



Original Article

Factors Associated with Antiretroviral Therapy Adherence and HIV-Related Stigma among People Living with HIV at a Tertiary Care Centre: A Cross-sectional Study

Dr Tanmayi Komal Kumar¹, Dr Laxmi B. Horatti², Dr Dilip Kumar N. R.³

¹Assistant Professor, Department of Dermatology Shri Atal Bihari Vajpayee Medical College and Research Institute (SABVMCRI), Bangalore

²Associate Professor, Department of Dermatology Shri Atal Bihari Vajpayee Medical College and Research Institute (SABVMCRI), Bangalore

³Associate Professor, Department of Dermatology Shri Atal Bihari Vajpayee Medical College and Research Institute (SABVMCRI), Bangalore

OPEN ACCESS

Corresponding Author:

Dr Tanmayi Komal Kumar

Assistant Professor, Department of Dermatology Shri Atal Bihari Vajpayee Medical College and Research Institute (SABVMCRI), Bangalore

Received: 10-06-2026

Accepted: 15-07-2026

Available online: 19-07-2026

ABSTRACT

Background: Antiretroviral therapy (ART) has significantly improved the survival and quality of life of people living with HIV (PLHIV). However, sustained treatment success depends on optimal medication adherence, which may be influenced by several sociodemographic, clinical, and psychosocial factors, including HIV-related stigma. This study assessed ART adherence, HIV-related stigma, and factors associated with adherence among PLHIV attending a tertiary care centre.

Methods: A hospital-based cross-sectional study was conducted among 320 PLHIV receiving ART at a tertiary care centre between August and October 2022. Data were collected using a structured questionnaire. ART adherence was assessed using the Medication Adherence Rating Scale (MARS), while HIV-related stigma was measured using the 12-item HIV Stigma Scale. Descriptive statistics were used to summarize the data. Associations between categorical variables were analysed using the Chi-square test, mean differences were compared using analysis of variance (ANOVA), and correlations between adherence and stigma scores were assessed using Pearson's correlation coefficient.

Results: Of the 320 participants, 268 (83.8%) were adherent to ART according to the MARS scoring system. ART-related adverse effects ($p = 0.030$), health status before ART initiation ($p = 0.014$), and health status following ART initiation ($p = 0.016$) were significantly associated with adherence. Participants experiencing higher levels of personalised stigma and negative self-image demonstrated significantly lower adherence scores. Although disclosure concerns and concerns regarding public attitudes contributed substantially to overall stigma, these domains were not significantly correlated with adherence.

Conclusions: ART adherence was high among the study population; however, HIV-related stigma and treatment-related factors remained important barriers to optimal adherence. Interventions focusing on stigma reduction, early identification and management of treatment-related adverse effects, and individualized adherence counselling may further improve long-term treatment outcomes among PLHIV.

Keywords: HIV, Antiretroviral therapy, Medication adherence, HIV stigma
People living with HIV Cross-sectional study India.

Copyright © International Journal of
Medical and Pharmaceutical Research

INTRODUCTION

Human immunodeficiency virus (HIV) infection continues to be one of the most significant public health challenges worldwide despite remarkable advances in prevention, diagnosis, and treatment. Over the past two decades, the widespread availability of antiretroviral therapy (ART) has transformed HIV infection from a uniformly fatal disease into a manageable chronic condition, resulting in substantial reductions in HIV-related morbidity and mortality. Improved access to ART has enabled people living with HIV (PLHIV) to achieve near-normal life expectancy when treatment is initiated early and maintained consistently. Consequently, the focus of HIV care has gradually shifted from short-term survival to long-term disease control, sustained viral suppression, quality of life, and prevention of HIV transmission.²

The effectiveness of ART depends not only on its availability but also on optimal adherence to treatment. Medication adherence has been defined by the World Health Organization as the extent to which an individual's behaviour corresponds with agreed recommendations from a healthcare provider.¹ Among PLHIV, adherence to ART remains the cornerstone of successful HIV management. High levels of adherence are associated with durable viral suppression, immune reconstitution, reduced incidence of opportunistic infections, lower rates of hospitalization, improved quality of life, and decreased HIV transmission.³ Conversely, poor adherence compromises treatment effectiveness, increases the risk of virological failure, accelerates disease progression, promotes the emergence of antiretroviral drug resistance, and limits future therapeutic options.⁴ Sustained adherence is therefore essential not only for improving individual patient outcomes but also for achieving broader public health goals aimed at controlling the HIV epidemic.

