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Adverse Effects Related to Antiretroviral Therapy in People with HIV in a General Reference Hospital in the Democratic Republic of the Congo

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Abstract

Antiretroviral therapy may be associated with adverse effects that can affect adherence among people with HIV. This study aimed to describe the adverse effects of antiretroviral therapy and their association with treatment interruption among people with HIV followed at the Provincial General Reference Hospital of Bukavu, Democratic Republic of the Congo. A retrospective cross-sectional study was conducted using medical records of patients receiving antiretroviral therapy between January 2018 and January 2024. A total of 210 patients were included, with a median age of 44 years [35 - 52]. Female sex predominated (55.8%), with a sex ratio of 0.79 (M/F). Digestive disorders were the most frequently reported adverse effects. More than two-thirds of patients experienced at least one treatment interruption, with adverse effects being the most reported associated factor. Adverse effects were more frequently reported among patients receiving efavirenz-based regimens. These findings highlight that adverse effects are commonly reported and may be associated with treatment interruption, underscoring the importance of optimized monitoring and patient counseling to improve adherence.

Keywords

Adverse Effects, Antiretroviral Therapy, People with HIV (PWV),

Democratic Republic of the Congo

1. Introduction

In 2023, 86% of HIV-infected individuals were aware of their status, 77% were taking antiretroviral drugs, and 72% had decreased viral load. HIV is still a major public health problem worldwide, having claimed an estimated 42.3 million lives to date. Transmission is currently happening in all countries around the world. By the end of 2023, there were estimated 39.9 million people with HIV, and 65% of them resided in the WHO African Region. In 2023, there were an estimated 630,000 deaths from HIV-related causes and an estimated 1.3 million new cases of the virus. There is no cure for HIV infection [1] [2].

Access to effective HIV prevention, diagnosis, treatment, and care, including for opportunistic infections, has enabled people with HIV to lead long and healthy lives. As of December 2021, the DRC had 490,000 PLHIV, of whom 400,000 knew their HIV status and were receiving ART [3]. For South Kivu province, the National Multisectoral AIDS Control Program (4) reported 42,711 PLHIV [4]. WHO, the Global Fund and UNAIDS all have global HIV strategies that are aligned with the SDG target 3.3 of ending the HIV epidemic by 2030. By 2025, 95% of all people with HIV should have a diagnosis, 95% of whom should be taking lifesaving antiretroviral treatment, and 95% of people with HIV on treatment should achieve a suppressed viral load for the benefit of the person's health and for reducing onward HIV transmission. In 2023, these percentages were 86%, 89%, and 93% respectively [5].

Usually, the first HIV regimen consists of three drugs from at least two different drug classes [6]. Although this treatment is not curative, it can provide longer lives for patients and reduce HIV transmission. For HIV-positive people with an HIV-negative partner, antiretroviral therapy is now frequently used to reduce transmission. In many parts of the world, the incidence of HIV progressing to AIDS has decreased due to the effectiveness of antiretroviral therapy [7]. According to studies, the three-drug regimen has reduced hospitalization, death, and AIDS rates by 60% to 80%. CDC wants to put in place a 90-90-90 plan by 2030, which stands for 90% HIV suppressed, 90% on therapy, and 90% diagnosed.

This activity explains HIV antiretroviral therapy's uses, side effects, and indications. It also emphasizes how important the interprofessional team is to ensure patients' safety [8]. Antiretroviral therapy can produce a diverse array of negative effects on the human body. Common yet mild side effects that often emerge early in various antiretroviral treatments include gastrointestinal issues such as bloating, nausea, and diarrhea, which may be temporary or can continue throughout the course of therapy [9]. Additional frequent nuisance side effects include fatigue and headaches linked to AZT, as well as nightmares associated with EFV. There are also less common but more serious side effects related to antiretroviral ther-

apy, such as AZT-related anemia, d4T-induced peripheral neuropathy, PI-associated retinoid toxicity (characterized by itching and ingrown toenails), and NNRTI-related hypersensitivity reactions, which are addressed following standard treatment protocols for these conditions in patients who are not on ART. Nevertheless, the subtle yet serious nature of other adverse effects—such as lactic acidosis, hepatic steatosis, hyperlactatemia, hepatotoxicity, hyperglycemia, fat redistribution, hyperlipidemia, bleeding disorders, osteoporosis, and skin rashes—requires a more in-depth examination [10].

Despite the widespread use of antiretroviral therapy and its proven effectiveness in reducing HIV-related morbidity and mortality, adverse effects remain a major challenge to long-term adherence, particularly in resource-limited settings. In the Democratic Republic of the Congo, limited local data are available on the nature, severity, and impact of antiretroviral therapy-related adverse effects on treatment adherence. This study was therefore conducted to describe adverse effects associated with antiretroviral therapy and to assess their association with treatment interruption among people with HIV followed at the Provincial General Reference Hospital of Bukavu.

