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The Relationship Between ARV Therapy Adherence And Clinical Outcomes in HIV Patients at Dr Moewardi Hospital

Putri Eka Prasetya[1]*, Niken Luthfiyanti[1], Vivin Marwiyati Rohmana[1], Angelina da Costa Fernandes[2]
[1]Departement of Pharmacy, Faculty of Health Sciences, Universitas Duta Bangsa Surakarta, Indonesia
[2]Instituto Superior Cristal Dili, Timor Leste
** Corresponding author: Putriekaprasetia843@gmail.com*

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ABSTRACT

Background: Human immunodeficiency virus (HIV) remains a major global public health problem with the number of people living with HIV continuing to increase, including in Indonesia. Antiretroviral therapy (ART) is the main treatment to suppress viral replication and improve immune function, however its success is highly dependent on patient adherence. **Objective:** This study aimed to determine the level of adherence to ART, evaluate clinical outcomes and analyze the relationship between ART adherence and clinical outcomes among HIV patients at Dr. Moewardi Hospital. **Methods:** This study employed a quantitative analytical design with a cross-sectional approach. A total of 83 patients (n=83) undergoing ART were included in this study. Data were collected using the Morisky Medication Adherence Scale (MMAS-8) and medical records. Data analysis was performed using univariate and bivariate methods. **Results:** The majority of patients demonstrated high adherence to ART (60.2%), followed by moderate adherence (34.9%) and low adherence (4.8%). Most patients achieved favorable clinical outcome with 89.2% having undetectable viral load and 10.8% having detectable viral load. CD4 levels were categorized as good (51.8%), very good (33.7%) and poor (14.5%). Bivariate analysis showed a significant relationship between ARV adherence and CD4 outcomes ($p = 0.007$) as well as viral load outcomes ($p < 0.000$). **Conclusion:** There is a significant relationship between ART adherence and clinical outcomes in HIV patients. Higher adherence is associated with improved CD4 levels and viral load suppression.

Keywords: ART adherence, CD4, Clinical outcomes, HIV, Viral load

INTRODUCTION

Human immunodeficiency virus (HIV) remains one of the world's major public health problems. According to the World Health Organization (WHO, 2025), approximately 40.8 million individuals worldwide are living with HIV, and more than 630,000 people died from HIV-related illnesses in 2023. Although Africa remains the region with the highest prevalence, Southeast Asia, including Indonesia has also experienced an increasing number of cases. The Joint United Nations Programme on HIV/AIDS (UNAIDS, 2025) aims to end the HIV/AIDS epidemic by 2030 through the Sustainable Development Goals (SDGs), which emphasize universal access to prevention, diagnosis, and treatment. However, HIV remains a leading cause of death in low- and middle-income countries.

In Indonesia, the number of people living with HIV/AIDS (PLHIV) continues to increase. Based on a report from the Indonesian Ministry of Health (Kemenkes RI, 2025) more than 564,000 PLHIV have been recorded. Central Java is among the provinces with a high number of HIV cases, particularly in urban areas such as Surakarta. Data from the Central Java Provincial Health Office reported 22,410 PLHIV cases with 3,028 new cases between January and June 2025 (Dinkes, 2025). Despite the expansion of antiretroviral therapy (ART) programs, achieving optimal clinical outcomes remains a challenge.

Antiretroviral therapy (ART) is the primary treatment for HIV infection, aiming to suppress viral replication and improve immune system function. Previous studies have shown that patients with adherence levels above 95% have significantly higher viral suppression rates and increased CD4 counts

compared to those with lower adherence (Legesse & Reta, 2019). In addition, a narrative review reported that although access to ARV therapy in Indonesia continues to expand, treatment success is still highly dependent on patient adherence and monitoring of clinical (Jocelyn *et al*., 2024)

Adherence to ART is influenced by various factors, including social support, patient knowledge and demographic characteristics. Studies in Indonesia have shown that family support, relationships with healthcare workers and stigma significantly affect adherence levels among HIV patients (Wulandari *et al*., 2024). Other studies also indicate that demographic factors such as education level are associated with adherence, where patients with lower education level are associated with adherence, where patients with lower education tend to have a higher risk of non-adherence (Putra *et al*., 2023). Furthermore, research at Dr. Moewardi Regional General Hospital found that patients with better knowledge levels had significantly higher adherence to ARV therapy (Soemijarto *et al*., 2024).

Despite extensive research on factors influencing adherence, there is still limited evidence that directly examines the relationship between adherence levels and clinical outcomes, particulary CD4 count and viral load in a specific local context such as referral hospitals in Central Java. Most previous studies focus primarily on determinants of adherence rather than linking adherence levels with measurable clinical outcomes.

Dr. Moewardi General Hospital was selected as the research location because it is a major referral hospital in the Surakarta area, providing comprehensive HIV/AIDS services and serving patients from various regions in Central Java. This study offers novelty by integrating adherence measurement using the Morisky Medication Adherence Scale (MMAS-8) with clinical outcome indicarors, namely CD4 count and viral load in a single analysis, thereby providing a more comprehensive understanding of treatment success.

MATERIALS AND METHOD

Materials

This study involved HIV patients undergoing antiretroviral therapy (ART) at Dr. Moewardi General Hospital in Surakarta. The materials used consisted of primary and secondary data. Primary data were collected using structured questionnaires, including the Morisky Medication Adherence Scale (MMAS-8) to assess medication adherence, along with additional question on demographic characteristics. Secondary data were obtained from patient medical records, including CD4 count and viral load as indicators of clinical outcomes. Ethical approval was formally granted by the Health Research Ethics Committee (HREC) of Dr. Moewardi General Hospital, Surakarta, Indonesia (Ethical Approval No. 2.470/XI/HREC/2025).

