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Factors related ART adherence and quality of life in PLHIV: Mediating role of positive self-care management and brain gym

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ARTICLE INFO	ABSTRACT
	Objectives: To investigate the factors affecting adherence to antiretroviral therapy (ART) and the quality of life in people living with human immunodeficiency virus (HIV), with a focus on evaluating the mediating roles of positive self-care management (PSCM) and brain gym. **Methods:** This is a descriptive study with a cross-sectional design. The data collected from June to August 2023. There are 262 respondents selected through convenience sampling. We used various research instruments, including questionnaires, which have undergone validity and reliability testing. The data were analyzed using the SEM-PLS analysis method. **Results:** Our data analysis shows that condition factors, physical and social environmental factors, and individual and family factors affect HIV individuals' PSCM and brain gym combination, ART adherence, and quality of life. Findings show that condition-specific factors indirectly affect antiretroviral drug adherence. This impact is mediated by PSCM and brain gym. **Conclusions:** Specific condition variables, namely complexity of the disease, barriers, and stability of conditions indirectly influence ART adherence, mediated through the combined influence of PSCM and brain gym. This finding suggests that to enhance adherence and the quality of life among PLHIV, it is important to adopt an approach that encompasses a range of internal and external individual factors. **Keywords:** ART adherence, brain gym, self-care management, quality of life, PLHIV

INTRODUCTION

Human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) gives rise to multiple interconnected crises, including a significant health crisis, a crisis in national development, an economic and a humanitarian crisis. People with HIV persistently exhibit a substantial prevalence of cases, and the level of adherence with adherence to antiretroviral therapy (ART) has yet to reach full saturation [1-3]. The lack of consistent ART adherence might result in a rise in viral population within the patient's body [4-7]. Consequently, the viral load will exhibit an elevated count, while CD4 count will continue to diminish, causing a gradual deterioration in the individual's immune system [8-10]. The decline in immune function can contribute to the exacerbation of the disease [11-13]. In addition, the impaired immune system resulting from inconsistent ART adherence heightens the susceptibility of patients living with HIV to a range of opportunistic infections (OIs) [14-16]. Consequently, individuals afflicted with HIV frequently encounter a deterioration in their daily state, which hampers their capacity

to partake in typical activities and influences their general state of health [3, 17].

The global HIV prevalence is on the rise, and Indonesia is among the countries with a significant number of HIV/AIDS cases [18, 19]. Despite the availability of ART, only 65.00% of the global HIV population has access to it. The main issue in Indonesia is the low adherence to ART [20], with a lost follow-up rate of 21.87%. For instance, in the province of East Java, which has the highest HIV incidence in Indonesia, many eligible individuals do not receive ART. Low ART adherence increases the risk of opportunistic infections and negatively impacts the quality of life for people living with HIV (PLHIV) in Indonesia [21].

Prior research has investigated many aspects that could potentially impact the adherence to treatment. In a study conducted in India in 2011, it was elucidated that treatment adherence in PLHIV might be considerably influenced by many social, individual, and family environmental factors [22]. Studies conducted in Ghana have also indicated that treatment adherence is influenced by both individual and environmental factors [23]. The findings of previous studies have identified several clinical variables that have an impact on ART adherence

[24]. Another prospective study has found that the degree of adherence among PLHIV was significantly low. Economic reasons were identified as one of the influential elements affecting adherence [24, 25]. Previous studies have also investigated variables that may impact the quality of life among those living with HIV. The quality of life experienced by PLHIV in Sinchuan Province is comparatively substandard. Several factors have been found to have a good correlation with quality of life, including age, education level, methadone use, CD4, lymphocyte count, number of symptoms, and body mass index [26]. A study with minimal variations was carried out in Zhejiang Province. According to this study, the well-being of individuals living with HIV is impacted by a range of elements across several domains, including physical, psychological, social, and environmental aspects [27]. Numerous prior research endeavors have examined various factors, including specific conditions, physical and social environmental factors, as well as individual and family factors, that are associated with treatment adherence and quality of life in PLHIV. However, there exist additional indicators of these factors, such as disease complexity, barriers, condition stability, access, availability of healthcare facilities, culture, social capital, learning habits, family structure, and coping mechanisms, which have not been adequately explored in the scholarly literature.

It is imperative to consider these characteristics when devising strategies and helping for PLHIV. By comprehending these elements, healthcare practitioners and researchers can develop more comprehensive interventions to enhance adherence and bolster quality of life [27]. This study adopts a novel perspective by examining the potential mediation effects of positive self-care management (PSCM) and brain gym therapies. The primary objective of PSCM is to enhance the agency of individuals living with HIV in managing their own health. This is achieved through several strategies, including engaging in activities that divert their attention, fostering social connections within their surroundings, incorporating complementary therapies, adhering to a consistent drug regimen, and employing positive self-dialogue. This approach incorporates not only the physical dimensions but also the psychological and social dimensions of self-care [28]. Brain gym, conversely, is a therapeutic intervention that has the potential to augment the immune response in individuals with chronic conditions, such as HIV/AIDS. Research has demonstrated that persons with chronic conditions see a decrease in depression levels, resulting in an overall enhancement in their quality of life [29]. By incorporating PSCM and brain gym techniques into the provision of healthcare for PLHIV, there exists a potential avenue for enhancing ART adherence, and eventually augmenting the overall quality of life experienced by these persons. This technique has the potential to decrease the occurrence of opportunistic infections and alleviate the adverse effects of HIV/AIDS on individuals' quality of life.

