Volume 4, No. 2 February 2026
p-ISSN3032-3037| e-ISSN 3031-5786

ADVANCES IN SOCIAL HUMANITIES RESEARCH

Arv Adherence as the Main Predictor of Viral Load Levels: A Case Study at Pasar Minggu Health Center

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Abstract
This study aims to analyze the effectiveness of adherence to antiretroviral (ARV) therapy on viral load levels among People Living with HIV (PLHIV) in the working area of the Pasar Minggu Health Center. The study employed a cross-sectional design with a total sample of 80 PLHIV. Data were obtained from medical records and a validated adherence questionnaire. Analysis was performed using Chi-square tests and multivariate logistic regression. The results showed that ARV adherence had a significant effect on viral load levels ($p = 0.001$; Exp(B) = 0.045), where non-adherent individuals had a 22-times higher risk of having a detectable viral load. The duration of HIV diagnosis was also significant ($p = 0.006$; Exp(B) = 0.086), while comorbidities were not statistically significant ($p = 0.078$) but clinically relevant (Exp(B) = 8.696). Both variables acted as confounders in the relationship between adherence and viral load. The study concludes that ARV adherence plays a crucial role in reducing viral load. Comorbidities and the duration of HIV diagnosis influence adherence and should be considered in therapeutic interventions. Education-based, counseling, and family-support interventions need to be strengthened to improve long-term adherence.

Keywords: HIV, ARV adherence, viral load, therapy effectiveness

Introduction

Your text is already well-written and demonstrates academic precision. I have carefully proofread it for grammar, punctuation, sentence flow, and coherence. I also italicized the non-English “Title” term, Pasar Minggu Health Center, as you requested. The improved version retains your citations and paragraph structure while ensuring formal clarity.

Human Immunodeficiency Virus (HIV) remains a serious global health challenge. The UNAIDS (2023) report recorded that 39.9 million people were living with HIV worldwide, with around 630,000 deaths caused by AIDS-related illnesses that year. Nevertheless, since the discovery of antiretroviral therapy (ART), AIDS-related mortality has significantly declined, particularly in countries with good access to treatment and care services (Deeks et al., 2013).

To accelerate HIV epidemic control, UNAIDS has set the global 95-95-95 targets: 95% of People Living with HIV (PLHIV) should know their HIV status, 95% of those diagnosed should access ART, and 95% of those on therapy should achieve viral load suppression (Gallant et al., 2017). Viral load suppession is critical because it indicates that the amount of virus in the blood is very low, thereby drastically reducing transmission risk while improving the quality of life of PLHIV (Nurhayati & Hafiz, 2022; Srikartika et al., 2023; Triyani, 2020).

In Indonesia, as of December 2022, there were 543,100 PLHIV, but only 41% were receiving ART, and just 19% of them had achieved viral load suppression (UNDP, 2022). DKI Jakarta is one of the provinces with a high prevalence, including the Pasar Minggu Health Center area, which continues to record an increase in ART recipients. Indonesia has implemented the “test and treat” policy, in which every PLHIV is immediately given ART upon diagnosis. However, suboptimal treatment outcomes persist, as evidenced by the fact that only about 60% of patients at the Pasar Minggu Health Center achieved an undetectable viral

load within the first six months of treatment, indicating variability in treatment response and underscoring a critical local service gap.

Adherence is a decisive factor in the success of ART. A study by Ford et al. (2018) reported that adherence to at least 95% of ART regimens is essential for achieving viral load suppression—a condition in which the virus becomes undetectable or remains at very low levels in the blood. This suppression is not only vital for individual health but also has major epidemiological implications, as it can reduce HIV transmission risk to nearly zero. However, maintaining such a high level of adherence is not easy. Various barriers to adherence have been identified in many studies, including side effects such as nausea, dizziness, or gastrointestinal disturbances that affect patient comfort. Moreover, social stigma and discrimination against PLHIV remain high in many communities, causing patients to avoid accessing health services openly or to conceal their status, which ultimately leads to non-adherence. A lack of social and emotional support, especially from family, partners, or the surrounding environment, also contributes to low motivation to take ART regularly. On the other hand, economic barriers—such as transportation costs to health facilities, job loss due to HIV status, or limited access to nutritious food—further aggravate the challenges faced by PLHIV in maintaining adherence.