Methods

This study employed a quantitative analytical approach with a cross-sectional design. The study was conducted at Dr. Moewardi General Hospital in Surakarta from December 2025 to January 2026. The study population consisted of all HIV outpatients undergoing ART registered at Voluntary Counseling and Testing (VCT) clinical. The sampling technique used was purposive sampling based on predefined inclusion and exclusion criteria. The sample size was calculated using the Slovin formula.

1. **Sample Criteria**
   Inclusion Criteria : HIV patients aged 18-65 years**,** Undergoing ART and having CD4 and viral load records**,** Willing to participate and sign informed consent, Outpatient
2. **Operational Definitions of Variables**
   Adherence level: measured using the MMAS-8 questionnaire and categorized into: High adherence (score =8), Medium adherence (score 6-7), Low adherence (score < 6), CD4: Low: 200 cells/mm^3, Moderate: 200-499 cells/mm^3. High: ≥500 cells/mm^3, Viral load : Suppressed: < 200 copies/mL, Unsuppressed: ≥ 200 copies/mL.
3. **Instrument Validity**
   Medication adherence was measured using the Morisky Medication Adherence Scale (MMAS-8), a validated instrument widely used to assess adherence in patients with chronic diseases (Morisky *et al*., 2008). In addition, a self-developed questionnaire was used to assess factors influencing adherence, including family support, the role of healthcare workers, and patient motivation. Prior to data collection, the validity and reliability of the self-developed questionnaire were tested. The validity test was conducted using the item-total correlation method, where each item score was

correlated with the total score. An item was considered valid if the correlation coefficient was greater than 0.20 (Murti, 2011). The questionnaire was tested on 30 HIV patients at Dr. Moewardi General Hospital. The reliability test was performed using Cronbach's Alpha to assess internal consistency. A Cronbach's Alpha value greater than 0.60 indicates acceptable reliability, while values above 0.70 indicate good reliability (Murti, 2011).

4. Data Collection Techniques

Data collection was conducted after obtaining ethical clearance and institutional permission. Respondents who met the inclusion criteria were recruited, and informed consent was obtained. Questionnaires were administered directly to respondents, while clinical data (CD4 and viral load) were extracted from medical records.

5. Data Analysis

Univariate analysis was conducted to describe the characteristics of respondents and study variables using descriptive statistics, including frequency and percentage distributions (Senjaya et al., 2022). Bivariate analysis was performed to examine the relationship between ART adherence level and clinical outcomes (CD4 count and viral load) using the Chi-square (χ^2) test. A p-value of less than 0.05 was considered statistically significant, indicating a significant relationship between variables (Akbar et al., 2024).

RESULTS

1. Validity and Reliability Test

Table 1. Validity Results of Factors Affecting ARV Therapy in HIV Patients

Item	*Scale mean if item deleted*	*Scale variance if item deleted*	*Corrected item total correlation*	*Cronbach alpha if item deleted*
Family Support 1	7.033	1.620	0.716	0.561
Family Support 2	69.333	2.271	0.117	0.685
Family Support 3	71.000	1.610	0.574	0.591
Family Support 4	69.000	2.369	0	0.688
Family Support 5	70.667	2.271	-0.04	0.74
Family Support 6	71.333	1.637	0.497	0.613
Family Support 7	70.333	1.620	0.716	0.561
Family Support 8	69.333	2.271	0.117	0.685
Family Support 9	70.667	1.857	0.356	0.651
Role of Health Workers 1	47.000	0.424	0.711	0.413
Role of Health Workers 2	47.000	0.631	0.156	0.688
Role of Health Workers 3	46.667	0.506	0.637	0.477
Role of Health Workers 4	47.000	0.424	0.711	0.413
Role of Health Workers 5	46.333	0.792	-0.078	0.708
Role of Health Workers 6	46.000	0.800	0.000	0.661
Motivation for Treatment 1	66.667	2.230	0.121	0.602
Motivation for Treatment 2	66.333	2.240	0.206	0.589
Motivation for Treatment 3	68.000	1.752	0.435	0.520
Motivation for Treatment 4	67.000	2.148	0.162	0.597
Motivation forTreatment 5	69.333	1.720	0.347	0.552
Motivation for Treatment 6	66.667	2.368	-0.059	0.534
Motivation for Treatment 7	66.667	2.023	0.414	0.547
Motivation for Treatment 8	68.667	1.775	0.341	0.552
Motivation for Treatment 9	68.667	1.568	0.547	0.474

Based on Table 1, several items within each variable did not meet validity criteria (corrected item-total correlation > 0.20) and were excluded from further analysis. Valid items retained were Family Support items 1, 3, 6, 7, and 9, Role of Healthcare Professionals items 1, 3, and Motivation for Treatment items 3, 5, 7, 8, and 9.

Table 2. Questionnaire Reliability Test

Questionnaire	*Cronbach's Alpha*	*N of Items*	Information
Family Support	0.831	5	Reliabel
Role of Health Workers	0.890	3	Reliabel
Motivation for Treatment	0.664	5	Reliabel

Table 2 above shows that all variables are reliable, with Cronbach's Alpha values of 0.831 (*family support*), 0.890 (*health professional role*), and 0.664 (*motivation for treatment*), exceeding the minimum threshold of 0.60.

2. Univariate Analysis

a. Respondent Characteristics

1) Gender

Table 3. Gender

Gender	Frequency	Persentase (%)
Male	60	72,3
Female	23	27,7
Total	**83**	**100**

Based on Table 3, most of the respondents were male (72.3%), while women numbered 27.7%.

