Use of non-HIV medication among people living with HIV and receiving antiretroviral treatment in Côte d’Ivoire, West Africa: A cross-sectional study

Mariam Mama Djima, Didier Koumavi Ekouevi, Jean-Pierre Gregoire, Boris Tchounga, Patrick Ahuatchi Coffie, Viet-Thi Tran, Franck Y. Touré, Jocelyne Moisan

1 PACCI, CHU Treichville, Abidjan, Côte d’Ivoire, 2 Institut Pasteur de Côte d’Ivoire, Abidjan, Côte d’Ivoire, 3 Faculté de pharmacie, Université Laval, Québec, Canada, 4 Centre Inserm U 1219, ISPED, Université Victor Segalen, Bordeaux, France, 5 Université de Lomé, Département de Santé Publique, Lomé, Togo, 6 Axe Santé des populations et pratiques optimales en santé, Centre de recherche du CHU de Québec–Université Laval, Québec, Canada

*madjimar@gmail.com

Abstract

Background

In Côte d’Ivoire, people living with HIV (PLHIV) have free access to antiretroviral therapy (ART) and cotrimoxazole. Yet, they may use other medications to treat non-HIV diseases. Scarce data are available regarding the use of non-HIV medications in Africa. This study describes the use of non-HIV medications and identifies the factors associated with their use by PLHIV on ART in Côte d’Ivoire.

Methods

A cross-sectional study was conducted in six HIV clinics in 2016. HIV-1-infected adults receiving ART for at least one year were eligible. A standardized questionnaire was used to collect demographics, HIV characteristics and medication use data. Associated factors were identified using a multivariate adjusted Poisson regression.

Results

A total of 1,458 participants (74% women) were enrolled. The median age was 44 years, and the median duration of ART was 81 months. A total of 696 (48%) participants reported having used at least one non-HIV medication. Among the 1,519 non-HIV medications used, 550 (36%) had not been prescribed and 397 (26%) were from the nervous system class. Individuals who were more likely to report the use of at least one non-HIV medication included those who had been treated in an Abidjan HIV clinic, had a high school education level, had a monthly income between 152 and 304 euros, had a poor perceived health status, had WHO advanced clinical stage, had used traditional medicine products and had not used cotrimoxazole.
Conclusion

Almost half PLHIV on ART reported using non-HIV medication. Further research is needed to assess whether the use of non-HIV medication is appropriate given about a third of those medications are not being prescribed.

Introduction

The successful scale-up of antiretroviral therapy (ART) during the last two decades has changed the face of the HIV epidemic, with HIV infection now being considered a chronic disease [1]. Adequate treatment has led to reductions in AIDS-related mortality and morbidity [2, 3] and has also improved the life expectancy of people living with HIV (PLHIV), which is now almost identical to the life expectancy observed in the general population [4–6]. Nevertheless, increased life expectancy and aging come with new challenges in HIV management. In addition to AIDS-related diseases, PLHIV are exposed to non-HIV diseases that occur independently of the weakness of the immune system [7, 8]. Non-HIV diseases are mostly chronic diseases [7, 9–12]; yet, PLHIV in Africa also suffer from acute diseases, such as malaria and respiratory infections [13, 14].

In resource-limited countries, the World Health Organization (WHO) recommends the initiation of an ART with a cotrimoxazole prophylaxis for every PLHIV [15]. In Côte d’Ivoire, ART is accessible nation-wide [16] and is free of charge in public pharmacies [17–19]. This is not the case for the therapeutic management of non-communicable diseases, such as diabetes, hypertension and cancer.

In low-income countries, non-HIV medications may be purchased with or without a prescription. Taking non-HIV medications without a prescription depends on many factors, such as previous successful experiences with the same or similar medications, the cost of non-HIV disease management [19, 20], non-HIV essential medications not usually being available in public health care settings [20], the accessibility of health facilities [21–24], insufficient health insurance coverage [25, 26] and perceiving that the disease is not serious [21–24]. When the use of non-prescribed medications is unjustified and inappropriate, there is an increased risk of drug-drug interactions [27, 28], medication resistances, undesirable side effects and increased health expenditures [29, 30].

There is limited information on the use of non-HIV medications among PLHIV. To our knowledge, seven studies have focused on the use of non-HIV medications among PLHIV in Africa [19, 26, 31–34]. In three of those studies, non-HIV medications were only listed [26, 32, 33], and in another one, the focus was on the cost of non ARV medications [19]. Only two studies, one from Senegal [31] and the other from South Africa [34], reported the proportions of PLHIV on ART who used at least one non-HIV medication (85% and 87%, respectively). In these studies, the patients included were on ART less than one year and data was not available on non HIV medication. Moreover, no distinction was made between non-HIV prescribed medications and non-HIV non-prescribed medications. To our knowledge, the use of non-HIV medications either prescribed or not has not been comprehensively studied in Africa. Our study aimed to describe the use of non-HIV medications among PLHIV on ART for at least 12 months in Côte d’Ivoire and to identify factors associated with the use of at least one non-HIV medication.

