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Original article

Association between perceptions of antiretroviral drug use and medication adherence in patients with human immunodeficiency virus

Muthmainnah[1], Sudirman Katu[1], Nur Ahmad Tabri[1], Saidah Syamsuddin[2], Syakib Bakri[1], Arifin Seweng[3]

[1]Department of Internal Medicine, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia; [2]Department of Psychiatry, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia; [3]Department of Biostatistics, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

Abstract. *Background and aim:* The effectiveness of antiretroviral therapy (ART) is determined by both antiretroviral (ARV) drugs and patient adherence. Positive perceptions of ART among people living with HIV and AIDS (PLHIVs) are crucial for maintaining good adherence; thus, negative beliefs about ARV drugs can result in lower ART effectiveness. This study analyzed the association between perceptions of ARV drug use and other medication adherence factors in patients with HIV. *Methods:* This observational, cross-sectional study included 102 PLHIVs to retrospectively assess adherence to ART through self-reports of patients while they were receiving ART. Perceptions of ARV drug use were evaluated with the Beliefs about Medicines Questionnaire. Statistical analysis was performed with the chi-square test, independent t-test, and Mann–Whitney test. Statistical significance was described as a p-value of <0.05. *Results:* Most participants (86.3%) exhibited good adherence. Participants with good adherence had stronger beliefs and positive perceptions about the benefits of ART (p = 0.915). They also had lower perceptions about the potential adverse effects of ARV drugs than participants with moderate or low adherence (p = 0.608). A CD4 T-cell count ≥ 200 cells/mm^3 was significantly associated with medication adherence (p < 0.001), but no other significant associations were observed between sociodemographic/other factors (i.e., side effects of ARV drugs, duration of ART, and number of ARV tablets) and medication adherence. *Conclusions*: Perceptions of ARV drugs were not significantly associated with medication adherence in patients with HIV. The only significant influencing factor was a CD4 T-cell count of ≥200 cells/mm^3. (www.actabiomedica.it)

Key words: perception, antiretroviral therapy, adherence, beliefs about medicines questionnaire

Introduction

In 2022, the United Nations Program on HIV/AIDS (UNAIDS) reported that 38.4 million patients worldwide had human immunodeficiency virus (HIV) (1). According to data from the Ministry of Health of the Republic of Indonesia, the cumulative number of HIV cases in the country in March 2022 was 329,581 people (2). Although antiretroviral therapy (ART) is provided at no cost, less than 20% of patients with HIV in Indonesia are on ART (3). The effectiveness of ART is determined by both antiretroviral (ARV) drugs and patient adherence to the therapy (4).

Perceptions regarding ART among people living with HIV and AIDS (PLHIVs) are crucial for maintaining high adherence to medication (5). Patients with HIV receive long-term therapy, and it is essential that they take their medication correctly. However, this

is challenging for patients who have negative beliefs about their medication (3). Patient perception refers to patients' cognitive frameworks for understanding their medical condition and treatments. Patients build these frameworks on the basis of the information they receive, individual experiences, and beliefs (6). Perceptions about ART should be identified because they may trigger intentional nonadherence (e.g., to avoid drug side effects) or unintentional nonadherence (e.g., forgetting to take medication) (7). Few studies have investigated the influence of patient perceptions of HIV illness and treatment on medication adherence (8).

Understanding the factors influencing the decision to accept or reject evidence-based treatment recommendations and underlying patient adherence is essential for developing patient-centered methods for facilitating informed choices and optimizing clinical outcomes (9). Therefore, this study explored the association between perceptions of ARV drug use and other medication adherence factors in patients with HIV.

Materials and methods

Ethical approval

This was an observational study with a cross-sectional design conducted from May to November 2023 at the HIV Policlinic of Dr. Wahidin Sudirohusodo Hospital, Makassar, Indonesia. The Ethics Committee of Biomedical Research on Humans, Faculty of Medicine, Hasanuddin University, approved the study; the approval number was 650/UN4.6.4.5.31/PP36/2023, and the protocol number was UH23080639.