Although remarkable progress has been made in expanding ART coverage globally, maintaining long-term adherence remains a considerable challenge. Adherence is a complex behaviour influenced by a multitude of interacting factors, including sociodemographic characteristics, treatment-related issues, health system factors, psychological well-being, social support, and economic circumstances. Forgetfulness, medication-related adverse effects, pill burden, complex dosing schedules, poor understanding of treatment, depression, substance use, financial constraints, and inadequate access to healthcare services have all been reported to adversely influence adherence.^{7,8} The relative importance of these determinants varies across different populations and healthcare settings, highlighting the need for context-specific evidence to guide interventions.

Among the numerous barriers to optimal adherence, HIV-related stigma remains one of the most persistent and challenging. HIV-related stigma is a socially constructed phenomenon characterized by prejudice, stereotyping, discrimination, and social exclusion directed towards PLHIV.⁵ Despite substantial improvements in public awareness regarding HIV infection, stigma continues to affect PLHIV across healthcare settings, workplaces, educational institutions, families, and communities. Fear of disclosure, anticipated discrimination, social isolation, and internalized negative beliefs frequently discourage individuals from seeking healthcare, disclosing their HIV status, and adhering consistently to lifelong treatment.^{9,10} Consequently, HIV-related stigma has emerged as a major psychosocial determinant of health outcomes among PLHIV.

MATERIALS AND METHODS

Study design and setting

A hospital-based cross-sectional observational study was conducted at the Antiretroviral Therapy (ART) Centre of a tertiary care teaching hospital.

Study participants

The study included adult people living with HIV (PLHIV) attending the ART centre during the study period. Individuals aged 18 years and above, receiving ART for at least three months, and willing to provide written informed consent were included in the study.

Participants younger than 18 years of age and those with mental illness or cognitive impairment that precluded participation in the interview were excluded.

Sample size

The sample size was calculated using the formula for estimation of a single population proportion:

$$n = \frac{Z^2 \times p \times (1 - p)}{d^2}$$

Where:

n	=		required	sample	size
Z	=	1.96	(95%	confidence	level)
p	=	0.833	(expected	ART	adherence)
d	=	0.05	(absolute		precision)

Substituting the values:

$$\frac{n}{n} = \frac{(1.96^2 \times 0.833 \times 0.167)}{0.05^2} = 213.6$$

Considering design requirements and to ensure adequate power, a final sample size of 320 participants was included.

$$n = \frac{Z^2pq}{d^2}$$

Based on a reported ART adherence rate of 83.3% from a previous Indian study, a confidence level of 95%, and an absolute precision of 5%, the minimum required sample size was calculated to be 320 participants. Simple random sampling was used to recruit eligible participants.

Data collection

Data were collected using a structured interviewer-administered questionnaire after obtaining written informed consent from all participants.

The questionnaire was pilot-tested among 20 PLHIV prior to commencement of the study to assess clarity and feasibility. Necessary modifications were made before final administration. Each interview lasted approximately 5–10 minutes. Confidentiality and anonymity of the participants were maintained throughout the study.

Study instruments

Assessment of ART adherence

Medication adherence was assessed using the Medication Adherence Rating Scale (MARS) developed by Thompson *et al.*²⁰

The MARS consists of ten dichotomous (Yes/No) items assessing medication-taking behaviour, attitudes towards medication, and perceived adverse effects. Responses were scored according to the original scoring system, with total scores ranging from 0 to 10. A score of ≥ 8 was considered indicative of good adherence.

