Original Research

To Evaluate The Medication Adherence And Adverse Effects Of HAART In People Living With HIV/AIDS

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ABSTRACT
Background: Highly Active Antiretroviral Therapy (HAART) has significantly improved the prognosis of people living with HIV/AIDS. However, its success is contingent on high levels of medication adherence, which may be affected by socioeconomic, psychological, and treatment-related factors, including adverse effects.
Objective: To assess the level of adherence to HAART and evaluate the associated adverse effects among HIV/AIDS patients attending the ART Centre and Department of Medicine at GGS Medical College and Hospital, Faridkot.
Methods: A prospective study was conducted on 200 HIV-positive adults on HAART for at least 3 months. Adherence was measured using the Medication Adherence Rating Scale (MARS-10), and adverse effects were recorded using a standard reporting form. Patients were followed up after 24 weeks. Data were analyzed using SPSS version 20.0, and statistical significance was set at $p < 0.05$.
Results: Most participants were male (56.5%), aged 31–45 years (40%), and married (80.5%). At baseline, adherence was high, with slightly lower responses for Q1 (forgetfulness, 86.5%) and Q2 (carelessness, 88%). At 24 weeks, adherence improved across all questions (Q1: 92%, Q2: 93%). Adverse events were minimal, with 84.5% reporting no issues; tiredness was the most common complaint (12.5%).
Conclusion: Overall adherence to HAART was high and improved over time, reflecting effective patient counseling and follow-up strategies. Adverse effects were generally mild and infrequent but had a small influence on subjective well-being. Continuous adherence support and side-effect management are critical to sustaining long-term treatment success.

INTRODUCTION

Human Immunodeficiency Virus (HIV) is a retrovirus that infects immune cells, weakening the body's defense mechanisms and increasing vulnerability to opportunistic infections. AIDS represents the most advanced stage of HIV infection and poses a major global health threat, impacting societies on multiple levels (1). The disease was first recognized in the early 1980s after an unusual rise in opportunistic infections and cancers in previously healthy homosexual men (2).

HIV-1 was soon identified as the principal causative agent in the United States, whereas HIV-2, discovered later in West Africa in 1985, differs significantly in transmission and progression (3). HIV-2 resembles a simian virus seen in macaques, suggesting that both HIV-1 and HIV-2 may have originated from interspecies transmission involving African primates (3).

Since its discovery, HIV/AIDS has led to over 40 million deaths. Despite advancements in prevention and treatment, global control efforts remain under threat. In 2021, around 1.5 million adults and 160,000 children contracted HIV, while 552,000 adults and 98,000 children died due to the disease (4).

HIV-1 and HIV-2 are transmitted similarly but differ in prevalence, progression, and genetic variability. HIV-1 is more widespread globally and has a higher mutation rate, making it more adept at evading immune responses and developing drug resistance (5,6,7). Conversely, HIV-2 is less transmissible, associated with a longer latency period, lower viral loads, and milder disease progression (8).

HIV is primarily spread through unprotected sexual contact, shared needles, mother-to-child transmission during childbirth or breastfeeding. It severely affects life expectancy and increases healthcare burdens (9). Once inside the body, HIV targets CD4 T lymphocytes, progressively weakening the immune

system. AIDS is diagnosed when CD4 count drops below 200 or when AIDS-defining illnesses are present (10,11).

The advent of Highly Active Antiretroviral Therapy (HAART) has transformed HIV/AIDS management, significantly lowering mortality and improving quality of life (12). HAART suppresses viral replication, allowing immune recovery and reducing transmission rates (13). However, the success of HAART is heavily dependent on adherence, which can be influenced by socioeconomic status, mental health, and access to healthcare (14).

Common barriers to adherence include lack of motivation, complex regimens, drug side effects, and inadequate support (15). Strategies like simplifying regimens, using reminder tools, early follow-ups, and ongoing support have shown to improve adherence (16). Research indicates that adherence rates of at least 95% are required to effectively suppress HIV (17).