2. Methods

2.1. Study Design

A retrospective study based on the analysis of patient records in the HPGRB (Provincial General Reference Hospital in Bukavu) to sort out all cases of adverse effects of PLIHV from 2018 to 2024. This was a retrospective cross-sectional study based on a review of medical records of people with HIV receiving antiretroviral therapy at the Provincial General Reference Hospital of Bukavu. Data were extracted at a single point in time from existing records, which did not allow longitudinal follow-up.

2.2. Study Site

Figure 1. The Provincial General Reference Hospital of Bukavu (HPGRB) [11].

Figure 1 shows the picture of the site. HPGRB is a tertiary medical structure of the Congolese State ceded to the Archdiocese of Bukavu in 1995 for its management, located at n˚02 on Avenue Michombero, Nkafu district, Kadutu commune. At the secondary level, it is a teaching hospital for Universities, Higher Institutes of Medical Techniques and Institutes of Health Sciences. With a capacity of 450 beds, 52 private rooms and 16 standard rooms for the hospitalization of patients [11]. It is structured in departments including internal Medicine; Surgery; Gynecology and Obstetrics; Pediatrics; Specialties; Medical Biology and Anatomopathology; Medical Imaging; Intensive Care Unit; Emergency Care Service, and the Mortuary. The medical staff includes 90 doctors, 207 nurses, pharmacists, laboratory technicians, midwives and anesthesiologists.

2.3. Patient Data Collection and Analysis

This is a cross-sectional study conducted from January 2018 to January 2024 at the Outpatient Department of Internal Medicine of the Hospital in the care of people with HIV. After authorization from the HPGRB, patients carrying an HIV retrovirus, followed at the HPGRB for at least three months, aged 18 years and over, were included, whose medical records were consulted. Patients were excluded if they were under 18 years of age, pregnant at the time of ART initiation, or had a medical record missing key baseline variables, such as age, sex, antiretroviral regimen, or follow-up data. The exact number of records screened before these exclusions were applied was not systematically logged. This limits the reproducibility of the selection process, and is acknowledged as a limitation below. Sociodemographic data (age, sex, marital status, level of education, profession), clinical-biological data, data on antiretroviral treatment and side effects of treatment were collected on a standardized data collection form. The degree of severity of adverse effects was assessed using the scale for rating the severity of adverse events in adults validated by the Guide to Integrated HIV Management in the Democratic Republic of the Congo.

These categories from 1 to 4 allow us to classify the most frequent adverse effects of antiretrovirals according to their severity, as follows: (a) Grade 1: mild intolerance, not influencing the patient's daily lifestyle and not requiring immediate drug treatment [12]; (b) Grade 2: moderate intolerance, partially influencing the patient's daily lifestyle and requiring drug treatment; (c) Grade 3: severe intolerance, completely influencing the patient's lifestyle, requiring drug treatment or even emergency hospitalization; (d) Grade 4: intolerance endangering the patient's life [13]. The medical record allowed us to collect information concerning the adverse effects of ARVs when significant organ dysfunction occurs. Treatment interruption was defined as any temporary or permanent discontinuation of antiretroviral therapy, as reported by the patient or documented in the medical record. Information obtained from patient interviews was cross-checked with pharmacy attendance records to minimize recall bias.

This study was conducted in accordance with the fundamental principles of the

Declaration of Helsinki. The protocol was approved by the ethics committee of the Provincial General Reference Hospital of Bukavu (HPGRB). Adverse effects were defined according to the national HIV management guidelines of the Democratic Republic of the Congo. They included any clinical or biological abnormality occurring after initiation of antiretroviral therapy. Severity was graded using the national adverse event severity scale, ranging from Grade 1 (mild) to Grade 4 (severe). Adverse effects were documented by clinicians during routine follow-up visits and recorded in patients' medical files. Both clinician-documented and patient-reported adverse effects were included. Data were retrospectively extracted from medical records. Incomplete or missing records were excluded from severity analyses. Although the study covered a six-year period, analyses were based on the most recent documented clinical information for each patient. Repeated measurements over time were not analyzed, which helped to minimize time-related bias.

2.4. Statistical Analysis

Data were entered and analyzed using descriptive statistical methods. Categorical variables were summarized as frequencies and percentages. Continuous variables were summarized using medians and interquartile ranges. Associations between adverse effects and treatment interruption were assessed using bivariate analyses. The exact statistical tests underlying each comparison were not systematically documented in the source data, so only the resulting p-values are reported here. A p-value below 0.05 was considered statistically significant. Multivariable analysis was not performed, because several key covariates, including exact treatment start date and complete viral load data, were missing for a large share of patients. This point is discussed further in the Limitations section (Table 1).