A preliminary study conducted at the Pasar Minggu Health Center (2024) confirmed the presence of these barriers in the local context. Respondents reported that economic limitations, medication side effects, and limited family support were the main challenges in undergoing long-term therapy. In addition to adherence, several other factors influence ART effectiveness. Age is related to the body's immunological capacity and the understanding of treatment importance; younger groups sometimes show lower adherence due to a lower perceived risk. Gender also plays a role; some studies show that women tend to be more adherent but are also more vulnerable to stigma and the dual burden of responsibilities (such as childcare and work).

The duration of HIV infection is another important factor, as patients with longer infections often experience more severe immunological damage, making response to ART slower or more complex. Comorbidities such as tuberculosis (TB) and hepatitis B/C further complicate therapy due to complex drug combinations, increased risk of drug interactions, and more severe side effects. Nutritional status is also critical, as malnutrition or poor nutrition may impair drug metabolism, worsen side effects, and weaken the immune system. Equally important is family and social support, which has been proven to significantly enhance patient motivation in adhering to therapy. International studies have shown that PLHIV with strong support systems from family or communities tend to have better adherence, lower stress levels, and higher quality of life.

A preliminary survey of 10 PLHIV patients in the Pasar Minggu Health Center area showed that 70% had achieved undetectable viral load, while 30% still had detectable viral load ranging from low to high. Although most patients demonstrated optimal treatment response, these findings highlight a subgroup that had not yet achieved maximum viral suppression. This indicates gaps in treatment effectiveness likely caused by risk factors such as non-adherence to ART, comorbidities, longer infection duration, and psychosocial barriers such as stigma and lack of family support. Patients with detectable viral loads remain at risk of treatment failure, which not only accelerates disease progression but also increases the potential for HIV transmission to partners or others.

This study aims to analyze the effectiveness of ART adherence on viral load levels among PLHIV in the working area of the Pasar Minggu Health Center, focusing on identifying patient characteristics such as age, gender, comorbidities, duration of therapy, length of HIV infection, nutritional status, and family support; describing adherence profiles and viral load levels; and analyzing the effect of ART adherence on viral load based on these characteristics to determine the most dominant influencing factors.

Method

This study employed a quantitative approach with a cross-sectional research design—an observational study conducted by collecting data at a single point in time to examine the relationship between independent and dependent variables. This design was chosen because it allows researchers to evaluate the relationship between adherence to antiretroviral therapy (ART) and viral load levels among People Living with HIV (PLHIV) without conducting interventions or long-term follow-ups. The cross-sectional design has been widely used in epidemiological and health service studies because it is time- and cost-efficient (Setia, 2016). The study was conducted at the Pasar Minggu Health Center, South Jakarta, one of the primary healthcare facilities actively engaged in ART programs and PLHIV support. This site was selected because it has a comprehensive data recording system and a sufficient population size to support the research.

The research was carried out from March to August 2025. Activities included proposal submission, proposal seminars, revisions and approvals, data collection, data analysis, and final report writing. These stages were conducted systematically to ensure the validity and reliability of the findings. The study population comprised all PLHIV receiving ART at the Pasar Minggu Health Center in the past two years (2023–2024), totaling 260 individuals based on medical records. The sample size was determined using Lemeshow's (1997) formula for testing hypotheses with two proportions, assuming viral load suppression in 80% of adherent respondents and 50% in non-adherent respondents. The calculation yielded a minimum sample size of 72, and to anticipate data loss, the sample was increased by 10% to 80 respondents.

Sampling was conducted using random sampling, selecting respondents randomly from those meeting the inclusion and exclusion criteria. Inclusion criteria included individuals diagnosed with HIV, receiving ART within the last two years, and having complete viral load data at 6–12 months and beyond 12 months. Exclusion criteria included respondents who did not consistently continue therapy, had incomplete data, or moved to another facility during the study period. Data collection was carried out using two main sources: review of medical records and semi-structured questionnaires filled out by active respondents. Medical records provided objective data such as age, gender, duration of therapy, comorbidity status, and viral load levels, while the questionnaire measured ART adherence and family support based on respondents' perceptions.