Self-report tools are often used to measure adherence due to their simplicity and affordability. However, they can be influenced by patient comprehension and honesty (18). The Medication Adherence Rating Scale (MARS), developed from earlier tools like the DAI and MAQ, measures adherence behavior on a 10-point scale, recognizing that adherence exists on a continuum (19).

Despite the benefits of HAART, side effects can impact adherence. These include lipodystrophy (21), metabolic complications like insulin resistance (22), gastrointestinal issues (23), peripheral neuropathy (24), and neuropsychiatric symptoms including depression and substance use disorders (25). Lack of understanding about the importance of adherence also contributes to poor compliance (26), further compounded by complex dosing schedules (27) and the stigma surrounding HIV/AIDS (28).

Addressing non-adherence requires a comprehensive approach involving education, mental health support, and stigma reduction strategies. Such efforts are vital to improving health outcomes and quality of life for people living with HIV/AIDS (29).

This study was undertaken to assess adherence levels and attitudes toward antiretroviral therapy among HIV/AIDS patients attending the ART Centre and the Medicine department at G.G.S Medical College and Hospital, Faridkot. With limited data from this region, the study aims to inform interventions that can enhance treatment adherence and improve disease management.

MATERIAL AND METHOD

This prospective study was conducted over a period of one year in the Department of Medicine and the ART Centre at Guru Gobind Singh Medical College and Hospital, Faridkot. The study aimed to assess adherence to highly active antiretroviral therapy (HAART) and associated adverse effects among HIV/AIDS patients.

A total of 221 patients were screened, out of which 21 were excluded based on the predefined exclusion criteria. The first 200 eligible patients, who fulfilled the inclusion criteria and gave written informed consent, were enrolled using a non-probability convenient sampling technique. Patients aged 18 years or above, regardless of gender, diagnosed with HIV/AIDS and on HAART for at least three months were included. Those with co-infections like Hepatitis B or C, known psychiatric illness, or critically ill/end-stage diseases such as cardiac, renal, hepatic failure, or malignancy were excluded.

After enrollment, detailed socio-demographic and clinical data were collected, including age, gender, education, occupation, marital status, family type, distance from the health facility, diagnosis, treatment duration, medication details, and reported adverse effects. All this information was recorded in the Case Report Form (CRF).

To assess medication adherence, the Medication Adherence Rating Scale (MARS-10), developed by Thompson et al., was used. It is a validated self-report tool comprising ten yes/no items that measure both intentional and unintentional nonadherence. For items 1 to 6 and 9 to 10, a "No" response indicates adherence and is scored as 1. For items 7 and 8, a "Yes" response indicates adherence and is also scored as 1. The total score ranges from 0 to 10, with scores above 5 considered adherent and scores of 5 or below considered non-adherent. The questionnaire was translated and validated in the vernacular language to ensure better understanding among the participants.

Adverse drug reactions (ADRs) reported by the patients were documented using the standard ADR reporting form. After the initial assessment, patients were followed up after 24 weeks to re-evaluate their adherence levels and any new or ongoing ADRs.

The collected data were tabulated using Microsoft Excel and analyzed with IBM SPSS version 20.0. Descriptive statistics were used to summarize the demographic and clinical characteristics. Comparisons between baseline and 24-week follow-up data were made using non-parametric tests such as the Chi-square test and Fisher's exact test. A p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Ethical Committee of Guru Gobind Singh Medical College and Hospital, Faridkot. Prior permission was also taken from the Punjab State AIDS Control Society (PSACS). Furthermore, the study was registered with the Clinical Trials Registry of India under registration number CTRI/2023/03/051142 on 28th March 2024.