Materials and methods

Study design and settings

A cross-sectional study was conducted from April 11th to September 28th, 2016, in six HIV clinics of Côte d’Ivoire. Three of these clinics were located in Abidjan, the economic capital,
one in San Pedro in the South-west of the country, one in Bouaké in the Center of the country and the last in Korhogo in the North. These cities were selected in regions with high HIV prevalence. In Abidjan, the three largest HIV clinics were selected. In the three other regions, we selected the clinic with the largest number of PLHIV.

**Study population and enrollment of patients**

The study population included individuals living with HIV-1, aged 18 years or older, receiving ART for at least one year. Every day during the study period, all eligible individuals attending the participating HIV clinics for a routine follow-up visit were offered to participate in the study. After confirming their eligibility in the medical patient record, the site investigator provided clear information on the study, discussed the information sheet with the participant and fixed an appointment for those who agreed to participate. Three days before the appointment date, each participant received a reminder call from a social worker to confirm the time of the interview.

**Data collection**

On the day of interview, the participant signed the consent form before the interview began. During the interview, a social worker collected each participant’s demographics and HIV characteristics (WHO clinical stage, history of CD4 count, clinical events, ART regimen and other treatments) using a standardized questionnaire formatted as a case report file (CRF). Data on all medications and traditional and complementary medicine (TCM) products used during the preceding 30 days were also collected. To help in identifying medications used, participants were asked to bring all medications they used. For participants who did not bring their medications, a photo library was shown to help them identify medications they were using. A pharmacist analyzed pictures of all the material brought by the participants (containers, prescription forms, and products) to determine the names, formulations and doses of all medications used by the participants.

**Outcome variable**

The main outcome was the use of at least one non-HIV medication. Participants were considered to use at least one non-HIV medication if they reported using any medication other than antiretroviral medications and cotrimoxazole.

**Independent variables**

Patient-related variables included demographic characteristics such as age, sex, having a significant other, education level, being employed or not, monthly income in euros and health insurance coverage. In the context of HIV infection, the term “older” refers to patients aged ≥ 50 years [35, 36]. A participant was considered to have health insurance coverage if he/she reported having medical or/and pharmaceutical insurance coverage. Region was defined according to the localization of the recruiting HIV center: economic capital (for clinics in Abidjan) or hinterland (for clinics in Bouaké, San Pedro and Korhogo).

Health-related variables consisted of data on perceived health status, alcohol consumption and HIV characteristics. Perceived health status was measured using a 6-level Likert scale (excellent to poor). Perceived health status was considered “at least acceptable” when the response was either excellent, very good, good or acceptable; otherwise, it was considered “poor”. Alcohol consumption was measured using questions from the WHO STEPS questionnaire (37). Two categories were defined. Alcohol users were those who reported they had used
alcohol in the 30 days prior to the interview. The following HIV characteristics were abstracted from the medical records: the date of HIV diagnosis, the initial CD4 count in cells/mm$^3$ ($< 200$, $200–349$, $350–499$, $\geq 500$), and the WHO clinical stage at diagnosis. The duration of HIV infection was the number of months between the date of HIV diagnosis and the date of the interview.

Concerning treatment-related variables, we measured the use of HIV and non-HIV medications along with traditional and complementary medicines. For HIV medications, current use of ART and cotrimoxazole was abstracted from medical records. ART was classified into two categories: first-line ART (either three nucleoside reverse transcriptase inhibitors or two nucleoside reverse transcriptase inhibitors with a non-nucleoside reverse transcriptase inhibitor) and second- or third-line ART (two nucleoside reverse transcriptase inhibitors with a protease inhibitor or with an integrase inhibitor) [37, 38]. The duration of ART in months was defined as the time between the date of ART initiation and the date of the interview. Each participant was asked to report the number of ART pills taken each day. Finally, participants were considered to have used a TCM product if they reported having used a TCM within the last 30 days. TCM products were from two main TCM therapeutic modalities: 1) TCM consisting of spiritual and manual treatments, 2) TCM consisting of herbal medicines, veterinary medicines and / or mineral medicines [39].

Non-HIV medications were classified according to the WHO Anatomical Therapeutic Chemical Classification (ATC) system [40]. For each non-HIV medication, the pharmacological classes were determined. Medications that could not be identified due to a lack of information (such as medications bought in a public market and medications with information written only in Arabic or Chinese) were coded 99999. Natural products that did not have a code in the ATC classification were coded 88888. When a drug had more than one ATC code, we used the code relevant to the self-reported illness. For the choice of ATC codes for generic medications whose International Common Denominations (ICDs) were difficult to identify, we used the national list of the reimbursable medications from ministry of health that contains generic medication names associated with the ICDs for medications.

Participants were considered to have used a TCM product if they reported having used a TCM within the last 30 days.