Study population

The study population comprised patients with HIV at the HIV outpatient department of Dr. Wahidin Sudirohusodo Hospital, Makassar City, South Sulawesi Province, Indonesia, from May to November 2023. Study samples were selected according to the inclusion and exclusion criteria. The estimated sample size was calculated with the Krejcie and Morgan sampling method. The minimum sample size was 83 patients. Sampling was carried out by consecutive sampling.

Inclusion and exclusion criteria

Outpatients with HIV aged 18–64 years who had been receiving ART for at least 3 months and were willing to participate in this study were included. Patients with HIV who had neuropsychiatric disorders were excluded from the study.

Clinical data and sample collection

The primary outcome measure was the correlation between patients' perceptions of ART and adherence. Perceptions of ART were assessed with a self-administered questionnaire after the participants' routine medical consultation at the HIV outpatient department. The questionnaire divided patient perceptions into two categories: (1) specific perceptions, defined as beliefs regarding the benefits and potential harmful effects of ART, and (2) general perceptions, defined as beliefs regarding the benefits and potential harmful effects of medical treatment in general. Perceptions were measured with the validated Indonesian version of the Beliefs about Medicines Questionnaire (BMQ) (3,10–12) which consists of two sections: the BMQ-Specific and the BMQ-General. The BMQ-Specific consists of 10 questions (A1–A10) and was utilized to measure patients' perceptions of ART. The BMQ-Specific consists of two scales focused on the necessity of ART (5 questions: A1, A3, A4, A7, and A10) and concerns about ART (5 questions: A2, A5, A6, A8, and A9). The BMQ-General consists of 8 questions (B1–B8) divided into two scales that focus on patient perceptions of overuse (4 questions: B1, B4, B7, and B8) and harm (4 questions: B2, B3, B5, and B6) related to medications. Each answer on the BMQ is assessed with a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score indicates stronger beliefs about each section. Strong beliefs about ART are defined as an average perception score on the BMQ-Specific of greater than 30 points, whereas weak beliefs are defined as an average perception score of less than or equal to 30 points. Strong beliefs about treatment are defined as an average perception score on the BMQ-General of

more than 24 points, and weak beliefs are defined as an average score less than or equal to 24 points.

Patient adherence to ART was assessed by the number of tablets consumed according to the patient's treatment control card and history of drug withdrawal or loss to follow-up. Participants' adherence to ART was classified as good (>95%) if the dose of untaken ARV was less than 3 tablets in 30 days, moderate (80–95%) if the dose of untaken ARV was 3–12 tablets in 30 days, and low (<80%) if the dose of untaken ARV was more than 12 tablets in 30 days.

The secondary outcome measure of this study was the correlation between several additional factors (age, sex, education level, duration of ART, number of ARV tablets, ARV side effects, CD4 T-cell count) and patient adherence to ART. Age, sex, education level, duration of ART (in years), number of ARV tablets, and ARV side effects were obtained from self-administered questionnaires, and the CD4 T-cell count was determined from blood samples taken during outpatient visits.

Statistical analysis

Data analysis was performed with Statistical Package for Social Science (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA). The Kolmogorov–Smirnov test was used to assess the normality of the data. Cronbach's alpha was used to determine the internal consistency of the BMQ; this coefficient describes the interrelatedness of questionnaire items and confirms the reliability of the questionnaire. It ranges from 0 (the items are independent) to 1 (the items are perfectly correlated). A generally accepted rule is that an α of 0.6–0.7 indicates an acceptable level of reliability (3,13,14). Data were analyzed with the chi-square test, independent t-test, and Mann–Whitney test. Statistical significance was described as a p-value of <0.05.

Results

Study population

This study enrolled 102 patients with HIV who met the inclusion criteria. The participants were predominantly male (86 patients, 84.3%); only 16 patients (15.7%) were female. The age group with the highest proportion of participants was 36–45 years old (38 patients, 37.3%). Most participants (58 patients, 56.9%) had a high education level, whereas 44 participants (43.1%) had a low education level. ARV side effects were experienced by 51% of the participants, whereas 49% of the participants did not report ARV side effects. Most participants (90 patients, 88.2%) took a single ARV tablet, and only 12 participants (11.8%) took multiple ARV tablets. The characteristics of the study participants are summarized in Table 1.