The questionnaire was developed based on theoretically validated indicators and previous studies. Adherence was measured by medication consumption in the past 30 days and categorized as adherent (≥95% of doses) or non-adherent (<95%), in accordance with Ministry of Health guidelines (2022). Family support was measured using emotional, instrumental, and informational indicators based on Friedman's theory (2018), and categorized as high or low based on the median score. Validity testing was conducted using Pearson's correlation on 20

pilot respondents, and all items were found valid. Reliability testing using Cronbach's Alpha yielded a value of 0.956, indicating very high internal consistency.

Data processing involved several steps: editing, coding, scoring, entry, and cleaning. The data were analyzed using univariate, bivariate, and multivariate analyses. Univariate analysis described respondents' characteristics, while bivariate analysis examined relationships between each independent variable and viral load levels using the Chi-square test. To assess simultaneous effects and identify the most dominant factors influencing viral load, multivariate analysis was performed using multinomial logistic regression, as the dependent variable had more than two categories. The enter method was applied by including all independent variables with initial eligibility ($p < 0.25$). Interpretation of results was based on p-values (<0.05) and odds ratios (OR), along with the analysis of dominant variables and potential confounders.

Data presentation included frequency tables, cross-tabulations, and regression outputs to support conclusions. The findings were presented in descriptive and interpretive narratives to aid reader understanding. Ethical considerations included approval from the Health Research Ethics Committee, assurance of respondent confidentiality, fairness in sample selection, and adherence to the principle of non-maleficence. This study is expected not only to contribute scientifically but also to directly improve ART services at primary healthcare facilities.

Results and Discussion

The research findings are presented in three main stages of analysis, beginning with univariate analysis, followed by bivariate analysis, and concluding with multivariate analysis. In the univariate stage, the researcher described respondent characteristics based on the frequency distribution and percentage of each variable studied. These variables included age, gender, presence of comorbidities, duration of antiretroviral therapy (ART), length of time living with HIV, nutritional status, family support, adherence to ART, and viral load levels of each respondent.

The purpose of this analysis was to determine the frequency distribution and percentage of each category within the variables studied. The results of this analysis are presented in Table 1 below.

Table 1. Frequency Distribution of PLHIV Respondent Characteristics Based on Sociodemographic, Clinical, Family Support, ARV Adherence, and Viral Load Status Variables

No	Variable	Category	f	%
1	Age	< 25 years	10	12.5
		25–34 years	13	16.3
		35–44 years	57	71.3
2	Gender	Male	65	81.3
		Female	15	18.8
3	Comorbidities	Present	17	21.3
		Absent	63	78.8
4	Duration of ART	6–12 months	24	30.0
		> 12 months	56	70.0
5	Duration of HIV Diagnosis	6–12 months	23	28.7
		> 12 months	57	71.3
6	Nutritional Status	Underweight	59	73.8
		Normal	11	13.8

		Overweight	10	12.5
7	Family Suppor	Low	23	28.7
		High	57	71.3
8	ARV Adherence	Non-adherent	16	20.0
		Adherent	64	80.0
9	Viral Load	Detectable	17	21.3
		Undetectable	63	78.8

Source: Processed data (2025)

The results of the univariate analysis in Table 1 show that the majority of respondents in this study were aged 35–44 years (57 respondents; 71.3%) and male (65 respondents; 81.3%). Most had no comorbidities (63 respondents; 78.8%) and had been on ART for more than 12 months (56 respondents; 70.0%). The duration since HIV diagnosis was also dominated by respondents with more than 12 months (57 respondents; 71.3%).

From other aspects, most respondents were underweight (59 respondents; 73.8%) and received high levels of family support (57 respondents; 71.3%). The level of adherence to therapy was also relatively high, with 64 respondents (80.0%) adhering to ART. Laboratory results showed that the majority of respondents had undetectable viral load levels (63 respondents; 78.8%), indicating treatment success in most participants.