**Statistical analysis**

Statistical analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC). Pearson Chi square tests were used to compare proportions, Student’s t-tests were used to compare means and Wilcoxon tests were used to compare medians. Factors associated with the use of at least one non-HIV medication were identified using a multivariate Poisson regression model. We calculated prevalence ratios (PRs) with their 95% confidence intervals (CIs) (32). To build the model, we included all variables associated with the use of at least one non-HIV medication in the unadjusted analysis ($P < 0.2$) and used the backward method to identify only variables independently predictive of the use of at least one non-HIV medication with a $P$-value $< 0.05$. Sex and age were forced into the final model (33, 34).

**Ethical consideration**

Before being enrolled in the study, each participant received clear information and provided written consent to participate, including the authorization to use personal data for research purposes. The study was approved by the National Ethics Committee for Research in Côte d’Ivoire and the ethics in research committee of CHU de Quebec-Université Laval.
Results

A total of 1,729 HIV patients were approached to participate in the study. Among them, 1,458 (84%) agreed and were included. The reasons for non-participation are summarized in Table 1.

Characteristics of the participants according to the region where they were recruited are presented in Table 2. They had a median age of 44 years, IQR (38–50), 27% were aged ≥ 50 years and 736 (50%) were recruited in Abidjan. Approximately 75% of the participants were women. Among the participants, 145 (10%) had health insurance coverage, of which 82% lived in Abidjan. In addition, 776 (53%) reported having used at least one TCM product in the 30 days preceding the interview. Participants attending an HIV clinic in Abidjan had a higher level of education and a higher income than the participants attending a hinterland HIV center.

HIV medications use

The median ART duration was 81 months (IQR: 47–110), with most participants (n = 1,182; 81%) on a first-line ART regimen. The median number of ART pills taken daily was 2 (IQR: 2–3), with 263 (18%) participants taking ≥ 5 ART pills. A total of 535 (37%) patients reported using cotrimoxazole in addition to ART, with the proportion of PLHIV using cotrimoxazole being higher in Abidjan than in the hinterland (48% vs. 25%, \( P = <0.0001 \)).

Non-HIV medications use

A total of 696 (48%) participants reported using at least one non-HIV medication. Among them, 319 (46%) reported using one medication, 169 (24%) two medications, 95 (14%) three medications and 113 (16%) ≥ four medications. The median number of non-HIV medications per person was two (IQR: 1–3). Among users of non-HIV medications, 284 (41%) used only non-prescribed medications (median: 1; IQR: 1–2), 318 (46%) used only prescribed medications (median: 2; IQR: 1–3) and 94 (13%) used both prescribed and non-prescribed medications (median: 3; IQR: 2–5). Concerning non-communicable disease, the proportions of users of non-HIV medications for the treatment of cardiovascular disease and diabetes were 5% (N = 68), and 1.1% (N = 16), respectively.

Table 1. Frequency of reported reasons to decline participation (N = 271).

| Reasons                                      | N  | %   |
|----------------------------------------------|----|-----|
| Were unavailable for the interview           | 88 | 32.5|
| Could not be reached                         | 41 | 15.1|
| Gave no reason to decline participation      | 20 | 7.4 |
| Were not interested by the study             | 20 | 7.4 |
| Were outside the city during the study period| 19 | 7.0 |
| Did not come to the interview                | 19 | 7.0 |
| Either had or a family member had already participated in another study | 14 | 5.2 |
| Did not use modern and traditional medicine  | 13 | 4.8 |
| Were not called to make an appointment       | 9  | 3.3 |
| Had other reasons*                           | 28 | 10.3|
| Total                                        | 271| 100 |

* accident, need approbation from family, fear of breaking confidentiality, financial difficulties

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Table 2. Characteristics of the 1458 participants according to the recruitment setting.