Assessment of HIV-related stigma

HIV-related stigma was assessed using the 12-item Short HIV Stigma Scale developed by Reinius *et al.*¹⁸ and adapted from the original Berger HIV Stigma Scale.¹⁷

The questionnaire evaluates four domains:

- Personalized stigma
- Disclosure concerns
- Concerns regarding public attitudes
- Negative self-image

Each domain comprises three items scored on a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). Higher scores indicate greater perceived HIV-related stigma.

Assessment of factors associated with ART adherence

Information regarding sociodemographic characteristics, clinical profile, treatment-related variables, and adherence-related practices was collected using a structured questionnaire. Participants were also asked about perceived barriers to ART adherence and strategies that could improve long-term adherence.

Outcome measures

The primary outcome was ART adherence as measured using the MARS.

Secondary outcomes included HIV-related stigma scores and factors associated with ART adherence, including sociodemographic, clinical, and treatment-related characteristics.

Statistical analysis

Data were entered into Microsoft Excel and analysed using IBM Statistical Package for the Social Sciences (SPSS) version 26.0.

Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages.

Associations between categorical variables were analysed using the Chi-square test. Differences in mean stigma scores were compared using one-way analysis of variance (ANOVA). Pearson's correlation coefficient was used to assess the relationship between ART adherence and HIV-related stigma scores.

A p value of <0.05 was considered statistically significant.

Ethical considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrolment in the study.

RESULTS

A total of 320 people living with HIV (PLHIV) receiving antiretroviral therapy (ART) were included in the study. Participants ranged in age from 18 to 78 years, with the largest proportion belonging to the 41–50-year age group (34.7%). Of the study population, 189 (59.1%) were female, 130 (40.6%) were male, and one participant (0.3%) identified as transgender. Most participants were married (55.0%), resided within 30 km of the ART centre (85.9%), and lived with their family or a companion (88.7%). The sociodemographic characteristics of the participants and their adherence status are summarized in Table 1.

Table 1. Baseline sociodemographic characteristics and ART adherence among the study participants

Variable	Category	Total n (%)	Adherent	Non-adherent	P value
Age group	<30	42 (13.1)	36	6	
	31–40	92 (28.8)	77	15	
	41–50	111 (34.7)	91	20	
	51–60	57 (17.8)	48	9	
	61–70	16 (5.0)	14	2	
	71–80	2 (0.6)	2	0	0.992
Gender	Female	189 (59.1)	159	30	
	Male	130 (40.6)	109	21	
	Transgender	1 (0.3)	0	1	0.217
Education	Illiterate	67 (20.9)	56	11	
	Below 10th	101 (31.6)	81	20	
	10th pass	96 (30.0)	82	14	
	University	56 (17.5)	49	7	0.658

The mean Medication Adherence Rating Scale (MARS) score was 8.65 ± 1.34 (range: 3–10). Based on the predefined MARS cut-off score of ≥ 8 , 268 participants (83.8%) were classified as adherent to ART, while 52 (16.2%) were classified as non-adherent. None of the assessed sociodemographic variables, including age, gender, educational status, employment status, marital status, personal habits, distance from the ART centre, or living arrangement, demonstrated a statistically significant association with ART adherence (all $p > 0.05$).

Clinical and treatment-related characteristics of the study participants are presented in Table 2. The majority of participants (58.8%) had been receiving ART for more than five years, and 81.3% were receiving the tenofovir–lamivudine–dolutegravir (TLD) regimen. Monthly drug dispensation was the most common practice (71.6%), while almost all participants (99.4%) reported clarity regarding their ART regimen. Although opportunistic infections were more frequently observed among non-adherent participants, this association did not reach statistical significance ($p = 0.056$).

