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Research Article

A HOLISTIC APPROACH TO UNDERSTANDING HIV ADHERENCE PSYCHOSOCIAL DETERMINANTS AND QUALITY OF LIFE

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Abstract
HIV remains a pressing public health issue in Indonesia, with Jambi City showing a steady increase in cases, especially among high-risk groups. This study aims to estimate the prevalence of HIV in Jambi City and examine various factors related to HIV infection, including socio-economic conditions, individual behaviors, and family history. It also explores public knowledge about HIV prevention, along with treatment adherence and quality of life among people living with HIV/AIDS (PLWHA). A cross-sectional study was conducted between August and September 2024 at four community health centers, involving 101 HIV-positive respondents who were undergoing antiretroviral therapy (ART). Data were collected through face-to-face interviews using validated questionnaires. The estimated HIV prevalence in Jambi City was 0.19%, based on average rates from the selected health centers. Among participants, 35.6% had low ART adherence, while 29.7% had high adherence. Better HIV prevention knowledge and fewer side effects were significantly associated with improved adherence. Additionally, having strong social support and being part of a peer-sharing community were linked to higher physical health-related quality of life. These findings highlight the need for more comprehensive HIV programs that not only focus on treatment but also strengthen education, manage treatment side effects, and build supportive community environments. This study offers a locally grounded perspective by combining prevalence estimates with psychosocial factors, providing useful input for targeted and sustainable intervention strategies in Jambi. The results may serve as a reference for health policymakers to design more integrated and context-appropriate HIV responses at the community level.

Keywords: ART Adherence, HIV, Prevalence, Quality of Life, Social Support.

INTRODUCTION

The tourism sector has emerged as a vital catalyst for regional development, offering pathways to bridge cultural diversity and stimulate inclusive and sustainable economic growth (Haigh, 2020;

Budiarti & Suryani, 2021; Sari et al., 2022; Yudhistira & Febrianti, 2023). The interaction between tourists and local communities establishes a synergistic relationship that enhances skill development, job creation, community welfare, and the conservation of both cultural values and environmental assets (Pangemanan et al., 2021; Suryanto & Putri, 2022; Utami & Hidayat, 2023; Rahayu et al., 2022; Indriani & Pramono, 2023; Taufik et al., 2023).

Human Immunodeficiency Virus (HIV) continues to be one of the most significant public health challenges worldwide. In 2023, approximately 39.9 million people were living with HIV, with 1.3 million new infections occurring during the year, and as many as 630,000 deaths resulting from AIDS-related illnesses (UNAIDS, 2024). In Indonesia, the prevalence of HIV remains a major challenge. According to the Ministry of Health of the Republic of Indonesia, the cumulative number of reported HIV cases up to March 2021 reached 427,201 cases. The productive age group, particularly individuals aged 25-49 years, represents the demographic with the highest percentage of infections (70.7%). Additionally, the proportion of HIV cases is higher among males (62%) compared to females (38%) (Kementrian Kesehatan Republik Indonesia, 2021).

Shifting the focus to a more localized context, Jambi City, like many regions in Indonesia, is experiencing a rising trend in HIV cases, particularly among key populations. National data indicate that men who have sex with men (MSM) contribute approximately 27% to the reported HIV transmission routes in Indonesia (Kementrian Kesehatan Republik Indonesia, 2021, 2022). These key populations, including MSM and commercial sex workers (CSW), are also considered critical groups in the local context. Although specific prevalence data for MSM and CSW in Jambi City is currently unavailable, the national trends strongly suggests that these populations likely play a significant role in the local HIV epidemic.

Despite the growing number of HIV cases in Indonesia, most studies have focused on national or provincial aggregates, often overlooking city-level epidemiological dynamics and psychosocial determinants. There is a lack of integrated analyses that simultaneously explore prevalence, behavioral risk factors, socio-economic influences, and treatment adherence, particularly in medium-sized urban settings like Jambi. This gap is critical, as local health responses require nuanced understanding of population-specific barriers and contexts. National studies have shown that HIV-related knowledge remains low among vulnerable populations, especially women living in rural areas with limited access to education and media (Efendi et al., 2020), and that geographic and social disparities persist in HIV awareness among youth (Murti et al., 2024). Moreover, even in urban centers like Bali, uptake of HIV testing among key populations remains critically low due to structural barriers and stigma, underscoring the need for community-based and assisted testing strategies (Wulandari et al., 2020). These findings reinforce the urgency of conducting comprehensive, city-level studies that provide a localized evidence base for designing more targeted and responsive HIV interventions.

This study is crucial because the increasing prevalence of HIV necessitates accurate, city-specific estimates to ensure that implemented policies are effective. By providing a clearer understanding of the local epidemic, more targeted and evidence-based prevention, education, and treatment strategies can be formulated—ultimately improving public health outcomes. Comprehensive knowledge of HIV prevalence in Jambi City, along with the factors influencing its transmission and treatment, is essential for both government bodies and healthcare providers in designing effective programs. Moreover, persistent challenges such as low adherence to antiretroviral (ARV) therapy and social stigma toward people living with HIV/AIDS (PLWHA) further complicate efforts to control the epidemic. Therefore, this research is expected to offer a comprehensive overview of the HIV situation in Jambi City and help address key gaps in local public health interventions.