3. Results

General characteristics of the study population:

Table 1. General characteristics of the study population.

Category	Subgroup	n
Sex	Male	93
Sex	Female	117
Marital status	Single	75
Marital status	Cohabitation	30
Marital status	Married	100
Marital status	Divorce	5
Education	No school	10
Education	Primary	65
Education	Secondary	105
Education	Higher	20

A total of 210 patient records met the inclusion criteria and were included in the study. Female sex predominated (55.8%; 44.2% male), with a sex ratio of 0.79 (M/F). More than half of the patients lived with a partner (married) (47.61%; n = 100/210) and most patients had attended school (n = 105/210; 50%), with a secondary education level (Figure 2).

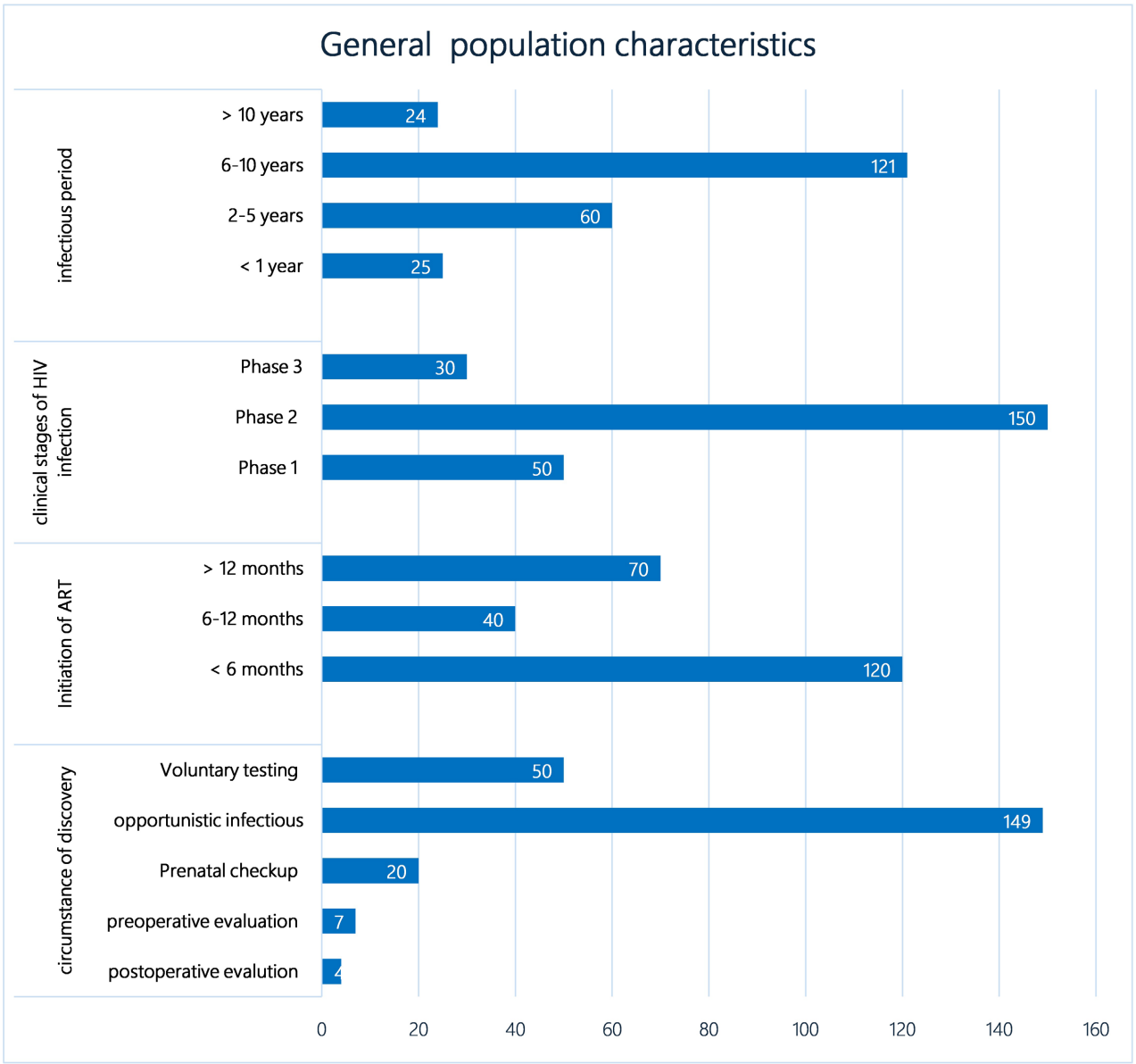

Figure 2. Identification and evolution of infection HIV.

