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Predictors Of Antiretroviral Therapy Failure In HIV/AIDS Patients At Dr. Moewardi Regional Hospital, Surakarta

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Abstract

Antiretroviral (ARV) therapy failure remains a significant issue in HIV/AIDS control as it contributes to disease progression and drug resistance. This study aims to analyze predictors of ARV therapy failure based on demographic and clinical characteristics of HIV/AIDS patients. This study used a retrospective quantitative descriptive analytical design with medical records of HIV outpatients at Dr. Moewardi Regional General Hospital from November 2024 to November 2025 as the data source. The study population was all HIV patients receiving ARV therapy, with a sample of 100 patients selected using accidental sampling. The research instrument was a medical record-based observation sheet, covering demographic, clinical, CD4, viral load, and clinical stage characteristics. Data analysis was performed univariately and bivariately using the Chi-square test with a significance level of $p<0.05$. The results showed that the majority of patients were male, productive age, married, had secondary or higher education, had a normal BMI, were in the early clinical stage, and did not experience opportunistic infections or side effects of therapy. No significant associations were found between demographic and clinical variables and CD4 count, viral load, or clinical stage. In conclusion, the immunological, virological, and clinical status of HIV patients is multifactorial and is not solely determined by the demographic and clinical characteristics studied.

Keywords: Antiretroviral Therapy, HIV/AIDS, Predictors, Treatment Failure, Viral Load

INTRODUCTION

HIV attacks CD4 T lymphocytes and can progress to AIDS if left untreated, becoming a global crisis that threatens socioeconomic resilience. By 2024, the WHO recorded 40.8 million people living with HIV (PLHIV), 1.3 million new infections, and 630,000 HIV-related deaths globally. In Indonesia, the estimated number of PLHIV reached 564,000 in 2025, with 63,707 new cases annually, although only 68% knew their status and a small proportion accessed routine antiretroviral therapy (ARV).

The Indonesian government implemented the STOP (Torch, Find, Treat, Maintain) strategy through Minister of Health Regulation No. 23 of 2022 to achieve the goal of Ending AIDS by 2030, including the expansion of ARVs, PrEP, and anti-stigma digital education. However, high social stigma leads to low adherence, discontinuation of treatment, and therapy failure, triggered by late presentation, TB coinfection, and advanced clinical stages.

ART therapy failure is characterized by virological (viral load > detection limit), immunological (CD4 decline), and clinical failure, with predictors such as CD4 increase <50 cells/mm³ after 6 months in adherent patients (10.7% of cases) [Kurniawan et al., 2017]. Other factors include low baseline CD4 (<200 cells/mm³), stage 3-4, and co-infection, which increase resistance and morbidity.

Sociodemographic barriers such as distance, transportation costs, and minimal family support hinder routine viral load monitoring, worsening viral replication even when physically stable. The first-line regimen (TDF+3TC+EFV) is susceptible to mutation if monitoring is delayed, limiting future therapeutic options [Jocelyn et al., 2024].

This study aims to analyze predictors of ART failure (clinical, behavioral, laboratory) and map sociodemographic barriers in HIV patients at Dr. Moewardi Regional General Hospital, Surakarta, a strategic location as a tertiary referral center in Central Java with routine HIV training. The urgency lies in validating local protocols for early detection, reducing morbidity, and supporting the 2030 target. Its novelty lies in the large-scale multicenter study at this hospital with strict criteria, complementing previous findings such as Kurniawan et al. (2017).

RESEARCH METHODS

This study uses a quantitative research type with a retrospective descriptive-analytic design to identify predictors of Antiretroviral (ARV) therapy failure in HIV patients at Dr. Moewardi Surakarta Regional General Hospital. According to Sugiyono (2021) and Crescenti (Creswell, 2022), descriptive-analytic quantitative research involves measuring measurable variables and statistical analysis to describe patterns and test relationships between variables using recorded data. In this study, a retrospective design was applied by taking secondary data from outpatient medical records of HIV patients using ARV therapy for the period November 2024–November 2025, thus allowing for tracing clinical history, CD4 count, viral load, and sociodemographic factors associated with therapy failure (Sugiyono, 2021) (Creswell, 2022) (Suhartini et al., 2024).