| Characteristics                | Total N = 1458 | Abidjan HIV clinics N = 736 | Hinterland HIV clinics N = 722 | Pearson chi-squared ($\chi^2$) test $^\dagger$ Wilcoxon test $^\ddagger$ P values |
|-------------------------------|----------------|-----------------------------|--------------------------------|--------------------------------------------------------------------------------|
| **Patient-related**           |                |                             |                                |                                                                                |
| Age (years)                   |                |                             |                                |                                                                                |
| Median [IQR]                  | 44 [38–50]     | 44 [39–51]                 | 44 [37–50]                      | 0.048                                                                          |
| < 50 years                    | 1070 73.4      | 525 71.9                   | 541 74.9                        | 0.18                                                                           |
| ≥ 50 years                    | 388 26.6       | 207 28.1                   | 181 25.1                        |                                                                                |
| Sex                           |                |                             |                                |                                                                                |
| Men                           | 381 26.1       | 198 26.9                   | 183 25.3                        | 0.499                                                                          |
| Women                         | 1077 73.9      | 538 73.1                   | 539 74.7                        |                                                                                |
| Body Mass index               |                |                             |                                |                                                                                |
| Underweight (< 18.5)          | 165 11.3       | 71 09.6                    | 94 13.0                         | <0.0001                                                                        |
| Normal weight (18.5–24.99)    | 796 54.6       | 373 50.7                   | 423 58.6                        |                                                                                |
| Overweight (25–29.99)         | 359 24.6       | 205 27.9                   | 154 21.3                        |                                                                                |
| Obese (≥ 30)                  | 138 09.5       | 87 11.8                    | 51 07.1                         |                                                                                |
| Have a significant other      |                |                             |                                |                                                                                |
| Yes                           | 726 49.8       | 360 48.9                   | 366 50.7                        | 0.496                                                                          |
| No                            | 732 50.2       | 376 51.1                   | 356 49.3                        |                                                                                |
| Education                     |                |                             |                                |                                                                                |
| No school                     | 454 31.1       | 142 19.3                   | 312 43.4                        | <0.0001                                                                        |
| Primary level                 | 433 29.7       | 217 29.5                   | 216 29.7                        |                                                                                |
| High school                   | 470 32.2       | 290 39.4                   | 180 24.9                        |                                                                                |
| > High school                 | 101 6.93       | 87 11.8                    | 14 01.9                         |                                                                                |
| Employment                    |                |                             |                                |                                                                                |
| Yes                           | 1179 80.9      | 620 84.2                   | 559 77.4                        | 0.0009                                                                         |
| No                            | 279 19.1       | 116 15.8                   | 163 22.6                        |                                                                                |
| Monthly income in euros       |                |                             |                                |                                                                                |
| < 92                          | 964 66.1       | 364 49.4                   | 600 83.1                        | <0.0001                                                                        |
| 92–151                        | 235 16.1       | 183 24.9                   | 52 07.2                         |                                                                                |
| 152–304                       | 148 10.2       | 105 14.3                   | 43 06.0                         |                                                                                |
| ≥ 304                         | 90 06.2        | 79 10.7                    | 11 01.5                         |                                                                                |
| Don’t Know                    | 21 01.4        | 05 00.7                    | 16 02.2                         |                                                                                |
| Health insurance coverage     |                |                             |                                |                                                                                |
| Yes                           | 145 10.0       | 119 16.2                   | 26 03.6                         | <0.0001                                                                        |
| No                            | 1313 90.0      | 617 83.8                   | 696 96.4                        |                                                                                |
| **Health related**            |                |                             |                                |                                                                                |
| Perceived Health Status       |                |                             |                                |                                                                                |
| At least acceptable           | 1166 80.0      | 610 82.9                   | 556 77.0                        | 0.0038                                                                         |
| Poor                          | 281 19.3       | 120 16.3                   | 161 22.3                        |                                                                                |
| Missing data                  | 11 00.7        | 06 00.8                    | 05 00.7                         |                                                                                |
| Hospitalization in the year before interview | | | | |
| Yes                           | 116 09.9       | 63 08.6                    | 53 07.3                         | 0.039                                                                         |
| No                            | 1313 90.1      | 673 91.4                   | 696 92.7                        |                                                                                |
| Alcohol consumption           |                |                             |                                |                                                                                |
| Yes                           | 361 24.8       | 284 38.6                   | 77 10.7                         | <0.0001                                                                        |
| No                            | 1096 75.2      | 451 61.4                   | 645 89.3                        |                                                                                |
| HIV duration (months); median [IQR] | 91 [57–120] 95 [58–129] 87 [55–113] | <0.0001 | |
| < 120                         | 1096 75.2      | 511 69.4                   | 585 81                          | <0.0001                                                                        |
| >120                          | 362 24.8       | 225 30.6                   | 137 19                          |                                                                                |

(Continued)
Overall, the number of non-HIV medications reported to be used by the 696 participants totaled 1,519 (Table 3), of which 969 (64%) were prescribed. Among the 1,519 reported non-HIV medications, 397 (26%) were from the nervous system class (reported by 349