2) Age

Table 4. Age

Age	Frequency	Persentase (%)
18-25	8	9.6
26-35	22	26.5
36-45	20	24.1
46-55	19	22.9
> 55	14	16.9
Total	**83**	**100**

Based on Table 4, the majority of respondents were in the productive age group of 26–55 years (73.5%), while a smaller proportion were in the younger age group (18–25 years) and the older age group (>55 years).

3) Level of Education

Table 5. Education Level

Education Level	Frequency	Persentase (%)
Did Not Attend School	2	2.4
Elementary School Graduate	1	1.2
Junior High School Graduate	7	8.4
High School Graduate	40	48.2
College Graduate	33	39.8
Total	**83**	**100**

Based on table 5 most respondents had completed at least high school (48.2%) or higher education (39.8%), indicating generally adequate educational background.

4) Employment

Based on table 6 more than half of respondents were private employees (54.2%), followed by unemployed individuals (18.1%) and other occupations.

Table 6. Employment

Employment	Frequency	Persentase (%)
PNS	2	2.4
Private Employee	45	54.2
Trader	5	6.0
Farmer/Laborer	6	7.2
Unemployed	15	18.1
Others	10	12.0
Total	**83**	**100**

5) Duration of Therapy

Table 7. Duration of Therapy

Category	Frequency	Persentase (%)
4 months - 1 year	2	2.4
1 year - 3 years	26	31.3
>3 years	55	66.3
Total	**83**	**100**

Based on table 7, Most respondents had undergone ARV therapy for more than 3 years (66.3%), while only a small proportion had therapy duration below 1 year .

6) Treatment Adherence

Table 8. Questionnaire and Answers on Treatment Adherence

No	Questions	Respondent Answers			
		Yes		No	
		N	%	N	%
1.	Do you sometimes forget to take your medication?	10	12.0	73	88.0
2.	In the past two weeks, have there been days when you did not take your medication?	1	1.2	82	98.8
3.	Have you ever reduced or stopped taking your medication without telling your doctor because you felt that it was making your condition worse?	2	2.4	81	97.6
4.	When traveling, do you sometimes forget to bring your medication?	5	6.0	78	94.0
5.	Did you take your medication yesterday?	2	2.4	81	97.6
6.	When you feel better, have you ever stopped your treatment?	2	2.4	81	97.6
7.	Have you ever felt bothered/bored with your regular medication schedule?	20	24.1	63	75.9
8.	How often do you have difficulty using your medication or taking all of your medication?	4	4.8	79	95.2

Table 8 presents the results of the adherence questionnaire. Overall, the majority of respondents demonstrated good adherence, as indicated by the low proportion of non-adherent responses across various items. The highest proportion of non-compliant behavior was observed in feeling bored with long-term treatment (24.1%), while other indicators such as forgetting to take medication (12.0%), missing a dose in the past two weeks (1.2%), and stopping treatment without medical advice (2.4%) were relatively low.

Table 9. Treatment Adherence

Category	Frequency	Persentase (%)
High	50	60.2
Moderate	29	34.9
Low	4	4.8
Total	**83**	**100**

Table 9 shows that the majority of respondents had high adherence (60.2%), followed by moderate adherence (34.9%) and low adherence (4.8%).

7) Factors Affecting Treatment Adherence

Table 10. Questionnaire on Factors and Responses

No	Questions	Respondent Answers			
		Yes		No	
		N	%	N	%
FAMILY SUPPORT					
1.	The family reminds the patient to take ARV medication on time every day	62	74.7	21	25.3
3.	The family is willing to accompany the patient when they have to see the doctor	56	67.5	27	32.5
6.	The family helps find accurate information about the progress of HIV treatment and care	58	69.9	25	30.1
7.	Family members provide moral support (words of encouragement and motivation) to keep patients optimistic	69	83.1	14	16.9
9.	Family members involve patients in important family decisions	67	80.7	16	19.3
ROLE OF HEALTHCARE WORKERS					
1.	Have you ever felt that the explanations given by healthcare workers were unclear?	10	12.0	73	88.0
3.	Do you feel free to ask healthcare workers questions about your health concerns?	83	100	-	-
4.	Are healthcare workers friendly when serving you?	82	98.8	1	1.2
MOTIVATION FOR TREATMENT					
3.	I have had doubts about the benefits of the treatment I am undergoing.	4	4.8	79	95.2
5.	I try hard to remember to take my medication every day without needing reminders from others	74	89.2	9	10.8
7.	I comply with treatment because I am afraid of being scolded or disappointing my family and partner.	25	30.1	58	69.9
8.	The desire to see my children or loved ones grow up is my main motivation for treatment.	77	92.8	6	7.2
9.	I comply because I am told to by healthcare workers, not because I want to	11	13.3	72	86.7

Table 10 presents respondents' responses regarding factors influencing adherence to treatment, including family support, the role of healthcare providers, and motivation to undergo treatment. Overall, the majority of respondents reported receiving good family support. The highest proportions were found for moral support from family members (83.1%) and involvement in family decision-making (80.7%). However, most respondents reported a lack of support in certain aspects, such as not being reminded to take medication (25.3%) and not being accompanied during visits to healthcare facilities (32.5%). Regarding the role of healthcare providers, respondents generally reported positive experiences. Most respondents stated that healthcare providers provided clear explanations (88.0%), were friendly (98.8%), and allowed patients to ask questions freely (100%).

In terms of motivation for treatment adherence, the majority of respondents demonstrated strong internal motivation. Most respondents reported having no doubts about the benefits of treatment (95.2%) and actively made an effort to remember their medication schedules (89.2%). Furthermore, adherence was largely driven by intrinsic motivation, such as the desire to see loved ones improve (92.8%), rather than external pressure from family or healthcare provider.