The research instrument was a medical record-based observation form, which referred to the operational definitions of variables that had been formulated, namely gender, age, marital status, education level, baseline BMI, clinical stage, CD4 profile, TB status, opportunistic infections, side effects, and viral load, with reference to categorization and classification sourced from previous studies in Indonesia (Zakiyah et al., 2022; Keban et al., 2021; Suhartini et al., 2024; Dewi, 2022; Dewi, 2018; Maria et al., 2023; Septiana et al., 2023). The data collection technique was carried out in a retrospective observational manner by reviewing the medical record data of outpatient HIV patients at the Medical Record Installation of Dr. Moewardi Surakarta Regional Hospital, in accordance with health research methodology guidelines which emphasize that secondary medical record data can be the main source in analytical quantitative research (Sudaryono, 2021; Saryono, 2021). The collected data was then processed and analyzed using statistical software, with the results presented in the form of frequency and percentage distribution tables for patient characteristics and for each clinical and sociodemographic variable (Sugiyono, 2021) (Emzir, 2021).

Data analysis techniques consisted of univariate and bivariate analysis according to the quantitative research steps described by Sudaryono (2021) and Emzir (2021). Univariate analysis was used to describe sample characteristics including gender, age, marital status, education level, baseline BMI, clinical stage, CD4 profile, TB status, opportunistic infections, and viral load, with presentations in the form of frequency distributions and percentages to provide a general overview of the pattern of ARV therapy use in HIV patients at Dr. Moewardi Surakarta Regional Hospital (Suhartini et al., 2024) (Saryono, 2021). Bivariate analysis was then performed by cross-tabulating independent variables (e.g., CD4 profile, viral load, clinical stage, age, and opportunistic infections) against the dependent variable of therapy failure, using the Chi-square test with a significance limit of p-value <0.05, as recommended in HIV epidemiological research based on medical record data (Sugiyono, 2021) (Creswell, 2022) (Suhartini et al., 2024).

The population in this study was all medical record data of outpatient HIV patients at Dr. Moewardi Surakarta Regional General Hospital who used ARV therapy in the period November 2024–November 2025 and were contained in the hospital's medical record system, while the sample was taken using the Accidental Sampling method consisting of medical records that met the inclusion and exclusion criteria (Sugiyono, 2022)(Sudaryono, 2021). The number of samples was determined using the Slovin formula, using a 90% confidence level and a 10% margin of error, so that the sample requirement was approximately 98.3 which was then rounded up to 100 medical records of outpatient HIV patients (Sugiyono, 2021)(Saryono, 2021). Inclusion criteria include: outpatients with a diagnosis of HIV/AIDS, have received ARV therapy, and have complete medical record data (name, medical record number, age, gender, and ARV administration records), while exclusion criteria include patients with inpatient medical record data, incomplete medical records, and patients who died during the study period, to ensure the data analyzed is relevant and consistent with the aim of explaining ARV therapy failure (Suhartini et al., 2024) (Saryono, 2021).

The research procedure begins with the preparation of a proposal and approval from the supervisor, followed by the submission of a research permit letter from the Faculty of Health Sciences,

Duta Bangsa University, Surakarta to Dr. Moewardi Regional Hospital as the field institution, in accordance with the health research permit application process described by Sudaryono (2021) and Crescenti (Creswell, 2022). After the permit letter is received by the Medical Records Installation, the researcher coordinates the schedule and data access mechanism, and signs a confidentiality statement to protect the patient's identity in accordance with ethical norms for health research (Sugiyono, 2021) (Saryono, 2021). The next stage includes identifying outpatients with a diagnosis of HIV/AIDS who are using ARV therapy in the period November 2024–November 2025, selecting data based on inclusion and exclusion criteria, recording information in an observation sheet, and processing data using univariate and bivariate analysis to identify variables that influence ARV therapy failure, in accordance with the conceptual framework and research objectives formulated in Chapter I (Suhartini et al., 2024)(Creswell, 2022)(Sudaryono, 2021).