Therefore, this study is designed not only to estimate HIV prevalence and assess risk factors, but also to identify the underlying barriers to treatment adherence and low quality of life—such as limited knowledge, drug side effects, and lack of social support—that must be addressed in future interventions. The findings are expected to inform the development of more integrated, community-based strategies that address both clinical and psychosocial dimensions of HIV care.

The objectives of this study are to: (1) estimate the prevalence of HIV in Jambi City; (2) identify socio-economic, behavioral, and familial risk factors associated with HIV infection; (3) assess HIV prevention knowledge among PLWHA; and (4) evaluate treatment adherence and quality of life among PLWHA in Jambi. These insights are expected to support more effective, contextually relevant, and sustainable policy interventions.

RESEARCH METHOD

This study employed a quantitative cross-sectional design, enabling the collection of data at a single point in time to analyze the prevalence, determinants of HIV, knowledge of HIV prevention among people living with HIV, quality of life, and treatment adherence in the selected population. This study was conducted in four community health centers (Puskesmas) in Jambi City: Pakuan Baru, Simpang Kawat, Putri Ayu, and Rawasari, during the period of August to September 2024. The four selected community health centers are located in areas representing both urban and semi-urban characteristics of Jambi City. Rawasari and Simpang Kawat are situated in densely populated urban areas with well-established infrastructures, while Putri Ayu and Pakuan Baru are located in semi-urban regions characterized by a combination of residential neighborhoods and partially developed areas. The selection of these centers was based on the availability of complete and consistent data regarding HIV cases and population size within their respective service areas.

The study involved 101 respondents diagnosed with HIV. Participants were selected using a consecutive sampling method, where all HIV-diagnosed individuals who visited one of the four participating community health centers during the study period were invited to participate consecutively if they met the inclusion criteria. The inclusion criteria were: aged 18 years or older, confirmed diagnosis of HIV, undergoing antiretroviral therapy (ART) for at least three months, and willing to provide written informed consent. The exclusion criteria were: individuals who refused to participate or individuals unable to complete the interview process.

The sample size for this study was determined using a single population proportion formula: $n = \frac{Z^2 \times p \times (1-p)}{d^2}$, where n is the minimum required sample size, Z is the Z-score for a 95% confidence level (1.96), p is the estimated HIV prevalence (0.003), and d is the margin of error (0.05). Based on this calculation, the minimum sample size was approximately 5 respondents. However, given the very low estimated prevalence and the study's aim to explore multiple factors associated with treatment adherence and quality of life, a larger sample size was necessary to ensure sufficient variability and meaningful analysis.Therefore, a total of 101 respondents were recruited, which was considered appropriate for the cross-sectional design and the exploratory objectives of the study. This final sample size provided more than 80% statistical power to detect moderate effect sizes in bivariate analyses, enhancing the reliability and generalizability of the study findings.

This study was conducted in accordance with ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Universitas Jambi, under approval number 1604/UN21.8/PT.01.04/2024. Written informed consent was obtained from all participants prior to their participation in the study. Participants were assured of confidentiality, and all data were anonymized to protect their identities. All participants were informed of their right to refuse or withdraw without any impact on their access to care.

Data collection was performed offline with the assistance of enumerators who conducted face-to-face interviews with respondents and recorded the data in Google Docs (GDoc) to ensure organized and accurate digital documentation. Prior to data collection, enumerators received training on the administration of questionnaires, interview techniques, procedures for obtaining informed consent, and maintaining participant confidentiality. During the interviews, data were entered directly into Google Docs in real time to minimize transcription errors. Although double data entry was not conducted, real-time supervision by the research coordinator was implemented to monitor data quality and periodically cross-check the entries. Access to the Google Docs platform was restricted to authorized research team members only, ensuring data security and confidentiality.

Data collection utilized validated questionnaires administered through face-to-face interviews. To gain a comprehensive understanding of HIV risk factors among respondents, the study explored several aspects through the questionnaires. Socio-economic factors assessed included occupation, monthly income, place of residence, accessibility to healthcare facilities, and barriers to access, such as cost, distance, transportation, information, or stigma. The questionnaires also evaluated experiences of stigma as an HIV patient, the availability of social support systems, and the presence of communities for experience sharing. Behavioral factors covered the number of sexual partners in the past year, condom use practices, history of sexually transmitted infections (STIs), sexual partners' history of STIs, history of same-sex relationships, intravenous drug use, blood transfusions, and organ transplants. Family history was examined by assessing whether respondents had a history of HIV infection in their mother or father. Knowledge of HIV prevention was also measured, including respondents' history of receiving HIV

prevention education and their level of knowledge. Knowledge was assessed using a validated and reliable questionnaire with a Cronbach's alpha of 0.818, consisting of 10 items evaluating HIV prevention understanding. Knowledge levels were categorized based on data percentiles (P25, P50, and P75), with poor knowledge defined as scores <8, moderate knowledge for scores between ≥8 and 9, and good knowledge for scores ≥9. Finally, treatment-related information was collected, focusing on the type of antiretroviral (ARV) regimen used by respondents and the side effects they experienced.