RESULTS AND OBSERVATIONS

The study included 200 participants on antiretroviral therapy, with a higher proportion of males (56.5%) compared to females (43.5%). The age distribution revealed that the majority of participants were in the 31–45 years age group (40%), followed by those aged

45–60 years (32%), 18–30 years (19.5%), and above 60 years (8.5%), indicating a predominance of middle-aged individuals. Educational status showed that most participants had either secondary (32%) or primary education (28%), while 23.5% were illiterate, and fewer had senior secondary (5.5%) or graduate-level education (11%), reflecting a population with mostly basic to moderate educational backgrounds. Marital status analysis revealed that 80.5% were married, 8% unmarried, 10% widowed, and 1.5% divorced, highlighting the predominance of married individuals in the cohort. In terms of accessibility to healthcare, the majority (81%) resided within 1–30 km of the treatment center, while 13.5% lived 31–60 km away, and only a small fraction (5.5%) lived beyond 60 km, suggesting that most participants had relatively easy access to ART services.(Table 1)

The majority of participants (61%) had been on antiretroviral therapy (ART) for 1–5 years, followed by 19% on therapy for 6–10 years, 14.5% for less than a year, and 5.5% for over 10 years, indicating that most were on ART for a moderate duration. Regarding adverse events, 84.5% of participants reported no issues, while tiredness was the most common complaint (12.5%), with very few reporting low moods (1.5%), paresthesia (1%), or itching (0.5%), suggesting good overall tolerance to ART. Substance abuse was relatively low in the study population, with 7.5% consuming alcohol, 4.5% reporting IV drug use, and 3.5% smoking(Table 2).

At baseline, adherence to ART was generally high across all 10 questions. Responses to Q1 (86.5%) and Q2 (88%) indicated slightly lower adherence related to forgetfulness and carelessness, suggesting areas needing intervention. Responses to the remaining questions were very positive, with over 99% adherence for Q3 to Q8, and slightly lower but still high adherence for Q9 (96.5%) and Q10 (94%), indicating strong overall commitment to the treatment plan.(Table 3)

Response to MARS Questionnaire at 24 Weeks
After 24 weeks, adherence improved further, particularly for Q1 (92%) and Q2 (93%), showing effective intervention or behavioral improvement. Near-perfect scores were observed for Q3 to Q8 (99.5%–100%), and a slight increase was noted in responses to Q9 (99.5%) and Q10 (95%), reflecting sustained and enhanced compliance with ART over time.(Table 4)

	Gender	n	Percentage
Gender	Male	113	56.50%
	Female	87	43.50%
Age group	18–30	39	19.50%
	31–45	80	40.00%
	45–60	64	32.00%
	>60	17	8.50%
Educational Status	Illiterate	47	23.50%
	Primary	56	28.00%
	Secondary	64	32.00%
	Senior Secondary	11	5.50%
	Graduate	22	11.00%
Marital Status	Unmarried	16	8.00%
	Married	161	80.50%
	Divorced	3	1.50%
	Widow	20	10.00%
Distance (in km)	1–30 km	162	81.00%
	31–60 km	27	13.50%
	61–90 km	7	3.50%
	91–120 km	1	0.50%
	>120 km	3	1.50%

Table 1: Sociodemographic characteristics of the study population

		n	Percentage
Duration (years)	<1 year	29	14.50%
	1–5 years	122	61.00%
	6–10 years	38	19.00%
	>10 years	11	5.50%
Adverse Event	None	169	84.50%
	Tiredness	25	12.50%
	Low moods	3	1.50%
	Itching	1	0.50%
	Paresthesia	2	1.00%

Substance Abuse	IV abuse	9	4.50%
	Alcohol	15	7.50%
	Smoking	7	3.50%

Table 2: Duration of ART, Adverse events and History of substance abuse of study population

S. No	Questions	n	Percentage
1	Do you ever forget to take your medication?	173	86.50%
2	Are you careless at times about taking your medication?	176	88%
3	When you feel better, do you sometimes stop taking your medications?	200	100%
4	Sometimes if you feel worse when you take the medication, do you stop taking it?	200	100%
5	I take my medication, only when I am sick?	199	99.50%
6	It is unnatural for my mind and body to be controlled by medication	199	99.50%
7	My thoughts are clear on medication	198	99%
8	By staying on medication, I can prevent getting sick	200	100%
9	I feel weird like "zombie" on the medication	193	96.50%
10	Medication makes me feel tired and sluggish	188	94%