Patients reporting ART-related adverse effects demonstrated significantly lower adherence than those without adverse effects ($p = 0.030$). Similarly, health status before initiation of ART ($p = 0.014$) and perceived health status after initiating ART ($p = 0.016$) were significantly associated with medication adherence. Participants whose health worsened after commencing ART exhibited comparatively lower adherence than those reporting stable or improved health. No significant association was observed between adherence and ART regimen, duration of therapy, drug dispensation schedule, or clarity regarding the treatment regimen.

Table 2. Clinical and treatment-related factors associated with ART adherence

Variable	Category	Total	Adherent	Non-adherent	P value
ART regimen	TLD	260	228	32	
	Others	60	40	20	
Drug dispensation	Monthly	229	199	44	
	Every 2 months	41	23	4	
	Every 3 months	50	46	4	0.206
Side effects	Yes	79	59	20	
	No	241	209	32	0.030

Health before ART	Recurrent infections	171	135	36	
	Normal	80	73	7	
	Diagnosed on blood check	32	25	7	
	TB	37	35	2	0.014

Forgetfulness was reported by 53.1% of participants, although it was not significantly associated with adherence ($p = 0.254$). The majority of participants (92.8%) had disclosed their HIV status to at least one family member, while fewer had disclosed to friends or had not disclosed their status to anyone. Self-reminders constituted the most frequently reported strategy for improving adherence (98.4%), followed by alarm reminders and support from family or friends. Although only two participants reported using weekly pill organizers, both were adherent to ART. Details regarding adherence-related behaviours and participant-reported intervention strategies are shown in Table 3.

Table 3. Adherence characteristics and participant-reported interventions

Variable	Category	Total	Adherent	Non-adherent	P value / %
Forgetfulness	Yes	170	128	42	
	No	150	140	10	0.254
Intervention	Self-reminder	315	264	51	83.8%
	Alarm reminders	37	31	6	83.7%
	Pill organizer	2	2	0	100%

Assessment of HIV-related stigma demonstrated several significant associations. Negative self-image differed significantly across age groups ($p = 0.004$), with participants aged 41–50 years reporting the highest scores. Educational status showed a significant association with disclosure concerns ($p = 0.010$). Participants with a history of tuberculosis before initiating ART demonstrated higher negative self-image scores ($p = 0.021$). Furthermore, perceived health after initiation of ART was significantly associated with personalized stigma ($p = 0.013$) and disclosure concerns ($p = 0.017$). Participants reporting forgetfulness also demonstrated significantly higher personalized stigma scores ($p = 0.021$). These significant associations are summarized in Table 4.

Table 4. Significant factors associated with HIV-related stigma

Factor	Stigma domain	P value
Age	Negative self-image	0.004
Education	Disclosure concerns	0.010
Health before ART	Negative self-image	0.021
Health after ART	Personalized stigma	0.013
Health after ART	Disclosure concerns	0.017
Forgetfulness	Personalized stigma	0.021

Pearson's correlation analysis demonstrated an inverse relationship between HIV-related stigma and medication adherence. Personalized stigma showed a significant negative correlation with adherence ($r = -0.252$, $p < 0.001$), indicating that higher personalized stigma was associated with lower adherence. Negative self-image also demonstrated a weak but statistically significant negative correlation with adherence ($r = -0.124$, $p = 0.026$). In contrast, disclosure concerns, concerns regarding public attitudes, and the overall stigma score did not show statistically significant correlations with adherence. Correlation coefficients between stigma domains and ART adherence are presented in Table 5.

Table 5. Correlation between stigma domains and ART adherence

Domain	Pearson r	P value
Personalized stigma	-0.252	<0.001
Disclosure concerns	-0.054	0.340
Public attitudes	-0.004	0.936
Negative self-image	-0.124	0.026
Overall stigma	-0.085*	0.129

DISCUSSION

The present study evaluated antiretroviral therapy (ART) adherence, HIV-related stigma, and factors associated with medication adherence among people living with HIV (PLHIV) attending a tertiary care ART centre. Overall, ART adherence was high, with more than four-fifths of participants achieving good adherence according to the Medication Adherence Rating Scale (MARS). Although sociodemographic characteristics were not significantly associated with

adherence, treatment-related factors, particularly ART-related adverse effects and perceived health status before and after ART initiation, demonstrated significant associations. Furthermore, specific domains of HIV-related stigma, namely personalized stigma and negative self-image, were significantly associated with lower adherence, highlighting the continuing influence of psychosocial factors on long-term HIV care.