### Pharmacologic classes of non-HIV medications

Overall, the number of non-HIV medications reported to be used by the 696 participants totaled 1,519 (Table 3), of which 969 (64%) were prescribed. Among the 1,519 reported non-HIV medications, 397 (26%) were from the nervous system class (reported by 349
| Cl: Classification | Total (N = 1519) | Medication prescribed (n = 969) | Medication not prescribed (n = 550) |
|-------------------|------------------|---------------------------------|-----------------------------------|
| **A: Alimentary tract and metabolism** | | | |
| A01: Stomatological preparations | 260 (17.12%) | 162 (18.18%) | 78 (14.18%) |
| A02: Medications for acid related disorders | 33 (2.17%) | 24 (2.48%) | 9 (1.64%) |
| A03: Drugs for functional gastrointestinal disorders | 13 (0.86%) | 11 (1.14%) | 2 (0.36%) |
| A04: Antiemetic and antinauseants | 02 (0.13%) | 02 (0.21%) | 0 (0.00%) |
| A05: Bile and live therapy | 04 (0.26%) | 04 (0.41%) | 0 (0.00%) |
| A06: Drugs for constipation | 03 (0.20%) | 02 (0.21%) | 01 (0.18%) |
| A07: Antidiarrheal, intestinal anti-inflammatory/anti-infective agents | 09 (0.59%) | 07 (0.72%) | 02 (0.36%) |
| A10: Medications used in diabetes | 20 (1.32%) | 20 (2.06%) | 00 (0.00%) |
| A11: Vitamins | 60 (3.95%) | 41 (4.21%) | 19 (3.45%) |
| A12: Mineral supplements | 88 (5.79%) | 49 (5.06%) | 39 (7.09%) |
| **B: Blood and blood forming organs** | | | |
| B01: Antithrombotic agents | 04 (0.26%) | 03 (0.31%) | 01 (0.18%) |
| B03: Anti-anemic drugs | 57 (3.75%) | 50 (5.16%) | 07 (1.27%) |
| **C: Cardiovascular system** | | | |
| C01: Cardiac therapy | 07 (0.46%) | 06 (0.62%) | 01 (0.18%) |
| C02: Antihypertensive | 04 (0.26%) | 02 (0.21%) | 02 (0.36%) |
| C03: Diuretics | 05 (0.33%) | 05 (0.52%) | 00 (0.00%) |
| C05: Vasoprotective | 07 (0.46%) | 05 (0.52%) | 02 (0.36%) |
| C07: Beta blocking agents | 12 (0.79%) | 12 (1.24%) | 00 (0.00%) |
| C08: Calcium channel blockers | 10 (0.66%) | 10 (1.03%) | 00 (0.00%) |
| C09: Agents acting on the renin (angiotensin system) | 24 (1.58%) | 24 (2.48%) | 00 (0.00%) |
| C10: Lipid modifying agents | 10 (0.66%) | 08 (0.83%) | 02 (0.36%) |
| **D: Dermatologic drugs** | | | |
| D01: Antifungals for dermatological use | 06 (0.39%) | 05 (0.52%) | 01 (0.18%) |
| D02: Emollients and protectives | 01 (0.07%) | 01 (0.10%) | 00 (0.00%) |
| D06: Antibiotics and chemotherapeutics for dermatological use | 02 (0.13%) | 01 (0.10%) | 01 (0.18%) |
| D07: Topical dermatological corticosteroids | 09 (0.59%) | 06 (0.62%) | 03 (0.55%) |
| D08: Antiseptics and disinfectants drugs | 03 (0.20%) | 03 (0.31%) | 00 (0.00%) |
| D10: Anti-acne preparations | 01 (0.07%) | 0 (0.00%) | 01 (0.18%) |
| D11: Other dermatological preparations | 02 (0.13%) | 2 (0.21%) | 00 (0.00%) |
| **G: Genitourinary system and reproductive hormones** | | | |
| G01: Gynecological anti-infectives and antisepsics | 09 (0.59%) | 07 (0.72%) | 02 (0.36%) |
| G03: Sex hormones and modulators of the genital system | 14 (0.92%) | 11 (1.14%) | 03 (0.55%) |
| G04: Urologicals | 01 (0.07%) | 01 (0.10%) | 00 (0.00%) |
| **H: Systemic hormonal preparations, excluding reproductive hormones and insulin** | | | |
| H02: Corticosteroids systemic | 10 (0.66%) | 09 (0.93%) | 01 (0.18%) |
| **J: Anti-infectives for systemic use** | | | |
| J01: Antibacterial drugs | 135 (8.88%) | 88 (9.08%) | 47 (8.55%) |
| J02: Antimycotic drugs | 07 (0.46%) | 07 (0.72%) | 00 (0.00%) |
| J05: Antivirals for systemic use | 02 (0.13%) | 02 (0.21%) | 00 (0.00%) |
| **M: Musculoskeletal system** | | | |
| M01: Anti-inflammatory and antirheumatic drugs | 100 (6.58%) | 56 (5.78%) | 44 (8.00%) |
| M02: Topical products for joint and muscular pain | 04 (0.26%) | 03 (0.31%) | 01 (0.18%) |
| M03: Muscle relaxants | 08 (0.53%) | 07 (0.72%) | 01 (0.18%) |

(Continued)
(24%) participants), and 260 (17%) were from the alimentary tract and metabolism class (reported by 214 (15%) participants). Among the 550 non-HIV non-prescribed medications, 210 (38%) were analgesics, with the majority being non-opioid medications (used by 177 (12%) participants), along with 47 (9%) antibacterial medications (used by 43 (3%) participants) and 44 (8%) anti-inflammatory and anti-rheumatic medications (used by 41 (3%) participants).

Factors associated with the use of at least one non-HIV medication

In the multivariate Poisson regression, after adjusting for age and sex, seven factors were statistically associated with the use of non-HIV medication (Table 4). Individuals who had a high school education level (PR = 1.17 [95% CI = 1.02–1.35] vs. unschooled), a monthly income between 152 and 304 euros (PR = 1.31 [95% CI = 1.12–1.53] vs. < 92 euros), a poor (vs. at least acceptable) perceived health status (PR = 1.30 [95% CI = 1.06–1.46]), a WHO clinical stage II or III/IV (PR = 1.24 [95% CI = 1.08–1.41]; PR = 1.22 [95% CI = 1.06;1.40]), and those who were TCM product users (vs. no (PR = 1.22 [95% CI = 1.10–1.37]) were more likely to report the use of at least one non-HIV medication. Participants recruited in a hinterland HIV clinic (PR = 0.72 [95% CI = 0.64–0.82]) and cotrimoxazole users (vs. not) (PR = 0.77 [95% CI = 0.67–0.84]) were less likely to report the use at least one non-HIV medication.
Discussion