The dependent variables in this study were quality of life and adherence to ARV treatment. Quality of life was measured using the Indonesian version of the WHOQOL-BREF, with a Cronbach's alpha reliability of 0.66 (Muhammad et al., 2017), indicating reliability in measuring various domains of quality of life. For quality-of-life data analysis, a transformed score with a cut-off of ≥60 indicated good quality of life, while scores below 60 were categorized as poor quality of life (Silva et al., 2019). Adherence to ARV treatment was assessed using the Indonesian version of the Morisky Medication Adherence Scale (MMAS-8), with a Cronbach's alpha of 0.824 (Riani, 2017), indicating good reliability in measuring treatment adherence.

To estimate HIV prevalence in Jambi City, data from the four health centers were used as the basis for calculation. Prevalence at each health center was determined by comparing the recorded number of HIV cases to the total population in the respective service area. The average prevalence was then calculated by summing the prevalence rates of the four health centers and dividing by the number of sampled centers. Extrapolation was performed to estimate the prevalence of HIV across Jambi City using the latest population data from the Central Bureau of Statistics (BPS). The estimated number of HIV cases in the city was calculated by multiplying Jambi City's population by the average prevalence and dividing by 100,000. This method provided a general overview of HIV prevalence in Jambi City. It should be noted that the prevalence estimates represent crude prevalence, as age-specific data at the health center level were not accessible for this study. Data processing was conducted using statistical software. Relationships between variables were analyzed using the Chi-square test for large-category, well-balanced distributions. For variables with small categories or uneven distributions, the Likelihood Ratio test was used as a more appropriate alternative. The Likelihood Ratio test was chosen for handling data with low frequencies or disproportionate distributions, where Chi-square tests might yield less accurate results. The specific statistical test applied for each variable is consistently indicated in the Results section to enhance clarity and methodological transparency. The significance level was set at $p < 0.05$

RESULTS AND DISCUSSION

Based on data from four community health centers (Puskesmas) in Jambi City, the number of HIV cases and the corresponding population served by each health center were as follows: Rawasari 62 cases out of 48,543 residents, Simpang Kawat 45 cases out of 28,256 residents, Putri Ayu 116 cases out of 43,627 residents, and Pakuan Baru 58 cases out of 27,900 residents. Based on these calculations, the recorded HIV prevalence rates were 127.7, 159.3, 265.9, and 207.9 cases per 100,000 population, respectively. The average prevalence across the four centers was 190.2 cases per 100,000 population. To estimate the HIV prevalence for the entire Jambi City, the latest population data from the Central Bureau of Statistics (BPS) in 2024, which recorded Jambi City’s population at 635,100, was used (Badan Pusat Statistik Provinsi Jambi, 2024). Using this average prevalence, it is estimated that there are around 1,207 HIV cases in Jambi City in 2024. This represents approximately 0.19% of the total population. This estimate provides an overview of HIV spread in Jambi City, with data reflecting the most recent population. However, it is acknowledged that relying solely on data from these four centers may limit the generalizability of the findings to the entire city.

The findings of this study indicate that the prevalence of HIV in Jambi City is estimated to be approximately 0.19% of the total population, based on data from four community health centers. This figure is lower than the national HIV prevalence of 0.3% among the adult population aged 15–49 years in Indonesia (World Health Organization, 2023). This discrepancy in prevalence may be attributed to various factors, such as population distribution, access to healthcare services, and the effectiveness of prevention programs in Jambi City. However, it is important to acknowledge the limitations when comparing these prevalence figures. The national prevalence rate is specifically calculated among adults aged 15–49 years using standardized survey methodologies, while the Jambi City prevalence in this study represents a crude estimate based on data from four community health centers, extrapolated to the general population without age standardization. Differences in target populations, sampling strategies, and data collection methods may influence the comparability of these figures. Thus, while the comparison provides

useful contextual insight, it should be interpreted with caution. Despite these limitations, regions with better access to healthcare services and prevention education tend to have lower prevalence rates. Furthermore, variations in prevalence across regions may reflect differences in awareness levels and the effectiveness of local prevention efforts. Although the prevalence in Jambi City is relatively low, increasing early detection and treatment coverage remains crucial. Strengthening prevention programs among high-risk populations and efforts to reduce HIV-related stigma can help curb the spread of infection in the future.

The study involved 101 respondents diagnosed with HIV, with the majority being male (82.2%), and females comprising 17.8% (Table 1). The mean age of respondents was 34.3 years (SD = 9.7 years), ranging from 18 to 59 years. Most respondents had completed high school (66.3%), with a small percentage having completed primary school (4.0%) and junior high school (7.9%). Regarding marital status, the majority were unmarried (64.4%), while a quarter were married (25.7%) or widowed (9.9%). In addition to the lower prevalence, the sociodemographic characteristics of the respondents also provide important insights into the HIV epidemic in Jambi City. The majority of respondents were male, consistent with previous studies indicating that HIV is more commonly found among men, particularly those engaged in same-sex relationships (UNAIDS, 2024). This finding aligns with global trends, where men who have sex with men (MSM) are recognized as a key population with significantly higher HIV prevalence rates across various regions (Baral et al., 2009; Coelho et al., 2021; Eluwa et al., 2019; Pattanasin et al., 2020). The higher proportion of male respondents and the notable percentage reporting same-sex relationships in this study suggest that MSM may contribute substantially to the local HIV burden in Jambi City. Strengthening targeted prevention and education programs for high-risk groups, particularly MSM, is therefore critical to curbing the epidemic at the local level.