Reliability test

The results of the correlation of each question with the total correlation, which indicates reliability, are described in Table 2. Overall, our data showed that Cronbach's alpha was acceptable (0.782). The Cronbach's alpha values for each section of the Indonesian version of the BMQ were as follows: BMQ-Specific—Necessity, 0.830; BMQ-Specific—Concerns, 0.766; BMQ-General—Overuse, 0.638; and BMQ-General—Harm, 0.656.

Table 1. Characteristics of study participants.

Variable		**n**	**%**
Sex	Male	86	84.3
	Female	16	15.7
Age (years)	18–25	14	13.7
	26–35	34	33.3
	36–45	38	37.3
	>45	16	15.7
Level of education	Low	44	43.1
	High	58	56.9
ARV drug side effects	Yes	52	51.0
	No	50	49.0
Duration of ART (years)	≤ 5	64	62.7
	>5	38	37.3
Number of ARV tablets	Single tablet	90	88.2
	Multiple tablets	12	11.8
CD4 T-cell count (cells/mm^3)	<200	36	35.3
	≥200	66	64.7

Table 2. Correlation of each question with total correlation.

Questionnaire item	Mean ± SD	Corrected Item, Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
A1	4.43 ± 0.76	0.673	0.792	0.830
A3	4.18 ± 0.92	0.664	0.787	
A4	4.19 ± 0.95	0.740	0.764	
A7	4.21 ± 0.82	0.738	0.772	
A10	3.82 ± 1.26	0.462	0.871	
Total Necessity	20.83 ± 2.21			
A2	2.97 ± 1.19	0.550	0.719	0.766
A5	3.53 ± 1.13	0.604	0.700	
A6	2.88 ± 1.14	0.362	0.782	
A8	2.31 ± 0.94	0.480	0.744	
A9	2.99 ± 1.23	0.707	0.657	
Total Concern	14.68 ± 3.26			
B1	2.59 ± 0.88	0.384	0.616	0.638
B4	2.59 ± 1.04	0.447	0.549	
B7	3.17 ± 1.02	0.359	0.615	
B8	2.87 ± 0.89	0.537	0.490	
Total Overuse	11.22 ± 1.37			
B2	2.42 ± 1.04	0.407	0.612	0.656
B3	2.72 ± 0.98	0.478	0.559	
B5	2.43 ± 0.86	0.514	0.543	
B6	2.33 ± 0.93	0.361	0.637	
Total Harm	9.9 ± 0.98			
Overall Cronbach's alpha for BMQ: 0.782				

Correlation between participant perception and adherence to ART

The results of the participants' perceptions of ART (measured by the BMQ-Specific) and medical treatment in general (measured by the BMQ-General) are described in Table 3. The maximum score for participants' perceptions regarding ART was 50, while the minimum score was 14 (mean 35.5). The maximum score of participants' perceptions regarding medical treatment in general was 32, and the minimum score was 8 (mean 21.1).

The mean score for perceptions of ARV drugs was 35.5 for participants with good adherence and 35.4 for those with medium/low adherence. Our data did not reveal a significant association between perceptions of ARV drugs and adherence to ART (p = 0.915). The mean score for perceptions about treatment in general was 21.2 for participants with good adherence and 20.5 for those with moderate/low adherence. Our data did not show a significant association between perceptions about treatment in general and adherence to ART (p = 0.608) (Table 4).

The Mann–Whitney test was carried out to assess the correlation between perception scores for participants who strongly agreed (5 points) or agreed (4 points) and their adherence to ART on each section of the BMQ-Specific. No significant correlations were detected (Table 5). The mean rank score for each item indicating good adherence was generally higher than that for medium/low adherence, which indicates that participants with good adherence generally agreed or strongly agreed with each item (except items A5 and

Table 3. Results of perceptions regarding ART and general medical treatment.

Variable	n	Minimum Score	Maximum Score	Mean (SD)
Perception of ARVs	102	14	50	35.5 (5.7)
Perception of general treatment	102	8	32	21.1 (4.8)

Abbreviation: SD, standard deviation.

Table 4. Correlation between perceptions regarding ART and general medical treatment with adherence to ART.