By comprehending the impact of these factors on the adherence of PLHIV and their quality of life, as well as the potential role of PSCM and brain gym as mediators, it becomes possible to develop interventions that are more efficacious and pertinent. Prioritizing extensive research on factors that influence therapy adherence and quality of life for PLHIV is essential for the development of effective, relevant, and sustainable interventions. This will ensure that these interventions effectively align with the specific requirements of patients and potentially yield substantial advantages in the management of HIV/AIDS. Furthermore, this study has the potential to develop solutions that effectively tackle the challenges that may arise during the implementation process.

Aims

The objective of this study is to examine the impact of various factors, including specific contextual factors, physical and social environments, and individual and family factors, on the adherence to treatment and quality of life among PLHIV. Additionally, this research seeks to investigate the mediating role of PSCM and brain gym in this relationship.

METHODS

Study Design

This study uses a descriptive research approach utilizing a cross-sectional design. The research was carried out at Tulungagung Aids Management Commission. Tulungagung Aids Management Commission is an autonomous governmental entity that operates independently and lacks a formal organizational structure. Its primary objective is to strengthen initiatives in the prevention, control, and mitigation of AIDS within the region of Tulungagung, Indonesia.

Sampling & Recruitment

This study's sample consisted of 262 respondents who were selected through convenience sampling. The determination of the research sample size was based on the application of defined criteria for inclusion and exclusion. The study employed the following inclusion criteria:

(1) patients diagnosed with HIV/AIDS through three diagnostic methods, namely oncoprotein, intake, and vikia,

(2) individuals within the age range of 20 to 55 years,

(3) possession of literacy skills,

(4) willingness to comply with the established rules and regulations of the activity,

(5) proficiency in effective communication in the Indonesian language, and

(6) voluntary agreement to participate as respondents by providing informed consent.

In contrast, the criteria for exclusion in this study were, as follows:

(1) individuals with a documented psychiatric medical history or those presently manifesting psychiatric symptoms,

(2) individuals who exhibited non-compliant behavior due to substance use, and

(3) individuals with visual or auditory impairments.

Instrument

Specific condition factors

Specific condition factors encompass three sub-variables, namely complexity of the disease**,** barriers, and stability of conditions.

The disease complexity instrument comprises a total of 23 questions, which have been categorized into four distinct domains: physical (10 questions), cognitive (three questions),

mental-emotional (five questions), and daily living activities (five questions). The participants were requested to evaluate several dimensions of disease complexity by utilizing a Likert scale comprising four response options:

(1) never experienced,

(2) experienced within the past month,

(3) experienced within the past week, and

(4) experienced virtually every day.

The instrument encompasses several categories, namely: light, which corresponds to a score range of zero-23; moderate, which corresponds to a score range of 24-46; heavy, which corresponds to a score range of 47-69; and very severe, which corresponds to a score range of 70-92.

The barriers instrument consists of a total of 12 questions that are categorized into two distinct domains: Uncertainty, which comprises five questions, and Social Involvement, which has seven questions. Participants were requested to evaluate several dimensions of disease complexity by employing a Likert scale with four response options, specifically: 4: always, 3: often, 2: occasionally, and 1: never. The categories encompass three distinct levels: low, medium, and high, which are defined by the numerical ranges of zero-16, 17-32, and 33-48, respectively.

The condition stability instrument has a set of nine questions, each assigned a rating scale ranging from zero to 10. As the score increases within the range of zero-10, there is an escalating level of risk posed to PLHIV. The categories are classified as low when the score falls within the range of zero-30, medium when the score falls within the range of 31-60, and high when the score falls within the range of 61-90.

Physical & social environmental factors

The variables pertaining to physical and social environmental factors encompass four sub-variables, namely access, availability of healthcare services, culture, and social capital. The researchers employed self-developed instruments to evaluate the four factors in question. The access instrument comprises four questions, the availability of health services comprises eight questions, culture comprises six questions, and social capital comprises ten questions. The available options for each question pertaining to the variables consist of "yes" represented by the numerical value one, and "no" represented by the numerical value zero. The access variable is classified as unaffordable when the score falls within the range of one-two, and as affordable when the score falls within the range of three-four. The health facility availability variable is categorized as inadequate if the score falls within the range of one to four, and as adequate if the score falls within the range of five to eight. The categories pertaining to the culture variable are deemed non-accepting when the score falls within the range of zero-three, while they are considered accepting when the score falls within the range of four-six. The variable category of social capital is classified as bad if the score ranges from zero to three, sufficient if the score ranges from four to six, and good if the score ranges from seven to 10.

Individual & family factors

The construct of individual and family factors encompasses four sub-variables, including learning habits, family structure, and coping methods. The factors in question were assessed using a combination of instruments devised by the researchers themselves, as well as instruments that were adapted from existing sources.