This is one of the first studies performed in West Africa describing the use of non-HIV medications among PLHIV on ART. In summary, 48% of PLHIV reported using at least one non-HIV medication, and 54% of them used non-prescribed drugs. The most reported classes of non-HIV medication used were the nervous system class (26%) and the alimentary tract and metabolism class (17%). Non-prescribed non-HIV medications represented 36% of 1,519 non-HIV medications, of which 39% were analgesic medications. Factors associated positively with the use of non-HIV medication were having a high level of school education, a monthly income between 152 and 304 euros, using TCM products, having a poor perceived health status and having a WHO stage II or III/IV. However, being treated in an HIV hinterland clinic and using cotrimoxazole were factors negatively associated with the use of non-HIV medication.

The proportion of PLHIV using non-HIV medications (48%) we observed was lower than those observed in most of the previous studies in both high- [41–50] and low-income countries [31, 34], where the proportions varied between 68% and 95%, distributed as follows: 68% in Switzerland [46, 50], 75% in Canada [45], 82% in Spain [42], 83% in USA [43], 85% in Senegal [31], 85% in USA [44], 87% in South Africa [34], 89% in Canada [41], 91% in Canada [47], 93% in USA [48] and 95% in Canada [49]. This difference might be explained by different reasons. Older PLHIV face many aging-related diseases [51, 52]. Our population was younger than those included in the high-income countries studies. Indeed, 32% [43, 47, 50] to 100% [42] of patients from high-income countries were over 50 years old, whereas in our study, only 27% were over 50 years old. Third, in the studies in high-income countries, 79% [43, 48] to 100% [45] of participants had public or private drug insurance, whereas only 10% of our study participants had such insurance, which may limit access to non-HIV medications.

One study conducted in Africa reported proportions of non-HIV medication users [31]. This was a retrospective study conducted in Senegal including 331 PLHIV who initiated ART between 2009 and 2011 and were followed until March 2012. PLHIV in the first year of ART initiation represented 43% of the participants. After a mean duration of 11.4 months on ART, 85% of patients received at least one prescription for a non-ART medication. In this study, the most frequently prescribed non-ART medications were cotrimoxazole (78.9% of patients), iron (33.2%), vitamins (21.1%) and antibiotics (19.6%).

Regarding non-HIV medication findings, in Côte d’Ivoire, before the availability of ART, in a cohort study, Nombela et al. reported 58,776 medications prescribed among 592 PLHIV. The most used classes of medication were the anti-infectious (32.8%) and pain medication (22.9%) classes [32]. In our study, the most common non-HIV medications used by participants were from the nervous system class (26%), as in some studies conducted in high-income countries [42, 47, 48]. However, we observed that the proportion of nervous system class medication users (24%) in our study was lower than the proportions observed in the USA (32%) [44], (52% [48]), Spain (44% [42]) and Canada (58% [47]). This difference could be explained by a greater diversity of therapeutic classes (antidepressants/antipsychotics/anxiolytics/analgesics) used in high-income countries, unlike in our study, where 96% of users of nervous system medications took analgesics. Indeed, accessibility to nervous system classes other than analgesics is limited in low-resource countries [53]. Furthermore, mental health services are only accessible in specialized health facilities.

