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Factors Influencing Antiretroviral Therapy Adherence among People Living with HIV: A Narrative Review

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ABSTRACT

Adherence to antiretroviral therapy (ART) remains a pivotal determinant of virological suppression and long-term clinical outcomes among people living with HIV (PLHIV). Nevertheless, adherence estimates and determinants frequently differ across settings, partly because of variation in adherence measurement and contextual influences. This narrative review synthesises evidence on factors influencing ART adherence among PLHIV. A literature search was conducted using Google Scholar and ScienceDirect and complemented by manual screening of reference lists to identify relevant studies published between 2015 and 2025. Studies were included if they reported adherence outcomes and/or determinants among PLHIV receiving ART. Five eligible studies were narratively synthesised because adherence measurement tools and reporting formats were heterogeneous, including pharmacy-based indicators such as proportion of days covered, validated questionnaires such as the Simplified Medication Adherence Questionnaire and the Morisky Green Levine Scale, self-report measures, and biological proxies based on antiretroviral concentrations in hair. Across the included studies, adherence levels ranged from suboptimal to high depending on the metric applied, indicating limited comparability across methods. Determinants that recurrently emerged comprised regimen- and treatment-related factors, psychosocial influences, and health-system or structural constraints, particularly pill burden, adverse effects, regimen line, family or partner support, stigma, mental health, service accessibility, appointment logistics, and continuity of care. Overall, the evidence indicates that ART adherence is shaped by an interplay of individual, treatment, and system-level factors, suggesting that adherence interventions should be multi-component and context-tailored, while future research should improve standardisation and transparency in adherence measurement to strengthen comparability.

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ABSTRAK

Kepatuhan terhadap terapi antiretroviral (ART) merupakan determinan penting untuk mencapai supresi virologis dan luaran klinis jangka panjang pada orang dengan HIV (ODHIV). Namun, estimasi kepatuhan dan faktor determinannya sering bervariasi antar konteks, antara lain karena perbedaan pendekatan pengukuran kepatuhan dan karakteristik layanan. Telaah naratif ini mensintesis bukti mengenai faktor-faktor yang memengaruhi kepatuhan ART pada ODHIV. Pencarian literatur dilakukan melalui Google Scholar dan ScienceDirect serta dilengkapi penelusuran manual daftar pustaka untuk mengidentifikasi studi relevan yang diterbitkan pada periode 2015–2025. Studi diikutkan apabila melaporkan luaran kepatuhan dan/atau determinan kepatuhan pada ODHIV yang menjalani ART. Sebanyak lima studi yang memenuhi kriteria disintesis secara naratif karena instrumen pengukuran kepatuhan dan format pelaporan bersifat heterogen, mencakup indikator berbasis farmasi berupa proportion of days covered, kuesioner tervalidasi berupa Simplified Medication Adherence Questionnaire dan Morisky Green Levine Scale, pengukuran self-report, serta proksi biologis berdasarkan kadar antiretroviral pada rambut. Tingkat kepatuhan pada studi-studi tersebut bervariasi dari suboptimal hingga tinggi bergantung pada metrik yang digunakan, sehingga keterbandingan antarstudi menjadi terbatas. Determinan yang berulang meliputi faktor regimen/terapi, faktor psikososial, serta faktor sistem layanan/struktural, terutama beban pil, efek samping, lini regimen, dukungan pasangan/keluarga, stigma, kesehatan mental, akses layanan, logistik kunjungan, dan kontinuitas perawatan. Secara keseluruhan, kepatuhan ART dibentuk oleh interaksi faktor individu, terapi, dan sistem, sehingga intervensi perlu bersifat multikomponen dan kontekstual, disertai upaya standardisasi dan transparansi pengukuran kepatuhan pada penelitian berikutnya.

Kata Kunci: Terapi antiretroviral; Kepatuhan; Orang dengan HIV; Determinan; Hambatan dan pendorong; Tinjauan Literatur Naratif

1. Introduction

Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) are among the major health problems in many countries around the world. According to UNAIDS 2011, this disease is widespread in low- and middle-income developing countries, such as South Africa, Botswana, and other sub-Saharan African countries. However, the introduction of antiretroviral therapy (ART) has brought dramatic changes to people's lives [1].

Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) is the most common secondary immunodeficiency disease in the world and is a serious global epidemic. Globally, HIV cases are a very serious health problem and must be addressed. By the end of 2016, 36.7 million people worldwide were living with HIV, 1.8 million of whom were new cases [2].