In terms of socio-economic risk factors, the majority of respondents were employed, either as self-employed (39.6%) or part-time workers (21.8%). The highest monthly income ranged from Rp 1,500,000 to Rp 3,037,121 (44.6%), and more than 40% of respondents lived in rented accommodations (41.6%). Most respondents (74.3%) reported very easy access to healthcare facilities, with only a few facing barriers such as cost (9.9%) or distance (7.9%). From a socio-economic perspective, the majority of respondents were employed; however, most fell within the low-income range. Economic status influences access to healthcare services and the ability to adhere consistently to HIV therapy. Economic instability is a well-known primary factor affecting adherence to HIV treatment (Carnevale et al., 2020). Recent studies continue to emphasize that economic instability and limited access to healthcare services are significant barriers to HIV treatment adherence. For instance, a study conducted among people living with HIV in Miami-Dade during the COVID-19 pandemic found that economic instability, such as job loss and difficulties paying rent, negatively impacted adherence to ARV treatment (Ward et al., 2023). In Uganda, interventions focused on family economic empowerment demonstrated positive outcomes, improving economic well-being and adherence to ARV treatment among children living with HIV (Dvalishvili et al., 2022). In the context of this study, most respondents in Jambi City reported ease of access to healthcare facilities. Additionally, statistical analysis showed no significant association between monthly income and treatment adherence ($p = 0.769$), suggesting that economic barriers may not strongly affect adherence locally. Nevertheless, economic instability remains a relevant concern in the broader global context.

Table 1. Demographic Profile, Socio-Economic Factors, Behavioral Factors, Family History, Barriers, Support Factors, Knowledge of HIV Prevention, Treatment, and Quality of Life for People with HIV

Variable	Frequency (n = 101)	Percent (%)
Demographic Characteristics		
Gender		
Male	83	82.2
Female	18	17.8
Education Level		
Primary School	4	4.0
Junior High School	8	7.9
Senior High School	67	66.3
Bachelor's Degree	20	19.8

Variable	Frequency (n = 101)	Percent (%)
Others	2	0.0
Marital Status		
Married	26	25.7
Single	65	64.4
Widowed/Divorced	10	9.9
Socio-Economic Risk Factors		
Occupation		
Full-time	21	20.8
Part-time	22	21.8
Entrepreneur	40	39.6
Unemployed	16	15.8
Student	2	2.0
Monthly Income		
< Rp 1.000.000	22	21.8
Rp 1.000.000 - < Rp 1.500.000	23	22.8
Rp 1.500.000 - < Rp 3.037.121	45	44.6
Rp 3.037.121 - < Rp 6.000.000	10	9.9
≥ Rp 6.000.000	1	1.0
Residence		
Own house	33	32.7
Rental	42	41.6
Living with family/friends	26	25.7
Access to Healthcare Facilities		
Difficult	0	0
Somewhat Easy	26	25.7
Very Easy	75	74.3
Barriers to Access Healthcare Facilities		
Cost	10	9.9
Distance	8	7.9
Lack of Transportation	4	4.0
Stigma	1	1.0
Lack of Information	4	4.0
No Barriers	64	63.4
Others	10	9.9
Experienced HIV-related Stigma/Discrimination		
Yes	30	29.7
No	71	70.3
Support System		
No	21	20.8
Yes	80	79.2
Community for Sharing		
No	21	20.8
Yes	80	79.2
Behavioral Risk Factors		
Number of Sexual Partners in the Last Year		
None	25	24.8
1 Partner	49	48.5
2 Partners	9	8.9
3 Partners	7	6.9
4 Partners	3	3.0
5 Partners	5	5.0
10 Partners	1	1.0
15 Partners	1	1.0
Condom Use		

Variable	Frequency (n = 101)	Percent (%)
Always	32	31.7
Sometimes	38	37.6
Never	21	20.8
Missing data	10	9.9
History of Sexually Transmitted Infections (STIs)		
Yes	43	42.6
No	58	57.4
History of Sexual Partner with STIs		
Yes	25	24.8
No	73	72.3
Missing data	3	3.0
Engaged in Same-sex Sexual Activity		
Yes	54	53.5
No	46	45.5
Missing data	1	1.0
Injectable Drug Use History		
Yes	4	4.0
No	97	96.0
Blood Transfusion History		
Yes	14	13.9
No	87	86.1
Organ Transplant History		
Yes	1	1.0
No	100	99.0
Family Risk History		
History of Mother with HIV		
Yes	2	2.0
No	99	98.0
History of Father with HIV		
Yes	2	2.0
No	99	98.0
HIV Prevention Knowledge		
Received HIV Prevention Education		
No	7	6.9
Yes	94	93.1
Level of HIV Prevention Knowledge		
Low	36	35.6
Moderate	35	34.7
High	30	29.7
Treatment		
ARV Regimen		
TDF + 3TC (or FTC) + EFV in FDC	24	23.8
TDF + 3TC (or FTC) + EFV	7	6.9
TDF + 3TC (or FTC)	22	21.8
DRV/r + DTG ± 1–2 NRTIs	6	5.9
AZT + 3TC + NVP	4	4.0
TDF + 3TC + DTG	31	30.7
AZT + 3TC + EFV	5	5.0
TDF + 3TC (or FTC) + NVP	2	2.0
ARV Side Effects		
≥ 3 Side Effects	15	14.9
2 Side Effects	15	14.9
1 Side Effects	71	70.3
Treatment Adherence		