Figure 1 shows that motivation for treatment was the most dominant factor, with 88.0% categorized as good, followed by the role of healthcare workers (86.7%) and family support (72.3%). However, family support also had the highest proportion in the poor category (19.3%) compared to other variables.

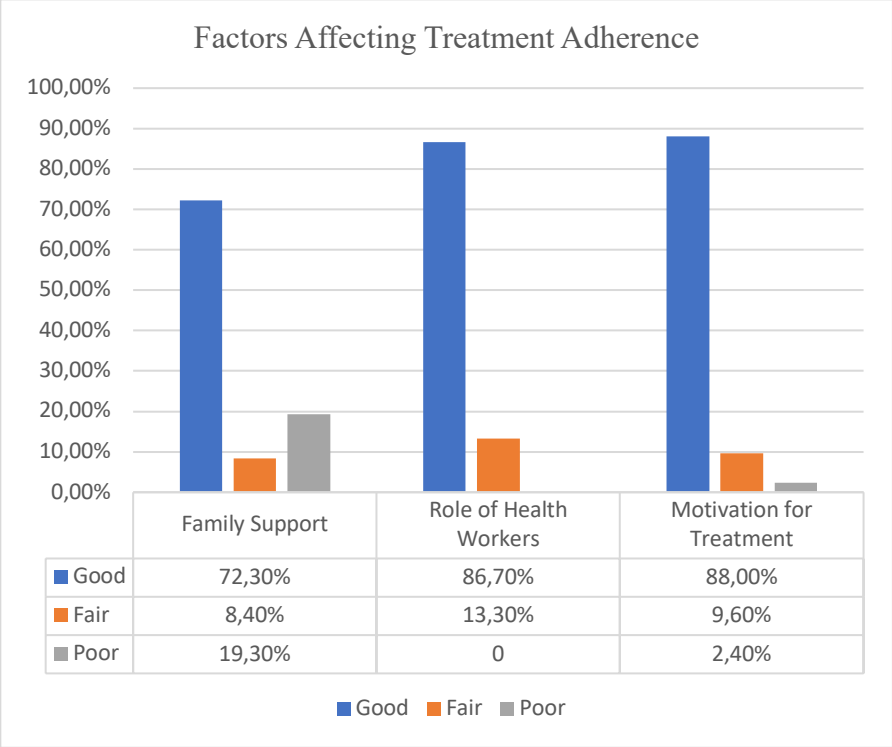

Figure 1. Diagram Based on Categories of Factors Affecting Treatment Adherence

8) Therapy Outcome

1) Viral Load

Tabel 11. *Viral Load*

Category	Frequency	Persentase (%)
Not Detected	74	89.2
Detected	9	10.8
Total	**83**	**100**

Table 11 shows that most respondents had undetectable viral loads (89.2%), while 10.8% still had detectable viral loads.

2) CD4

Tabel 12. CD4

Category	Frequency	Persentase (%)
Very Good	28	33.7
Good	43	51.8
Poor	12	14.5
Total	**83**	**100**

Table 12 shows that the majority of respondents had CD4 levels in the good category (51.8%), followed by very good (33.7%) and poor (14.5%).

3. Bivariate Analysis

a. Relationship Between Treatment Adherence and Respondent Characteristics

Table 13 shows that there was no significant relationship between gender ($p = 0.310$), age ($p = 0.809$), and employment status ($p = 0.325$) with treatment adherence ($p > 0.05$). In contrast, education level ($p = 0.040$) and duration of therapy ($p = 0.030$) were significantly associated with treatment adherence ($p < 0.05$). Respondents with higher education levels and longer duration of therapy tended to have higher adherence levels.

Table 13. Relationship between Treatment Adherence and Respondent Characteristics

Relationship Between Treatment Adherence and Gender					
		Gender		**Total**	***p-value***
		Male	**Female**		
HIV Patient Treatment Adherence	High	39	11	50	0.310
	Moderate	18	11	29	
	Low	3	1	4	
Total		60	23	83	

Relationship Between Treatment Adherence and Age						
		Age			**Total**	***p-value***
		18-35	**36-55**	**>55 years**		
HIV Patient Treatment Adherence	High	17	23	10	50	0.809
	Moderate	10	15	4	29	
	Low	3	1	0	4	
Total		30	39	14	83	

Relationship Between Treatment Adherence and Employment					
		Employment		**Total**	***p-value***
		Working	**Not Working**		
HIV Patient Treatment Adherence	High	39	11	50	0.325
	Moderate	25	4	29	
	Low	4	0	4	
Total		68	15	83	

Relationship Between Treatment Adherence and Education Level								
		Education Level					**Total**	***p-value***
		Elementary	**Junior High**	**High School**	**College**	**Did Not Attend**		
HIV Patient Treatment Adherence	High	0	4	27	19	0	50	0.040
	Moderate	1	1	12	13	2	29	
	Low	0	2	1	1	0	4	
Total		1	7	40	33	2	83	

Relationship Between Treatment Adherence and Duration of Therapy						
		Duration of Therapy			**Total**	***p-value***
		4 months-1 year	**1 year-3 years**	**>3 years**		
HIV Patient Treatment Adherence	High	1	17	32	50	0.030
	Moderate	0	9	20	29	
	Low	1	0	3	4	
Total		2	26	55	83	

b. Relationship Between Treatment Adherence and Factors

Based on Table 14, the results of the Pearson Chi-Square test showed that family support ($p = 0.404$), the role of healthcare workers ($p = 0.725$), and motivation for treatment ($p = 0.195$) were not significantly associated with treatment adherence ($p > 0.05$). This indicates that statistically, these factors did not have a significant relationship with ARV therapy adherence among HIV patients in this study.