At the end of 2017, there were approximately 2 million [1.5–2.3 million] people living with HIV (PLHIV) in Latin America. In Peru, there were approximately 72,000 [55,000–94,000] PLHIV; however, an estimated 16,250 of these individuals were unaware of their infection. HIV accounted for 1.8% of the total disease burden and 1.9% of total annual deaths in Peru [3].

As of 2017, there were 280,623 people living with HIV/AIDS in Indonesia [4]. By June 2018, the number had increased again to 301,959 people ("World AIDS Day," 2018).

Although fluctuating, HIV/AIDS case data in Indonesia continues to increase from year to year. During 2009-2019, the number of HIV cases in Indonesia peaked in 2019, with 50,282 cases. Based on WHO data from 2019, 78% of new HIV infections were in the Asia-Pacific region. The highest number of AIDS cases in the last eleven years was in 2013, with 12,214 cases.

Based on the 2019 report from the Directorate General of P2P (HIV/AIDS and STI Information System), the five provinces with the highest number of HIV cases were East Java, DKI Jakarta, West Java, Central Java, and Papua, which also had the highest number of HIV cases in 2017. It is known that the provinces with the highest number of AIDS cases are Central Java, Papua, East Java, DKI Jakarta, and Riau Islands. AIDS cases in Central Java account for about 22% of the total cases in Indonesia. The highest trend of HIV and AIDS cases from 2017 to 2019 remains the same, with most cases occurring on the island of Java.

Combination antiretroviral therapy (ART) is currently the standard of care for patients infected with Human Immunodeficiency Virus (HIV). The primary goal of ART is to suppress viral replication, thereby improving immune function and reducing morbidity and mortality related to opportunistic infections. In 2015, the World Health Organization (WHO) reported that ART coverage reached 46% of people living with HIV worldwide. The scale-up of ART, which consists of combinations of antiretroviral (ARV) medications, has contributed to a decline in HIV/AIDS-related deaths from 1.5 million in 2010 to 1.1 million in 2015. In addition to its therapeutic benefits, effective ART also plays a crucial role in preventing HIV transmission to sexual partners and from mother to child, thereby reducing the incidence of new HIV infections globally.

Antiretroviral (ARV) medications have been provided free of charge through the Indonesian government program since 2014 and are currently available in more than 400 health care facilities across Indonesia. ARV regimens are categorized into first-line and second-line regimens. First-line ART typically consists of a combination of two nucleoside reverse transcriptase inhibitor (NRTI) drugs—such as Zidovudine (AZT) or Tenofovir (TDF) combined with Lamivudine (3TC) or Emtricitabine (FTC)—and one non-nucleoside reverse transcriptase inhibitor (NNRTI), such as Nevirapine (NVP) or Efavirenz (EFV). Second-line ART is reserved for treatment failure and consists of a combination of two NRTIs with a ritonavir-boosted protease inhibitor (PI), most commonly Lopinavir/Ritonavir. Thus, first-line ART comprises two NRTIs plus one NNRTI, whereas second-line ART comprises two NRTIs plus one PI [5].

The 2011 Study on the Health Sector Response to HIV and AIDS in Indonesia emphasized the development of sustainable HIV services encompassing prevention, care, treatment, and support through strengthened collaboration with communities to accelerate the expansion of decentralized, integrated, and effective treatment services. In line with this policy direction, the Ministry of Health, in collaboration with multiple stakeholders, has implemented a comprehensive and sustainable HIV service model to ensure integrated service delivery across the health system, including primary health care facilities. Within this context, the present review aims to summarise antiretroviral therapy adherence levels and the key determinants influencing adherence as reported in peer-reviewed studies published between 2010 and 2021 [6].

2. Methods

Review Design

This study was conducted as a focused narrative literature review to synthesise evidence on adherence to antiretroviral therapy (ART) and its determinants among

people living with HIV (PLHIV). A narrative synthesis approach was applied because the eligible studies demonstrated substantial heterogeneity in adherence measurement, operational definitions, and reporting formats, which limited direct comparability and precluded meaningful quantitative pooling across studies [8]–[12].

Information Sources and Search Strategy

A structured literature search was performed using Google Scholar, PubMed, and ScienceDirect to identify relevant articles published between **2015 and 2025**. The search strategy combined core concepts related to HIV/PLHIV, ART, adherence, and determinant-related terms. Key terms were applied iteratively using database-appropriate syntax and field restrictions where available. A representative Boolean strategy was: ("HIV" OR "people living with HIV" OR "PLHIV") AND ("antiretroviral therapy" OR "ART") AND ("adherence" OR "compliance" OR "persistence") AND ("determinant" OR "factor" OR "barrier" OR "facilitator"). In addition, reference lists of relevant full-text articles were manually screened to identify potentially eligible studies not retrieved through the primary database search. Full-text retrieval was facilitated when necessary through author-available repositories; however, such sources were used solely for access to full texts already identified as potentially relevant and were not treated as primary bibliographic databases.