Variable	Frequency (n = 101)	Percent (%)
Low	36	35.6
Moderate	35	34.7
High	30	29.7
Quality of Life		
Physical Health Domain		
Good	73	72.3
Poor	28	27.7
Psychological Domain		
Good	81	80.2
Poor	20	19.8
Social Relationship Domain		
Good	71	70.3
Poor	30	29.7
Environmental Domain		
Good	79	78.2
Poor	22	21.8

In terms of sexual behavior, nearly half of the respondents reported having one sexual partner in the past year (48.5%), while about a quarter had no partners (24.8%). Condom usage varied, with the majority using condoms occasionally (37.6%), and about one-third consistently using them (31.7%). A total of 42.6% of respondents reported a history of sexually transmitted infections (STIs), and 53.5% had a history of same-sex sexual activity, though only 4.0% reported a history of injectable drug use. Among the 83 male respondents, 54 individuals (100% of those engaging in homosexual behavior) admitted to having same-sex relationships, while 29 individuals (63%) denied engaging in such behavior. Sexual behavior among respondents was also a concern, with only 31.7% consistently using condoms. Studies have shown that inconsistent condom use is a major risk factor for the spread of HIV, particularly among high-risk populations. A study in Nigeria revealed that 85.03% of sexually active men with low HIV knowledge were less likely to use condoms consistently, increasing the risk of HIV transmission (Bolarinwa et al., 2022). Additionally, research in Rustenburg, South Africa, found that 74.1% of men involved in heterosexual relationships and 68.2% of men who have sex with men reported inconsistent condom use, directly correlating with an increased risk of HIV infection in these groups (Maenetje et al., 2019). This underscores the need to enhance education on the importance of consistent condom use as a preventive measure against HIV infection, particularly among respondents engaged in high-risk sexual behavior. Given that only one-third of respondents in Jambi City reported consistent condom use, targeted interventions are urgently needed. These could include strengthening condom promotion campaigns, integrating routine condom education and negotiation skills into HIV counseling services at community health centers, and ensuring easier access to free or affordable condoms, especially for high-risk groups such as MSM and sexually active young adults.

The majority of respondents (93.1%) had received HIV prevention education, though their level of knowledge varied, ranging from low (35.6%) to high (29.7%). The most commonly used antiretroviral therapy (ARV) regimen was a combination of TDF + 3TC + DTG (30.7%). Most respondents (70.3%) experienced at least one side effect from treatment. The most frequently reported side effects were dizziness (42 individuals) and nausea (33 individuals), followed by itching (23 individuals), fatigue (19 individuals), and rash (14 individuals). Other complaints, such as diarrhea, headache, hallucinations, vomiting, and allergies, were recorded but were less common (Figure 1). Treatment adherence varied significantly, with 35.6% of respondents showing low adherence and 29.7% demonstrating high adherence. This variation in adherence appeared to correlate with respondents' knowledge levels.