Descriptively, respondents with good family support, positive perceptions of healthcare workers, and strong motivation tended to show higher adherence levels. For example, most respondents with high adherence were found in the "good" category for all three factors. However, the differences between categories were not statistically significant. The absence of a significant relationship may be influenced by the relatively homogeneous distribution of responses, where most respondents already had good levels of support, healthcare service experience, and motivation, resulting in limited variability in the data. These findings indicate that although these

factors were not statistically significant, they may still play a supporting role in maintaining treatment adherence, especially in the long term.

Table 14. Relationship Between Treatment Adherence and Factors

Relationship Between Treatment Adherence and Family Support						
		Family Support			**Total**	***p-value***
		Good	**Fair**	**Poor**		
HIV Patient Treatment Adherence	High	38	2	10	50	0.404
	Moderate	20	4	5	29	
	Low	2	1	1	4	
Total		60	7	16	83	
Relationship Between Treatment Adherence and Role of Health Workers						
		Role of Health Workers			**Total**	***p-value***
		Good	**Fair**	**Poor**		
HIV Patient Treatment Adherence	High	43	7	0	50	0.725
	Moderate	25	4	0	29	
	Low	4	0	0	4	
Total		72	11	0	83	
Relationship Between Treatment Adherence and Motivation for Treatment						
		Motivation for Treatment			**Total**	***p-value***
		Good	**Fair**	**Poor**		
HIV Patient Treatment Adherence	High	41	8	1	50	0.195
	Moderate	28	0	1	29	
	Low	4	0	0	4	
Total		73	8	2	83	

c. Relationship Between Treatment Adherence and Therapeutic Outcomes

1) Relationship Between CD4 Outcomes

Tabel 15. *Outcome* CD4

Relationship Between Treatment Adherence and *Outcome* CD4						
		***Outcome* CD4**			**Total**	***p-value***
		Very Good	**Good**	**Poor**		
HIV Patient Treatment Adherence	High	18	28	4	50	0,007
	Moderate	10	14	5	29	
	Low	0	1	3	4	
Total		28	43	12	83	

Based on Table 15, the results of the Pearson Chi-Square test showed a p-value of 0.007 ($p < 0.05$), indicating a statistically significant relationship between treatment adherence and CD4 outcomes in HIV patients.

Descriptively, respondents with high treatment adherence mostly had good to very good CD4 outcomes, with 18 respondents in the very good category and 28 respondents in the good category. In contrast, respondents with low adherence were predominantly in the poor CD4 category (3 out of 4 respondents). Meanwhile, respondents with moderate adherence were distributed across good and poor categories, but in lower proportions compared to the high adherence group. These findings indicate that higher levels of treatment adherence are associated with better CD4 outcomes. Good adherence allows antiretroviral therapy to work optimally in suppressing viral replication and supporting the recovery of immune function, as reflected in increased CD4 cell counts.

2) Viral Load Outcome Relationship

Based on Table 16, the results of the Pearson Chi-Square test showed a p-value of 0.000 ($p < 0.05$), indicating a statistically significant relationship between treatment adherence and viral load outcomes in HIV patients.

Descriptively, most respondents with high treatment adherence had undetectable viral loads, with 47 out of 50 respondents in the "not detected" category. In the moderate adherence group, the majority of respondents also had undetectable viral loads (26 out of 29 respondents). In contrast, in the low adherence group, most respondents had detectable viral loads (3 out of 4 respondents). These findings indicate that higher levels of treatment adherence are associated with a greater likelihood of achieving an undetectable viral load. Good adherence allows antiretroviral therapy to effectively suppress viral replication, while low adherence increases the risk of detectable viral load.

Tabel 16. Outcome Viral Load

Relationship Between Treatment Adherence and Outcome Viral load					
		Viral Load		Total	*p-value*
		Not Detected	Detected		
HIV Patient Treatment Adherence	High	47	3	50	0,000
	Moderate	26	3	29	
	Low	1	3	4	
Total		74	9	83	

DISCUSSION

1. Validity and Reliability Test

The validity test results showed that not all questionnaire items met the validity criteria (Corrected Item-Total Correlation > 0.20). Several items in the family support, role of healthcare workers, and motivation for treatment variables were found to be invalid and were therefore excluded from further analysis. The removal of invalid items was necessary to ensure that only items that accurately measure the intended constructs were included in the study (Murti, 2011).

The presence of invalid items may be influenced by several factors, such as respondents' misunderstanding of the questions, ambiguity in item wording, or differences in respondents' perceptions. In addition, cultural and social context may also affect how respondents interpret certain statements, particularly in sensitive topics such as HIV treatment and support systems. Items that do not adequately represent the underlying construct tend to show low correlation values and should be excluded to improve measurement accuracy.

After removing invalid items, the remaining questionnaire items were tested for reliability using Cronbach's Alpha. The results showed that all variables had acceptable reliability levels, with Cronbach's Alpha values of 0.831 for family support, 0.890 for the role of healthcare workers, and 0.664 for motivation for treatment. These values indicate that the instruments have adequate internal consistency and are reliable for measuring each variable. An instrument is considered reliable if it has a Cronbach's Alpha value ≥ 0.60, indicating consistent measurement across items (Anggraini *et al*., 2022).

The relatively lower Cronbach's Alpha value in the motivation variable compared to other variables may indicate that respondents had more varied interpretations of motivation-related items, or that motivation is a more complex and multidimensional construct. Overall, the results of the validity and reliability tests indicate that the research instruments used in this study are sufficiently valid and reliable to measure factors affecting treatment adherence among HIV patients.