Table 3: Response to MARS questionnaire at baseline

S. No	Questions	n	Percentage
1	Do you ever forget to take your medication?	184	92%
2	Are you careless at times about taking your medication?	186	93%
3	When you feel better, do you sometimes stop taking your medications?	199	99.50%
4	Sometimes if you feel worse when you take the medication, do you stop taking it?	200	100%
5	I take my medication, only when I am sick?	200	100%
6	It is unnatural for my mind and body to be controlled by medication	200	100%
7	My thoughts are clear on medication	200	100%
8	By staying on medication, I can prevent getting sick	199	99.50%
9	I feel weird like "zombie" on the medication	199	99.50%
10	Medication makes me feel tired and sluggish	190	95%

Table 4: Response to MARS questionnaire at 24 weeks

DISCUSSION

The present study was conducted in the Department of Pharmacology and the ART Centre at Guru Gobind Singh Medical College and Hospital, Faridkot, to evaluate medication adherence and adverse drug reactions to HAART among people living with HIV/AIDS aged ≥18 years. The Medication Adherence Rating Scale (MARS), a validated self-report tool, was used to assess both intentional and unintentional nonadherence, with higher scores indicating better compliance.

Sociodemographic Trends and Their Implications

The age distribution in this study predominantly featured middle-aged individuals, with the highest proportion (40%) falling in the 31–45 year group, followed by those aged 45–60 years (32%). This pattern aligns with findings from Tegegne et al.,[30] Basti et al.,[31] and Pujari et al.,[32] all of whom observed that middle-aged adults represent the majority of individuals undergoing ART. These findings emphasize the importance of tailoring adherence strategies to this demographic, who often balance employment, family responsibilities, and stigma-related concerns.

Educational levels were largely concentrated in the basic to intermediate range, with 32% having secondary education and 28% having primary education. Although 23.5% of participants were illiterate, adherence did not significantly differ across education levels at baseline or 24 weeks. This is consistent with the findings of Madi D et al.[33] and Sameeksha et al.,[34] who also reported no statistically significant correlation between education and adherence. This suggests that adherence may be more strongly influenced by counseling, medication literacy interventions, and simplified regimens than formal education status.

The majority of participants (80.5%) were married, a factor often associated with improved adherence due to partner support and shared responsibility in managing healthcare routines. Meena et al.[35] and Saha et al.[36] reported similar marital trends in their studies. However, like in the present study, they found no statistically significant association between marital status and adherence levels, indicating that while a supportive spouse may facilitate adherence, other psychosocial and healthcare-related factors may have a stronger influence.

Proximity to healthcare facilities also played a noteworthy role. In this study, 81% of participants

resided within 30 km of the ART center, which likely contributed to ease of access and follow-up. Although Legesse et al.[37] highlighted the importance of geographic proximity in enhancing adherence, the current findings suggest that proximity alone is not a statistically significant determinant. Instead, factors such as availability of transport, appointment scheduling flexibility, and psychosocial support systems may play more substantial roles.

Duration of Therapy and Tolerability

A majority of study subjects (61%) had been on HAART for 1–5 years. This moderate duration reflects a stable treatment population familiar with their regimen and its associated demands. A smaller group (5.5%) had been on treatment for over 10 years, indicating long-term adherence feasibility in select individuals.

In terms of tolerability, 84.5% of the participants reported no adverse events, while a minority experienced fatigue (12.5%), low moods (1.5%), itching (0.5%), or paraesthesia (1%). Although most participants tolerated therapy well, a small subset who experienced neuropsychological side effects—such as tiredness or cognitive dulling ("feeling like a zombie")—highlighted the subtle but real impact of HAART on quality of life and adherence perception.