The overall ART adherence rate of 83.8% observed in the present study is comparable to findings reported in several studies from India and other low- and middle-income countries. Khede et al. (2021) reported a similar adherence rate among PLHIV receiving ART in central India, while Banagi Yathiraj et al. (2016) also demonstrated satisfactory adherence among patients attending ART centres in South India. Similar adherence rates have been reported internationally by Hansana et al. (2013) and Sianturi et al. (2019), suggesting that structured ART programmes, simplified treatment regimens, and improved accessibility to medications have substantially enhanced treatment adherence over the past decade. Nevertheless, approximately one-sixth of participants in the present study remained non-adherent, emphasizing that achieving universal optimal adherence continues to be a challenge.

Interestingly, none of the sociodemographic variables, including age, sex, educational status, marital status, employment status, distance from the ART centre, or living arrangements, showed a statistically significant association with ART adherence. Similar observations have been reported by Tran et al. (2013), who found that adherence was influenced more strongly by treatment-related and psychosocial factors than by demographic characteristics. These findings suggest that improvements in ART service delivery, patient education, and counselling may have reduced disparities in adherence across demographic groups. However, conflicting evidence exists in the literature, with several studies reporting lower adherence among younger individuals, those with lower educational attainment, or individuals experiencing socioeconomic disadvantage. Such inconsistencies may reflect differences in study populations, healthcare systems, cultural contexts, and methods used to assess adherence.

Among the treatment-related variables, participants experiencing ART-related adverse effects demonstrated significantly lower adherence. Medication-related adverse effects remain one of the most frequently reported barriers to long-term ART adherence, as unpleasant symptoms may discourage patients from taking medications consistently or lead to intentional treatment interruption. Similar findings have been reported by Khede et al. (2021) and Sahoo et al. (2020), both of whom identified adverse drug reactions as an important determinant of poor adherence. These findings underscore the importance of early identification and prompt management of treatment-related adverse effects through regular follow-up, patient education, and timely modification of treatment regimens when clinically indicated.

Perceived health status before and after initiation of ART also demonstrated significant associations with adherence. Participants reporting poorer health before treatment initiation or worsening health after commencing ART were less likely to demonstrate optimal adherence. This finding may indicate that patients experiencing persistent illness or inadequate clinical improvement are more likely to become discouraged, resulting in reduced treatment motivation. Conversely, individuals who experience symptomatic improvement following ART initiation may become increasingly motivated to continue treatment because they perceive clear clinical benefits. Similar observations have been reported by Palepu et al. (2004), who demonstrated that perceived health status influences long-term medication adherence among PLHIV. These findings highlight the importance of counselling patients regarding realistic treatment expectations and emphasizing that clinical improvement may require sustained adherence over time.

Although opportunistic infections were more frequently observed among non-adherent participants, the association did not reach statistical significance. Likewise, ART regimen, duration of therapy, and drug dispensation schedule were not significantly associated with adherence. The absence of significant associations may reflect the widespread use of simplified, once-daily dolutegravir-based regimens within the study population. More than 80% of participants were receiving the tenofovir–lamivudine–dolutegravir (TLD) regimen, which has been associated with improved tolerability, reduced pill burden, and higher adherence rates compared with older multidrug regimens. The relatively homogeneous treatment profile of the study population may therefore have minimized differences attributable to regimen characteristics. Forgetfulness was the most commonly reported barrier to medication adherence, affecting more than half of the participants, although the association with adherence was not statistically significant. This finding is consistent with previous studies identifying forgetfulness as one of the most frequently reported reasons for missed doses. Importantly, nearly all participants reported using self-reminders to improve medication adherence, while a smaller proportion relied on alarm reminders or family support. These findings suggest that simple behavioural interventions remain acceptable and widely practiced among PLHIV and may contribute to sustaining high adherence levels in routine clinical practice.