RESULTS AND DISCUSSION

Univariate Analysis

Patient Characteristics

Patient characteristics by gender

Table 1. Patient characteristics by gender

Variables	Category	Frequency (f)	Percentage (%)
Gender	Man	75	75
	Woman	25	25
Amount		100	100

Patient characteristics by age

Table 2. Patient characteristics by age

Variables	Category	Frequency (f)	Percentage (%)
Age	18-24 years old	5	5
	25-39 years	48	48
	40-49 years	27	27
	≥50 years	20	20
Amount		100	100

Patient characteristics based on marital status

Table 3. Patient characteristics based on marital status

Variables	Category	Frequency (f)	Percentage (%)
Marital status	Marry	58	58
	Bachelor	25	25
	Divorced	17	17
Amount		100	100

Patient characteristics based on educational status

Table 4. Patient characteristics based on educational status

Variables	Category	Frequency (f)	Percentage (%)
Last education	Graduated from elementary school	1	1
	Graduated from junior high school	15	15
	Graduated from high school/vocational school	47	47
	College	37	37
Amount		100	100

Clinical Characteristics

Characteristics based on BMI number

Table 5. Characteristics based on BMI

Variables	Category	Frequency (f)	Percentage (%)
BMI	<18.5	3	3
	18.5-25	90	90
	>25	7	7
Amount		100	100

Patient characteristics based on HIV stage

Table 6. Patient characteristics based on HIV stage

Variables	Category	Frequency (f)	Percentage (%)
Clinical Stage	Stage I	75	75
	Stage II	21	21
	Stage III	3	3
	Stage IV	1	1
Amount		100	100

Patient characteristics based on tuberculosis status

Table 7. Patient characteristics based on TB status

Variables	Category	Frequency (f)	Percentage (%)
TB status	TB	20	20
	Non-TB	80	80
Amount		100	100

Patient characteristics in opportunistic infections

Table 8. Characteristics of patients with opportunistic infections

Variables	Category	Frequency (f)	Percentage (%)
Opportunistic Infections	There is	7	7
	There isn't any	93	93
Amount		100	100

Characteristics of Treatment History

Patient characteristics based on drug side effects

Table 9. Patient characteristics based on drug side effects

Variables	Category	Frequency (f)	Percentage (%)
Side Effects of ARV Therapy	There is	8	8
	There isn't any	92	92
Amount		100	100

Bivariate Analysis

Relationship between demographic characteristics and CD4

Table 10. Relationship between Demographic Characteristics and CD4

Variables	Univariate						Total N=100	Bivariate (Chi-square)	
	CD4 (cells/mm³)							*P-value*	Contingency Coefficient
	<200		200-499		>500				
	n	%	n	%	n	%	n		
Gender									
Man	37	48	14	18	26	34	77	.120	.548
Woman	12	52	2	9	9	39	23		
Age (Years)									
25-39	2	29	2	29	3	43	7	.151	.468
40-49	47	51	14	15	32	34	93		
Marital status									
Marry	28	46	13	21	20	33	61	.411	.319
Bachelor	12	52	1	4	10	44	23		
Divorced	9	56	2	13	5	31	16		
Level of education									
Elementary School	2	100	0	0	0	0	2		
JUNIOR HIGH SCHOOL	4	50	1	13	3	38	8	.282	.831
High School/Vocational School	24	46	10	62	18	35	52		
College	19	50	5	13	14	37	38		
BMI									
<18.5	2	50	0	0	2	50	4	.939	.919
18.5 - 25	44	49	15	16	31	34	90		
>25	3	50	1	17	2	33	6		
TB status									
TB	7	70	1	10	2	20	10	.196	.375
Non-TB	42	47	15	17	33	32	90		
Opportunistic Infections									
There is	6	86	0	0	1	14	7	.419	.123
There isn't any	43	46	16	17	34	37	93		
Side effects									
There is	5	63	1	13	2	25	8	.638	.727
There isn't any	44	48	15	16	33	36	92		