The proportions of users of medications for the treatment of cardiovascular diseases and diabetes in our study were 5% and 1%, respectively, which are lower than those found in high-income countries (with the percentages of cardiovascular medication users being 43% [47], 26% [42], and 42% [44] and the percentage of diabetes medication users being 11% [44, 48]).
| Characteristics                  | Use of at least one non-HIV medication | Crude prevalence ratios | 95% Confidence Intervals (CI) | P values | Adjusted prevalence ratios | 95% CI | P values |
|---------------------------------|---------------------------------------|-------------------------|-------------------------------|----------|---------------------------|--------|----------|
| **Patient-related**             |                                       |                         |                               |          |                           |        |          |
| Age (years)                     |                                       |                         |                               |          |                           |        |          |
| < 50                            | 518 (74.4)                            | 552 (72.4)              | 0.96                          | [0.85–1.10] | 0.40                      | 0.90   | [0.84–1.09] | 0.59 |
| ≥ 50                            | 178 (25.6)                            | 210 (27.6)              | 1                             |           | 1                         | 1      | 1        |
| Sex                             |                                       |                         |                               |          |                           |        |          |
| Men                             | 173 (24.9)                            | 208 (27.3)              | 1.07                          | [0.94–1.21] | 0.30                      | 1.12   | [0.97–1.29] | 0.12 |
| Women                           | 523 (75.1)                            | 554 (72.7)              | 1                             |           | 1                         | 1      | 1        |
| HIV clinics                     |                                       |                         |                               |          |                           |        |          |
| Hinterland                      | 296 (42.5)                            | 426 (55.9)              | 0.75                          | [0.68–0.84] | <0.001                     | 0.72   | [0.64–0.82] | <0.001 |
| Abidjan                         | 400 (57.5)                            | 336 (44.1)              | 1                             |           | 1                         | 1      | 1        |
| Have a significant other        |                                       |                         |                               |          |                           |        |          |
| Yes                             | 362 (52.0)                            | 364 (47.8)              | 1                             |           | 1                         | 1      | 1        |
| No                              | 334 (48.0)                            | 398 (52.2)              | 0.91                          | [0.82–1.01] | 0.10                      | 1      | 1        |
| Education                       |                                       |                         |                               |          |                           |        |          |
| No school                       | 184 (26.4)                            | 270 (35.4)              | 1                             |           | 1                         | 1      | 1        |
| Primary level                   | 199 (28.6)                            | 234 (30.7)              | 1.13                          | [0.97–1.32] | 0.103                     | 1.04   | [0.89–1.21] | 0.62 |
| Secondary school                | 249 (35.8)                            | 221 (29.0)              | 1.31                          | [1.14–1.50] | <0.0002                    | 1.17   | [1.02–1.35] | 0.026 |
| > High school                   | 94 (9.2)                              | 37 (4.9)                | 1.56                          | [1.30–1.88] | <0.0001                    | 1.23   | [0.99–1.50] | 0.055 |
| Monthly Income in Euros         |                                       |                         |                               |          |                           |        |          |
| < 92                            | 437 (62.8)                            | 527 (69.2)              | 1                             |           | 1                         | 1      | 1        |
| 92–151                          | 107 (15.4)                            | 128 (16.8)              | 1.00                          | [0.86–1.17] | 0.95                      | 0.91   | [0.77–1.06] | 0.24 |
| 152–304                         | 92 (13.2)                             | 56 (7.3)                | 1.37                          | [1.19–1.58] | <0.0001                    | 1.31   | [1.12–1.53] | 0.0006 |
| ≥ 304                           | 52 (7.5)                              | 38 (5.0)                | 1.27                          | [1.05–1.54] | 0.01                      | 1.11   | [0.88–1.41] | 0.36 |
| Don’t Know                      | 8 (1.1)                               | 13 (1.7)                | 1                             |           | 1                         | 1      | 1        |
| Insurance coverage              |                                       |                         |                               |          |                           |        |          |
| Yes                             | 88 (12.6)                             | 57 (7.5)                | 1.31                          | [1.14–1.51] | 0.0002                    | 1      | 1        |
| No                              | 608 (87.4)                            | 705 (92.5)              | 1                             |           | 1                         | 1      | 1        |
| **Health-related**              |                                       |                         |                               |          |                           |        |          |
| Perceived Health Status         |                                       |                         |                               |          |                           |        |          |
| Poor                            | 500 (71.9)                            | 596 (78.2)              | 1.38                          | [1.23–1.55] | <0.0001                    | 1.30   | [1.16–1.46] | <0.0001 |
| At least acceptable             | 195 (28.0)                            | 166 (21.8)              | 1                             |           | 1                         | 1      | 1        |
| Missing data                    | 1 (0.1)                               | 0.1                     | 1                             |           | 1                         | 1      | 1        |
| Time since HIV diagnosis (months) | 96 (12–235)                          | 85 (12–270)             |                               |           |                           |        |          |
| ≤ 120                           | 498 (71.5)                            | 598 (78.5)              | 0.83                          | [0.74–0.93] | 0.0014                    | 1      | 1        |
| > 120                           | 198 (28.5)                            | 164 (21.5)              | 1                             |           | 1                         | 1      | 1        |
| Initial CD4 count in cells/mm³  |                                       |                         |                               |          |                           |        |          |
| ≤ 200                           | 334 (48.0)                            | 351 (46.0)              | 1.004                         | [0.83–1.21] | 0.96                      | 1      | 1        |

(Continued)
This difference could be explained by the fact that diagnosis of non-communicable diseases in low-income countries is not routinely performed during HIV visits and by the low proportion of old PLHIV in our study. Therefore, we hypothesize that in our study, PLHIV with potentially non-communicable diseases may suffer from cardiovascular disease or diabetes, but they are not aware of their condition because they do not have access to diagnostics. The users of sex hormones and modulators of the genital system represented 9% [47] and 19% [44] in the PLHIV populations of high-income countries. In our study, only 0.9% used these drugs.

The use of a prescription medication without a prescription from a health professional was observed in our PLHIV population. Antibiotics and anti-malaria medications were used without prescription by 3.0% and 2.5% of participants, respectively. Individuals using those drugs without a prescription have likely not been exposed to appropriate diagnostic tests. The misuse of antibiotics or malaria medications can increase the risk of resistance to these medications and of drug-drug interactions [47, 54].

Seven factors were associated with the use of non-HIV medications. Some of these factors, such as WHO advanced clinical stage [31] and high level of education and high income [19], are in line with those that have been reported in previous studies. In our study, we observed that PLHIV living in Abidjan had higher incomes and access to non-HIV medications compared with PLHIV from the hinterland HIV clinics.