A major finding of the present study was the significant inverse association between specific domains of HIV-related stigma and ART adherence. Among the four stigma domains assessed, personalized stigma demonstrated the strongest negative correlation with adherence, while negative self-image also showed a weaker but statistically significant negative correlation. In contrast, disclosure concerns, concerns regarding public attitudes, and the overall stigma score were not significantly associated with adherence. These findings suggest that internal experiences of stigma may exert a greater influence on medication-taking behaviour than perceived societal attitudes alone.

Personalized stigma reflects an individual's perception of discrimination, rejection, and differential treatment because of their HIV status. Participants reporting higher levels of personalized stigma were significantly less adherent to ART, indicating that experiences or anticipation of discrimination may discourage regular engagement with HIV care. Fear of being recognized while attending ART clinics, collecting medications, or taking tablets in the presence of others may lead patients to skip doses or avoid healthcare services altogether. Similar findings have been reported by Berger et al. (2001), who identified personalized stigma as one of the principal components influencing the psychosocial well-being of PLHIV, and by Reinius et al. (2018), whose abbreviated HIV Stigma Scale demonstrated that personalized stigma remains an important determinant of HIV-related outcomes across diverse settings. Comparable associations between stigma and poor treatment adherence have also been described by Mbonye et al. (2013), reinforcing the importance of addressing stigma as part of comprehensive HIV care.

Negative self-image was also significantly associated with lower adherence. Internalized stigma often manifests as feelings of guilt, shame, worthlessness, or self-blame following an HIV diagnosis. Such psychological distress may reduce motivation to maintain lifelong treatment and negatively affect interactions with healthcare providers. Similar observations have been reported by Eller et al. (2013), who demonstrated that internalized stigma adversely affected psychological health and medication adherence among PLHIV. The findings of the present study further support the growing body of evidence that interventions addressing mental health and self-perception should complement conventional adherence counselling.

Interestingly, disclosure concerns and concerns regarding public attitudes were not significantly correlated with medication adherence despite contributing substantially to the overall stigma experienced by participants. One possible explanation is that although participants remained concerned about disclosing their HIV status or anticipated negative societal attitudes, these concerns did not necessarily translate into missed medication doses. More than 90% of participants in the present study had disclosed their HIV status to at least one family member, suggesting that the availability of family support may have mitigated the adverse impact of disclosure-related anxiety on adherence. Similar observations have been reported in some Indian studies, where family support has been shown to improve treatment continuity despite persistent community stigma. These findings emphasize that different dimensions of stigma may influence health behaviours differently and should therefore be addressed individually rather than as a single construct.

The study also identified several factors associated with HIV-related stigma. Negative self-image varied significantly across age groups, with middle-aged participants reporting comparatively higher scores. Educational status was associated with disclosure concerns, suggesting that differences in health literacy, awareness, and social circumstances may influence willingness to disclose HIV status. Participants with a previous history of tuberculosis exhibited significantly higher negative self-image scores, possibly reflecting the compounded psychological burden associated with coexisting illnesses and previous experiences of illness-related discrimination. Furthermore, participants who perceived poorer health following initiation of ART reported significantly greater personalized stigma and disclosure concerns, indicating that continued ill health may reinforce feelings of vulnerability and social isolation.

An additional finding was the association between forgetfulness and personalized stigma. Participants reporting forgetfulness demonstrated significantly higher personalized stigma scores, suggesting that stigma may indirectly contribute to non-adherence by disrupting medication-taking routines. Individuals concerned about being identified as living with HIV may intentionally avoid carrying medicines, taking doses in public, or setting visible reminders, thereby increasing the likelihood of missed doses. This observation highlights the complex interaction between psychological and behavioural factors influencing long-term adherence.