Source: Processed secondary data (2026)

Relationship between demographic characteristics and viral load

Table 11. Relationship between Demographic Characteristics and Viral Load

Variables	Univariate						Total N=100	Bivariate (Chi-square)	
	Viral Load (Copy/ml)							*P-value*	Contingency Coefficient
	<50		50-1000		>1000				
	n	%	n	%	n	%			
Gender									
Man	26	34	10	13	41	53	77	.246	.884
Woman	9	39	3	13	11	48	23		
Age (Years)								.263	.877

25-39	3	43	1	14	3	43	7		
40-49	32	34	13	13	48	53	93		
Marital status									
Marry	20	33	6	10	35	57	61	.741	.115
Bachelor	10	44	6	26	7	30	23		
Divorced	5	31	1	6	10	63	16		
Level of education									
Elementary School	0	0	1	50	1	50	2		
JUNIOR HIGH SCHOOL	3	38	2	25	3	37	8	.437	.626
High School/Vocational School	18	35	6	12	28	54	52		
College	14	37	4	11	20	53	38		
BMI									
<18.5	2	50	1	25	1	25	4	.231	.679
18.5 - 25	31	34	12	13	47	52	90		
>25	2	33	0	0	4	67	6		
TB status									
TB	2	20	4	40	4	40	10	.725	.027
Non-TB	33	37	9	10	48	53	90		
Opportunistic Infections									
There is	1	14	1	14	5	71	7	.147	.477
There isn't any	34	37	12	13	47	51	93		
Side effects									
There is	2	25	1	13	5	63	8	.434	.805
There isn't any	33	36	12	13	47	51	92		

Source: Processed secondary data (2026)

Relationship between demographic characteristics and clinical stage

Table 12. Relationship between Demographic Characteristics and Clinical Stage

Variables	Univariate								Total N=100	Bivariate (Chi-square)	
	Stadium										
	1		2		3		4			*P-value*	Contingency Coefficient
	n	%	n	%	n	%	n	%	n		
Gender											
Man	57	74	16	21	2	3	2	3	77	.786	.853
Woman	17	74	5	22	1	33	0	0	23		
Age (Years)											
25-39	4	57	2	29	2	14	0	0	7	.384	.279
40-49	70	75	19	20	2	2	2	2	93		
Marital status											
Marry	44	72	12	19	3	5	2	3	61		
Bachelor	18	78	5	22	0	0	0	0	23	.346	.749
Divorced	12	75	4	25	0	0	0	0	16		
Level of education										.195	.992

Elementary School	2	100	0	0	0	0	0	0	2		
JUNIOR HIGH SCHOOL	7	88	1	12	0	0	0	0	8		
High School/Vocational School	37	71	12	23	2	4	1	2	52		
College	28	74	8	21	1	3	1	3	38		
BMI											
<18.5	0	0	1	25	1	25	2	50	4		
18.5 - 25	68	76	20	22	2	2	0	0	90	.597	.000
>25	6	100	0	0	0	0	0	0	6		
TB status											
TB	9	90	0	0	1	10	0	0	10	.475	.191
Non-TB	65	72	21	23	2	2	2	2	90		
Opportunistic Infections											
There is	6	86	1	14	0	0	0	0	7	.678	.878
There isn't any	68	73	20	22	3	3	2	2	93		
Side effects											
There is	5	63	1	12	0	0	2	25	8	.237	.000
There isn't any	69	75	20	22	3	3	0	0	92		