Eligibility Criteria

Studies were included if they: (i) involved PLHIV receiving ART, (ii) reported adherence outcomes using a clearly described measurement approach, and (iii) examined factors associated with adherence or provided extractable information relevant to adherence determinants. Eligible adherence measurement approaches included pharmacy refill-based indicators (such as proportion of days covered), questionnaire-based measures, self-report instruments, and biological proxies based on antiretroviral concentrations in hair, consistent with established variability in adherence operationalisation across the literature [8]–[12]. Studies were excluded if they were non-original reports (editorials, opinion pieces, commentaries), conference abstracts lacking sufficient methodological detail, duplicates, non-retrievable full texts, or articles that did not report extractable adherence outcomes or determinants among PLHIV on ART.

Study Selection

All records identified from the databases were compiled and deduplicated prior to screening. Titles and abstracts were screened for relevance, followed by full-text assessment against the eligibility criteria. The study identification and selection process is summarised in the PRISMA-style flow diagram (**Figure 1**). Overall, 286 records were identified (Google Scholar = 24; PubMed = 135; ScienceDirect = 127). After removal of 25 duplicates, 261 records were screened, and 246 were excluded based on title/abstract. Full texts of 15 articles were assessed for eligibility, and 10 were excluded following full-text review. Ultimately, five studies met the inclusion criteria and were included in the narrative synthesis.

Data Extraction

Data were extracted using a structured extraction framework capturing: country/setting, study design, sample size, participant characteristics (where reported), adherence measurement method, adherence definition or cut-off, reported adherence level, and determinants associated with adherence. Where multiple adherence metrics were reported, each metric was retained and interpreted according to its methodological basis to avoid conflating non-equivalent adherence constructs [8]–[12].

Narrative Synthesis and Thematic Organisation

Findings were synthesised narratively, with determinants mapped into conceptually coherent domains to improve interpretability across heterogeneous study designs and adherence measures. Determinants were organised into: (i) treatment/regimen-related factors, (ii) psychosocial and interpersonal influences, and (iii) health-system or structural factors. Given the heterogeneity in adherence measurement and reporting, adherence estimates were not averaged across studies; instead, results were presented and discussed within the context of the measurement approach used in each study [8]–[12]. This framework enabled identification of recurrent determinants and facilitated discussion of their plausible mechanisms and programmatic implications [11], [12].

Methodological Considerations

Formal risk-of-bias appraisal was not applied as a standalone scoring exercise because the included studies varied in design and adherence measurement approaches, limiting the suitability of a single unified appraisal tool. Instead, methodological limitations relevant to inference were addressed narratively in the Discussion, particularly with respect to adherence operationalisation and cross-study comparability [8]–[12].

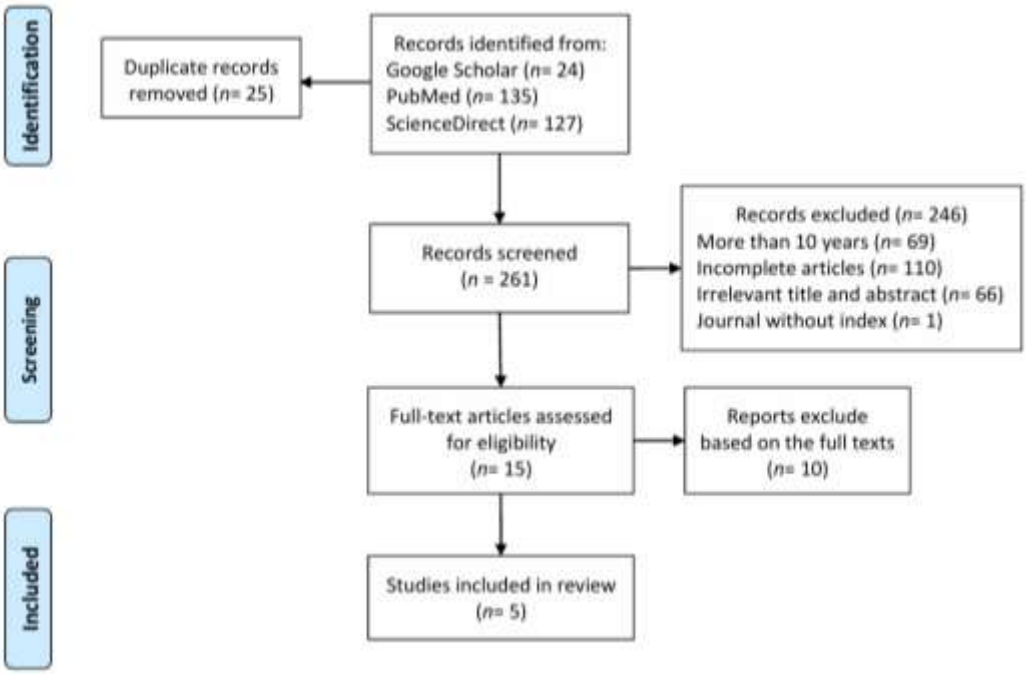

Figure 1. The PRISMA chart of the identification and selection process.