Medication Adherence and MARS Analysis

At baseline, adherence was remarkably high across the MARS questionnaire items, with 100% adherence noted in critical areas such as continuing medication when feeling better or worse (Q3, Q4), and in understanding the benefits of staying on treatment (Q5, Q8). The only slightly lower scores were seen in Q1 (forgetfulness – 86.5%) and Q2 (carelessness – 88%). This initial gap highlights common barriers such as memory lapses and treatment fatigue, which are well-documented in the literature.

By 24 weeks, adherence further improved, particularly for Q1 and Q2, rising to 92% and 93% respectively. This suggests that interventions during follow-up—such as adherence counseling, education, and peer support—may have positively impacted patient behavior. The findings are consistent with studies by Hansana et al. and Okuku et al., who noted that reminder strategies, consistent provider engagement, and health system support can significantly reduce forgetfulness and improve long-term adherence.

However, adherence to Q10 ("medication makes me feel tired and sluggish") remained a concern, with statistical significance (p=0.000) suggesting that subjective adverse effects could influence compliance. Studies by Saha et al.[36] and Zeng C et al.[38] support this interpretation, indicating that physical or psychological side effects are often under-recognized but important contributors to nonadherence.

Participants' descriptions of feeling "like a zombie" or "sluggish" reflect a subjective burden of therapy, which although subtle, may compound over time. While the overall adherence scores remained high, these qualitative insights offer a valuable opportunity for future intervention—such as screening for mental fatigue, promoting wellness strategies, or rotating medications when tolerability issues arise.

Integrated Understanding and Comparative Context

Your findings align closely with global and Indian literature on ART adherence. Consistent high adherence scores, even in the presence of minor side effects, reflect the success of current national strategies that emphasize single-tablet regimens, regular follow-up, and support services. As demonstrated by Okuku et al.,[39] forgetfulness remains the most common reason for nonadherence, and this was evident in your study as well—indicating an ongoing need for technological aids (e.g., reminders, pill boxes, mobile alerts).

Despite minor challenges like fatigue or perception-related side effects, the robust adherence at 24 weeks highlights the resilience of the patient population and the effectiveness of the TLD regimen in real-world settings. Moreover, the absence of significant variation in adherence based on education, marital status, or distance reaffirms that equitable care delivery and patient-centric counseling can overcome traditional barriers.

REFERENCE

1. Koyra HC. Adherence to antiretroviral therapy among adult persons living with HIV/AIDS in Southern Ethiopia. Int J Virol AIDS. 2018;5(038):10-23937.
2. Bhatti AB, Usman M, Kandi V. Current scenario of HIV/AIDS, treatment options, and major challenges with compliance to antiretroviral therapy. Cureus. 2016 Mar;8(3).
3. Sharp PM, Hahn BH. Origins of HIV and the AIDS pandemic. Cold Spring Harbor perspectives in medicine. 2011 Sep 1;1(1):a006841.
4. Nachega JB, Musoke P, Kilmarx PH, Gandhi M, Grinsztejn B, Pozniak A, Rawat A, Wilson L, Mills EJ, Altice FL, Mellors JW. Global HIV control: is the glass half empty or half full?. The Lancet HIV. 2023 Sep 1;10(9):e617-22.
5. Kalinichenko S, Komkov D, Mazurov D. HIV-1 and HTLV-1 transmission modes: Mechanisms and importance for virus spread. Viruses. 2022 Jan 14;14(1):152.
6. Kirchner JT. The origin, evolution, and epidemiology of HIV-1 and HIV-2. Fundamentals of HIV Medicine 2019. 2019 May 8;14.
7. Zainul R, Kharisma VD, Ciuputri P, Ansori AN, Herdiansyah MA, Sahadewa S, Durry FD. Antiretroviral activity from elderberry (Sambucus nigra L.) flowers against HIV-2 infection via reverse transcriptase inhibition: a viroinformatics study. Healthcare in Low-resource Settings. 2024 Jun 13.
8. Alford JE, Marongiu M, Watkins GL, Anderson EC. Human Immunodeficiency Virus Type 2 (HIV-2) Gag Is Trafficked in an AP-3 and AP-5 Dependent Manner. PLoS One. 2016 Jul 8;11(7):e0158941.
9. Shaw GM, Hunter E. HIV transmission. Cold Spring Harbor perspectives in medicine. 2012 Nov 1;2(11):a006965.