DISCUSSION

Univariate Analysis

Patient characteristics by gender

Based on demographic data, the majority of respondents in this study were male (77%), indicating that men tend to have greater risk exposure than women. This is in line with data from the Directorate General of Disease Prevention and Control (DGPC), which shows a higher disease prevalence in men, primarily due to the accumulation of environmental and behavioral risk factors, such as unhealthy lifestyles. Men are generally more likely to engage in risky habits, such as smoking, alcohol consumption, and unhealthy diets, which contribute to an increased burden of chronic disease and visits to health facilities. Furthermore, the theory of health-seeking behavior explains that men are more likely to ignore early symptoms of disease and only utilize health services when their condition has worsened or become acute, thus making them a more dominant patient proportion (Yousaf et al., 2015).

This difference in gender distribution is also influenced by environmental, social, and biological factors. Socioculturally, men still dominate the field, industrial, and transportation sectors, which involve high physical workloads and greater exposure to pollution and chemicals, increasing the risk of chronic health disorders and organ function decline. On the other hand, women have estrogen, which functions as cardiovascular and metabolic protection, thus providing greater protection against degenerative diseases until menopause, while men lack comparable hormonal protection mechanisms. This combination of biological vulnerability, physical workload, and risky lifestyles explains why male patients in this study reached approximately 77% of the total respondents (Klein & Flanagan, 2016).

Patient characteristics by age

In terms of age, the 40–49 age group constituted the largest population in this study's sample (93%), indicating that HIV infections in this study were predominantly found in mature adults. This finding aligns with reports from the Directorate General of Disease Prevention and Control (DGPC) of the Indonesian Ministry of Health, which consistently states that HIV/AIDS cases in Indonesia are most prevalent among the productive age group, particularly those aged 25–49. Various health studies also confirm that early adulthood is the most vulnerable group to HIV/AIDS transmission, primarily due to the more active and dynamic sexual activity in this age range compared to other age groups.

The high prevalence of HIV/AIDS among those aged 25–39 is driven by several key factors. Behavioral factors include unsafe sexual intercourse, multiple partners without condom use, and high mobility, which increases the likelihood of risky social contact. Furthermore, inadequate knowledge and risk perceptions lead many individuals of productive age to feel they are not at risk, thus rarely engaging in preventive measures or routine screening. The long incubation period for HIV also explains why diagnoses often occur during productive ages, even though exposure occurs during adolescence or young adulthood. Psychosocial factors, such as the search for identity and financial independence, sometimes accompanied by a promiscuous lifestyle or injecting drug use, further exacerbate the vulnerability of this age group, necessitating strengthened education programs and more aggressive prevention interventions targeted at young and productive adults.

Patient characteristics based on marital status

The results showed that the majority of patients were married (58 people), followed by singles (25 people) and divorced (17 people). The predominance of married patients indicates the risk of domestic heterosexual transmission and transmission to partners within the household. This finding is in line with national trends where HIV cases are often found in housewives or married couples, which often begins with risky behavior by one partner outside the marriage who then transmits the virus unknowingly. Married patients tend to be late in realizing their HIV status.-This is because they consider marriage to be "safe," leading them to rarely undergo routine checkups. Meanwhile, the proportion of single and divorced patients indicates the vulnerability of individuals who are socially active outside of marriage. Therefore, these data underscore the need for sexual health education that targets not only singles but also strengthens couples counseling for those who are married to break the chain of HIV/AIDS transmission within the family.

Patient characteristics based on educational status

The results showed that most patients had secondary or higher educational backgrounds, with 47 (47%) having graduated from high school (SMA/SMK) and 37 (37%) having graduated from college. While fewer patients had lower levels of education (elementary and junior high school graduates), these data confirm that higher levels of education do not always correlate directly with better HIV/AIDS prevention behaviors. While education increases access to information and knowledge about HIV/AIDS risks, behavioral change is more influenced by personal risk perception, social pressure, and environmental factors than by academic capacity alone. Individuals with secondary and higher education generally have broader economic access and mobility, which, if not balanced with self-control, can open up opportunities for risky lifestyles. Therefore, good knowledge often does not align with practice in the field. Thus, these data emphasize that HIV/AIDS education strategies need to go beyond informative approaches and focus on behavioral interventions that comprehensively address all levels of education.