The learning habits instrument comprises a total of six questions. Participants were requested to evaluate several dimensions of disease complexity by utilizing a Likert scale with four response options, specifically 4: always, 3: often, 2: occasionally, and 1: never. The categories can be classified as poor if the score falls within the range of zero-eight, fair if the score falls within the range of nine-16, and good if the score falls within the range of 17-24.

The family structure instrument has a set of ten questions. The participants were requested to evaluate several dimensions of disease complexity by utilizing a Likert scale comprising four response options: 4: always, 3: often, 2: occasionally, and 1: never. The categories can be classified as poor if the score falls within the range of zero-13, fair if the score falls within the range of 14-26, and good if the score falls within the range of 27-40.

The coping mechanism instrument was the brief 28-item COPE inventory. The present instrument comprises a set of ten questions. The participants were requested to evaluate several dimensions of disease complexity by utilizing a Likert scale that consisted of four response options: 5: strongly agree, 4: agree, 3: undecided, 2: disagree, and 1: strongly disagree. The categories can be classified as adaptive if the score falls within the range of 21-40, while they are considered maladaptive if the score falls within the range of one-20.

Positive self-care management

PSCM encompasses various sub-variables, including knowledge, trust, self-efficacy, self-regulation ability, and social facilities. The questionnaire employed for each variable was designed by the researcher.

The knowledge instrument comprises a total of ten questions, which are categorized into three distinct categories. These areas include the definition, symptoms, and transmission of the disease (consisting of three questions), the impact of the disease and its treatment (comprising four questions), and the prevention of opportunistic infections (comprising three questions). Participants were requested to provide ratings using a set of three response options - true, false, and do not know. The categories can be classified as low when the score falls within the range of zero-three, medium when the score falls within the range of four-six, and high when the score falls within the range of seven-10.

The trust instrument was designed by the researcher and consists of eight questions. The assessment employs a numerical scale ranging from one to nine, whereby the following categories are delineated: high confidence (seven-nine), moderate confidence (four-six), and low confidence (one-three). The classification scheme consists of three categories: very confident, somewhat confident, and very not confident. A score falling within the range of zero-24 is assigned to the very confident category, while a score ranging from 25-48 is classified as somewhat confident. Lastly, a score between 49-72 is designated as very not confident.

The self-efficacy instrument comprises a total of ten questions, which are categorized into three distinct domains: magnitude, strength, and generality. Each category consists of three questions. Participants were requested to evaluate each question item by utilizing a Likert scale with four response options: 4: strongly agree, 3: agree, 2: disagree, and 1: strongly

disagree. The categorizations are, as follows: low, encompassing scores ranging from ero to 13; medium, encompassing scores ranging from 14 to 26; and high, encompassing scores ranging from 27 to 40.

Self-regulation ability consists of ten queries with yes or no answer options. The self-regulation instrument is scored as poor if the score is between zero and three, fair if the score is between four and six, and good if the score is between seven and 10. The social facilities survey has seven inquiries. On this test, the answer choices consist of specific answer options. The categories include poor if the score is zero-three, fair if the score is four-six, and good if the score is seven-nine.

Adherence questionnaire

The researchers self-developed the adherence questionnaire. 20 questions are divided into six domains in the adherence instrument. Schedule, quantity, type, side effect management, information acceptance, and motivation are these domains. Schedule accuracy has four questions, quantity accuracy two questions, type accuracy three questions, side effect management three questions, information acceptance three questions, and motivation seven questions. Each question has a binary response format with "yes" as one and "no" as zero.

Quality of life instrument

The researchers also collected data using a self-made quality of life questionnaire. *The quality-of-life instrument* is composed of 27 questions, which are divided into six domains, namely physical function (eight questions), emotional function (eight questions), social well-being (seven questions), cognitive function (four questions), level of depression (nine questions), and disclosure status (18 questions). The answer choices for each question in the domains of physical function, emotional function, social well-being, and cognitive function are 4: not at all, 3: a little, 2: moderately, 1: very often, and 0: an excessive amount. Meanwhile, the answer choices for each question in the depression level domain are 0: not at all, 1: several days, 2: more than half the day, and 3: almost every day. Furthermore, the answer choices for each question in the status disclosure domain are yes: one and no: zero.

Validity &Reliability Test

Each questionnaire for each variable has been tested for validity and reliability with Cronbach's alpha values between 0.875 to 0.995. This value indicates that the questionnaire has a very high level of reliability.

Data Collecting

The data collection period took place from Juni to Agustus 2023. At the beginning of the meetings with the participants, they were provided with a detailed explanation of the purpose of this research, the procedures to be followed, and their rights and responsibilities as research participants. After receiving this explanation, the participants were asked to provide written informed consent by signing the prepared informed consent form before they began participating in the study. In this process, we ensured that each participant had a clear understanding of the research's objectives, their right to withdraw at any time without negative consequences, and how their personal information would be handled confidentially. This process was conducted to ensure that participants'

participation in this research was entirely voluntary and based on a clear understanding of all aspects of the research involved.

