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ORIGINAL RESEARCH

# Predictors of Non-Communicable Disease Risk Factors Among People Living with HIV and HIV-Negative Patients in a Nigerian Tertiary Hospital

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**Purpose:** In recent years, People Living with HIV (PLHIV) in sub-Saharan Africa have experienced a growing burden of non-communicable diseases (NCDs), straining already limited health systems. Identifying behavioural risk factors for NCDs in both PLHIV and HIV-negative individuals is essential for designing targeted interventions. This study aimed to identify common risk factors for NCDs in these groups and determine their predictors.

**Patients and Methods:** A comparative cross-sectional study was conducted among 250 PLHIV and 250 age- and sex-matched HIV-negative individuals attending the Antiretroviral Therapy (ART) and General Out-Patient clinics of Jos University Teaching Hospital from March 1–12, 2021. Participants aged 18–65 years were enrolled. Data were collected using a semi-structured questionnaire and blood pressure measurements. Multivariable logistic regression was used to identify predictors of behavioural risk factors while adjusting for potential confounders.

**Results:** While both groups had similar age and gender distributions, significant differences were observed in education level, marital status, employment, residence, income, ethnicity, and household size ($p<0.05$). Among PLHIV, long-term ART use reduced smoking by 93%. In HIV-negative individuals, urban residence and non-harmful alcohol use reduced smoking by 94% and 99%, respectively. Problematic alcohol use was significantly lower in women and non-smokers among PLHIV and HIV-negative individuals, respectively. Low physical activity was associated with poor self-rated health status in both groups, with gender and age playing additional roles among PLHIV and HIV-negative participants, respectively. Among the HIV-negative, unhealthy diets were linked to lower income.

**Conclusion:** Predictors of behavioural risk factors among PLHIV included ART duration, gender, and self-rated health. In the HIV-negative group, age, gender, residence, income, and self-rated health were key predictors. The notable overlap between smoking and alcohol use underscores the need for integrated interventions targeting these behaviours in both populations.

**Keywords:** non-communicable disease, risk factors, PLHIV, HIV-negative, predictors of non-communicable diseases

## Introduction

Over time, the widespread access to antiretroviral therapy (ART) has markedly improved the survival and quality of life of people living with HIV (PLHIV), transforming HIV infection from a terminal condition into a manageable chronic condition.[1–3] However, this extended life expectancy has brought about a rise in the burden of non-communicable diseases (NCDs) among PLHIV.[3–8] This trend is of huge concern in sub-Saharan Africa (SSA), home to over two-thirds

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of the global burden of HIV,[9] where health systems are weak and inadequately equipped to handle the dual epidemic of HIV and NCDs.

The PLHIV are faced with a double burden of NCD risks: the traditional behavioural risk factors seen in the general population – smoking, harmful alcohol use, unhealthy diet, and physical inactivity[10,11] – and those arising from the consequences of HIV itself, such as chronic inflammation, kidney disease, dyslipidaemia, and ART induced metabolic changes.[12,13] Besides predisposing to NCDs, the traditional NCD risk factors have been linked to adverse health outcomes in PLHIV such as suboptimal and slow immune recovery owing to poor ART adherence, low CD4 cell counts, and unsuppression of HIV viral load.[14–21]

Similar to the global picture, PLHIV in SSA have reported higher rates of behavioural risk factors than the general population.[22–31] Unfortunately, only 15% of populations in low-income countries have access to comprehensive to cessation and risk reduction services, compared to over 30% globally.[32–34]

The control of NCDs is hinged on reduction of the four behavioural risk factors through local action plans.[11] However, progress in Nigeria remains slow largely due to poor implementation of the national action plan.[35] While predictors of these risk factors have been widely studied in other settings, a critical gap in local evidence from North-Central exists as existing studies that measured and compared the NCD risk factors between HIV-infected and HIV-negative populations did not explore their determinants.[36,37] Given the potential role of the risk factors in increasing NCD burden in PLHIV and reverse ART gains, it is essential to identify predictors specific to our setting. This study attempts to address this gap by examining the predictors of smoking, harmful alcohol use, unhealthy diet, and physical inactivity among PLHIV and HIV-negative individuals in North-Central Nigeria. We aimed to provide evidence to guide targeted risk reduction interventions such as smoking cessation and alcohol reduction programmes. The study also explored if HIV status influenced the determinants of the risk factors, offering insights for more tailored public health and clinical approaches in NCD control.