Patient characteristics based on BMI

Most respondents in this study had relatively stable clinical conditions, as reflected by 90% of respondents with a Body Mass Index (BMI) in the normal category, indicating that most HIV/AIDS patients studied had a fairly good nutritional status despite being diagnosed. This finding is in line with research by Handayani et al. (2023) which confirmed that with advances in Antiretroviral (ARV) therapy, many patients are now able to maintain ideal body weight and prevent wasting syndrome, which was once a hallmark of HIV/AIDS. BMI serves as an important indicator of nutritional status

and disease progression, where patients with a low BMI (<18.5) are at higher risk of experiencing rapid immune decline and opportunistic infections, while maintaining a BMI within the normal range (18.5–25) contributes to the effectiveness of ARVs and improves patients' quality of life.

Maintaining a normal BMI in 90% of respondents also indicates that most patients are in a controlled clinical phase and may have received adequate nutritional intervention during treatment, supported by medication adherence, access to adequate nutritional intake, and psychosocial support that reduces emotional stress and depression that can lead to decreased appetite. Adopting a healthy lifestyle after diagnosis, such as a regular diet and appropriate physical activity, also helps maintain body mass balance. Therefore, regular BMI monitoring is an important part of nursing and medical care for HIV/AIDS patients, so that a sudden decrease in BMI can be identified as an early warning sign of therapy failure or intercurrent infections, which requires synergistic integration between medical therapy, nutritional counseling, and behavioral support to ensure nutritional status supports long-term treatment success.

Patient characteristics based on HIV stage

Based on the research results, most HIV/AIDS patients were in the early clinical stage, with 75 people (75%) in Stage I, 21 people (21%) in Stage II, 3 people (3%) in Stage III, and only 1 person (1%) in Stage IV, thus indicating that patients tend to be detected in the asymptomatic phase or early stage without severe symptoms. This finding is in line with the report of the Directorate General of Disease Prevention and Control (Ditjen P2P) of the Ministry of Health of the Republic of Indonesia which stated an increase in case detection in the early stage thanks to the expansion of the Voluntary Counseling and Testing (VCT) program, as well as research by Pratama et al. (2023) which confirmed that a Stage I diagnosis provides a better prognosis because the CD4 value is still relatively maintained and the clinical condition is still relatively stable.

The dominance of Stage I (75%) is a positive indicator in HIV/AIDS management, because early administration of Antiretroviral (ARV) therapy has been proven effective in suppressing viral load to undetectable levels, thereby increasing patient life expectancy while reducing the risk of transmitting the virus to others. This condition is also in line with data that most patients have normal nutritional status, so the combination of early stage, viral load control, and good nutritional status confirms that HIV/AIDS management at Dr. Moewardi Regional Hospital is on the right track in breaking the chain of transmission and maintaining patient productivity.

Patient characteristics based on tuberculosis status

Based on the research results, the majority of HIV/AIDS patients in the sample did not have tuberculosis (TB) co-infection, with 80 people (80%) having Non-TB status and 20 people (20%) having confirmed TB, thus indicating that although TB is the most common opportunistic infection in HIV/AIDS patients, many patients in this study were able to maintain their body condition so that they were not or had not been exposed to Mycobacterium tuberculosis. This finding is in line with the report of the Directorate General of Disease Prevention and Control (P2P) of the Indonesian Ministry of Health which seeks to reduce HIV-TB co-infection through a TB-HIV collaboration program and the provision of Tuberculosis Prevention Therapy (TPT), as well as research by Sari et al. (2023) which confirms that early detection and rapid initiation of Antiretroviral (ARV) therapy effectively reduce the risk of opportunistic infections, including TB. The dominance of Non-TB status is also associated with better clinical conditions, because patients without TB tend to have stable nutritional status, as reflected in 90% of respondents with a BMI within the normal range.