This study provides insight on the use of non-HIV medication by PLHIV on ART in West Africa. To our knowledge, this is the first study conducted in Africa that describes the extent to which non-HIV medications used were prescribed or not.

| Characteristics | Use of at least one non-HIV medication | Crude prevalence ratios | 95% Confidence Intervals (CI) | P values | Adjusted prevalence ratios | 95% CI | P values |
|-----------------|---------------------------------------|-------------------------|--------------------------------|----------|----------------------------|--------|----------|
|                 | Yes                                    | No                      |                                |          |                            |        |          |
| 200–349         | 186                                    | 207                     | 27.2                           | 0.97     | [0.78–1.19]                | 0.80   |          |
| 350–499         | 96                                     | 122                     | 16.0                           | 0.90     | [0.72–1.14]                | 0.40   |          |
| ≥ 500           | 67                                     | 71                      | 9.3                            | 1        |                            |        |          |
| Missing data    | 13                                     | 11                      | 1.5                            |          |                            |        |          |
| WHO HIV clinical stage |                      |                          |                                |          |                            |        |          |
| I               | 219                                    | 316                     | 41.5                           | 1        |                            |        |          |
| II              | 265                                    | 256                     | 33.6                           | 1.24     | [1.09–1.42]                | 0.0013 | 1.24     | [1.08–1.41] | 0.0017 |
| III or IV       | 205                                    | 205                     | 23.0                           | 1.32     | [1.15–1.81]                | <0.0001| 1.22     | [1.06–1.40] | 0.005  |
| Missing data    | 0                                      | 0                       | 0.001                          |          |                            |        |          |
| Data not available |                                   |                         |                                |          |                            |        |          |

**Treatment-related**

| Use of cotrimoxazole |                               |                               |                               |          |                            |        |          |
|----------------------|-------------------------------|-------------------------------|-------------------------------|----------|----------------------------|--------|----------|
| No                   | 462                           | 461                           | 60.5                          | 1        |                            |        |          |
| Yes                  | 234                           | 301                           | 39.5                          | 0.87     | [0.78–0.98]                | 0.022  | 0.77     | [0.69–0.87] | <0.0001|

| Use of traditional and complementary products |                               |                               |                               |          |                            |        |          |
|-----------------------------------------------|-------------------------------|-------------------------------|-------------------------------|----------|----------------------------|--------|----------|
| Yes                                           | 407                           | 369                           | 48.4                          | 1.24     | [1.11–1.38]                | 0.0001 | 1.22     | [1.10–1.37] | <0.0001|
| No                                            | 289                           | 393                           | 51.6                          | 1        |                            |        |          |

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Our study has some limitations. First, we could not include patients who did not show up for their HIV follow-up. It is possible that these people were sicker than our participants. Therefore, we may have underestimated the proportion of non-HIV medication users. Second, the use of non-HIV medication was self-reported, which is susceptible to a memory bias. Therefore, the proportion of people using non-prescribed non-HIV medications may have been underestimated. Similarly, PLHIV who forgot their medications or prescriptions at home may have under-reported the use of non-HIV medications. If these medications were not actually medications, the proportion of non-HIV medications would be underestimated. Moreover, answers to questions related to income and health status perception may have suffered from social desirability bias. Next, since our study was conducted in only four regions in Côte d’Ivoire, our results are not generalizable to the entire population of PLHIV on ART in Côte d’Ivoire.

**Conclusion**

In this study, we observed that approximately 50% of PLHIV on ART for at least one year used a non-HIV medication. More than half of them used non-HIV medications that were not prescribed. The results of this study suggest that healthcare professionals should pay attention to the needs of PLHIV in terms of non-HIV medications, particularly for patients living in Abidjan and those who are not using cotrimoxazole.

**Supporting information**

S1 Database. Database_MOTUHS. (DOCX)

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**Author Contributions**

**Conceptualization:** Mariam Mama Djima, Didier Koumavi Ekouevi, Jocelyne Moisan.

**Data curation:** Mariam Mama Djima, Didier Koumavi Ekouevi.

**Formal analysis:** Mariam Mama Djima, Didier Koumavi Ekouevi.

**Funding acquisition:** Mariam Mama Djima, Didier Koumavi Ekouevi, Jocelyne Moisan.

**Investigation:** Mariam Mama Djima.

**Methodology:** Mariam Mama Djima, Didier Koumavi Ekouevi, Jean-Pierre Gregoire, Boris Tchounga, Patrick Ahuatchi Coffie, Jocelyne Moisan.

**Project administration:** Mariam Mama Djima, Didier Koumavi Ekouevi.

**Supervision:** Mariam Mama Djima, Franck Y. Touré.

**Validation:** Mariam Mama Djima, Didier Koumavi Ekouevi, Franck Y. Touré.

**Visualization:** Mariam Mama Djima, Didier Koumavi Ekouevi, Jocelyne Moisan.
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