3. Results and Discussion

Literature Study Results

The literature search and selection process yielded a focused evidence base that was ultimately synthesised narratively due to methodological heterogeneity in adherence measurement and reporting. The review process followed a structured approach consistent with established procedures for evidence identification and synthesis in review-based studies, particularly in situations where study designs, adherence constructs, and outcome operationalisation vary across settings [7]. In this

review, five eligible studies were included as the core evidence base, encompassing different health-system contexts and adherence measurement approaches (**Table 1**). These approaches included real-world adherence thresholds for viral suppression, clinic-based adherence assessments, questionnaire-derived adherence measurement, and biological adherence proxies based on antiretroviral concentrations in hair [8]–[12]. This heterogeneity is not a minor methodological detail; rather, it shapes interpretability because adherence metrics capture different behavioural windows and levels of objectivity, thereby limiting direct comparability of adherence estimates across studies [8]–[12].

Table 1. Characteristics of included studies on ART adherence among PLHIV

No	Author (Year)	Country/setting	Study design	Sample size (n)	Adherence measure	Operational definition / cut-off (as reported)	Adherence outcome (as reported)	Key determinants (as reported)
1	Byrd et al. (2019) [8]	United States	Retrospective cohort (real-world data)	765	Pharmacy refill indicator (PDC) and viral load	PDC threshold(s) evaluated against virological suppression; regimen-specific performance examined	Higher PDC associated with viral suppression; adherence requirement varies by regimen	Regimen characteristics and complexity; adherence–suppression threshold
2	Eyassu et al. (2016) [9]	South Africa (Kwa-Thema clinic)	Cross-sectional	290	Self-report (recall) and pill count	Categorised as adherent vs non-adherent based on reported intake and pill-count assessment	77.0% adherent	Pill burden; perceived ability to adhere; educational status; co-treatment; regimen-related factors
3	Gandhi et al. (2019) [10]	India	Prospective observational	75	Hair antiretroviral concentrations (biological adherence proxy)	Hair ARV concentrations used as exposure-based adherence proxy over preceding weeks	Hair levels supported stratification of adherence; higher concentrations indicate higher adherence	ARV regimen; exposure variability; behavioural adherence patterns
4	Leyva-Moral et al. (2019) [11]	Northern Peru	Cross-sectional	180	SMAQ and viral load	Adherence categorised using SMAQ; 90% threshold used for high adherence	41.5% achieved ≥90% adherence	TB co-infection; ART adverse effects; prior treatment interruption; family factors

						classification		
5	Wardhani and Yona (2021) [12]	Bandung, Indonesia	Cross-sectional	115	MGLS questionnaire	MGLS scoring: 0 (high), 1–2 (moderate), 3–4 (low) adherence	88.7% high adherence	Spousal intimacy/partner support; regimen line; social support

Substantively, the included evidence was interpreted within the broader epidemiological and programmatic context of HIV care, where sustained adherence to ART is central to viral suppression, reduced morbidity, and transmission control. Global and national reports consistently emphasise that HIV remains a persistent public health burden and that the effectiveness of ART programs depends strongly on treatment continuity and adherence at the population level [1]–[4]. In Indonesia, national technical guidance and treatment guidelines highlight the importance of adherence support as a routine component of ART delivery, including counselling, monitoring, and linkage to care systems that reduce loss to follow-up [5],[6],[17],[21]. These policy documents provide the necessary interpretive background for reading empirical adherence findings not merely as individual behaviour, but as outcomes emerging from clinical, psychosocial, and service-delivery environments [5],[6],[17],[21]. Furthermore, national surveillance summaries underscore the continuing relevance of HIV program strengthening and the need for systematic adherence-support strategies aligned with service realities in the field [13].

Patient Characteristics

In the study Byrd et al. (2019) in the United States shows that the majority of HIV sufferers based on gender are men, with a percentage of 78% compared to women at 22%. This is in line with research Leyva-Moral et al. (2019) in the Province of Lambayeque (Northern Peru) where the majority of HIV sufferers are men with a percentage of 80% and women with a percentage of 20%. This differs from the research conducted Eyassu et al. (2016) in South Africa, Gandhi et al. (2019) in India, and Wardhani & Yona (2021) in Indonesia, where the majority of HIV sufferers are women, with percentages of 67.9%, 50.7%, and 52.17%, respectively.