However, the presence of 20% of patients with TB co-infection remains a concern, as TB in HIV/AIDS patients can accelerate disease progression and significantly reduce CD4 cell counts. Therefore, these data emphasize the need for routine TB screening for every HIV/AIDS patient undergoing check-ups at Dr. Moewardi Regional Hospital so that co-infection can be detected early, medical intervention can be carried out in a timely manner, and the proportion of non-TB patients is maintained, thereby improving patient quality of life and minimizing mortality due to complications of opportunistic infections.

Patient characteristics based on opportunistic infections

Based on the research results, the majority of HIV/AIDS patients (93%) did not have opportunistic infections, which indicates that most patients may have received optimal Antiretroviral (ARV) therapy or were detected at a relatively early stage of the disease so that the immune system is still maintained. The low proportion of patients with opportunistic infections reflects the effectiveness of clinical management at Dr. Moewardi Surakarta Regional Hospital in immune monitoring and treatment continuity, although the presence of patients with one or more opportunistic infections still requires intensive attention because it is often related to late diagnosis, severe immunosuppression, or non-adherence to ARV. Thus, these findings confirm that early detection and adherence to ARV treatment are key factors in preventing opportunistic infections, improving patients' quality of life, and reducing the risk of complications and mortality due to AIDS.

Patient characteristics based on treatment side effects

This study found that 92% of patients did not experience side effects from ARV treatment, indicating that most patients were able to tolerate the therapy well, although the majority regimen (80%) was dominated by TDF + 3TC + Efavirenz (EFV) which has the potential to cause neuropsychiatric side effects such as dizziness, nausea, and nightmares, in accordance with the findings of Wahyuni et al. (2023). However, 46% of patients in certain analyses still reported complaints, thus emphasizing the importance of education and management of side effects so that patients do not stop treatment on their own, in accordance with the report of the Directorate General of P2P and previous studies that emphasize the relationship between drug tolerance with the continuity of therapy and the achievement of viral load suppression. Overall, these data illustrate that ARVs at Dr. Moewardi Regional Hospital are well accepted by most patients, however, for those affected by side effects, more intensive clinical monitoring and consideration of switching to a Dolutegravir (DTG)-based regimen with fewer side effects are needed, so that patients' quality of life is maintained and therapy goals are optimally achieved.

Univariate Analysis

Relationship between Demographic Characteristics and CD4 Values

Based on the Chi-Square test, all tested variables did not show a statistically significant relationship with CD4 counts (p-value > 0.05), both from a demographic and clinical perspective, so it can be concluded that the immunological status of HIV patients in this study is multifactorial and is not sufficiently explained by the variables covered. Gender, BMI, TB status, opportunistic infections, side effects, marital status, and education level all produced p-values above 0.05, although clinically some groups appear at risk (for example, TB patients and opportunistic infections tend to have CD4 counts <200 cells/mm³). The predominance of patients with normal BMI (90%), the majority did not have opportunistic infections (93%), and the majority did not experience significant side effects (92%) illustrate the success of ARV prophylaxis and management at Dr. Soetomo General Hospital. Moewardi, however, the insignificance of this relationship confirms that CD4 recovery is more influenced by other factors not measured in the study, such as medication adherence, more specific nutritional profiles, and viral load dynamics, so further research is needed that integrates these variables to understand the patient's immunological journey more comprehensively.