The circumstances surrounding HIV discovery were mainly opportunistic infections, followed by voluntary screening. More than half of patients (65.2%; n = 150/230) were at WHO stage 2 at the time of diagnosis. Table 2 reports this variable, together with the circumstance of HIV diagnosis and CD4/viral load data below, on a basis of 230 patients, which does not match the 210 patients in the

general cohort described in Table 1. This discrepancy could not be resolved from the data available and is discussed as a limitation below. Among the opportunistic infections found, tuberculosis predominated in more than half of cases. Antiretroviral treatment was initiated early (<6 months) in most cases, and the duration of infection was at least six years in most patients. In terms of immunovirology, the median CD4 count measured in all patients and most of result: [132 - 400]/mm^3 and the median initial viral load was 15,000 [4586 - 50,100] copies/ml. The latter had been performed in less than a quarter of patients (n = 50/210; 23.80%) during the initial assessment.

Table 2. Identification and evolution of infection HIV.

Category	Subgroup	n
Circumstance of discovery	Postoperative evaluation	4
Circumstance of discovery	Preoperative evaluation	7
Circumstance of discovery	Prenatal checkup	20
Circumstance of discovery	Opportunistic infection	149
Circumstance of discovery	Voluntary testing	50
Initiation of ART	<6 months	120
Initiation of ART	6 - 12 months	40
Initiation of ART	>12 months	70
Clinical stage of HIV infection	Phase 1	50
Clinical stage of HIV infection	Phase 2	150
Clinical stage of HIV infection	Phase 3	30
Duration of infection	<1 year	25
Duration of infection	2 - 5 years	60
Duration of infection	6 - 10 years	121
Duration of infection	>10 years	24

ARV initiation treatment regimen and time to treatment initiation. Although one-third of patients had TDF-3TC-DTG as their initial treatment regimen, the preferred combination therapy of TDF + 3TC/FTC + EFV was the most prescribed to patients at the start of care. The TDF + 3TC/FTC + EFV regimen was prescribed to more than half of patients regardless of the time to ARV initiation, followed by the TDF + 3TC/FTC + DTG combination in patients who started ART early, and TDF + 3TC/FTC + NVP in those who started ART more than six months later (p = 0.004) (Figure 3, Table 3).