In the second stage, bivariate analysis was conducted using the Chi-square statistical test to examine the relationship between ART adherence and viral load levels among PLHIV. This analysis also evaluated the extent to which other variables—such as age, gender, comorbidities, duration of therapy, length of HIV diagnosis, nutritional status, and family support—could act as confounding variables influencing the relationship between therapy adherence and viral load levels. The relationship was considered statistically significant if the p-value ≤ 0.05. Thus, if the test results showed a p-value below 0.05, it indicated a significant relationship between the independent variables and the viral load status of PLHIV. A summary of the bivariate analysis results is presented in Table 2 below.

Table 2. Relationship Between Respondent Characteristics and Viral Load Levels in the Working Area of Pasar Minggu Health Center, 2025

Variable	Category	Detectable Viral Load (n/%)	Undetectable Viral Load (n/%)	Total (n)	p-value	OR (95% CI)
Age	<25 years	2 (20%)	8 (80%)	10	0.404	–
	25–34 years	1 (8%)	12 (92%)	13		
	35–44 years	14 (25%)	43 (75%)	57		
Gender	Male	15 (23%)	50 (77%)	65	0.237	1.95 (0.4–9.6)
	Female	2 (13%)	13 (87%)	15		
Comorbidity	Present	8 (47%)	9 (53%)	17	0.009	5.3 (1.6–17.5)
	Absent	9 (14%)	54 (86%)	63		
Duration of ART	6–12 months	11 (46%)	13 (54%)	24	0.001	7.05 (2.2–22.6)
	>12 months	6 (11%)	50 (89%)	56		
Duration of HIV Diagnosis	6–12 months	11 (48%)	12 (52%)	23	0.001	7.79 (2.4–25.3)
	>12 months	6 (11%)	51 (89%)	57		

Nutritional Status	Underweight	13 (22%)	46 (78%)	59	0.602	–
	Normal	3 (27%)	8 (73%)	11		
	Overweight	1 (10%)	9 (90%)	10		
Family Support	Low	10 (44%)	13 (56%)	23	0.005	5.49 (1.7–17.2)
	High	7 (12%)	50 (88%)	57		
ARV Adherence	Non-adherent	10 (62%)	6 (38%)	16	0.000	13.6 (3.7–48.8)
	Adherent	7 (11%)	57 (89%)	64		

Source: Processed data (2025)

The results of the bivariate analysis using the Chi-square test showed that several variables had a statistically significant relationship with viral load levels among People Living with HIV (PLHIV) in the working area of the Pasar Minggu Health Center in 2025. Adherence to ART was the strongest factor associated with viral load levels. Non-adherent respondents had a 13.6-times higher risk of having a detectable viral load compared to those who were adherent ($p = 0.000$; OR = 13.6; 95% CI: 3.7–48.8). This emphasizes the importance of adherence in suppressing HIV replication in the body. Family support was also significant ($p = 0.005$), where individuals with low family support had a 5.49-times higher risk of having a detectable viral load. Social support, especially from family, plays an important role in encouraging adherence to treatment.

The presence of comorbidities also had a significant effect ($p = 0.009$), with an odds ratio of 5.3. This indicates that HIV patients with comorbid illnesses are at greater risk of having uncontrolled viral load levels. Similarly, ART duration and length of HIV diagnosis had significant effects on viral load status. Patients who had only recently started ART (6–12 months) and those newly diagnosed (<12 months) had higher risks (OR = 7.05 and 7.79, respectively) of having a detectable viral load compared to those who had been on treatment and living with HIV for more than a year. This finding highlights the importance of maintaining long-term treatment continuity to achieve viral suppression. Meanwhile, age, gender, and nutritional status did not show statistically significant relationships with viral load levels ($p > 0.05$). Although there were descriptive variations in certain age and gender groups, the statistical results were not strong enough to conclude any actual effect.