# Methods and Tools

## Study Area

The study was conducted at Jos University Teaching Hospital (JUTH), a 600-bed federal tertiary facility located in Jos North Local Government Area (LGA), the most urban and cosmopolitan of the 17 LGAs in Plateau State, North-Central Nigeria.[38] The adult HIV prevalence in Plateau State is 1.5%, slightly above the national average of 1.4%. Although recent data are lacking, Jos North LGA has historically recorded the highest HIV prevalence in the state.[39]

JUTH serves as a major referral centre for Plateau and surrounding states, providing a wide range of clinical services, including comprehensive HIV/AIDS care. The hospital's HIV programme is supported by APIN Public Health Initiatives, a leading indigenous organisation focused on sustainable HIV interventions. The JUTH-APIN centre currently manages over 15,000 hIV-infected clients—the highest in the state—underscoring its central role in HIV care delivery.[40] Services provided include adult and paediatric antiretroviral therapy (ART), prevention of mother-to-child transmission, tuberculosis care, and laboratory support. The clinic operates weekdays from 8:00 am to 4:00 pm, attending to over 1,000 adult clients weekly. ART and related services are offered at no cost, along with counselling and psychosocial support.

In addition, the hospital's General Outpatient Department (GOPD) clinic provides general medical consultations and HIV counselling and testing. It operates Monday to Friday from 8:00 am to 6:00 pm and attends to an average of 250 clients daily. The JUTH-APIN and GOPD clinics are supervised by the Department of Family Medicine, which consultants and resident doctors with expertise in lifestyle and preventive medicine staff.

## Study Population

The study was conducted among PLHIV and HIV-negative clients who attended the JUTH-APIN and GOPD clinics during the study period (1st – 12th March 2021) and were aged between 18–65 years.

## Inclusion Criteria

### PLHIV Group

PLHIV who attended the JUTH-APIN clinic during the study period, aged 18–65 years and have consented to participate. The age range was chosen because the physical activity questions in the STEPS tool are valid only for persons within this age bracket.

### HIV-Negative Group

HIV-negative clients who attended the GOPD clinic during the study period and matched for sex and age within three years (± 3 years) to the participants in the HIV-infected group. Sex and age matching were done to control for the effect of these variables and to ensure that study subjects in the two groups were comparable as sex and age are independently associated with hypertension and behavioural risk factors.

## Exclusion Criteria

Among those meeting the inclusion criteria above, pregnant women were excluded because some NCDs such as cardiovascular disorders and diabetes that occur in pregnancy are often transient medical conditions. Similarly, individuals already diagnosed with any of the major NCDs – cardiovascular disorders, chronic respiratory diseases, diabetes, and cancer were excluded as the interest of this study is risk factors assessment and possible reduction in NCD-free individuals. Furthermore, clients with a physical disability were excluded because their condition is likely to limit participation in physical activity and physical inactivity is one of the risk factors under assessment.

## Study Design

A comparative cross-sectional study NCDs behavioural risk factors among PLHIV and HIV-negative adults. The assessment was clinic-based and involved clients who presented at the JUTH-APIN and GOPD clinics. The PLHIV were the study group, while the HIV-negative clients formed the comparison group.

## Sample Size Estimation

The minimum sample size was determined using the formula for determining the sample size for a comparative study when the outcome variable is qualitative, $n= (Z_\alpha + Z_\beta)^2. (P_1 (1-P_1) + P_2 (1-P_2)) / (P_1 – P_2)^2$,[41] at a 95% confidence level, power of 80%, $P_1$ (proportion of PLHIV found to have an NCD risk factor from a previous study comparing PLHIV and HIV-negative adults accessing care in a tertiary hospital in Southern Nigeria) = 19.5%, and $P_2$ (proportion of HIV-negative adults reported to have a risk factor from the same study) = 10.2%.[42] To compensate for non-response, 10% of the calculated minimum sample size was added to arrive at a final sample size of 250. Therefore, 250 patients were selected per study group, totalling 500 participants.