Data Analysis

This research utilized SEM-PLS (structural equation modeling-partial least square) analysis to determine the validity and reliability of the measurement instruments and the extent to which the research model can explain the relationship between the studied variables. This is essential for producing reliable results and analyzing the influence of these variables within the context of the research. In PLS testing, there are two test models namely the measurement model (outer model) and the structural model (interior model).

Measurement model (outer model)

This study used an outer model to assess the validity and reliability. The use of data analysis methods in conjunction with SmartPLS for evaluating the outer model involves three key criteria: convergent validity, discriminant validity, and composite reliability.

Structural model (inner model)

The subsequent phase is examining *the structural model.* The structural model test was conducted to examine the interrelationships among the study variables. The evaluation of the structural model or inner model involves several components to assess its goodness of fit. These components include:

(1) the coefficient of determination or R^2 (R-square),

(2) the predictive relevance or Q^2 (Q-square),

(3) the assessment of model fit,

(4) the evaluation of collinearity, and

(5) hypothesis testing.

RESULTS

Summarizes data from 262 PLHIV with the majority (94 respondents or 35.90%) were in the 31-35 age range, 159 (60.70%) were male, and 58 (22.10%) held a high school diploma. In terms of the number of siblings, most PLHIV had one-two siblings, totaling 108 (41.20%), and 138 (52.70%) were married. The majority of PLHIV were of Javanese ethnicity, with 115 (43.90%) individuals, and the predominant religion was Islam, with 189 (72.10%) members. Most PLHIV were housewives (IRT), making up 70 (26.70%), and a significant portion earned less than the minimum wage (UMR), with 163 (62.20%). The majority of PLHIV had a history of metabolic diseases, with 88 (33.60%), while 96 (36.60%) had a family history of respiratory infections. As for the duration of HIV treatment, the highest proportion, 176 (67.20%), fell within the six months to one year range, with the most common treatment duration being 6-12 months, accounting for 180 (68.70%) individuals.

Outer Model Evaluation

Convergent validity test

Evaluation of construct validity was performed by means of the computation of convergent validity. The evaluation of convergent validity was determined by examining the loading factor value and T statistic.

Table 1. Convergent validity test results

Latent variables	Observe variables	Loading factor	T value	Cut off	Notes
X1 Specific condition factors	X1.1 Disease complexity	0.926	10.406	0.5	Valid
	X1.2 Barriers	0.861	9.302	0.5	Valid
	X1.3 Condition stability	0.721	8.787	0.5	Valid
X2 Physical & social environment factors	X2.1 Access	0.968	8.293	0.5	Valid
	X2.2 Availability of healthcare facilities	0.988	9.292	0.5	Valid
	X2.3 Culture	0.784	7.111	0.5	Valid
	X2.4 Social capital	0.852	7.224	0.5	Valid
X3 Individual & family factors	X3.1 Learning habits	0.794	7.233	0.5	Valid
	X3.2 Family structure	0.842	8.186	0.5	Valid
	X3.3 Coping mechanism	0.949	9.698	0.5	Valid
X4 PSCM combined with brain gym	X4.1 Knowledge	0.871	8.378	0.5	Valid
	X4.2 Self-confidence	0.939	9.556	0.5	Valid
	X4.3 Self efficacy	0.874	8.520	0.5	Valid
	X4.4 Self-regulation skills	0.820	7.550	0.5	Valid
	X4.5 Social facility	0.868	7.730	0.5	Valid
Y1 ART adherence	Y1.1 Schedule accuracy	0.934	10.774	0.5	Valid
	Y1.2 Accuracy of quantity	0.879	9.743	0.5	Valid
	Y1.3 Accuracy of type	0.823	8.756	0.5	Valid
	Y1.4 Management of side effects	0.789	7.774	0.5	Valid
	Y1.5 Information reception	0.773	6.648	0.5	Valid
	Y1.6 Motivation	0.913	10.279	0.5	Valid
Y2 Quality of life in PLHIV	Y2.1 Physical function	0.894	9.243	0.5	Valid
	Y2.2 Emotional function	0.904	9.423	0.5	Valid
	Y2.3 Social well-being	0.835	9.044	0.5	Valid
	Y2.4 Cognitive function	0.731	7.264	0.5	Valid
	Y2.5 Depression level	0.787	8.016	0.5	Valid
	Y2.6 Status revelation	0.784	7.613	0.5	Valid

Table 2. Fornell-Larcker criterion test results

Variables	X1	X2	X3	X4	X5	Y1
X1	0.784					
X1	0.580					
X2	0.204	0.715				
X3	0.131	0.296	0.617			
X4	0.291	0.217	0.235	0.824		
Y1	0.278	0.130	0.129	0.973	0.727	
Y2	0.292	0.119	0.127	0.967	0.984	0.623

Convergent validity is established when an instrument has a loading factor beyond 0.5 and a T statistic surpassing 1.96. The indicator with the greatest outer loading value indicates that it is the most robust measure of the latent variable (**Table 1**).

Based on the analysis results, it is known that the outer loading values for all latent variables indicate results of λ≥0.5 and T-statistic values ≥1.96. This means that the indicators used properly represent the latent variables they measure and have a significant contribution in explaining the latent variables.