The final stage of data analysis was multiple logistic regression, used to identify the factors most strongly influencing the success of viral load reduction among PLHIV. This method was chosen because the dependent variable, viral load, is dichotomous (detectable/undetectable). In addition to testing the effect of ART adherence, this analysis also controlled for confounding variables to obtain more accurate results. The regression results are expected to provide a basis for determining more effective intervention priorities focusing on aspects that significantly contribute to ART success.

Table 3. Selection of Candidate Variables for Multiple Logistic Regression Based on Bivariate Test

No	Variable	p-value	Status
1	ARV Adherence	0.000	Candidate
2	Age	0.404	Not included
3	Gender	0.630	Not included
4	Comorbidities	0.009	Candidate

5	Duration of ART	0.001	Candidate
6	Duration of HIV Diagnosis	0.001	Candidate
7	Nutritional Status	0.602	Not included
8	Family Support	0.005	Candidate

Source: Processed data (2025)

The initial selection of bivariate variables (Table 3) identified five variables that met the criteria as regression candidates ($p < 0.25$), namely: ARV Adherence, Comorbidities, Duration of ART, Duration of HIV Diagnosis, and Family Support. Variables with $p > 0.25$ were considered to have insufficient contribution to the model and were excluded from the multivariate analysis.

Table 4. Final Model of Multiple Logistic Regression: Factors Influencing Viral Load Levels among PLHIV

Variable	B	SE	p-value	Exp(B)	Interpretation
ARV Adherence	-3.09	0.96	0.001	0.045	Non-adherent → 22 times more at risk of detectable viral load
Comorbidities	2.16	1.23	0.078	8.696	With comorbidities → 8.7 times more at risk of detectable viral load
Duration of HIV Diagnosis	-2.45	0.88	0.006	0.086	Longer duration of diagnosis → reduces the risk of detectable viral load

Nagelkerke R^2: 0,415

Source: Primary Data, processed in 2025

Furthermore, the final multiple logistic regression model (Table 4) showed that ARV adherence ($p = 0.001$; Exp(B) = 0.045) and duration of HIV diagnosis ($p = 0.006$; Exp(B) = 0.086) were significant predictors of successful viral load suppression. This indicates that non-adherent individuals were 22 times more likely to have a detectable viral load, while patients who had known their HIV status for a longer period were more likely to achieve an undetectable viral load due to greater discipline in adhering to therapy.

Although comorbidities were not statistically significant ($p = 0.078$), the Exp(B) value of 8.696 indicates a substantial clinical effect; therefore, this variable was retained as an important confounder. Overall, the model explained 41.5% of the variability in viral load levels, a reasonably good value for a population-based epidemiological model.

Characteristics of PLHIV in the Working Area of Pasar Minggu Health Center

The results of the study showed that the majority of respondents were aged 35–44 years (71.3%) and predominantly male (81.3%). Clinically, most had no comorbidities (78.8%) and had been on ART for more than 12 months (70%). A total of 71.3% of respondents had been diagnosed with HIV for more than one year. Another notable finding was that although most respondents were underweight (73.8%), they still demonstrated high adherence to ART (80%) and undetectable viral load levels in 78.8% of respondents.

Theoretically, viral load (VL) is the main indicator of ART success, with the target being an undetectable VL. High adherence (>95%) is the key to viral suppression, while non-adherence carries the risk of resistance and treatment failure. The study found that respondents with high adherence were more likely to have undetectable VL, consistent with (Paterson et

al., 2000). Treatment duration also played an important role, as most respondents who had been on ART for more than 12 months showed favorable VL outcomes, supporting Palella et al. (1998) regarding the importance of long-term therapy. Beyond adherence and duration, other factors such as comorbidities and family support also played critical roles. In this study, most respondents had no comorbidities, which protected them from treatment complications. Psychological factors were also relevant, as high family support (71.3%) helped sustain patient motivation and consistency in therapy. These findings align with Catz et al. (2000), who emphasized that social support is closely associated with lower VL.