2. Univariate Analysis

a. Respondent Characteristics

The distribution of respondent characteristics in this study provides an important overview of the profile of HIV patients undergoing antiretroviral therapy (ART), which may influence treatment adherence and clinical outcomes.Based on gender, the majority of respondents were male (72.3%). This finding is consistent with previous studies showing that HIV cases are more prevalent among men due to higher exposure to risky behaviors, such as unsafe sexual practices and lower utilization of healthcare services (Kemenkes RI, 2019; Manopo *et al*., 2025). In addition, sociocultural factors such as masculinity norms and stigma may contribute to men's reluctance to access HIV-related services, which can indirectly affect treatment adherence and disease management.

In terms of age, most respondents were in the productive age group (26–55 years). This reflects that HIV infection predominantly affects individuals with high social and economic activity, which increases exposure risk and presents challenges in maintaining consistent treatment adherence. Similar findings were reported by Manopo *et al*., (2025), who found that HIV cases were most common in adults aged 26–45 years. At this stage of life, work demands, mobility, and lifestyle factors may interfere with regular medication intake and follow-up visits.

Regarding education level, the majority of respondents had secondary to higher education (high school and college). This indicates that most patients have adequate cognitive ability to understand health information, including ARV therapy instructions. Previous studies have shown that higher education is associated with better health literacy and improved adherence to ARV therapy (Haryadi *et al*., 2020; Windiramadhan *et al*., 2024). Patients with higher education levels are generally more capable of understanding the importance of long-term therapy and the consequences of non-adherence, which contributes to better clinical outcomes.

In terms of employment, most respondents were private employees (54.2%), indicating that a large proportion of patients were economically active. Employment status can have both positive and negative effects on treatment adherence. On one hand, employment provides financial stability and access to healthcare services. On the other hand, work-related factors such as time constraints, fatigue, and high mobility may hinder adherence to medication schedules and routine clinical visits (Maulida et al., 2022). Therefore, flexible healthcare services are needed to support working patients in maintaining adherence.

The duration of therapy results showed that most respondents had been undergoing ART for more than three years (66.3%). This suggests that the majority of patients had adapted to their treatment regimen and developed long-term adherence behaviors. According to Liyanovitasari & Lestari (2020), patients with longer duration of HIV diagnosis tend to have better coping mechanisms and are more capable of integrating treatment into their daily routines, which supports sustained adherence and improved quality of life.

Furthermore, the findings on treatment adherence indicate that most respondents demonstrated high adherence, as reflected in both questionnaire responses and adherence categorization, where 60.2% of respondents were classified as having high adherence. These results suggest that the majority of patients have good awareness and discipline in following ARV therapy. High adherence is crucial for achieving optimal viral suppression, increasing CD4 levels, and preventing drug resistance (Arifa *et al*., 2022; Rantepadang & Tamuntuan, 2025).

However, despite the overall high adherence level, some respondents reported feeling bored or fatigued with long-term medication use. This highlights the importance of addressing psychological factors in maintaining long-term adherence. Previous studies have emphasized that adherence is not only influenced by individual discipline but also by continuous support from healthcare providers, family, and the surrounding environment (Rantepadang & Tamuntuan, 2025).

Overall, the respondent characteristics in this study indicate that HIV patients are predominantly male, within the productive age group, relatively well-educated, and economically active. These characteristics provide important insights for designing targeted interventions, particularly in improving adherence through patient education, flexible healthcare services, and psychosocial support.

b. Factors Affecting Treatment Adherence

The findings of this study indicate that treatment adherence among HIV patients is influenced by a combination of family support, the role of healthcare workers, and patients' internal motivation. These results are consistent with previous studies in Indonesia, which highlight that adherence is shaped by the interaction of psychosocial and healthcare service factors (Amalia *et al*., 2025).

In terms of family support, most respondents reported receiving positive support, including reminders to take medication, emotional encouragement, and involvement in family decisions. This suggests that family plays a crucial role in providing both instrumental and emotional support that can facilitate adherence. However, despite the generally positive findings, a proportion of

respondents still reported inadequate family involvement. This indicates that family support is not uniformly distributed and may depend on factors such as family knowledge, stigma, and communication patterns. Previous studies have shown that insufficient understanding of HIV within families can lead to stigma and reduced support, which may indirectly affect adherence (Arizwansyah *et al*., 2023).

Regarding the role of healthcare workers, the results demonstrate very positive perceptions, with almost all respondents stating that healthcare providers were friendly, communicative, and approachable. Effective communication and patient-centered care are known to improve trust and engagement in long-term therapy. These findings are in line with Wulandari & Rukmi (2021), who emphasized that clear information and supportive interactions from healthcare workers significantly contribute to maintaining adherence in HIV patients. The high satisfaction reported in this study also suggests that the quality of healthcare services at Dr. Moewardi Hospital has been optimal in supporting treatment continuity.

Furthermore, motivation for treatment emerged as the most dominant factor, with the majority of respondents showing strong internal motivation. Most patients adhered to therapy not due to external pressure, but because of intrinsic reasons, particularly the desire to see their children or loved ones grow. This finding highlights the importance of internal awareness and long-term life goals in sustaining adherence. According to Fadilah *et al*., (2024), high self-motivation is a key determinant in achieving the ≥95% adherence rate required for effective viral suppression.

Despite the overall positive trends, the distribution of categories shows that family support still has the highest proportion in the "poor" category compared to other variables. This indicates that, although healthcare services and patient motivation are strong, family-related factors remain a gap that needs to be addressed. Mahdalena & Maharani (2022) also reported that the presence of family members who actively support and supervise medication intake significantly increases adherence rates. Therefore, interventions should not only target patients but also involve family education to build a more supportive home environment.