According to data from the Directorate General of P2P sourced from the HIV, AIDS, and STI Information System (SIHA) in 2019, the fourth quarterly report states that HIV and AIDS cases in Indonesia are higher among men than women. In 2019, 64.50% of HIV cases were among men, while 35.50% were among women. The Directorate General of P2P report on the development of HIV AIDS & PIMS in Indonesia in the second quarter of 2020 states that the number of HIV cases in the April-June 2020 period based on gender shows that the percentage of HIV cases found in men was 67.6% and in women was 32.4%, with a male to female ratio of 2:1. This is in line with the results of HIV reports based on gender from 2008 to 2020 in Indonesia, where the percentage of male patients has always been higher than that of female patients [13].

Many factors influence the differences in HIV patient characteristics according to gender. These include self-awareness in terms of HIV testing, environment, and occupation. The higher prevalence of HIV cases among men is due to risky sexual behavior, which men are more prone to than women [14]. Umam et al. (2015) He said that men's vulnerability to HIV/AIDS infection is caused by negative behaviors such as

homosexuality, purchasing commercial sex services, injecting drugs, and men also have high mobility and are far from their partners. In several studies, the number of HIV cases in women is higher than in men. One of the influencing factors is the high level of awareness regarding HIV testing. Women tend to pay more attention to themselves, so their concern for their health is also high. Research Eyassu et al. (2016) found that women are more likely than men to voluntarily attend counseling services, undergo HIV testing, and actively care for their health. The idea of getting married and having children also encourages women to prepare themselves better, one way being by undergoing regular health checks.

In the study Byrd et al. (2019) in the United States shows that HIV patients based on age are ≥50 years old with a percentage of 53% and <50 years old with a percentage of 47%, with an average age of 49 years (45-57 years). Research Eyassu et al. (2016) In South Africa, the majority of HIV patients are aged 40-49 years, with a percentage of 33.8%. Research conducted by Monica Gandhi (2019) in India found that the average age of HIV patients is 41 years. Research by Juan M. Leyva-Moral (2019) in Lambayeque Province, Northern Peru, found that the average age of HIV patients is 30 years (24-38.5 years). Research Wardhani & Yona (2021) In Indonesia, the majority of HIV patients are aged 18-35 years, accounting for 60.87%.

Based on age data from the Directorate General of Disease Control and Prevention on the development of HIV/AIDS and PIMS in Indonesia in the second quarter of 2020, the number of HIV cases in the April-June 2020 period was mostly in the 25-49 age group (70%), followed by the 20-24 age group (14.9%), and the ≥ 50 age group (10.2%) [13]. In a study conducted by Kambu Yowel et al. in 2016 in West Papua, a significant difference was found between the proportion of young PLWHA (adolescents and adults) and older PLWHA (elderly). This data explains that HIV infection is more prevalent among young people than older people. This is because younger people are more likely to engage in unsafe sexual behavior that puts them at risk of HIV transmission. The high number of HIV cases among young adults is due to the fact that during adolescence, people are easily influenced by their environment and friends, leading them to engage in promiscuous behavior and unsafe sexual practices. There is also an increase in injecting drug use (IDU) and homosexuality, which puts people at high risk of HIV infection [16].

Characteristics of Medicines

In the study Byrd et al. (2019) In the United States, the most commonly used treatment regimen was a combination of INSTI + 2 NRTI, accounting for 31% of the total sample, followed by a combination of NNRTI + 2 NRTI, accounting for 21%. Research Eyassu et al. (2016) In South Africa, it was found that a combination of NNRTI and NRTI was used, with Efavirenz being the most widely used NNRTI at 77.9% and Tenofovir being the most widely used NRTI at 67.6%. Research conducted Gandhi et al. (2019) In India, a combination of 2 NRTI + NNRTI is used across the board. The difference in this study is the NNRTI group, which consists of 49.3% Efavirenz and 50.7% Nevirapine.

Research Leyva-Moral et al. (2019) In Lambayeque Province, Northern Peru, the majority of ARV combinations used are a combination of 2 NRTI + NNRTI, where the drugs used are ZDV+3TC +EFV with a percentage of 34.4%. Research Wardhani & Yona (2021) In Indonesia, the majority of treatments used are a combination of 2 NRTI + NNRTI, where the drug used is Atripla with a percentage of 56.52%. Atripla is a single fixed-dose tablet containing Efavirenz (NNRTI), Emtricitabine (NRTI) and Tenofovir (NRTI), which is usually taken once a day. The World Health Organization encourages

the use of ARV therapy that has fewer side effects, is more comfortable, and has a simpler combination. The ARV therapy of choice must also be able to be used in combination with drugs used for various co-infections and comorbidities commonly found in PLWHA [17].