From a clinical perspective, the findings of this study reinforce the importance of adopting a holistic approach to HIV care. Although pharmacological advances have simplified ART regimens and improved overall adherence, psychosocial barriers continue to influence treatment success. Routine assessment of HIV-related stigma, particularly personalized stigma and internalized negative self-image, should be incorporated into clinical practice alongside adherence monitoring. Healthcare providers should provide individualized counselling, proactively identify treatment-related adverse effects, and facilitate access to psychological support services when required. Strengthening family involvement, peer-support programmes, community education initiatives, and stigma-reduction interventions may further improve long-term treatment adherence and quality of life among PLHIV.

Strengths

The present study has several strengths. It simultaneously evaluated ART adherence, HIV-related stigma, and treatment-related factors using validated instruments, providing a comprehensive assessment of determinants influencing long-term HIV care. The use of the Medication Adherence Rating Scale (MARS) and the 12-item HIV Stigma Scale ensured standardized measurement of the primary study variables. Furthermore, the inclusion of a relatively large sample of 320 PLHIV attending a tertiary care ART centre enhanced the reliability of the findings and allowed evaluation of multiple sociodemographic, clinical, and psychosocial factors associated with adherence. By assessing individual stigma domains

rather than overall stigma alone, the study also provides insights into specific psychosocial factors that may be targeted through future interventions.

Limitations

The findings of this study should be interpreted in light of certain limitations. First, the cross-sectional design precludes the establishment of causal relationships between HIV-related stigma and ART adherence. Second, adherence was assessed using a self-reported questionnaire, which may be influenced by recall bias and social desirability bias, potentially resulting in overestimation of adherence. Third, the study was conducted at a single tertiary care ART centre, which may limit the generalizability of the findings to other healthcare settings or regions. In addition, virological outcomes such as viral load suppression and CD4 cell counts were not incorporated into the assessment of treatment success. Future multicentre longitudinal studies integrating objective adherence measures and clinical outcomes are warranted to better understand the dynamic relationship between stigma and long-term ART adherence.