Overall, this study confirms that treatment adherence is a multidimensional phenomenon influenced by internal factors, such as motivation, and external factors, such as healthcare services and family support. While motivation and the role of healthcare workers have shown optimal results, strengthening family involvement remains an important priority. Collaboration between patients, families, and healthcare providers is essential to ensure sustainable adherence and to minimize the risk of treatment failure. These findings are also supported by Lestari *et al*., (2024), who emphasized the importance of integrated psychosocial support in improving long-term treatment outcomes.

c. Therapy Outcome

The findings of this study indicate that the majority of HIV patients undergoing antiretroviral therapy (ART) at Dr. Moewardi General Hospital have achieved favorable clinical outcomes, as reflected by both viral load suppression and improved CD4 levels. These two indicators are essential in evaluating the success of HIV treatment, as viral load reflects virological response, while CD4 count represents immunological recovery. In terms of viral load, most respondents (89.2%) had undetectable levels, indicating successful suppression of viral replication. This finding suggests that ART has been effective in controlling the progression of HIV infection among the majority of patients. Viral suppression is a critical goal of HIV treatment because it reduces the risk of disease progression, prevents opportunistic infections, and lowers the likelihood of HIV transmission. These results are consistent with Lubis & Zein (2025), who state that achieving an undetectable viral load is a key indicator of successful therapy and improved patient outcomes.

The high proportion of patients with undetectable viral loads in this study is likely associated with good adherence to ARV therapy. Adherence ensures consistent drug levels in the body, allowing optimal suppression of viral replication. Conversely, the small proportion of patients with detectable viral loads (10.8%) may indicate potential issues such as non-adherence or the development of drug resistance. This finding aligns with previous research showing that adherence to ARV therapy is significantly associated with virological success, where patients with high adherence are more likely to achieve undetectable viral loads (Ulyah *et al*., 2021).

In addition to virological outcomes, the immunological status of patients, as measured by CD4 count, also showed positive results. The majority of respondents were in the good (51.8%) and very good (33.7%) CD4 categories, indicating that ART has effectively improved or maintained immune system function. Adequate CD4 levels are crucial in reducing susceptibility to opportunistic infections and slowing the progression of HIV disease. These findings are in line with Febriani *et al*., (2019), who reported that ART significantly increases CD4 counts and contributes to improved immunological outcomes in HIV patients.

The relationship between adherence and CD4 outcomes can be explained by the mechanism of ART, which suppresses viral replication and allows immune system recovery. Patients with good adherence tend to experience sustained viral suppression, leading to gradual increases in CD4 cell counts. Conversely, patients with poor CD4 outcomes (14.5%) may be affected by factors such as inconsistent adherence, delayed initiation of therapy, or other clinical conditions that hinder immune recovery. This is supported by Amalia *et al*., (2025), who found that higher adherence levels are associated with better CD4 outcomes and improved quality of life among HIV patients.

Overall, the findings of this study demonstrate that successful HIV treatment is closely linked to consistent adherence to ARV therapy, which contributes to both virological suppression and immunological improvement. The combination of high rates of undetectable viral load and favorable CD4 levels indicates that the majority of patients in this setting have achieved optimal clinical outcomes. However, the presence of a small proportion of patients with detectable viral loads and poor CD4 counts highlights the need for continuous monitoring, adherence support, and individualized interventions. These results reinforce the importance of strengthening adherence strategies, including patient education, counseling, and support from healthcare providers and families, to ensure sustained treatment success and improved long-term outcomes for HIV patients.

3. Bivariate Analysis

a. Relationship Between Treatment Adherence and Respondent Characteristic

The results of this study indicate that not all respondent characteristics are associated with adherence to antiretroviral (ARV) therapy. Variables such as gender, age, and employment status were not significantly related to treatment adherence, while education level and duration of therapy showed significant associations. These findings suggest that adherence is influenced more by cognitive and experiential factors rather than purely demographic characteristics. The absence of a significant relationship between gender and treatment adherence indicates that both male and female patients have equal opportunities to adhere to ARV therapy. This finding suggests that adherence behavior is not determined by biological sex, but rather by individual awareness, motivation, and access to healthcare services. This result is consistent with the study by Sari *et al*., (2019), which also reported no significant association between gender and ARV adherence, although descriptively women tended to show slightly higher adherence levels.

Similarly, age was not found to be significantly associated with adherence. This indicates that patients across different age groups have relatively similar adherence patterns. Although younger patients may face challenges related to lifestyle and mobility, and older patients may face issues related to comorbidities or memory, these factors may balance out, resulting in no statistically significant differences. This finding reinforces the idea that adherence is not solely determined by age, but more by behavioral and psychosocial factors (Sasi *et al*., 2024).

Employment status also did not show a significant relationship with adherence. This suggests that both working and non-working patients can maintain adherence as long as they have adequate support and motivation. While employment may influence time availability and access to healthcare, it does not necessarily determine adherence behavior. This finding indicates that structural factors such as flexible healthcare services and accessible treatment systems may help minimize the impact of employment-related barriers.

In contrast, education level showed a significant relationship with treatment adherence. Patients with higher levels of education tended to have better adherence compared to those with lower educational backgrounds. This can be explained by the role of education in improving health literacy, enabling patients to better understand treatment instructions, the importance of adherence,

and the consequences of non-compliance. These findings are consistent with Sari *et al*., (2019), who reported that higher education is associated with increased adherence due to better comprehension of health-related information and decision-making capacity.

In addition, the duration of therapy was also significantly associated with adherence, where patients who had undergone therapy for more than three years showed higher adherence levels. This finding suggests that longer exposure to treatment allows patients to adapt to medication routines, develop habitual behaviors, and gain a deeper understanding of their condition. Patients in the early stages of therapy may still be adjusting to side effects and lifestyle changes, which can affect adherence. This result is supported by Abdu & Walelgn (2021), who found that patients with longer treatment duration were more likely to maintain adherence compared to those in the initial phase of therapy.

b. Relationship Between Treatment Adherence and Factors

The results of this study indicate that family support, the role of healthcare workers, and motivation for treatment were not significantly associated with adherence to antiretroviral (ARV) therapy, as shown by p-values greater than 0.05. This finding suggests that, statistically, these factors did not directly influence adherence levels among HIV patients in this study population. However, descriptively, respondents with good family support, positive perceptions of healthcare workers, and strong motivation tended to have higher adherence, indicating a potential practical influence despite the lack of statistical significance.