Variable	Adherence	n	Mean (SD)	p-Value*
Perception of ARVs	Good	88	35.5 (5.8)	0.915
	Medium/Low	14	35.4 (5.6)	
Perception of general treatment	Good	88	21.2 (4.9)	0.608
	Medium/Low	14	20.5 (4.8)	

Abbreviation: *Independent t-test; SD, standard deviation.

Table 5. Correlation between the perception scores for "strongly agree" or "agree" on each BMQ-Specific section and patient adherence to ART.

	Adherence				p-Value*
	Good		Medium/Low		
BMQ Specific Section	n	Mean Rank	n	Mean Rank	
A1	81	47.93	13	44.81	0.652
A2	35	20.79	5	18.50	0.606
A3	73	44.38	13	38.54	0.369
A4	73	44.45	12	34.17	0.121
A5	53	30.94	9	34.78	0.472
A6	32	18.97	5	19.20	0.948
A7	76	45.25	11	35.36	0.161
A8	11	7.77	3	6.50	0.442
A9	38	22.13	4	15.50	0.189
A10	62	37.40	10	30.90	0.289

Abbreviation: *Mann–Whitney test.

A6). However, the results were not statistically significant (all with $p > 0.05$; Table 5).

The correlation between patients' perceptions of medical treatment in general and their adherence to ART (as measured by the BMQ-General questionnaire) was also assessed with the Mann–Whitney test. The mean rank score for each item indicating good adherence was generally higher than that for medium/low adherence, which indicates that participants with good adherence typically agreed/strongly agreed with each item (except item B4). However, according to the results of the statistical tests, none of these differences were significant (all with $p > 0.05$; Table 6).

Correlations between other factors and adherence to ART

In addition to the correlation between patient perceptions and adherence to ART, this study also assessed the correlations between other factors (sex, age, education level, ARV side effects, duration of ART,

Table 6. Correlation between the perception scores for "strongly agree" or "agree" on each BMQ-General section and patient adherence to ART.

	Adherence				p-Value*
	Good		Medium/Low		
BMQ General Section	n	Mean Rank	n	Mean Rank	
B1	16	8.50	0	0.00	NA
B2	14	8.93	2	5.50	0.257
B3	22	13.20	3	11.50	0.504
B4	16	9.31	2	11.00	0.606
B5	12	7.04	1	6.50	0.773
B6	11	6.55	1	6.00	0.763
B7	42	23.24	4	26.25	0.462
B8	18	13.00	6	11.00	0.295

Abbreviation: *Mann–Whitney test; NA, not available.

number of ARV tablets taken, and CD4 T-cell count) and patient adherence to ART. A chi-square test was carried out to assess the associations between perceptions of ARV drugs, treatment in general, and other factors and medication adherence (Table 7).

The proportion of participants with good adherence was greater for those with strong beliefs about ARV (88.1%) than for those with poor beliefs (77.8%), whereas moderate/low adherence was greater for those with poor beliefs about ARV (22.2%) than for those with strong beliefs (11.9%). However, the difference was not significant (p = 0.248). The proportion of participants with good adherence was greater for those with poor beliefs about general treatment (86.4%) than for those with strong beliefs (85.7%), whereas medium/low adherence was greater for those with strong beliefs (14.3%) than for those with poor beliefs (13.6%). However, the results of statistical tests showed that these differences were not significant (p = 0.933). Therefore, patient perceptions of ARV drugs and treatment in general were not significantly associated with the level of adherence (Table 7).

The results also revealed a difference in adherence to ART between female and male patients. A greater percentage of females reported good adherence to ART compared with males (87.5% vs. 86%), whereas medium/low adherence was greater in males (14.0% vs. 12.5%). However, the correlation between sex and adherence to ART was not significant (p = 0.877). In addition, the 36–45-year age group had the highest proportion of patients with good adherence to ART (89.5%), whereas the >45-year age group had the lowest adherence to ART (18.8%). However, the correlation between age and adherence to ART was not significant (p = 0.873). The proportion of participants with good adherence was greater among those with a high education level versus those with a low education level (89.7% vs. 81.8%), and participants with low/medium adherence were more likely to have a low education level than those with high adherence (18.2% vs. 10.3%), although this difference was not statistically significant (p = 0.255).