Discriminant validity test

The validity of the construct is assessed by evaluating the square root of the Fornell-Larcker criterion in respect to the correlation coefficients among latent variables. The square root of the Fornell-Larcker criterion should have a higher magnitude than the correlation values observed between latent variables. The model's discriminant validity is deemed satisfactory if the square root values of the Fornell-Larcker criterion for each construct exceed the correlation values between the construct and other constructs in the model. **Table 2** displays the outcomes of the Fornell-Larcker criterion and cross-loading computations.

The data provided indicates that the Fornell-Larcker criterion values inside variables are consistently higher than the values between variables. Hence, it may be inferred that the model has satisfactory discriminant validity. Discriminant validity is assessed by examining the cross-loadings of indicators. If the cross-loading value of an indicator within its corresponding variable is higher than the correlation value with indicators in other variables, it is deemed to be a valid measure of that variable. The discriminant validity calculations have been tabulated and are shown in **Table 3**.

Based on the cross-loading measurements shown in **Table 4**, it is evident that the indicators of all variables exhibit loading values that surpass the loading values of other variables in general. Hence, it can be stated that based on the discriminant validity test, each indication has the capability to assess the latent variable associated with the indicator.

Composite reliability test

Composite reliability testing the reliability of indicators within a variable is of utmost importance. The reliability assessment may also be conducted using the average variance extracted (AVE). A variable is considered to meet composite reliability if it has a composite reliability value of 0.7 or higher and an AVE above 0.50.

Table 3. Discriminant validity test results

	X1	X2	X3	X4	Y1	Y2
X1.1	**0.926**	0.188	0.141	0.224	0.184	0.191
X1.2	**0.861**	-0.103	-0.040	-0.171	-0.194	-0.204
X1.3	**0.721**	-0.137	-0.049	0.010	0.018	0.033
X2.1	0.198	**0.968**	0.218	0.183	0.121	0.116
X2.2	0.171	**0.988**	0.238	0.204	0.129	0.122
X2.3	0.167	**0.784**	0.305	0.093	0.036	0.014
X2.4	0.027	**0.852**	0.161	0.103	0.041	0.030
X3.1	-0.062	0.045	**0.794**	-0.024	-0.034	-0.063
X3.2	0.020	0.030	**0.842**	0.117	0.088	0.085
X3.3	0.141	0.371	**0.949**	0.221	0.101	0.094
X4.1	0.173	0.444	0.570	**0.871**	0.389	0.381
X4.2	0.295	0.275	0.265	**0.939**	0.880	0.879
X4.3	-0.252	-0.060	-0.131	**0.874**	-0.879	-0.904
X4.4	-0.194	-0.106	-0.103	**0.820**	-0.823	-0.858
X4.5	0.271	0.146	0.094	**0.868**	0.913	0.838
Y1.1	0.267	0.150	0.129	0.891	**0.934**	0.894
Y1.2	-0.252	-0.060	-0.131	-0.874	**0.879**	-0.904
Y1.3	-0.194	-0.106	-0.103	-0.820	**0.823**	-0.858
Y1.4	-0.001	0.119	-0.043	0.019	**0.789**	-0.025
Y1.5	-0.019	0.128	-0.006	0.000	**0.773**	-0.026
Y1.6	0.271	0.146	0.094	0.868	**0.913**	0.838
Y2.1	0.267	0.150	0.129	0.891	0.934	**0.894**
Y2.2	-0.252	-0.060	-0.131	-0.874	-0.879	**0.904**
Y2.3	-0.203	-0.112	-0.094	-0.781	-0.771	**0.835**
Y2.4	0.003	0.085	-0.099	0.017	0.092	**0.731**
Y2.5	-0.389	0.164	0.243	-0.055	-0.068	**0.787**
Y2.6	0.017	0.167	0.180	0.079	0.076	**0.784**

Table 4. Composite reliability test results

Latent variables	Cronbach's alpha	rho_A	Composite reliability	AVE
X1	0.875	0.854	0.801	0.536
X2	0.884	0.814	0.796	0.612
X3	0.825	0.824	0.851	0.581
X4	0.867	0.908	0.823	0.680
Y1	0.848	0.911	0.803	0.653
Y2	0.811	0.854	0.817	0.588

Table 5. Coefficient of determination (R^2) test results

Variables	R square	R square adjusted
X4 PSCM combined with brain gym	0.136	0.120
Y1 ART adherence	0.960	0.959
Y2 Quality of life in PLHIV	0.952	0.950

Table 5 presents the composite reliability and Cronbach's alpha values for each variable.

According to **Table 5**, the reliability test conducted on the latent variables indicates that the composite reliability value satisfies the stipulated criteria, namely above 0.7. Similarly, it is expected that *Cronbach's alpha values* >0.6 and AVE>0.50. Thus, it can be inferred that all latent variables examined in the research have successfully passed the reliability testing.