The findings were also supported by national studies showing a positive association between adherence and quality of life (Nurhayati & Hafiz, 2022), as well as the effectiveness of mobile phone reminders in improving adherence (Valentina Meta Srikartika et al., 2023). However, differences were noted in other studies that highlighted stigma and lack of social support as key barriers (Sholihatul Mukarromah, 2023). The researcher's analysis indicated that ART success is strongly determined by adherence, which in turn is influenced by family support, treatment duration, and the absence of comorbidities. Although most respondents were underweight, this did not necessarily hinder treatment success, as VL remained undetectable in the majority. Nevertheless, nutritional status should be monitored as a potential long-term risk factor.

In conclusion, the characteristics of PLHIV in the Pasar Minggu Health Center area suggest clinical and social conditions that are relatively supportive of treatment success. High adherence, longer treatment duration, and strong family support were the main strengths underlying undetectable VL results. Future efforts to enhance treatment outcomes should continue emphasizing psychosocial interventions and nutritional monitoring to ensure sustained treatment success.

Overview of Viral Load Levels and ART Adherence

The results of this study showed that most PLHIV respondents had a high level of adherence to ART (80%), and 78.8% had an undetectable viral load. These findings illustrate that the majority of PLHIV in the Pasar Minggu Health Center area followed therapy with good discipline, successfully suppressing viral replication below the laboratory detection threshold. This outcome serves as an indicator of the success of the ART program implementation in the area.

Theoretically, viral load (VL) is the primary indicator of ART effectiveness, with the goal of reducing virus levels to undetectable (<200 copies/ml). Adherence above 95% is essential to achieve viral suppression, while non-adherence can trigger resistance and treatment failure. Other factors such as duration of therapy, presence of comorbidities, and social support also influence outcomes. Patients with high adherence and long-term therapy generally have more stable VL Palella et al., (1998), whereas comorbidities can complicate VL control (Deeks et al., 2018).

These findings are reinforced by studies such as Nurhayati & Hafiz (2022), which showed a significant relationship between ART adherence and quality of life, and Triyani (2020), who found that 90% of adherent patients did not require hospitalization. Technology has also proven effective; for example, mobile phone reminders increased adherence by up to 80% (Valentina Meta Srikartika et al., 2023). However, regression analysis in this study

indicated that once adherence was included in the model, other variables such as therapy duration, family support, and comorbidities were no longer statistically significant ($p > 0.05$). This suggests that adherence is the dominant factor determining treatment success, alongside the duration of HIV diagnosis.

Psychosocial factors remain highly relevant, as stigma, drug side effects, and lack of social support can hinder adherence (Sholihatul Mukarromah, 2023). Banna & Manoppo (2019) also highlighted the role of family support in improving the quality of life of PLHIV, even though in this study family support was not directly significant. These findings confirm that social support functions indirectly by improving adherence. Therefore, HIV interventions should not only focus on medical aspects but also address psychosocial support to maintain long-term adherence.

From the researcher's perspective, the high level of viral load suppression in this study serves as concrete evidence that the ART program at the Pasar Minggu Health Center has been effective. Consistent education, individualized approaches, and the use of simple technologies such as alarms or reminder messages appear highly effective in helping patients maintain a regular medication schedule. Nevertheless, to ensure sustainability, routine monitoring, psychosocial interventions, and community empowerment are needed so that patients continue to receive long-term support. Overall, the findings of this study are consistent with various national and international studies, which conclude that ART adherence is the key factor in controlling viral load. When patients are adherent, VL tends to remain undetectable, transmission risk decreases, complications can be avoided, and quality of life improves. However, to maintain this success, it is crucial for healthcare providers and policymakers to continue supporting patients through services that integrate medical, psychological, and social dimensions.

The Effect of Adherence on Viral Load Levels

The results of this study indicate that adherence to antiretroviral therapy (ART) has a highly significant effect on viral load status among People Living with HIV (PLHIV) in the Pasar Minggu Health Center area. Of the total respondents, 80% demonstrated high adherence, and 78.8% of them had an undetectable viral load. This finding reinforces the basic principle of HIV management, namely that adherence levels of ≥95% are required to achieve optimal viral load suppression (WHO, 2016).