Most patients who did not experience ARV side effects had good adherence (92.0%); by contrast, medium/low adherence was more common for participants who experienced ARV side effects than for those who did not (19.2% vs. 8.0%). However, the difference between these two groups was not significant (p = 0.099). The same trend was observed for patients who had been treated with ARV for more than 5 years; good adherence was more common among participants who had received ARV for more than 5 years than in those who had received ARV for 5 years or less (89.5% vs. 84.4%), whereas low/moderate adherence was more common among participants who had received ARV for less than 5 years

Table 7. Associations between adherence and perceptions of ARV drugs, treatment in general, sex, age, education level, ARV side effects, duration of ART, number of ARV drug tablets, and CD4 T-cell count.

Variable		Adherence		p-Value*
		Good	Medium/Low	
Perceptions of ARVs				
Strong	n (%)	74 (88.1)	10 (11.9)	0.248
Poor	n (%)	14 (77.8)	4 (22.2)	
Perceptions of general treatment				
Strong	n (%)	18 (85.7)	3 (14.3)	0.933
Poor	n (%)	70 (86.4)	11 (13.6)	
Sex				
Male	n (%)	74 (86.0)	12 (14.0)	0.877
Female	n (%)	14 (87.5)	2 (12.5)	
Age (years)				
18–25	n (%)	12 (85.7)	2 (14.3)	0.873
26–35	n (%)	29 (85.3)	5 (14.7)	
36–45	n (%)	34 (89.5)	4 (10.5)	
>45	n (%)	13 (81.3)	3 (18.8)	
Level of education				
Low	n (%)	36 (81.8)	8 (18.2)	0.255
High	n (%)	52 (89.7)	6 (10.3)	
ARV drug side effects				
Yes	n (%)	42 (80.8)	10 (19.2)	0.099
No	n (%)	46 (92.0)	4 (8.0)	
Duration of ART (years)				
≤5	n (%)	54 (84.4)	10 (15.6)	0.469
>5	n (%)	34 (89.5)	4 (10.5)	
Number of ARV tablets				
Single tablet	n (%)	77 (85.6)	13 (14.4)	0.563
Multiple tablets	n (%)	11 (91.7)	1 (8.3)	
CD4 T-cell count (cells/mm^3)				
<200	n (%)	25 (69.4)	11 (30.6)	<0.001
≥200	n (%)	63 (95.5)	3 (4.5)	

Abbreviation: *Chi-square test

(15.6% vs. 10.5%); however, this difference was not statistically significant (p = 0.469). Compared with patients who took single ARV tablets, participants who took multiple ARV tablets had better adherence (91.7% vs. 85.6%), although this difference was not significant (p = 0.563). In addition, the proportion of participants with good adherence was greater in those with CD4 ≥ 200 cells/mm^3 (95.5%) than in those with CD4 < 200 cells/mm^3 (69.4%); moderate/low adherence was greater in participants with CD4 < 200 cells/mm^3 (30.6%) than in those with CD4 ≥ 200 cells/mm^3 (4.5%). In contrast to the previous factors, CD4 T-cell count and adherence to ART were significantly correlated (p < 0.001) (Table 7).

Discussion

In this study, participants with good adherence had a mean ARV-specific perception score of 35.5 ± 5.8. These results indicate that participants with good adherence had stronger beliefs and more positive perceptions of the benefits of ART than participants with moderate/low adherence. By contrast, participants with good adherence had a mean general treatment perception score of 21.2 ± 4.9. This finding shows that participants with good adherence had poorer beliefs about the excessive use of medication by doctors and the potential negative effects of medication than participants with moderate/low adherence.

A previous study suggested that patients with good medication adherence had higher perception scores regarding their treatment (15). A comparison of the perception scores of participants who strongly agreed or agreed with each BMQ-Specific question showed that participants with good adherence generally had strong beliefs about each BMQ-Specific item, except for items A5 and A6; however, the difference was not significant. Item A5 concerns the long-term effects of ART, and item A6 is a question regarding how ARV drugs work. These two questions are included in the concern scale. This finding demonstrates that participants with moderate/low adherence had strong beliefs regarding the potential adverse effects and long-term effects of ARV drugs. This aligns with previous research, which has shown that concerns regarding the long-term effects of ART are common (15,16).