Based on a systematic review, the once-daily fixed-dose combination of TDF+3TC (or FTC)+EFV is less likely to cause serious side effects and shows better therapeutic and virological responses compared to once- or twice-daily NNRTIs or combinations containing protease inhibitors (PIs). The same applies to the use of TDF. The fixed-dose combination available in Indonesia is TDF+3TC+EFV, making this combination the primary choice for first-line ARV regimens in Indonesia [17]. Of the five journals, the majority used first-line ARVs rather than second-line ARVs. This indicates a high success rate in first-line ART treatment because second-line ARVs are used when there is treatment failure in first-line ARVs, as measured by CD4 cell count, HIV viral load, or clinical features. First-line drugs are considered the most effective combination of drugs with minimal side effects and are easy to take because they are only taken once a day, thereby increasing ART compliance.

The most widely used NRTI is tenofovir. Tenofovir is considered safer than other types of NRTIs. Tenofovir is also the ARV of choice when used in combination with rifampicin for TB co-infection, and can be used in pregnant women or women of childbearing age. Meta-analyses and several subsequent studies comparing the use of TDF with other ARV drugs in the first trimester of pregnancy show that ETDF does not increase the risk of congenital abnormalities such as neural tube defects in babies.

For research Byrd et al. (2019), Eyassu et al. (2016), Leyva-Moral et al. (2019), and Wardhani & Yona (2021) The most commonly used NNRT group is Efavirenz. Systematic reviews and meta-analyses show that substitution due to side effects of NVP use is more common than EFV, partly due to hepatotoxicity and drug hypersensitivity reactions. However, NVP can still be used with caution, especially in PLWHA with high CD4 counts and pregnant women [17].

This differs from the results of the study Gandhi et al. (2019) The most commonly used NNRT group is Nevirapine compared to Efavirenz. Efavirenz toxicity involves the central nervous system in the form of neuropsychiatric side effects. Although most reports are mild and temporary, some people also experience significant mental disorders such as mania, depression, suicidal thoughts, and psychosis. Side effects mostly occur in the first month of treatment and tend to increase with higher plasma levels of Efavirenz. Patients with depressive symptoms prior to starting Efavirenz therapy are more likely to experience neuropsychiatric side effects during treatment [18].

The use of sedative drugs such as Diazepam and Fluoxetine can reduce the side effects of ARV drugs such as Efavirenz. Efavirenz can cause neuropsychiatric side effects (such as nightmares, headaches, depression) which generally improve after several weeks of treatment, but can persist for a long time in some PLWHA. [17]. During the natural course of HIV infection, there is an acute HIV retroviral syndrome, according to Bartlett et al. (2002) Acute HIV retroviral syndrome includes fever, adenopathy, pharyngitis, morbilliform skin rash, diarrhea, headache, nausea/vomiting, and neurological disorders. As the host's immune system weakens due to HIV infection, various microorganisms both inside and outside the host's body tend to become active, causing opportunistic infections. Common opportunistic infections include pneumonia, toxoplasmosis, mycosis, tuberculosis, Mycobacterium avium complex, herpes simplex virus infection, varicella-zoster virus infection, cytomegalovirus infection, and hepatitis B and C [20].

Antimicrobial prophylaxis using cotrimoxazole is part of HIV care. Based on WHO and ISTC recommendations, all HIV patients diagnosed with TB as an opportunistic infection should be given cotrimoxazole to prevent other infections without assessing CD4 count or CD4 value, administered at a dose of 960 mg once daily while receiving OAT therapy [17]. Various studies have proven the effectiveness of cotrimoxazole prophylaxis in reducing mortality and morbidity in people infected with HIV [21].

People infected with HIV often experience nutrient intake disorders that cause a decline in the body's biological functions. Free radicals formed during endogenous infection can be suppressed by various enzymes in the body. Exogenous antioxidant supplements such as Fe, Zn, Se, Mn, vitamin C, vitamin B6, and vitamin E are needed [20]. Micronutrients are absolutely necessary for people living with HIV/AIDS to build a strong immune system to fight opportunistic infections [20].