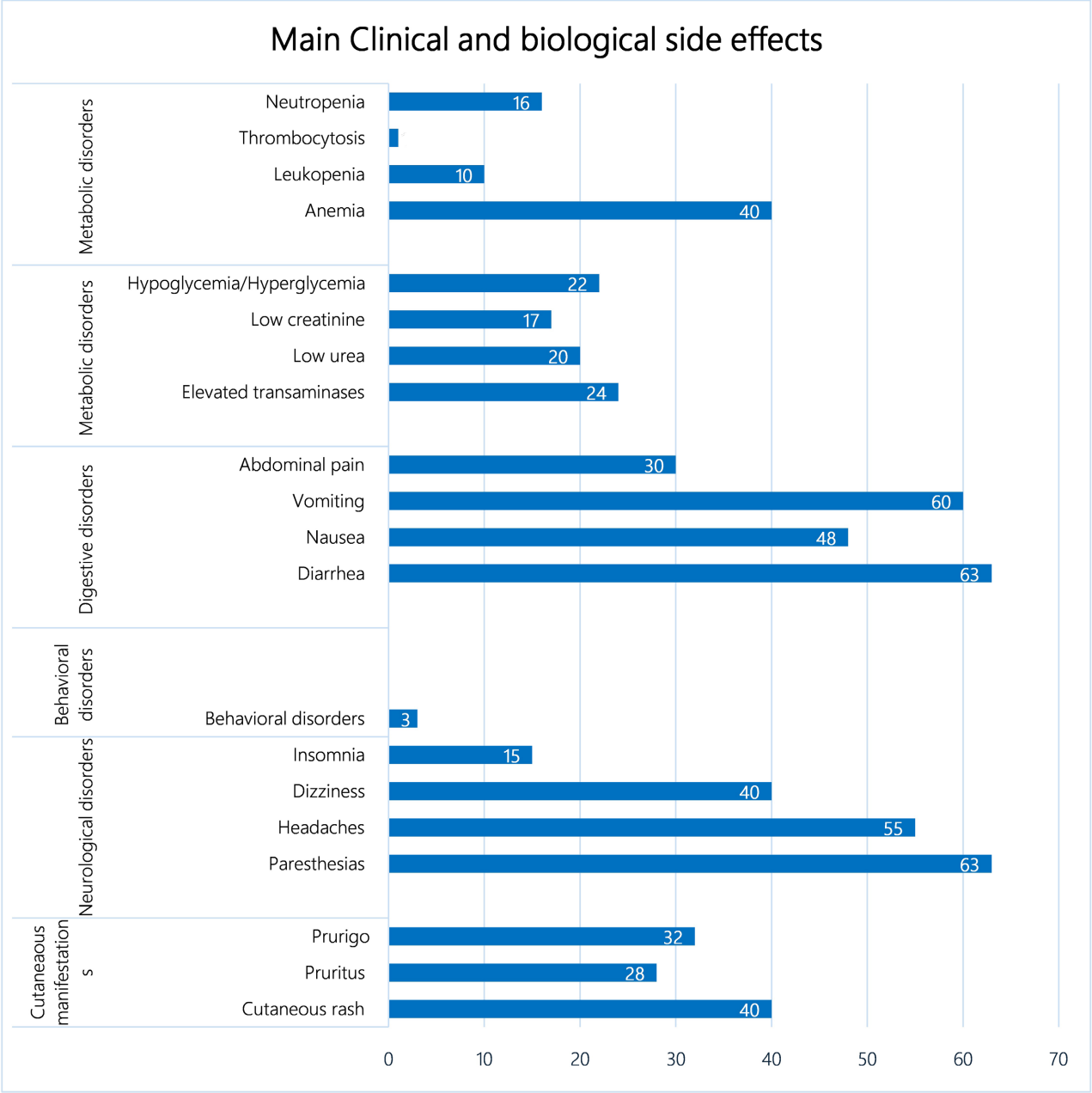

Figure 3. Main clinical and biological side effects.

Table 3. Main clinical and biological side effects.

Category	Adverse effect	% (n = 88)
Digestive disorders	Diarrhea	63
Digestive disorders	Vomiting	60
Digestive disorders	Nausea	48
Digestive disorders	Abdominal pain	30
Neurological disorders	Paresthesias	63
Neurological disorders	Headaches	55

Continued

Neurological disorders	Dizziness	40
Neurological disorders	Insomnia	15
Neurological disorders	Behavioral disorders	3
Cutaneous manifestations	Cutaneous rash	40
Cutaneous manifestations	Pruritus	28
Cutaneous manifestations	Prurigo	32
Hematological disorders	Anemia	40
Hematological disorders	Leukopenia	10
Hematological disorders	Thrombocytosis	1
Hematological disorders	Neutropenia	16
Metabolic disorders	Elevated transaminases	24
Metabolic disorders	Low urea	20
Metabolic disorders	Low creatinine	17
Metabolic disorders	Hypoglycemia/Hyperglycemia	22

Among patients with at least one adverse effect (n = 88/210), digestive disorders affected nearly two-thirds of them (63%; n = 55/88). Diarrhea was the most frequent symptom. We found a statistically significant relationship between the severity level of diarrhea, vomiting, and nausea with antiretroviral therapeutic regimens. Patients who suffered from diarrhea were primarily on TDF + 3TC/FTC + EFV, regardless of the severity level of the symptoms, while those on TDF + 3TC/FTC + DTG only experienced diarrhea at severity level 1 ($p < 0.0001$). More than 60% of patients who experienced vomiting were primarily on TDF + 3TC/FTC + EFV, regardless of the severity level of the symptoms, followed by those on TDF + 3TC/FTC + NVP who had presented grade 2 vomiting in most cases ($p < 0.0001$). Patients who reported nausea were primarily on TDF + 3TC/FTC + EFV with a predominant severity level of 2, followed by those on TDF + 3TC/FTC + NVP ($p = 0.001$) (Table 4).

Table 4. Evaluation of antiretroviral treatment adherence to antiretroviral treatment.

Category	Subgroup	n
Voluntary causes	Denial	24
Voluntary causes	Religion	4
Voluntary causes	Stigmatization	11
Voluntary causes	Undesirable effects	30
Voluntary causes	Therapeutic failure	4
Involuntary causes	Undesirable effects	57
Involuntary causes	Forgetfulness	14
Involuntary causes	Breakup	3

Continued

Involuntary causes	Travel	2
Interruption of ART	Intentional	69
Interruption of ART	Non intentional	80

More than two-thirds of the patients (71%; n = 149/210) had interrupted ART at least once. Among these, 38% (n = 80) did so unintentionally. Adverse effects were the factor most frequently reported in association with treatment interruption (Figure 4).