Participants with good adherence had a higher mean rank of strongly agree/agree perception scores on the necessity scale than participants with moderate/low adherence. In addition, participants with good adherence had a total mean rank score for the concern scale regarding treatment lower than the necessity scale. This finding indicates that most participants with good adherence strongly believe that their current and future health depends on the ART that they are receiving and that these drugs could prevent the deterioration of their condition.

A comparison of the perception scores of participants who strongly agreed or agreed with each question in the general section of the BMQ showed that participants with good adherence generally had stronger beliefs for each BMQ-General section than participants with medium/low adherence, except for item B4, although the difference was not significant. Item B4, which is part of the general overuse scale, is a question about whether natural remedies are safer than conventional medicines. This finding indicates that participants with moderate/low adherence had negative perceptions about medicines and stronger beliefs that doctors overuse these medications. Notably, 22.6% of participants in this study consumed herbal medicine to increase their appetite and immunity. A study by Glendinning et al. suggested that doubts about the effectiveness of ART stemmed from participants' common-sense beliefs about their medicines, which were often at odds with the medical rationale for treatment. For example, some participants perceived that ART would not be necessary if they were able to boost their immune system in a more natural way, such as by eating healthily or taking natural remedies (15).

For the BMQ-Specific, the proportion of participants with good adherence was greater for those with strong beliefs (88.1%), and the proportion of participants with moderate/low adherence was greater for those with poor beliefs (22.2%). This suggests that participants with good adherence had strong beliefs and positive perceptions regarding the benefits and importance of ART for their health. By contrast, participants with moderate/low adherence had poor beliefs about ART. Drug use behavior is strongly influenced by patients' perceptions of the benefits of taking drugs. Positive or negative beliefs about medication influence the cognitive perspective of health behavior. Although we did not detect a significant association, the strong positive beliefs held by participants about the need for ARVs and concerns regarding the potential negative effects of ARVs are in line with findings from the literature. A previous study showed that patients with higher adherence had positive beliefs about using medications for chronic disease conditions (10).

For the BMQ-General, the proportion of participants with good adherence was greater for those with poor beliefs (86.4%), while the proportion of participants with moderate/low adherence was greater for those with strong beliefs (14.3%). This suggests that participants with good adherence had poor beliefs about the potential negative effects of the drugs they

consumed. By contrast, participants with moderate/low adherence had negative perceptions of drugs and strong beliefs about the harmful effects of these drugs. This finding is in line with the results of a study by Alhewiti, which concluded that the prevalence of low adherence among patients on long-term medications was high, and it was correlated with negative beliefs/perceptions about medications and inadequate information about their medications (17).

The proportion of females with good adherence was higher than that of males with good adherence (87.5% vs. 86%). According to a study by Rivero-Méndez et al., HIV/AIDS illness affects women in Puerto Rico more negatively because of sociocultural structures and norms (16). Women had more roles and responsibilities in their homes and for their partners, children, and family members. Moreover, pregnant women with HIV infection are more likely to adhere to ART to protect their babies (18). Another study showed that women responded better to HIV treatment than men. Women tend to have a more caring attitude because when they experience stress, they prefer to find friends to socialize with, support, or something that makes them feel better. By contrast, men are more likely to solve problems themselves (19,20).

The highest proportion of participants with good adherence was found in the 36–45-year age group (89.5%). This age range is classified as productive; people at this age tend to participate in many activities and social interactions, feel important, and believe they have a great responsibility for staying healthy. This finding is in accordance with the findings of other studies, which have shown that older patients are more adherent to ARV therapy, with the highest level of adherence occurring in the age range of 34–46 years (19,21). This was presented at the British HIV Association (BHIVA) conference in Bournemouth, which reported that barriers to adherence in young patients with HIV were mood swings, anxiety, and disclosure, with some young people self-harming or requiring psychiatric medication (22).