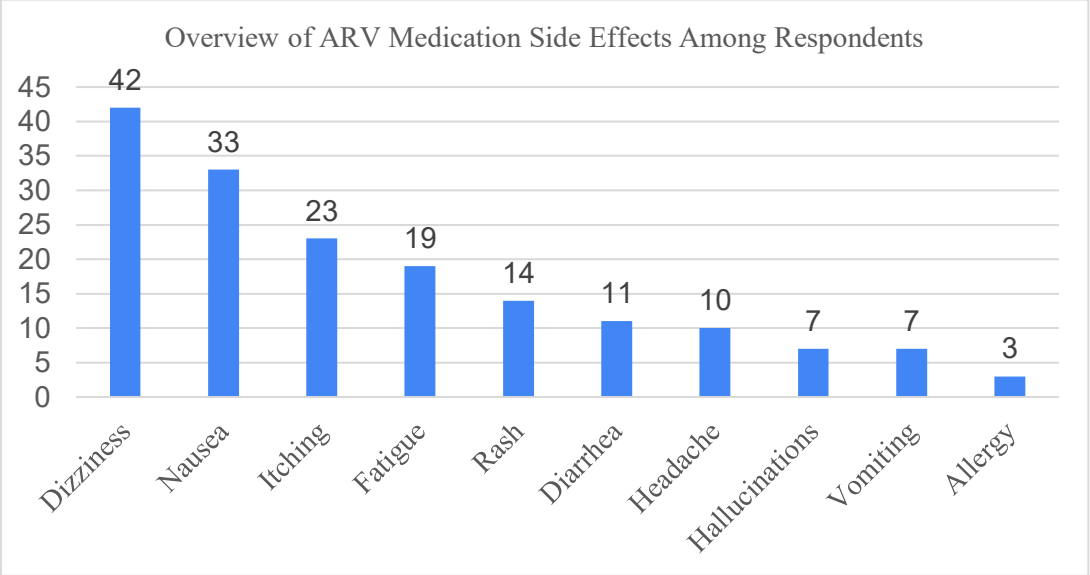

Figure 1. Overview of ARV Medication Side Effects Among Respondents

Low levels of HIV prevention knowledge were directly associated with poor treatment adherence. Comprehensive and accurate education about HIV and long-term therapy plays a crucial role in helping patients maintain adherence. Research by (Zhang et al., 2019) demonstrated that the Problem-Based Learning (PBL) approach can improve awareness about HIV and treatment adherence, particularly among newly diagnosed patients. In Uganda, studies found that the lack of continuous education about ARV treatment is a primary reason for non-adherence to long-term (Bukenya et al., 2019). Therefore, sustained educational support is necessary to help patients overcome challenges such as stigma, medication side effects, and myths about treatment.

In the context of Jambi City, effective educational interventions could include the implementation of PBL-based HIV counseling sessions at community health centers, the establishment of peer education programs involving trained HIV-positive individuals, and the integration of regular HIV treatment workshops as part of routine care services. PBL is recommended because it encourages active participation, builds critical thinking, and strengthens practical problem-solving abilities among patients, helping them face challenges like stigma and treatment side effects with more confidence and resilience (D'Eon et al., 2010). Although PBL-based patient education has not yet been widely implemented in Indonesia, studies from other countries, such as China, have demonstrated its success in improving both HIV-related knowledge and medication adherence (Zhang et al., 2019). Furthermore, the use of structured workshops to train healthcare professionals in PBL techniques has shown significant improvements in educational delivery and learner outcomes, supporting its feasibility and effectiveness even in low-resource settings (Shahi et al., 2021). Given the education level and knowledge variability among respondents in Jambi City, adapting PBL models into HIV counseling may offer a more interactive and empowering learning experience compared to traditional lecture-based approaches. Such strategies are essential to provide continuous support, personalize learning experiences, and effectively address misconceptions that may hinder adherence.

ARV side effects also significantly influence treatment adherence. Side effects such as nausea, rash, and fatigue are reported as major causes of non-adherence to ARV therapy (Bukenya et al., 2019; Li et al., 2017; Sefah et al., 2022). However, the majority of respondents in this study experienced only one side effect, and adherence remained high among them. These findings suggest that addressing barriers such as side effects through early identification, routine assessment of adherence, and improved healthcare services is critical to help patients cope and maintain adherence (Sefah et al., 2022). Providing early information about potential adverse drug reactions, counseling patients on coping mechanisms, and reinforcing the perceived benefits of therapy have been shown to improve adherence outcomes (Li et al., 2017). Thus, education and support in managing treatment side effects are vital components of a sustainable HIV care strategy.

The quality of life for the majority of respondents was rated as good across various aspects, including physical health (72.3%), psychological well-being (80.2%), social relationships (70.3%), and environmental conditions (78.2%). However, some reported poor quality of life in certain domains.

Compared to (Fernandes et al., 2025), who observed a similar pattern—where psychological and social domains were rated higher than physical and environmental ones—our findings further emphasize the complexity of quality of life among people living with HIV. While most domains showed generally favorable outcomes in our study, the variability across domains suggests that interventions should not focus solely on clinical health but also address social and environmental challenges that still affect a portion of this population.

Based on the analysis presented in Table 2, no significant association was found between gender and treatment adherence ($\chi^2 = 4.395$, df = 2, p = 0.111). However, a trend was observed where male respondents showed slightly higher adherence levels compared to females, although this difference did not reach statistical significance. Male respondents exhibited varying levels of adherence, with 31 respondents in the low adherence category, 25 in the moderate category, and 27 in the high adherence category. Female respondents showed a smaller distribution, with 5 respondents in the low adherence category, 10 in the moderate category, and 3 in the high adherence category. This finding is consistent with a recent study conducted in Ethiopia, where gender was also found to have no statistically significant association with ART adherence (Tezera et al., 2023).

Residence also showed no significant association with treatment adherence ($\chi^2 = 4.310$, df = 4, p = 0.366). Respondents living in their own homes, rented accommodations, or with family/friends displayed similar adherence distributions. Similarly, ease of access to healthcare facilities did not exhibit a significant relationship with adherence ($\chi^2 = 1.963$, df = 2, p = 0.375), although respondents who reported very easy access to healthcare facilities tended to have higher adherence levels. This finding contrasts with results from Cluver et al. (2021), who observed a significant improvement in ART adherence associated with shorter clinic travel time among adolescents in South Africa. Such differences may reflect varying geographic contexts, healthcare infrastructure, or age group dynamics between the two populations (Cluver et al., 2021). Regarding stigma or discrimination as HIV patients, although not statistically significant ($\chi^2 = 3.597$, df = 2, p = 0.166), respondents experiencing stigma were more likely to have low adherence compared to those who did not experience stigma. Social support and the presence of a sharing community also showed no significant relationship with adherence (p > 0.05). Nonetheless, these variables remain important from a psychosocial perspective, as literature supports their indirect influence on motivation and behaviors (da Silva Oliveira et al., 2020).