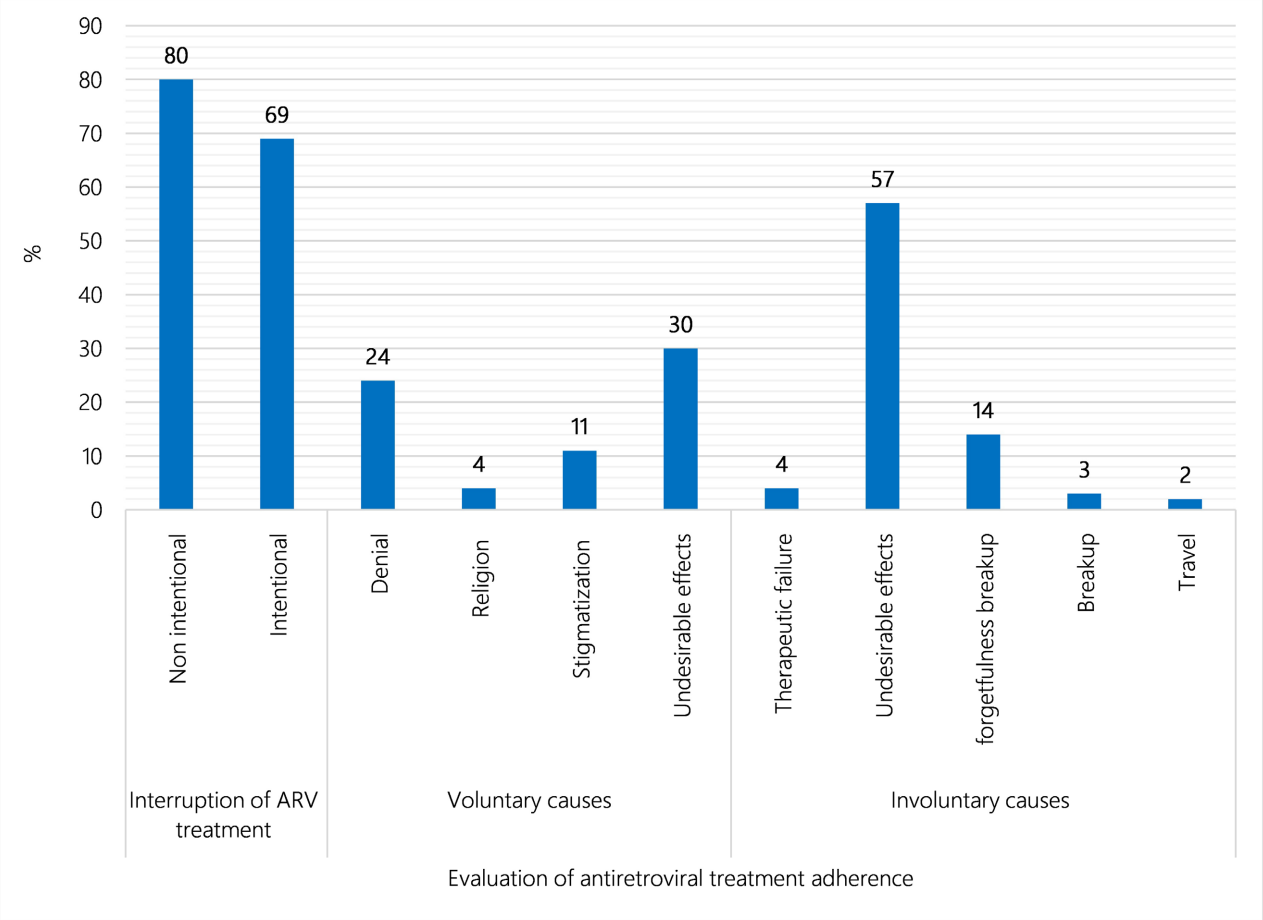

Figure 4. Evaluation of antiretroviral treatment adherence.

4. Discussion

This study evaluates the severity of adverse effects of first-line treatment in adults with HIV retroviral infection. Maintaining a non-optimal first-line antiretroviral treatment is associated with an increased risk of mortality. This study therefore aimed to evaluate the adverse effects associated with taking antiretrovirals, their frequency, their severity, and the relationship between adverse effects and adherence in a population of people with HIV on first-line antiretroviral treatment in

Provincial Hospital in Bukavu.

4.1. Sociodemographic Characteristics

Generally, HIV infection predominantly affects the young sexually active population, as shown by the median age of our study population, which was 44 [35 - 52] years. Studies conducted in the DRC and Burkina Faso reported comparable median ages [20 - 21]. Within the study population, women were predominantly represented, at 55.8%. These results are comparable to those found in the DRC in 2020 and in Mali in 2015, which respectively showed a female predominance of 77.2% and 61.41% [14] [15]. UNAIDS in 2020 reports that the female sex accounts for approximately 48% of all new HIV infections in 2019 worldwide and 59% in sub-Saharan Africa [16]. Moreover, women often have more access to screening services than men due to prenatal consultations [17]. To this is added a combination of biological factors and inequalities related to gender and circumcision, which protects men from sexually transmitted infections by 51% to 60% [18] [19].