The proportion of participants with good adherence was greater among participants with higher education than among those with low education levels (89.7% vs. 81.8%). Previous studies have shown that participants with higher education levels have greater adherence and greater chances of attaining viral suppression than those with lower education levels. This is because participants with low education levels generally present minimal knowledge of their health condition, have difficulty understanding instructions from health service providers, have lower perceptions about ART that they are receiving, and exhibit decreased immune function; research indicates that they are three times less adherent to their ARV therapy than participants with higher education who have good knowledge and understanding of highly active ARV therapy (4).

The proportion of participants with good adherence was higher for patients who did not experience side effects from ARV drugs than for those who did. A previous study showed that the side effects of ARV drugs were a barrier to medication adherence (23). Patients who reported medication side effects expressed distrust of the benefits of ART. Patients who have relatively good health before beginning ART may be skeptical about the benefits of ART, as side effects may be perceived as causing a deterioration in their health (8). Overcoming and managing ART side effects is critical for maintaining not only high adherence but also high quality of life. Interventions involving ARV side effect management skills had positive effects on ART adherence (24).

According to one study, having an HIV diagnosis for 5 years or more was associated with poorer adherence and % less than excellent adherence than having an HIV diagnosis for less than 5 years (25). By contrast, our study found that the proportion of participants with good adherence was greater in those who had used ARVs for more than 5 years, but this difference was not statistically significant. These findings are similar to those of a study conducted by Martiana et al., which revealed no significant association between the duration of ART and ART adherence (26). Patients who have received therapy for a longer duration may be more accustomed to taking their medication and are likely to be more stable regarding their treatment and disease management, and hence, they may be more likely to demonstrate better adherence. Patients who have been receiving therapy for a longer period may also be more aware of the risks of non-adherence because of their previous experiences with disease symptom emergence, such as a history of opportunistic infections and comorbidities (25).

UNAIDS and the World Health Organization (WHO) highly recommend once-daily fixed-dose combinations of ARVs to improve medication adherence (27). Our study found that the proportion of participants with good adherence was higher among those who took multiple ARVs. A study by Cardoso et al. reported a greater chance of adherence among patients receiving multi-tablet regimen dolutegravir (MTR-DTG) in those who received and understood counseling about their treatment and those who had a higher quality of life (28). Another study by Ndoro et al. reported that multi-tablet regimens were associated with greater adherence to ART than single-tablet regimens. This finding was unexpected because a previous study reported that ART regimens with higher pill burdens lead to nonadherence (29).

Our study showed that the proportion of participants who adhered well was greater in participants with a CD4 T-cell count ≥ 200 cells/mm^3, this association was significant. This finding is consistent with the results of Giordillo et al., who concluded that adherence was better in participants with a CD4 T-cell count of over 200 cells/mm^3 (30). CD4 T-cells are a good indicator of adherence and are correlated with weight gain (12). The results of ART are monitored according to clinical staging by the WHO, immunology (CD4 T-cell count), and routine viral load tests. Clinically, one of the consequences of nonadherence is a decrease in CD4 T-cells, which causes decreased levels of immunity, an increased risk of opportunistic infections, and the possibility of developing AIDS and even death (28).

The main limitation of this study is that it was only conducted at one institution and over a short period (6 months). Therefore, a multicenter study with a longer duration is needed to evaluate the role of other factors that can influence medication adherence in patients with HIV, such as health service factors, family support, and peer community support.

Conclusion

In this study, no significant associations were found between perceptions of the use of ARV drugs, sociodemographic factors (age, sex, or education), or other factors (side effects of ARV drugs, duration of ART, or number of ARV tablets) and the level of medication adherence in patients with HIV. However, a CD4 T-cell count of ≥ 200 cells/mm^3 significantly influenced medication adherence in these patients. Further multicenter studies are needed to evaluate the role of other factors that could influence medication adherence in patients with HIV, such as health service factors, family support, and peer community support.

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Correspondence:
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Muthmainnah, MD
Department of Internal Medicine, Faculty of Medicine, Hasanuddin University
Makassar City, South Sulawesi Province, 90245, Indonesia
Phone: +62 822-9364-5371
E-mail: muthmainnahstr@gmail.com