Conversely, the level of knowledge about HIV transmission prevention showed a highly significant association with treatment adherence ($\chi^2 = 202$, df = 4, p < 0.0001), implying that as knowledge levels improved, adherence to ARV treatment also significantly increased among respondents. The extremely low p-value (<0.0001) supports a very strong relationship between these variables. All respondents with low knowledge were in the low adherence category, while those with moderate and high knowledge were exclusively in the moderate and high adherence categories. This finding emphasizes that knowledge about HIV prevention plays a critical role in motivating patients to adhere to their therapy consistently The Likelihood Ratio test in Table 2 indicated no significant association between educational level, marital status, occupation, or monthly income and treatment adherence (p > 0.05). However, ARV side effects showed a significant relationship with adherence (p = 0.001). Respondents who experienced more than three side effects were more likely to have low adherence, while those who experienced only one side effect tended to have higher adherence levels. This underscores the need for proactive clinical management of side effects as part of ART adherence interventions and calls for integrating this component into counseling and follow-up programs to ensure sustained engagement.

Table 2. Bivariate Analysis of Treatment Adherence

	Treatment Adherence			Chi-square	
	Low	Moderate	High	χ^2 (df), N=101	*p*
Gender					
Male	31	25	27	4.395 (2)	0.111
Female	5	10	3		
Residence					
Own house	10	16	7	4.310 (4)	0.366
Rental	16	12	14		
Living with family/friends	10	7	9		

	Treatment Adherence			Chi-square	
	Low	Moderate	High	χ^2 (df), N=101	*p*
Access to Healthcare Facilities					
Somewhat Easy	10	11	5	1.963 (2)	0.375
Very Easy	26	24	25		
Experienced HIV-related Stigma/Discrimination					
Yes	12	13	5	3.597 (2)	0.166
No	24	22	25		
Support System					
No	11	5	5	3.293 (2)	0.193
Yes	25	30	25		
Community for Sharing					
No	9	8	4	1.491 (2)	0.474
Yes	27	27	26		
Level of HIV Prevention Knowledge					
Low	36	0	0	202 (4)	<0.0001*
Moderate	0	35	0		
High	0	0	30		
	Treatment Adherence			*Likelihood Ratio, p*	
	Low	Moderate	High		
Education level					
Primary School	1	3	0	0.419	
Junior High School	4	1	3		
Senior High School	24	24	19		
Bachelor's Degree	7	6	7		
Others	0	1	1		
Marital status					
Married	9	8	9	0.840	
Single	24	22	19		
Widowed/Divorced	3	5	2		
Occupation					
Full-time	10	4	7	0.314	
Part-time	9	5	8		
Entrepreneur	12	16	12		
Unemployed	4	9	3		
Student	1	1	0		
Monthly Income					
< Rp 1.000.000	7	8	7	0.769	
Rp 1.000.000 - < Rp 1.500.000	8	10	5		
Rp 1.500.000 - < Rp 3.037.121	16	14	15		
Rp 3.037.121 - < Rp 6.000.000	5	3	2		
> Rp 6.000.000	0	0	1		
ARV Regimen					
TDF + 3TC (or FTC) + EFV in FDC	2	11	11	0.143	
TDF + 3TC (or FTC) + EFV	2	3	2		

	Treatment Adherence			Chi-square	
	Low	Moderate	High	χ^2 (df), N=101	*p*
TDF + 3TC (or FTC)	9	6	7		
DRV/r + DTG ± 1–2 NRTIs	2	2	2		
AZT + 3TC + NVP	1	1	2		
TDF + 3TC + DTG	15	10	6		
AZT + 3TC + EFV	2	1	0		
AZT + 3TC + EFV	2	0	0		
TDF + 3TC (or FTC) + NVP	1	1	0		
ARV Side Effects					
≥ 3 Side Effects	4	8	3	0.001*	
2 Side Effects	11	4	0		
1 Side Effects	21	23	27		

*Statistically significant.

The variables of occupation, monthly income, residence, ease of access to healthcare facilities, stigma, social support, community presence, and ARV side effects were evaluated to determine their association with patients' quality of life across each domain. The analysis results indicated that social support ($\chi^2 = 5.238$, df = 1, p = 0.022) and the presence of a sharing community ($\chi^2 = 8.045$, df = 1, p = 0.005) had a significant influence on the physical health domain of patients. Patients with social support and a community were more likely to have better physical health. This finding emphasizes that beyond clinical variables, psychosocial aspects play a vital role in shaping patients' well-being.

Other variables, such as residence, ease of access to healthcare facilities, stigma, occupation, monthly income, and ARV side effects, did not show a significant association with the physical health domain. In the psychological and social relationship domains, none of the variables showed any significant association with quality of life. However, discrimination/stigma ($\chi^2 = 5.549$, df = 1, p = 0.018) had a significant influence on the environmental domain. This suggests that while stigma may not directly reduce adherence, it could negatively impact patients' perceptions of safety, support, and access to essential services in their environments.

Social support has proven to be significant in improving patients' quality of life, especially in the domain of physical health. A meta-analysis by (Yonita et al., 2020) supports this, showing that strong social support contributes to improved quality of life among people living with HIV/AIDS (OR=2.82; 95% CI=2.26-3.53). Another study in India by (Subramanian et al., 2021) found that social support from family and friends significantly contributed to better physical, social, and cognitive functioning while reducing the risk of depression. Community support, which enables patients to share their experiences, also plays a vital role in enhancing their physical and emotional well-being. These findings echo the current study, highlighting the value of peer and family involvement as a protective factor across both clinical and quality-of-life outcomes.