4.2. Clinical Stage of the Patients

The patients were predominantly at clinical stages 2 (65.2%; n = 150/230) and 3 (13.0%; n = 30/230) of the WHO with a median CD4 lymphocyte count of 269 cells/mm^3 at the beginning of care. This result is comparable to data from other studies conducted in Burkina Faso and Senegal in 2018, which respectively show a predominant clinical stage 2 and 3 of the WHO (59%) among patients with an average CD4 T lymphocyte count of 245.8 cells/mm^3 and an advanced stage of infection with a CD4 T lymphocyte count below 200 cells/mm^3 in 45.6% of cases [20].

This situation could be explained by the fact that the patients would have mostly discovered their serological status at an advanced stage of HIV infection, characterized by a predominance of opportunistic infections (64.8%; n = 149/230) as the circumstance of HIV diagnosis, with tuberculosis being the most frequent among these opportunistic infections (58.6%). Indeed, it is the most frequently associated opportunistic infection with AIDS in tropical areas [21]. Data on viral load was available for less than a third (23.80%) of the patients. This data is comparable to that found in a study conducted in Burkina Faso in 2018, during which the viral load was very rarely measured. These data could be justified by a lack of financial resources because despite the health insurance present in the country, the non-negligible costs of blood tests are borne by the patient.

4.3. Adverse Effects

Overall, antiretroviral treatment was well-tolerated. Nearly half of the patients (41.7%; n = 88/210) experienced at least one adverse effect. Most side effects were reported in patients taking the TDF-3TC-EFV combination. Among the 88 patients with at least one adverse effect, digestive disorders were the most frequent. Diarrhea affected 63% of them (n = 55/88) and vomiting affected 60% (n = 53/88).

Nausea followed at 48% (n = 42/88) and abdominal pain at 30% (n = 26/88). Neurological disorders were also frequent. Headaches affected 55% of these patients (n = 48/88) and dizziness affected 40% (n = 35/88). Insomnia and behavioral disorders followed at 18% (n = 16/88). Cutaneous manifestations were less frequent. Skin rash affected 40% of patients with adverse effects (n = 35/88), pruritus affected 28% (n = 25/88), and prurigo affected 32% (n = 28/88). Hematological disorders were dominated by anemia, at 40% (n = 35/88). Metabolic disorders affected 24% of patients (n = 21/88), mostly through blood sugar disorders, at 22% (n = 19/88). Each patient could report more than one adverse effect. This is why the percentages within this subgroup add up to more than 100%.

These results are comparable to those found in a study in Mali in 2017 in which digestive disorders were predominantly observed, followed by neurological, cutaneous, hematological, and metabolic disorders [22]. This high frequency of digestive disorders was also found during the work of Deng *et al.* in China in 2022 among patients on TDF-3TC-EFV. Unlike a study conducted in Mali in 2019, which reported a predominance of neurological disorders in 46.2% of cases, marked by headaches and dizziness, followed by digestive disorders dominated by anorexia (37.2%) and diarrhea (28.1), cutaneous and mucosal manifestations with a predominance of pruritus (33.4%), hematological disorders marked by anemia (19.4%), and metabolic disorders dominated by elevated blood sugar levels (47.2%) [23].

Although efavirenz-containing therapeutic regimens are known to be more often associated with central nervous system side effects [24], these differences could be explained by the short duration of our study, whereas the Mali study took into account side effects in patients over 15 years old in which all patients underwent intensive screening for long-term adverse effects, whereas in our cross-sectional study, adverse effects were mainly self-reported. However, although usually of mild or moderate intensity, these digestive disorders posed real problems with adherence and therapeutic management, sometimes leading to complete or partial interruption of treatment. The problem was more acute because this combination was the most prescribed. The availability since the end of 2020 of the TDF-3TC-DTG association in Gabon has provided a salutary alternative, which should enhance the overall effectiveness of HIV management [25].

4.4. Evaluation of Adherence to Antiretroviral Treatment

The predominance of efavirenz-based regimens observed in this study reflects national treatment practices during the earlier years of the study period. During this time, dolutegravir-based regimens were not yet widely implemented in routine HIV care. The progressive transition toward dolutegravir-based regimens in more recent years should be considered when interpreting these findings, as efavirenz is known to be more frequently associated with neuropsychiatric and digestive adverse effects.