In addition to opportunistic infections, ARVs used by PLWHA often cause side effects. AZT, for example, often causes anemia, one type of which is macrocytic anemia. The causes of macrocytic anemia include vitamin B12 deficiency, folate deficiency, medication, bone marrow disorders (myelodysplasia, leukemia), and other chronic diseases [22]. Therefore, it is necessary to supplement with vitamin B complex and vitamin B12 to prevent anemia. Vitamin B6 25 mg can also be used as an anti-nausea medication (PIONAS 2021). Especially if the patient is using isoniazid as TB prophylaxis, it must be combined with vitamin B6 [20].

One way to prevent HIV/AIDS transmission is through condom use. Laboratory studies show that the materials used to make most condoms, such as latex, nitrile, polyurethane, and polyisoprene, are capable of preventing the transmission of HIV/AIDS viruses that enter through bodily fluids such as semen and vaginal fluids containing HIV/AIDS viruses into the vagina and surrounding areas as well as the penis [23]

Adherence to ARV Therapy

HIV/AIDS infection can be effectively controlled with antiretroviral (ARV) therapy when high levels of adherence are achieved. Non-adherence to ARV therapy has been associated with virological failure, declining CD4 cell counts, progression to AIDS, and increased risk of drug resistance. Therefore, adherence to ARV therapy is a critical component of achieving optimal therapeutic outcomes, including sustained viral suppression, immune restoration, and reduced HIV-related morbidity and mortality. Clinical guidelines recommend that people living with HIV/AIDS (PLHIV) maintain adherence levels of at least 95% (i.e., missing fewer than three doses in a 30-day period for twice-daily regimens) to maximize treatment effectiveness [6]. However, adherence estimates vary considerably depending on measurement methods, study populations, and health system contexts.

In the study Byrd et al. (2019) conducted in the United States, adherence to ART was measured using the pharmacy refill–based *Proportion of Days Covered* (PDC), which reflects medication availability rather than actual ingestion [8]. Using this method, approximately 67% of participants achieved PDC values greater than 90%. The study also demonstrated that the level of adherence required to achieve a 90% reduction in viral load was approximately 82%, and this threshold varied according to ART regimen type, highlighting the influence of regimen complexity on adherence outcomes.

In contrast Eyassu et al. (2016) In South Africa, ART adherence status was measured using self-reported assessments over a one-month period and by counting

medications recorded by healthcare providers. The findings showed ART adherence of 76.9% compared to non-adherence of 23.1%. Research conducted Gandhi et al. (2019) In India, ART adherence rates were assessed using the Tel-Me-Box (TMB) Study. This study was designed to validate adherence using a new low-cost wireless device, a monitoring device as an innovative monitoring tool to assess ART adherence and predict treatment outcomes among Indians living with HIV (PLHIV). The results obtained were 30.7% in the 85-95% adherence category and 69.3% in the ≥95% adherence category. Research Leyva-Moral et al. (2019) assessed ART adherence among PLHIV in Northern Peru using the *Simplified Medication Adherence Questionnaire* (SMAQ), which categorizes adherence based on predefined behavioral thresholds. Using this method, 58.3% of participants were classified as having adherence levels below 90%, while only 41.5% achieved adherence ≥90%. Importantly, this lower adherence was context-specific and was associated with several factors, including concurrent tuberculosis infection, discomfort or side effects related to ART, prior treatment interruption, work-related commitments, and clinic attendance schedules. More than half of participants reported experiencing side effects, particularly gastrointestinal discomfort and skin rash, which contributed to non-adherence. These findings indicate that results from SMAQ-based assessments should not be generalized to all settings.

Research Wardhani & Yona (2021) In Indonesia, ARV adherence is measured using the Morisky Green Levine Scale (MGLS) questionnaire. The MGLS measurement scale is assessed with a total score between 0-4, indicating high adherence if the total score is 0, moderate adherence if the total score is 1-2, and low adherence if the total score is 3-4. The results obtained were a moderate adherence category of 1.31% and a high adherence category of 88.69%.

Across the included studies, adherence estimates cannot be directly compared or averaged because of fundamental differences in measurement methods, including pharmacy refill data (PDC), self-report questionnaires (MGLS and SMAQ), biological markers (hair concentrations), and combined recall–pill count approaches. Nevertheless, several common correlates of ART adherence consistently emerged across diverse settings. These included pill burden and regimen simplicity, treatment-related side effects, particularly the neuropsychiatric effects associated with efavirenz type of ART regimen (first-line versus second-line), partner and family support, social stigma, tuberculosis comorbidity and concurrent therapy, and logistical factors such as clinic accessibility and visit schedules

According to the study Eyassu et al. (2016) found that 8.3% of respondents who did not adhere to treatment said they complained about the burden of too many pills, 2.76% felt better and therefore skipped doses, 2.41% said they skipped doses because of travel or migration to another location, and 2.07% said they skipped ART doses because they were very sick. The remaining respondents said they missed their ART because of drug side effects (1.72%), economic problems (1.38%), and social stigma (0.67%). Although the study shows a relatively high level of adherence, the development of guidelines for implementing adherence management strategies is urgently needed. Measures that need to be taken to address this issue include adherence counseling, bringing treatment closer to the community, a family care model approach to ART, practical reminders, adherence case management, and medication organizers.