REFERENCES

1. Alemu, K. (2013). Adherence to highly active antiretroviral therapy and predictors of non-adherence among pediatrics attending Ambo Hospital ART Clinic, West Ethiopia. *Journal of HIV/AIDS and Infectious Diseases*.
2. Banagi Yathiraj, A., Unnikrishnan, B., Ramapuram, J. T., Kumar, N., Mithra, P., Kulkarni, V., et al. (2016). 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*, 15(6), 529–533.
3. Berger, B. E., Ferrans, C. E., & Lashley, F. R. (2001). Measuring stigma in people with HIV: Psychometric assessment of the HIV Stigma Scale. *Research in Nursing & Health*, 24(6), 518–529.
4. Eller, L. S., Rivero-Mendez, M., Voss, J., Chen, W. T., Chaiphibalsarisdi, P., Ipinge, S., et al. (2013). Depressive symptoms, self-esteem, HIV symptom management self-efficacy and self-compassion in people living with HIV. *AIDS Care*, 26(7), 795–803.
5. Hansana, V., Sanchaisuriya, P., Durham, J., Sychareun, V., Chaleunvong, K., Boonyaleepun, S., et al. (2013). Adherence to antiretroviral therapy among people living with HIV in Lao PDR. *BMC Public Health*, 13, 617.
6. Heylen, E., Chandy, S., Shamsundar, R., Nair, S., Ravi Kumar, B. N., & Ekstrand, M. L. (2020). Correlates of and barriers to ART adherence among adherence-challenged people living with HIV in southern India. *AIDS Care*.
7. Joshi, B., Chauhan, S., Pasi, A., Kulkarni, R., Sunil, N., Bachani, D., et al. (2014). Level of suboptimal adherence to first-line antiretroviral treatment and its determinants among HIV-positive people in India. *The Indian Journal of Medical Research*, 140(1), 84–95.
8. Khede, M., Parija, P., Madhukar, M., & Bhinjwar, S. (2021). Determinants of adherence to antiretroviral therapy among people living with HIV/AIDS in Chhattisgarh, India. *International Journal of Community Medicine and Public Health*, 9(1), 282.
9. Kuritzkes, D. (2004). Preventing and managing antiretroviral drug resistance. *AIDS Patient Care and STDs*, 18(5), 259–273.
10. Mbonye, M., Nakamanya, S., Birungi, J., King, R., Seeley, J., & Jaffar, S. (2013). Stigma trajectories among people living with HIV embarking on a lifetime journey with antiretroviral drugs in Jinja, Uganda. *BMC Public Health*, 13, 804.
11. National AIDS Control Organization. (2023). HIV facts and figures. <https://naco.gov.in/hiv-facts-figures>
12. Owie, G., Olotu, S., & James, B. (2018). Reliability and validity of the Medication Adherence Rating Scale in a cohort of patients with schizophrenia from Nigeria. *Trends in Psychiatry and Psychotherapy*, 40(2), 85–92.
13. Palepu, S., Bandyopadhyay, A., Chaurasia, R., & Yadav, R. (2019). A study of adherence to antiretroviral therapy in a tertiary care hospital at Allahabad, India. *Indian Journal of Sexually Transmitted Diseases and AIDS*, 40(1), 46–50.
14. Patel, A., Patel, R., Pandya, A., Patel, K., & Malhotra, S. (2021). Assessment of self-reported adherence to ART and patients' virological/CD4 response in a tertiary care clinic and government free ART clinic. *Indian Journal of Sexually Transmitted Diseases and AIDS*, 42(1), 62–67.
15. Reinius, M., Wettergren, L., Wiklander, M., Svedhem, V., Ekström, A. M., & Eriksson, L. E. (2017). Development of a 12-item short version of the HIV Stigma Scale. *Health and Quality of Life Outcomes*, 15, 115.
16. Sahoo, S., Khanna, P., Verma, R., Verma, M., Mahapatra, S., Parija, P., et al. (2020). Social stigma and its determinants among people living with HIV/AIDS: A cross-sectional study at an ART center in North India. *Journal of Family Medicine and Primary Care*, 9(11), 5646–5652.
17. Sianturi, E. I., Perwitasari, D. A., Islam, M. A., & Taxis, K. (2019). The association between ethnicity, stigma, beliefs about medicines and adherence in people living with HIV in a rural area in Indonesia. *BMC Public Health*, 19, 55.
18. Steward, W. T., Herek, G. M., Ramakrishna, J., Bharat, S., Chandy, S., Wrubel, J., et al. (2008). HIV-related stigma: Adapting a theoretical framework for use in India. *Social Science & Medicine*, 67(8), 1225–1235.
19. Thompson, K., Kulkarni, J., & Sergejew, A. A. (2000). Reliability and validity of a new Medication Adherence Rating Scale (MARS) for the psychoses. *Schizophrenia Research*, 42(3), 241–247.

20. Tran, B. X., Fleming, M., Do, H. P., Nguyen, L. H., & Latkin, C. A. (2018). Quality of life improvement, social stigma and antiretroviral treatment adherence: Implications for long-term HIV/AIDS care. *AIDS Care*, 30(12), 1524–1531.
21. World Health Organization. (2003). Adherence to long-term therapies: Evidence for action. World Health Organization.
22. World Health Organization. (2021). Consolidated guidelines on HIV prevention, testing, treatment, service delivery and monitoring: Recommendations for a public health approach. World Health Organization.
23. Yuvaraj, A., Mahendra, V. S., Chakrapani, V., Yuniastuti, E., Santella, A. J., Ranauta, A., et al. (2020). HIV and stigma in the healthcare setting. *Oral Diseases*, 26(Suppl. 1), 103–111.