The results of the multiple logistic regression analysis showed that ART adherence was highly and significantly associated with viral load, where adherent individuals had a 95.5% lower risk of having a detectable viral load compared to non-adherent individuals ($p = 0.001$; $Exp(B) = 0.045$). In other words, non-adherent patients were about 22 times more likely to have a detectable viral load. These findings are consistent with studies by Madeira et al. (2020) in Brazil and Eka et al. (2019) in Indonesia, both of which confirmed that high adherence is strongly linked to viral load reduction. Within the framework of the Health Belief Model Rosenstock, (1974), adherence is influenced by individuals' perceptions of treatment benefits, disease severity, perceived barriers, and sources of support such as education from healthcare providers, access to services, and family encouragement.

This study also showed that other factors such as family support, comorbidities, duration of HIV diagnosis, and length of therapy did not have significant effects once adherence was

included in the model. This demonstrates that adherence is the primary mediator of ART success. Therefore, strategies to improve adherence—such as counseling, peer group education, technology-based reminders, and family involvement—are essential to ensure patients maintain adherence levels of ≥95%. These efforts will reduce the risk of drug resistance while improving the quality of life and life expectancy of PLHIV (UNAIDS, 2021).

The researchers conclude that adherence to ART has a very strong impact on the success of viral load suppression. Therefore, interventions to enhance adherence must continue comprehensively through education, counseling, and psychosocial support. In addition, healthcare providers should regularly monitor patient adherence behavior to provide timely interventions when non-adherence is identified. Interpersonal communication strategies that are empathetic and educational also need to be strengthened to build trusting relationships between patients and healthcare professionals.

Analysis of the Effect of Adherence Based on Other Factors

Based on the results of the multiple logistic regression analysis, adherence to ART was found to be the most significant factor influencing viral load status among PLHIV in the Pasar Minggu Health Center area. The final logistic regression model showed that ART adherence had a significant effect on viral load ($p = 0.001$; $Exp(B) = 0.045$), where non-adherent individuals were 22 times more likely to have a detectable viral load. Duration of HIV diagnosis was also significant ($p = 0.006$; $Exp(B) = 0.086$), indicating that the longer a person has been diagnosed, the less likely their viral load is to be detectable. Although comorbidities were not statistically significant ($p = 0.078$), the high Exp(B) value (8.696) suggests a clinically relevant effect. These two variables act as confounders that can influence the relationship between adherence and viral load. The Nagelkerke R^2 value of 0.415 indicates that the model explains 41.5% of the variation in viral load at the epidemiological level.

Adherence to ART is crucial for achieving optimal viral suppression. Paterson et al. (2000) emphasized that adherence must exceed 95%, as non-adherence can trigger viral resistance, increased viral load, and treatment failure. This is reinforced by Chesney (2000), who noted that inconsistent medication intake leads to unstable ART concentrations in the blood. Local studies show similar findings, such as Nurhayati & Hafiz (2022), who found that adherence positively correlates with quality of life, and Triyani (2020), who reported that 90% of adherent patients did not require hospitalization. Mutya Herdianti (2017) also highlighted that increased adherence is directly proportional to improvements in CD4 counts. Moreover, long-term therapy with high adherence has been shown to result in more stable viral suppression. However, the presence of comorbidities such as TB or hepatitis can disrupt treatment effectiveness due to drug interactions and immunological stress (Deeks et al., 2018), making a multidisciplinary approach necessary.

In this study, family support was not significantly associated with viral load ($p = 0.999$). This finding differs from social support theories and previous studies such as Catz et al. (2000) and Wrubel et al. (2001), which showed that family support enhances adherence and lowers viral load. Nevertheless, clinically, emotional and instrumental support remain important for sustaining treatment. This difference aligns with Mills et al. (2006), who suggested that the influence of family support may be diminished when patients experience depression or internalized stigma. This highlights that psychological factors can mediate the relationship

between social support and adherence, underscoring the importance of psychological support strategies to ensure HIV treatment success.