Inner Model Evaluation

Coefficient of determination (R^2)

The coefficient of determination (R^2) is used to evaluate the degree to which seen factors can account for the variability in underlying variables, or alternatively, to appraise the influence of observed variables on latent variables. The R-squared (R^2) coefficient is used as a metric to quantify the extent to which a certain latent variable has an impact on the observed variable. It has been determined that a value of R^2 more than 0.67 signifies a robust model, while an R^2 value over 0.33 suggests a moderate level of strength. Also, an R^2 value surpassing 0.19 is indicative of poor or insufficient strength. R^2 findings are shown in **Table 5**. **Table 5** presents R^2 values for variables, indicating degree of variance explained by each variable. Relationship between X4 PSCM and brain gym is elucidated by various factors related to specific conditions, physical and social environment, as well as individual and family circumstances, accounting for 12.00% of variance. Similarly, the association between Y1 ART adherence and the combination of PSCM and brain gym is found to explain 95.90% of the variance. Quality of life in PLHIV is attributed to the combination of PSCM and brain gym, with a statistically significant correlation coefficient of 0.950 (95% confidence interval). This suggests that strength of model is within range of R-square values greater than 0.33, suggesting a moderate level of model strength.

Predictive relevance (Q^2)

The Q^2 statistic is used to assess the degree to which the model and parameter estimations accurately create the observed values.

Table 6. Predictive relevance (Q^2) test results

Variables	SSO	SSE	Q^2 (=1-SSE/SSO)
X4 PSCM combined with brain gym	840.000	657.415	0.217
Y1 ART adherence	1,080.000	244.263	0.433
Y2 Quality of life in PLHIV	957.000	623.423	0.359

Table 7. Model fit test

	Saturated model	Estimated model
SRMR	0.097	0.099
d_ULS	3.419	3.590
d_G	1.145	1.173
Chi-square	736.261	743.420
NFI	0.956	0.951
rms theta		0.097

Table 8. Collinearity (inner VIF values) test results

Variables	Y1 ART adherence	Y2 Quality of life in PLHIV
X1 Specific condition factors	1.049	1.119
X2 Physical & social environment factors	1.130	1.146
X3 Individual & family factors	1.102	1.135
X4 PSCM combined with brain gym		1.158
Y1 ART adherence		-
Y2 Quality of life in PLHIV		-

Table 9. Hypothesis testing results

Hypothesis	Variables	Path coefficient (O)	T statistics (|O/STDEV|)	P-values	Note
H1	X1->X4	0.845	10.363	0.001	Significant
H2	X1->Y1	0.710	3.408	0.027	Significant
H3	X1->Y2	0.729	4.871	0.014	Significant
H4	X2->X4	0.812	9.414	0.006	Significant
H5	X2->Y1	0.762	5.729	0.018	Significant
H6	X2->Y2	0.777	7.527	0.013	Significant
H7	X3->X4	0.817	10.912	0.002	Significant
H8	X3->Y1	0.791	6.833	0.007	Significant
H9	X3->Y2	0.788	8.477	0.014	Significant
H10	X4->Y1	0.705	7.756	0.018	Significant
H11	X4->Y2	0.996	11.441	0.000	Significant

A Q^2 score over zero signifies that the model is deemed satisfactory, but a Q^2 value below zero shows a lack of predictive significance in the model. The following findings provide the outcomes of the predictive relevance (Q^2) examination in **Table 6**.

The results in **Table 7** show that all variables produce a Q^2 value greater than zero, hence indicating the adequacy of the model.

Model fit

Model fit is shown so that a model meets the criteria by looking at the RMS theta value or root mean square theta <0.102, SRMR or standardized root mean square value <0.10 and NFI value >0.9. According to the fit model image above, RMS theta value is 0.197>0.102 and the NFI value is 0.556<0.9. According to the results obtained from the two model assessments, the model meets the model fit criteria. Likewise, with SRMR value or standardized root mean square, the value is 0.099<0.10, so the model is fit. Consequently, it can be inferred that model adequately aligns with the collected data.

Collinearity evaluation

Collinearity is a term to describe a correlation between latent variables in a model, its predictive power is unreliable and unstable. The cause of collinearity is due to repeated

correlations from one variable to another. The indicator for the occurrence of inner model collinearity is if VIF variance inflation factor is >5, then the construct variable must be removed from the structural model (unfit model) (**Table 8**).

Based on the results of the collinearity test (inner VIF value) in **Table 9**, the value is <5, which can be said that this research model is free from problems of vertical, lateral collinearity and common method bias. So that all construct variables in the model development must be in the structural model.

Hypothesis testing results on inner model

The purpose of significance testing is to assess the presence of a statistically significant relationship between the independent variable and the dependent variable. According to the test criteria, it is determined that if the T-statistics value is more than or equal to the T-table value of 1.96, or if the p-value is less than the significant alpha level of 5.00% or 0.05, it may be concluded that there exists a significant impact of the independent variables on the dependent variable. The results of the significance tests are shown in **Table 9**.