Adherence was assessed by combining two methods: interview (subjective

method) and regularity at ARV dispensing appointments (objective method). Adherence to antiretroviral treatment in the study population was reported in less than one-third of the patients, regardless of the therapeutic regimen used, with non-adherence rates of 71% under TDF + 3TC/FTC + EFV and 68% in patients under TDF + 3TC/FTC + DTG. These results corroborate with a study conducted in Gabon in 2019, in which patients were non-adherent at 66% [25]. On the other hand, these results are higher than those presented in Congo in 2020, which showed a non-adherence rate of 25.5% [14] respectively. Our low reported adherence rate could be due to different population characteristics, the quality of health services, study parameters, and the adherence evaluation system used. The focus should therefore be on adherence to antiretroviral treatment, particularly during counselling sessions, as this is necessary for an optimal clinical response and complete viral suppression.

4.5. The Determinants and Factors Related to Poor Adherence

Several factors influence the quality of adherence to ART: treatment-related factors, patient-related factors, environmental factors, and healthcare provider-related factors [24]. The main determinants of non-adherence in this study were primarily: adverse effects, denial, stigmatization, religion, medication shortages, forgetfulness, travel. It had also been noted that the patient/healthcare provider relationship, the patients' level of knowledge about HIV infection, and the support of a close relative could be considered as factors influencing adherence. Colinnet *et al.* in Gabon in 2019 had found as reasons for non-compliance: misunderstanding of the disease, denial, and the accessibility of adverse effects.

This study provides useful information for developing future interventions aimed at improving adherence to antiretroviral therapy. Due to a wide range of obstacles and facilitators to adherence, it has been difficult to develop effective interventions to improve long-term adherence to medications. Future interventions aimed at increasing self-efficacy in adherence and more effectively managing side effects through education and guidance from healthcare providers are necessary.

Ethics Approval

The study has been approved by the ethical review committee of The Provincial General Reference Hospital of Bukavu (HPGRB). According to Article 32 of the Declaration of Helsinki—Ethical Principles for Medical Research Involving Human Subjects, the research can be done only after consideration and approval of a research ethics committee in situations where consent would be impossible or impracticable to obtain. As a result, consent to review medical records of patients was not required by the ethical review committee. Patient-related data were kept confidential throughout the study. The study was approved by the Institutional Ethics Committee of the Université Catholique de Bukavu (CIE-UCB), under approval UCB/CIES/PB/07/2018, granted in January 2018, before data collection began.

Data Sharing Statement

All the datasets used/or analyzed during the current study are available from the corresponding author on reasonable request.

Limitations

This study has several limitations. The retrospective design relies on medical records from a single hospital, so the findings may not extend to other settings. The total number of records screened before inclusion, and the exact reasons for exclusion, were not systematically logged. This limits the reproducibility of the selection process. Table 2, covering the circumstance of HIV diagnosis, WHO clinical stage, and CD4/viral load data, is based on 230 patients, which does not match the 210 patients in the general cohort described in Table 1. This discrepancy could not be resolved from the data available. Adverse effects were partly self-reported during clinical interviews, which may introduce recall bias. The tool used to screen adverse effects was structured around a predefined list. It may not have captured effects outside this list, so some adverse effects are likely underreported. The exact statistical tests used for each comparison, and effect estimates such as odds ratios and confidence intervals, were not systematically documented in the source data. Only p-values are reported here. Results were not stratified by antiretroviral therapy era, because individual data on treatment start date were not exhaustively available. First-line regimens shifted from efavirenz-based to dolutegravir-based combinations between 2018 and 2024, and this lack of stratification limits comparisons across treatment periods. Multivariable analysis was not performed, because several key covariates, including complete viral load data and exact treatment start dates, were missing for a substantial share of patients. As a result, the association between adverse effects and treatment interruption should be read as a bivariate association, not as an independent or causal effect. Confounding by regimen era, baseline clinical stage, tuberculosis co-infection, and incomplete viral load data cannot be excluded. Future prospective studies, with more complete data and analysis stratified by treatment era, are needed to confirm these findings and to support adjusted, multivariable analysis.

In conclusion, adverse effects were frequently reported among people with HIV receiving first-line antiretroviral therapy and were associated with treatment interruption. Although most adverse effects were mild to moderate, they had a significant impact on adherence. Strengthening patient counseling at treatment initiation and improving clinical and laboratory monitoring may help mitigate adverse effects and support sustained adherence to antiretroviral therapy in resource-limited settings.

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Author Contributions

All authors contributed to data collection, analysis, drafting or critical revision of the manuscript, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

Conflicts of Interest

All authors declare that there is no conflict of interest.

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Abbreviations

HPGRB	The Provincial General Reference Hospital of Bukavu
IV	Intravenous
NG	Nasogastric
PPI	Proton Pump Inhibitor