Based on these findings, it can be concluded that adherence to ART is the primary determinant in controlling viral load. However, adherence does not stand alone. Factors such as treatment duration, length of diagnosis, comorbidities, and family support all interact and influence treatment outcomes. Therefore, HIV treatment approaches cannot focus solely on ART provision but must also target patient education, social support, and integrated psychosocial interventions. Active family involvement, routine monitoring by healthcare providers, and the use of technologies such as mobile-based reminders can be effective strategies to improve treatment success and reduce the overall burden of the HIV epidemic.

Dominant Factors Influencing Viral Load

The results of this study show that adherence to antiretroviral therapy (ART) is the most dominant factor influencing viral load among People Living with HIV (PLHIV) in the Pasar Minggu Health Center area. With an Exp(B) value of 0.045 and a p-value < 0.001, adherence demonstrated the strongest predictive power in the logistic regression model. When adherence was included in the model, other variables such as comorbidities, treatment duration, and family support became statistically insignificant ($p > 0.05$). This indicates that the influence of these variables on viral load is controlled or mediated by the level of patient adherence to ART.

The study also found that the duration of HIV diagnosis was significantly associated with viral load ($p = 0.006$; Exp(B) = 0.086), where the longer a patient had lived with HIV, the less likely their viral load was detectable. This may be because patients become more adapted to their chronic condition, gain greater experience in managing therapy, and have more frequent interactions with healthcare services, all of which enhance adherence. The length of diagnosis also functions as a confounder influencing both adherence and viral load, making its inclusion in the model crucial for ensuring valid results. These findings reaffirm that adherence is the foundation of ART success, as emphasized by Paterson et al. (2000) and Chesney (2000), who argued that adherence above 95% is required to suppress viral replication, prevent resistance, and avoid treatment failure.

Several national studies reinforce these findings. Nurhayati & Hafiz (2022) demonstrated a significant relationship between adherence and quality of life among PLHIV, while Mutya Herdianti (2017) reported improvements in CD4 counts among adherent patients. Triyani (2020) also found that 90% of adherent patients did not experience hospitalization. Technology-based interventions, such as mobile reminders, have been shown to improve adherence by up to 80% and reduce viral load (Valentina Meta Srikartika et al., 2023). However, other factors such as treatment duration and comorbidities did not show significant effects once adherence was controlled for. This suggests that treatment length and comorbid conditions yield optimal results only when patients remain adherent (Deeks et al., 2018).

Family support also did not show a direct relationship with viral load, but it can still influence patient adherence. Previous studies Catz et al., (2000); Wrubel et al., (2001) emphasized that social support enhances motivation for adherence, even if it does not always directly affect virological outcomes. Psychological factors such as stigma and depression also affect treatment success, as highlighted by Sholihatul Mukarromah (2023) and Mills et al. (2006). Thus, adherence remains the key variable as well as the mediator of other influencing

factors. Efforts to improve ART outcomes must therefore focus on strategies that strengthen adherence—such as education, psychosocial counseling, technology utilization, and family involvement—since without adherence, other interventions will not be effective.

Conclusion

Based on the results of this study, it can be concluded that the majority of PLHIV in the Pasar Minggu Health Center area are of productive age, predominantly male, with underweight nutritional status, no comorbidities, have been on ART for more than 12 months, and receive strong family support. Most respondents had undetectable viral loads and were categorized as adherent to ART in terms of timing, dosage, and frequency. Adherence to ART was proven to have a significant effect on viral load, with non-adherent individuals being 22 times more likely to have a detectable viral load. In addition, the duration since HIV diagnosis was also a significant predictor, where the longer the diagnosis, the less likely the viral load was detectable. The logistic regression model explained 41.5% of the variation in viral load, indicating that adherence and the length of HIV diagnosis are the main factors influencing the success of ART. It is necessary to strengthen the role of healthcare workers in providing education, counseling, and family support to PLHIV to improve ART adherence. Health centers and the District Health Office are also expected to enhance HIV service policies through the provision of supporting facilities such as psychosocial services and easier access to medications. Future studies are recommended to explore psychosocial and cultural aspects influencing adherence and to employ longitudinal and mixed-method approaches to gain a more comprehensive understanding.

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