The validity of the structural model (inner model) is assessed based on the outcomes of data processing. Prior to conducting the model assessment, it is important to emphasize that the research instrument used as a tool for data collecting is both valid and reliable.
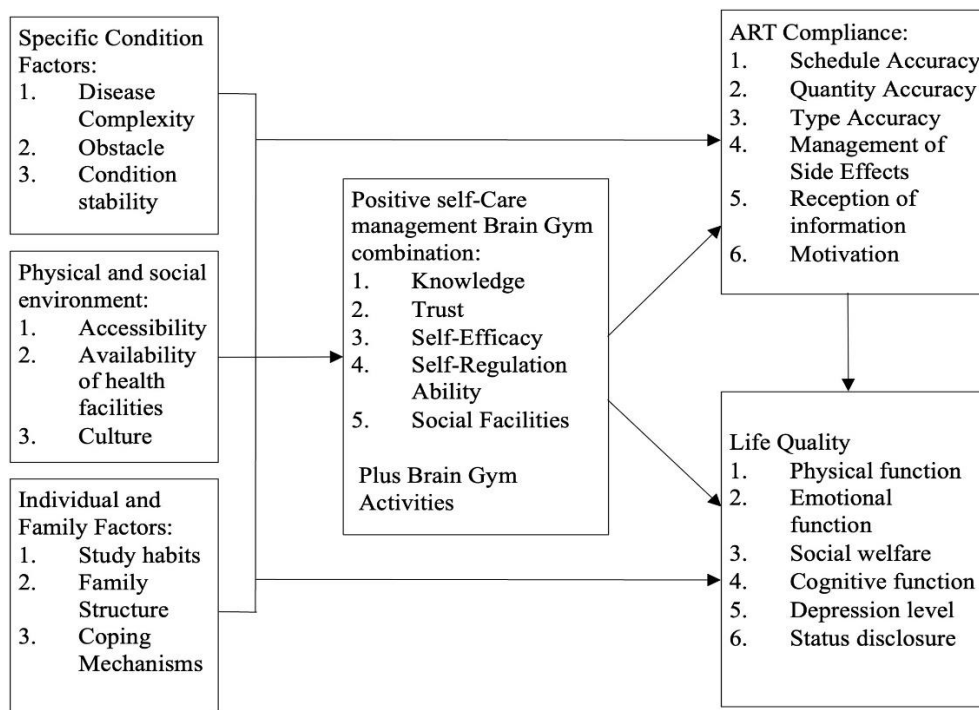
Figure 1. Final model (fit model) (Source: Authors' own elaboration)

Table 10. Results of indirect hypothesis testing

Variables	Path coefficient (O)	T statistics (|O/STDEV|)	P-values	Note
X1->X4->Y1	0.946	1.215	10.225	Significant
X2->X4->Y1	0.817	1.210	8.227	Significant
X3->X4->Y1	0.871	1.475	9.141	Significant
X1->X4->Y2	0.924	1.134	9.258	Significant
X2->X4->Y2	0.812	1.050	7.294	Significant
X3->X4->Y2	0.817	1.276	8.203	Significant

Final Model (Fit Model)

The final model in this study is a model that has removed non-significant correlations between variables. The final model is provided in **Figure 1**.

The results of indirect hypothesis testing are used to determine the influence and analysis path of an independent variable on the dependent variable. Test the influence of the indirect hypothesis in this study can be seen based on **Table 10**.

The findings of the study indicate that there is an indirect relationship between specific condition factors (X1) and ART adherence (Y1), which is mediated via the impact of PSCM (X4). In the present study, it is hypothesized that PSCM may serve as a mediating variable in the relationship between specific condition factors and ART adherence.

DISCUSSION

The findings of the hypothesis testing conducted in this study indicate a statistically significant relationship between different factors, including specific condition factors, physical and social environmental factors, as well as individual and family factors, and PSCM in conjunction with brain gym exercises, ART adherence, and the quality of life among PLHIV. The results align with a systematic review conducted within the framework of the individual and family self-management

theory. Based on this theoretical framework, it is posited that various contextual elements, including specific circumstances, physical and social environmental factors, and individual and familial factors, have the potential to impact the efficacy of interventions and ART adherence, as well as the overall quality of life experienced by PLHIV [30]. When examining a situation, it is crucial to consider several aspects, including but not limited to social support, environmental factors, and individual and family considerations. This statement may serve as a foundation or suggestion for designing interventions with the goal of enhancing adherence and quality of life in PLHIV [27].

The statistical analyses performed in this research indicate a noteworthy and favorable influence of self-care management, especially when used in conjunction with brain gym approaches, on the adherence to antiretroviral medication and the general quality of life among PLHIV. This discovery is consistent with previous studies that have shown the efficacy of different interventions, particularly when multiple modalities are integrated, in enhancing self-management outcomes. These outcomes include ART adherence and the improvement of quality of life among individuals who have HIV [30-32].

Moreover, the findings highlight the intricate interaction between internal and external variables that impact an individual's capacity to effectively participate in self-care management for their health problems [33-36]. Therefore, it is essential that interventions aimed at helping PLHIV consider these complex aspects to optimize their efficacy [36]. In

conclusion, the results of the research underscore the significance of self-care management, particularly when implemented with brain gym practices, in augmenting adherence to antiretroviral medication and the overall quality of life for those living with HIV.