In Jambi City, social support for people living with HIV is facilitated primarily through Voluntary Counseling and Testing (VCT) services integrated into community health centers and hospitals. Selected Puskesmas and hospitals also offer psychosocial counseling alongside antiretroviral therapy (ART) services, aiming to support emotional well-being and treatment adherence. These services play a vital role in providing emotional support, reducing stigma, and helping patients maintain long-term engagement with care. However, these initiatives can be further strengthened by expanding structured peer-support sessions within healthcare facilities, ensuring that psychosocial counseling becomes a standard component of ART services, and enhancing collaboration between healthcare providers and community organizations. Strengthening monitoring and evaluation mechanisms is also crucial to ensure that support services are responsive to the evolving needs of people living with HIV.

Based on the findings, strengthening a holistic approach to HIV management in Jambi City requires integrating community-based interventions, healthcare system improvements, and supportive policies. Public health initiatives should include expanding peer-education programs, improving access to voluntary counseling and testing (VCT) services through mobile clinics, and integrating stigma-reduction workshops into routine healthcare services. Healthcare providers should implement structured

psychosocial support programs alongside ART provision to address both medical and emotional needs. Strengthening partnerships between government health offices, non-governmental organizations (NGOs), and community leaders is critical to creating sustainable and culturally appropriate interventions. These integrated efforts could improve treatment adherence, enhance quality of life, and curb new infections among people living with HIV in Jambi City.

Overall, this study reveals that factors such as HIV knowledge, social support, and ARV side effect management play key roles in determining the quality of life and treatment adherence among HIV patients in Jambi City. Proper education, continuous social support, and strengthened side effect management programs are necessary to improve quality of life and curb the spread of HIV. Hence, a holistic approach to HIV care, addressing not only medical aspects but also social and psychological factors, is essential for the success of therapy. Therefore, strengthening these interrelated domains through integrated, patient-centered strategies should be prioritized to achieve sustainable improvements in HIV outcomes at the community level.

One of the key contributions of this study is its integrated approach, which brings together local prevalence estimates, behavioral and psychosocial factors, and quality-of-life assessments into a unified analysis. While earlier research often focused on isolated aspects of HIV—such as adherence or stigma—this study offers a more complete picture of the challenges faced by people living with HIV in Jambi City. By grounding the analysis at the city level, the findings are not only more relevant to local health systems, but also offer valuable direction for urban areas in Indonesia facing similar issues. This approach supports the development of more responsive, community-based strategies that reflect the realities on the ground and can be adapted to comparable settings.

By combining HIV prevalence estimates with behavioral, social, and psychological insights, this study presents a detailed snapshot of the epidemic at the city level—something rarely explored in urban Indonesian contexts. The results point to the importance of integrated interventions that go beyond treatment, addressing gaps in knowledge, social support, and adherence behavior. While the findings offer valuable input for adapting national HIV strategies to local realities, they should be interpreted with caution due to the study's limited sample size and cross-sectional design. Future research would benefit from involving multiple urban settings, tracking patients over time, and incorporating objective clinical markers to strengthen the evidence base.

CONCLUSION

This study indicates that the crude prevalence of HIV in Jambi City is estimated at 0.19%, with the majority of cases found among male populations and individuals in the productive age group. Key determinants of treatment adherence and quality of life among people living with HIV include knowledge about HIV prevention, availability of social support, and management of ARV side effects. Adequate education on HIV prevention and ARV therapy, as well as strengthened social support, are essential to improve treatment adherence and the quality of life of people living with HIV/AIDS in Jambi City. From a practical standpoint, strengthening community-based, patient-centered interventions that integrate medical, social, and psychological support is crucial. Specific actionable strategies could include expanding mobile VCT services, establishing structured peer-support groups within healthcare centers, and implementing stigma-reduction training for healthcare providers. Promoting collaboration between health authorities, non-governmental organizations, and community leaders is essential to create sustainable and culturally appropriate interventions. Public health policy should focus on expanding HIV education programs, scaling up peer-support initiatives at community health centers, and reinforcing early management of ARV side effects to sustain treatment success. However, this study has limitations, including reliance on data from only four community health centers, the use of a cross-sectional design that precludes causal inference, and the absence of age-standardized prevalence estimates. Future research should aim to conduct longitudinal studies with broader and more representative samples, incorporate biomarker data, and explore intervention effectiveness over time to better inform policy and programmatic responses to the HIV epidemic in Jambi City and similar settings. Adopting a holistic approach that simultaneously addresses medical treatment, psychological well-being, and community empowerment will be essential for achieving sustainable improvements in HIV care outcomes.

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AUTHOR CONTRIBUTIONS

Conceptualization, E.K. and I.M.; Methodology, A.S.; Field Coordinator, M.; Validation, P.S.W., A.D. and W.I.D.A.; Data Analysis, I.M.; Writing – Original Draft Preparation, I.M.; Writing – Review & Editing, W.I.D.A.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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