According to the study Wardhani & Yona (2021) High levels of intimacy between partners influence high levels of ARV adherence. This shows that these married couples share emotional and physical support with their partners: as a result, these respondents have higher levels of adherence to ART. This support helps with retention and adherence

by motivating PLWHA, reminding them to take their medication every day, reducing fear associated with treatment, and helping them financially to remain in treatment. Similarly, with regard to the type of ARV, it was found that respondents with first-line ARVs had higher levels of adherence than respondents with second-line ARVs. Factors contributing to non-adherence in this study were social stigma from family members, which tended to discourage access to health services. Knowledge about HIV and ARVs also influenced PLWHA non-adherence, such as how to deal with side effects or the importance of ARVs for PLWHA. According to [24], Several factors can influence compliance improvement mechanisms. First, easy access to health facilities or clinics; second, additional accompanying practices such as facilitated rescheduling, appointment reminders via text messages, follow-up monitoring calls, and intensive counseling; third, measuring and reporting patient preferences such as stigma in the community.

According to Nafisah (2020), Factors that increase adherence to ARV therapy in this study include access to information, internal motivation, doctor-patient relationships, education level, and social support. Access to information is seen as one of the factors that help increase adherence to ARV therapy among PLWHA. Informants decided to get tested for HIV and also undergo ARV therapy after finding information about it on the internet. They searched for places that guaranteed privacy and more flexible opening hours through the internet and information from people they knew, whether partners, friends, or NGOs. Internal motivation, such as wanting to be healthy and fear of exposure to opportunistic infections, influenced the regularity with which PLWHA took ARVs. Other motivations included fear of looking thin, wanting to look like healthy people in general, and being able to work calmly and safely as usual. Health workers' efforts to improve patient relationships include consultation duration, providing explanations to patients, always reminding and helping patients if there are obstacles, and giving feedback to patients. Regarding side effects, doctors have warned PLWHA about the possible side effects after taking ARV during the counseling process.

Evidence from these studies suggests several actionable programmatic implications. Strategies to improve adherence should prioritize simplified, once-daily fixed-dose combinations, such as TDF+3TC/FTC+EFV, routine and structured adherence counseling, early identification and management of drug side effects, and integration of HIV and tuberculosis services. Additional interventions, including SMS-based appointment reminders, follow-up monitoring calls, family or partner involvement in care, and flexible clinic scheduling, may further enhance sustained adherence. Given the heterogeneity of adherence measures and contextual factors, caution is required when generalizing adherence levels across settings, and adherence outcomes should always be interpreted within the methodological and social context of each study [26].

This review has several limitations that should be considered when interpreting the findings. First, only five studies were included, which may limit generalisability. Second, adherence was measured using heterogeneous approaches across studies, limiting comparability and precluding quantitative pooling; therefore, conclusions rely on narrative synthesis and method-anchored interpretation rather than aggregated estimates. Third, most included studies were observational, commonly cross-sectional, which restricts causal inference and increases susceptibility to confounding. Finally, a formal risk-of-bias appraisal using a single unified instrument was not undertaken because study designs and adherence measures varied across the included evidence.

4. Conclusion

Adherence to antiretroviral therapy (ART) among people living with HIV varied across settings and studies, largely reflecting differences in adherence measurement methods, operational definitions, and clinical contexts. Although several studies reported moderate-to-high adherence, these findings should be interpreted cautiously because adherence was assessed using heterogeneous approaches, including questionnaire-based self-report, pharmacy refill indicators, and biological proxies. Across the evidence base, determinants of adherence were repeatedly situated across treatment-related, psychosocial, and health-system domains, suggesting that adherence support is most likely to be effective when it is multi-component, integrating regimen simplification where feasible, structured adherence counselling, stigma-sensitive care, and strengthened psychosocial or partner support. Future research should prioritise standardised and transparently reported adherence metrics, incorporate objective measures such as pharmacy refill–based indicators including proportion of days covered when appropriate, and evaluate sustained clinical outcomes, particularly long-term viral load suppression, to strengthen the evidence base for adherence interventions and their implementation in routine care.

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Conflicts of Interest:

The authors declare that there are no conflicts of interest associated with this research or its publication.

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