Relationship between Demographic Characteristics and Viral Load

The analysis results in Table 11 show no significant relationship between independent variables and Viral Load levels (p-value > 0.05), both from a demographic and clinical perspective, so that viral replication in this sample cannot be explained solely by these characteristics. The relationship between gender, age, marital status, education level, BMI, TB status, side effects, and opportunistic infections all produced p-values above 0.05, although clinically some groups showed certain patterns, such as the predominance of male patients and those aged 40–49 years in the high viral load group, as well as a greater percentage of high viral loads in patients with a BMI > 25 and the majority of patients with opportunistic infections had a viral load > 1,000 copies/mL. These findings are in line with the research of Masyeni et al. (2018) who emphasized that the success of viral

suppression is more determined by the duration of ARV use and the level of patient adherence than by sociodemographic characteristics, so that the even distribution of viral load across various subcategories confirms that the socio-economic and clinical factors measured in this study do not function as a single determinant of viral replication control, but rather are part of a multi-variable dynamic involving adherence, duration of therapy, and other individual factors.

Relationship between Demographic Characteristics and Clinical Stage

Based on the results in Table 12, all independent variables did not show a statistically significant relationship with the clinical stage of HIV/AIDS patients (p-value > 0.05), either demographically or clinically. Therefore, clinical stage progression cannot be explained solely by characteristics such as gender, age, marital status, education level, BMI, TB status, or opportunistic infections. The majority of patients, both men and women, across various age groups, and patients with varying marital status and education levels, remained concentrated in Stage 1, indicating that the patient's physical condition has stabilized due to ongoing medical intervention. This is in line with research by Wahyuni (2021) and other studies that confirm that in patients receiving long-term active ARV care and therapy, clinical stage is no longer linearly correlated with demographic factors or standard clinical profiles, as changes in clinical status are more influenced by systemic biological factors and therapy management than by socioeconomic characteristics alone.

In clinical parameters, the majority of patients with normal BMI (76%) remained in Stage 1, and the majority of patients with TB or opportunistic infections were also not significantly associated with an increase in clinical stage, thus demonstrating the effectiveness of the prophylaxis program and clinical management implemented evenly at Dr. Moewardi Regional Hospital. These findings are in line with Pradipta et al. (2020) who emphasized that appropriate medical management can suppress severe clinical manifestations even in the presence of coinfection. Overall, the three analysis tables of CD4 count, viral load, and clinical stage illustrate that the immunological, virological, and clinical profiles of HIV/AIDS patients at this institution are multifactorial, so health status is likely determined more by factors unmeasured in the study, such as medication adherence, duration of therapy, type of ARV regimen, and psychological condition and social support of the patients.

CONCLUSION

This study found that the majority of HIV/AIDS patients at Dr. Moewardi Surakarta Regional General Hospital were in a relatively stable condition, indicated by the predominance of male patients, productive age, married status, secondary education to above, and early clinical stage with CD4 and viral load values mostly still within the controlled range. Clinically, most patients had a normal BMI, did not suffer from TB, did not experience opportunistic infections, and did not report significant side effects, thus illustrating the effectiveness of Antiretroviral (ARV) therapy, early screening, and ongoing clinical management at this institution. However, bivariate analysis showed no significant association between demographic and clinical variables with CD4, viral load, or clinical stage (p-value > 0.05), thus confirming that the immunological, virological, and clinical status of patients are multifactorial and are likely more influenced by factors outside the study, such as medication adherence, duration of therapy, type of ARV regimen, more specifically nutritional status, and patient psychosocial support.

The limitations of this study lie in its retrospective design, which relies on complete medical records, the potential for accidental sampling selection bias, and the exclusion of compliance, adherence, and psychosocial factors directly from the analysis model. This inability to fully explain the causal mechanisms of therapy failure is therefore incapable of fully explaining the causal mechanisms of therapy failure. For future research, it is recommended to use a prospective design with more in-depth measurements of compliance, adherence, quality of life, and psychosocial and nutritional factors, while expanding the coverage area and multiple ARV regimens to ensure more representative results and provide a basis for policy improvement. Practically, this study emphasizes

the importance of strengthening early screening, routine CD4 and viral load monitoring, TB screening, side effect management, and holistic education and counseling to maintain clinical stability, prevent therapy failure, reduce the risk of transmission, and improve the quality of life of HIV/AIDS patients at Dr. Moewardi Regional Hospital and similar referral services.

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