Non-adherence to highly active antiretroviral therapy predicts progression to AIDS. AIDS 2001;15:1181-3.
7. Weidle PJ, Wamai N, Solberg P, Liechty C, Sendagala S, Were W, et al. Adherence to antiretroviral therapy in a home-based AIDS care program in rural Uganda. Lancet 2006;368:1556-7.
8. Ministry of Health and Family Welfare, New Delhi, Department of AIDS Control. Antiretroviral therapy guidelines for HIV-infected adults and adolescents including post-exposure prophylaxis. May 2007.
9. Horizons/Population Council, International Centre for Reproductive Health and Coast Province General Hospital, Mombasa Ministry of Health, Kenya. Adherence to antiretroviral therapy in adults: A guide for trainers. Nairobi, Kenya: Population Council. 2004; 1-130.
10. Achappa B, Madi D, Bhaskaran U, Ramapuram JT, Rao S, Mahalingam S. Adherence to antiretroviral therapy among people living with HIV. N Am J Med Sci 2013;5:220-3.
11. Shah B, Walshe L, Saple DG, Mehta SH, Ramnanai JP, Kharkar RD, et al. Adherence to antiretroviral therapy and virologic suppression among HIV-infected persons receiving care in private clinics in Mumbai, India. Clin Infect Dis 2007;44:1235-44.
12. Bello SI. HIV/AIDS patients’ adherence to antiretroviral therapy in Sobi Specialist Hospital, Ilorin, Nigeria. J Adv Sci Res 2011;2:52-7.
13. Naik E, Casanas B, Pazare A, Wabale G, Sinnott J, Salihu H. Cost of treatment: The single biggest obstacle to HIV/AIDS treatment adherence in lower-middle class patients in Mumbai, India. Indian J Sex Transm Dis 2009;30:23-7.
14. Sharma M, Singh RR, Laihram P, Kumar B, Nanao H, Sharma C, et al. Access, adherence, quality and impact of ARV provision to current and ex-injecting drug users in Manipur (India): An initial assessment. Int J Drug Policy 2007;18:319-25.
15. Sarna A, Pujari S, Sengar AK, Garg R, Gupta I, Dam Jv. Adherence to antiretroviral therapy & its determinants amongst HIV patients in India. Indian J Med Res 2008;127:28-36.
16. Mills EJ, Nachega JB, Buchan I, Orbinski J, Attaran A, Singh S, et al. Adherence to antiretroviral therapy in sub-Saharan Africa and North America: A meta-analysis. JAMA 2006;296:670-90.
17. Mhaskar R, Alandikar V, Emmanuel P, Djulbegovic B, Patel S, Patel A, et al. Adherence to antiretroviral therapy in India: A systematic review and meta-analysis. Indian J Community Med 2013;38:74-82.
18. Kumarasamy N, Safren SA, Rampanini SR, Pickard R, James R, Krishnan AK, et al. Barriers and facilitators to antiretroviral medication adherence among patients with HIV in Chennai, India: A qualitative study. AIDS Patient Care STDS 2005;19:526-3.
19. Cauldbeck MB, O’Connor C, O’Connor MB, Saunders JA, Rao B, Mallesh VG, et al. Adherence to anti-retroviral therapy among HIV patients in Bangalore, India. AIDS Res Ther 2009;28:6-7.
20. Olowookere SA, Fatiregun AA, Adewole IF. Knowledge and attitudes regarding HIV/AIDS and antiretroviral therapy among patients at a Nigerian treatment clinic. J Infect Dev Ctries 2012;6:809-16.
21. Wasti SP, Simkhada P, Randall J, Freeman JV, van Teijlingen E. Factors influencing adherence to antiretroviral treatment in Nepal: A mixed-methods study. PLoS ONE 2012;7:e35547.
22. Bonolo PF, César CC, Acúrcio FA, Ceccato Md, de Pádua CA, Alvares J, et al. Non-adherence among patients initiating antiretroviral therapy: A challenge for health professionals in Brazil. AIDS 2005;19:5-513.
23. Sorensen S, Klinge H, Mravca-Wilkey V, Elzey J, Fife K. Gender-related factors influencing medication and clinic visit adherence in HIV/AIDS patients. The XIV International AIDS Conference Barcelona: International AIDS Society WePeB5856, 2002.
24. Salami AK, Fadeyi A, Ogummodede JA, Desalu O. Factors influencing adherence to antiretroviral medication in Ilorin, Nigeria. J Int Assoc Physicians AIDS Care (Chic) 2010;9:191-5.