10. Swinkels H, Vaillant AJ, Nguyen A, Gulick P. HIV and AIDS. StatPearls.2024 May 6.

11. Poorolajal J, Hooshmand E, Mahjub H, Esmailnasab N, Jenabi E. Survival rate of AIDS disease and mortality in HIV-infected study subjects: a meta-analysis. Public health. 2016 Oct 1;139:3-12.

12. Lv R, Li G, Wu J, Zhu Y, Qin X, Li S. Research on AIDS study subjects' survival time after highly active antiretroviral therapy, treatment effect and treatment modes. Saudi Pharmaceutical Journal. 2016 May 1;24(3):318-21.

13. Jin M, Yang Z, Li J, Liu X, Wu Z. Factors influencing survival status of HIV/AIDS after HAART in Huzhou City, Eastern China. Canadian Journal of Infectious Diseases and Medical Microbiology. 2022;2022(1):2787731.

14. Ickovics JR, Meade CS. Adherence to HAART among study subjects with HIV: breakthroughs and barriers. AIDS care. 2002 Jun 1;14(3):309-18.

15. Oku AO, Owoaje ET, Ige OK, Oyo-Ita A. Prevalence and determinants of adherence to HAART amongst PLHIV in a tertiary health facility in south-south Nigeria. BMC infectious diseases. 2013 Dec;13:1-9.

16. Rolón MJ, Sued O, Cahn P. Simplifying HAART: the Role of Two-Drug Therapy. Current Treatment Options in Infectious Diseases. 2017 May 6;9(2):250–61.

17. Hansana V, Sanchaisuriya P, Durham J, Sychareun V, Chaleunvong K, Boonyaleepun S, et al. Adherence to Antiretroviral Therapy (ART) among People Living With HIV (PLHIV): a cross-sectional survey to measure in Lao PDR. BMC Public Health. 2013 Jun 28;13(1).

18. Snibsøer AK, Ciliska D, Yost J, Graverholt B, Nortvedt MW, Riise T, Espehaug B. Self-reported and objectively assessed knowledge of evidence-based practice terminology among healthcare students: A cross-sectional study. PLoS One. 2018 Jul 12;13(7):e0200313.

19. Fialko L, Garety PA, Kuipers E, Dunn G, Bebbington PE, Fowler D, Freeman D. A large-scale validation study of the Medication Adherence Rating Scale (MARS). Schizophrenia research. 2008 Mar 1;100(1-3):53-9.

20. Mellins CA, Brackis-Cott E, Dolezal C, Abrams EJ. The role of psychosocial and family factors in adherence to antiretroviral treatment in human immunodeficiency virus-infected children. The Pediatric infectious disease journal. 2004 Nov 1;23(11):1035-41.

21. Cunha CL, editor. Lipodystrophy Associated with HIV/ART and Cardiovascular Risk Factors. International Journal of Cardiovascular Sciences. 2020 Nov 25;33(6):616-7.

22. da Cunha J, Maselli LMF, Stern ACB, Spada C, Bydlowski SP. Impact of antiretroviral therapy on lipid metabolism of human immunodeficiency virus-infected study subjects: Old and new drugs. World Journal of Virology 2015 May 12;4(2):56–77.

23. Silva B, Peixoto G, Luz S, Moraes S, Peres S. Adverse effects of chronic treatment with the Main subclasses of highly active antiretroviral therapy: a systematic review. HIV Medicine. 2019 Apr 22;20(7):429–38.

24. Anastasi JK, Capili B, Chang M. HIV Peripheral Neuropathy and Foot Care Management. AJN, American Journal of Nursing. 2013 Dec;113(12):34–40.