The absence of a significant relationship may be explained by the homogeneity of the respondents. Most patients in this study reported good levels of family support, positive interactions with healthcare workers, and high motivation for treatment. This limited variation among respondents can reduce the ability of statistical tests to detect significant associations. Similar findings have been reported in previous studies in Indonesia, where no significant relationship was found between family support and ARV adherence due to relatively uniform levels of support among participants (Mahdalena & Maharani, 2022; Hardika, 2022).

Although family support was not statistically significant, it remains an important contextual factor in influencing adherence behavior. Family members can provide emotional encouragement, reminders, and practical assistance that help patients maintain their treatment routines. However, the effectiveness of family support may depend on its quality, consistency, and the level of understanding about HIV within the family. Khamid *et al*., (2024) emphasized that family support contributes indirectly to adherence by shaping patients' psychological readiness and coping mechanisms rather than acting as a direct determinant.

Similarly, the role of healthcare workers did not show a significant relationship with adherence in this study. This may be due to the generally high quality of healthcare services reported by respondents, where most patients perceived healthcare workers as communicative, friendly, and supportive. When service quality is consistently high across respondents, it becomes difficult to identify differences in adherence based on this factor. Nevertheless, previous studies have consistently highlighted that effective communication, trust, and continuous support from healthcare providers are essential in maintaining long-term adherence (Wulandari & Rukmi, 2021).

Motivation for treatment also did not show a statistically significant relationship with adherence, despite being descriptively high among respondents. This finding may indicate that motivation alone is not sufficient to determine adherence behavior, especially when most patients already possess strong intrinsic motivation. In such conditions, adherence may be more influenced by other factors, such as behavioral habits, routine formation, or structural aspects of healthcare access. However, motivation remains a fundamental component in sustaining long-term adherence, as it drives patients' commitment to continue therapy despite challenges (Fadilah *et al*., 2024).

c. Relationship Between Treatment Adherence and Therapeutic Outcomes

The results of this study demonstrate a statistically significant relationship between treatment adherence and therapeutic outcomes in HIV patients, both in terms of CD4 counts and viral load. These findings highlight that adherence to antiretroviral (ARV) therapy is a key

determinant of clinical success in HIV management. In terms of immunological outcomes, the analysis showed a significant association between treatment adherence and CD4 levels (p-value = 0.007). Patients with high adherence predominantly had good to very good CD4 outcomes, whereas those with low adherence were more likely to have poor CD4 levels. This finding indicates that consistent adherence enables optimal suppression of viral replication, allowing the immune system to recover, as reflected by increased CD4 counts. This result is consistent with previous studies which state that adherence to ARV therapy plays a crucial role in improving immunological status and reducing the risk of opportunistic infections (Nursalam *et al*., 2024).

From a clinical perspective, the improvement in CD4 counts among adherent patients suggests that long-term adherence contributes to immune reconstitution. Patients who consistently take ARV medications are more likely to maintain stable immune function, while non-adherence may lead to immune deterioration and increased susceptibility to infections. Therefore, adherence is not only a behavioral factor but also a critical clinical determinant in HIV treatment outcomes.

Similarly, the analysis of virological outcomes showed a highly significant relationship between treatment adherence and viral load (p-value = 0.000). The majority of patients with high adherence achieved undetectable viral loads, while those with low adherence tended to have detectable viral loads. This indicates that adherence is essential for achieving virological suppression, which is the primary goal of ARV therapy.

These findings support previous studies showing that consistent adherence to ARV therapy effectively suppresses viral replication, prevents drug resistance, and improves overall clinical outcomes (Arifa et al., 2022; Olyvia & Purnamawati, 2025). Furthermore, viral load suppression is a key indicator not only for individual patient health but also for reducing HIV transmission risk, aligning with the concept of "Undetectable = Untransmittable" (U=U).

The strong relationship between adherence and both CD4 and viral load outcomes in this study suggests that adherence is a more critical determinant of therapeutic success than demographic characteristics. While factors such as age, gender, and employment did not show significant associations with adherence, consistent medication-taking behavior directly influenced both immunological and virological outcomes. In addition, these findings are supported by studies conducted in Indonesia, which report that patients with high adherence are more likely to achieve undetectable viral loads and better clinical outcomes compared to those with low adherence (Putra *et al*., 2023; Nurhasanah *et al*., 2025). This consistency across studies strengthens the evidence that adherence is a central component in HIV treatment success.

CONCLUSION

This study found that the majority of HIV patients at Dr. Moewardi General Hospital in Surakarta had a high level of adherence to antiretroviral (ARV) therapy. Although family support, the role of healthcare workers, and motivation for treatment were descriptively good, these factors were not statistically associated with adherence. Clinical outcomes were generally favorable, with most patients achieving undetectable viral loads and good CD4 levels. Importantly, treatment adherence showed a significant relationship with both immunological (CD4) and virological (viral load) outcomes, indicating that adherence is the key determinant of therapeutic success in HIV patients. These findings highlight the importance of strengthening adherence-focused interventions, such as continuous patient education, counseling, and support systems, particularly for patients in the early stages of therapy or with lower health literacy. Further studies are recommended to explore other factors influencing adherence, such as psychological, behavioral, and health system variables, using larger and more diverse samples to better capture variability among.

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