Furthermore, it is essential to implement comprehensive interventions that consider the many aspects that impact self-care management to provide enhanced support for those who are living with HIV. The results of this research, obtained via the use of indirect hypothesis testing, are highly intriguing. Specifically, it was seen that adherence to antiretroviral medication is indirectly influenced by condition-specific characteristics. The impact of condition-specific variables on adherence to antiretroviral medication is mediated through the integration of PSCM and brain gym techniques. This finding suggests that the integration of PSCM and brain gym techniques may have a role in mediating the association between condition-specific variables and adherence to antiretroviral medication within the scope of this research. This suggests that to enhance ART adherence in PLHIV, it is imperative to not only address the factors related to the condition itself but also to incorporate a PSCM approach, potentially integrating it with a brain gym. Individuals who are vulnerable, such as those living with HIV, may enhance their ability to manage their health difficulties and enhance their health outcomes and quality of life by using robust self-care management resources [37-39]. Ongoing counselling and vigilant supervision are essential, together with the promotion of physical activities such as brain gyms, to support individuals in maintaining self-care management practices. These measures aim to ensure that patients with HIV achieve a high level of adherence to antiretroviral medication treatment and have an ideal quality of life [32, 40].

Thus far, there is a lack of research examining the efficacy of the combined use of PSCM and brain gym treatments. However, some studies have been conducted to evaluate the efficiency of self-care management and brain gym interventions in treating different illness diagnoses. The use of self-care management has shown efficacy in mitigating the occurrence of long-term problems among individuals diagnosed with diabetes mellitus [41], heart failure [42-44], patient with breast cancer [45], PLHIV [30], obesity [46], and colostomy [47]. In the realm of cognitive health, brain gym has demonstrated efficacy in various domains. For instance, it has been found to effectively enhance self-esteem levels and improve overall quality of life while also mitigating symptoms in individuals diagnosed with schizophrenia [48]. Furthermore, brain gym interventions have shown a notable impact on both gross motor and fine motor functions, thereby enhancing the overall quality of daily activities for children with Down syndrome [49]. Additionally, these interventions have been associated with a reduction in stress, anxiety levels and quality of life among the elderly population [50-52]. Moreover, they have been linked to a decrease in the incidence of dementia and depression in older adults [29]. Lastly, brain gym exercises have been found to have positive effects on cognitive function, functional independence, quality of life, and fitness levels in older individuals with cognitive impairment [53-55].

Limitation

The study faces several limitations that impact the interpretation of its outcomes. Firstly, it relies on a cross-sectional research methodology, which, by design, limits the ability to track temporal changes and establish definitive causal relationships between variables. Additionally, data collection is based on self-report questionnaires, which have the potential to introduce bias due to respondents possibly providing answers that align with social expectations rather than reflecting their actual behaviors accurately. While partial least squares (PLS) analysis was utilized, it's important to note that the results can be influenced by sample size, potentially affecting the strength and reliability of the findings.

To address these limitations, future research endeavors should consider alternative research designs that enable a more comprehensive examination of temporal changes and causal relationships. Exploring diverse data collection methods, such as combining self-report questionnaires with objective measures, can enhance data validity by reducing potential bias. Diversifying statistical approaches beyond PLS analysis can provide additional perspectives and strengthen result validation. Furthermore, conducting intervention trials for PSCM and brain gym in real-world settings can provide valuable insights into their practical effectiveness, considering diverse groups of PLHIV and different geographical contexts. It is vital to account for individual variability, cultural nuances, and environmental factors when assessing the suitability and effectiveness of intervention models. Addressing the practical challenges and barriers that may arise during implementation, including healthcare system support, resource availability, and government policies, will be critical to ensuring the successful real-world application of these interventions. By systematically incorporating these recommendations into future research, the field can advance its understanding and improve the quality of life and medication adherence in PLHIV.

Relevancy of This Research to Nursing Practice, Research, Education, & Policy

This research has a direct relevance to various aspects of nursing practice, research, education, and policy. By investigating the factors affecting adherence to ART and the quality of life in individuals living with HIV, this study addresses critical issues in healthcare. The focus on evaluating the mediating role of PSCM and brain gym underscores the importance of holistic care in nursing and healthcare practice. Understanding the impact of condition-specific, physical, social, and individual factors on ART adherence and overall quality of life contributes to the body of nursing research, providing insights that can inform evidence-based care. Moreover, the findings of this study have the potential to inform healthcare policy related to HIV care and treatment. Understanding the mediating roles of self-care management and brain gym in ART adherence can guide the development of policies aimed at improving the quality of care for people living with HIV.

CONCLUSIONS

An interesting finding from this research is that specific condition variables indirectly influence ART adherence, mediated through the combined influence of PSCM and brain gym. This finding suggests that to enhance adherence and the quality of life among PLHIV, it is important to adopt an approach that encompasses a range of internal and external individual factors. Moreover, this approach should promote the use of interventions involving a combination of PSCM and

brain gym. This framework can serve as the foundation for the development of effective intervention techniques in the treatment of HIV/AIDS, with a particular emphasis on addressing both physical and mental aspects simultaneously.

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