25. Lanman T, Letendre S, Ma Q, Bang A, Ellis R. CNS neurotoxicity of antiretrovirals. Journal of Neuroimmune Pharmacology. 2021 Mar;16:130-43.

26. Lazarus JV, Wohl DA, Cascio M, Guaraldi G, Rockstroh J, Hodson M, et al. Long-term success for people living with HIV: A framework to guide practice. 2023;24(S2):8–19.

27. Engler K, Lenart A, Lessard D, Toupin I, Lebouche B. Barriers to antiretroviral therapy adherence in developed countries: a qualitative synthesis to develop a conceptual framework for a new patient-reported outcome measure. Aids Care. 2018 Dec 14;30(sup1):17-28.

28. Sallam M, Alabbadi AM, Abdel-Razeq S, Battah K, Malkawi L, Al-Abbadi MA, Mahafzah A. HIV knowledge and stigmatizing attitude towards people living with HIV/AIDS among medical students in Jordan. International Journal of Environmental Research and Public Health. 2022 Jan 10;19(2):745.

29. Okonji EF, Mukumbang FC, Orth Z, Vickerman-Delport SA, Van Wyk B. Psychosocial support interventions for improved adherence and retention in ART care for young people living with HIV (10–24 years): a scoping review. BMC public health. 2020 Dec 1;20(1):1841.

30. Tegegne AS. Socio-demographic, economic and clinical predictors for HAART adherence competence in HIV-positive adults at felege hiwot teaching and specialized hospital, North west Ethiopia. HIV/AIDS-Research and Palliative Care. 2021 Jul 9:749-58.

31. Mahesh V, Basti B, Bant D, Bathija G. Factors affecting antiretroviral treatment adherence among people living with human immunodeficiency virus/acquired immunodeficiency syndrome: A prospective study. J Family Med Prim Care. 2017;6(3):482.

32. Pujari SN, Gaikwad S, Joshi K, Dabhade D, Sane S, Rao NP, Bele V. Integrase Resistance–Associated Mutations on Raltegravir Failure in Western India: A Preliminary Analysis. JAIDS Journal of Acquired Immune Deficiency Syndromes. 2018 Apr 15;77(5):e42-5.

33. Madi D, Bhaskaran U, Ramapuram J, Rao S, Mahalingam S, Achappa B. Adherence to antiretroviral therapy among people living with HIV. N Am J Med Sci [Internet]. 2013;5(3):220. Available from: http://dx.doi.org/10.4103/1947-2714.109196

34. Sameeksha MD, Girish HO. Level of adherence to antiretroviral therapy and its determinants among people living with HIV/AIDS accessing services at tertiary hospital-ART Centre. National Journal of Community Medicine. 2020;11(01):45–8.

35. Meena SK, Negi R, Chaudhary SS, Misra SK. Adherence to anti-retroviral therapy and factors influencing it among HIV/AIDS adult patients in Agra: a cross-sectional study. International Journal of Community Medicine and Public Health. 2019 Aug;6(8):3373.

36. Saha R, Saha I, Sarkar AP, Das DK, Misra R, Bhattacharya K, et al. Adherence to highly active antiretroviral therapy in a tertiary care hospital in West Bengal, India. Singapore Med J [Internet]. 2014 [cited 2024 Jul 10];55(2):92–8.

37. Legesse TA, Reta MA. Adherence to antiretroviral therapy and associated factors among people living with HIV/AIDS in Hara Town and its surroundings, North-Eastern Ethiopia: a cross- sectional study.

Ethiopian journal of health sciences. 2019;29(3).

38. Zeng C, Li X, Qiao S, Yang X, Shen Z, Zhou Y. Anticipated stigma and medication adherence among people living with HIV: the mechanistic roles of medication support and ART self- efficacy. AIDS care. 2020 Aug 2;32(8):1014-22.

39. Okuku MO, Dan-Jumbo A. Forgetfulness and Non-Adherence to Antiretroviral Therapy in Nigeria: A Review. Asian Journal of Medical Principles and Clinical Practice. 2021;4(1):34-41.