## Sampling Techniques

### PLHIV Group

A simple random sampling technique was used to select study participants in the APIN clinic. Based on the clinic booking list for the week of data collection ($1^{st}$ – $5^{th}$ March 2021), a list of 403 eligible clients was drawn up and serial numbers were assigned to each client on the list. Using a Microsoft Excel computer-generated list of random numbers, 250 clients were selected from the list to participate in the study. If a selected client did not consent to participate in the study, the client with the next consecutive number was selected.

## HIV-Negative Group

Eligible clients at the GOPD clinic were consecutively recruited based on age and sex matching with HIV-infected participants. Consecutive sampling was used due to the absence of appointment lists during data collection (8–$12^{th}$ March 2021). Unlike the APIN clinic, the GOPD does not use a booking system. Each day, eligible clients were identified from the medical records list and recruited until the sample size (n = 250) was achieved. Non-consenting

individuals were replaced by the next eligible match. Matching was done to reflect the age and sex distribution of the HIV-positive group.

## Study Instruments

The study instruments were a semi-structured questionnaire and a blood pressure (BP) measuring device. The semi-structured interviewer-administered questionnaire was adapted from the English version of the WHO STEPS instrument. The BP was measured using an OMRON model M3 digital/automated sphygmomanometer. An automatic sphygmomanometer eliminates the observer's digit preference and bias.

## Data Collection

Permission to conduct the study was obtained from the APIN Principal Investigator and the Head of Family Medicine, JUTH. Five resident doctors from the Department of Community Medicine were trained by the researcher to ensure consistency in data collection.

The questionnaire was pre-tested on 50 participants (25 hIV-positive, 25 hIV-negative) at Faith Alive Hospital, Jos North LGA, to identify ambiguities and estimate administration time (12 minutes).

Data collection occurred over two weeks (1–12 March 2021), one week each at the APIN and GOPD clinics. About 50 clients were interviewed daily in private rooms using WHO STEPS show cards to aid understanding of alcohol and dietary measures.

Voluntary HIV testing was offered to GOPD clients using the Determine rapid test, following national guidelines. Only HIV-negative individuals were included; two positives were detected and referred for confirmation and care.

Blood pressure was measured using standard procedures after a 5-minute rest, with two readings taken and averaged. Elevated cases were referred to the Physicians in the clinic. Participants also received brief health education on WHO lifestyle recommendations for alcohol use, smoking, physical activity, and fruit and vegetable consumption.

## Data Management

### Measurement of Variables

#### Independent Variables

Included sociodemographic characteristics - age, sex, occupation, highest educational attainment, marital status, ethnicity, religion, family type, household size, place of residence, household income, self-rated health status, family history of hypertension, history of raised BP - and clinical information (HIV status, ART use, and duration of ART).

#### Outcome Variables

These included the four behavioural risk factors (tobacco use, harmful alcohol use, unhealthy diet, and physical inactivity). The variables were defined as follows:

#### Tobacco Use

A current smoker had smoked tobacco products in the last 30 days, while a non-current smoker had never smoked or smoked any tobacco product in the past, irrespective of the duration of smoking and length of time since stopping.[43]

#### Harmful Alcohol Use

Defined as engaging in heavy episodic drinking (consumption of 6 or more drinks on any occasion in the past 30 days) by an alcohol drinker, while non-harmful alcohol use included drinkers who did not engage in heavy episodic drinking in the past 30 days. A standard drink was defined as a bottle or can of beer, a calabash of locally brewed beer (burkutu), a glass of wine, or a shot of any spirits (gin, whiskey, vodka or brandy).[43]

#### Physical Inactivity/Low Physical Activity

Defined as less than 150 minutes of moderate-intensity physical activity in a week, or less than 75 minutes of vigorous-intensity physical activity in a week, or less than an equivalent combination of moderate and vigorous-intensity activity

achieving less than 600 metabolic equivalents (METs) minutes. MET is the ratio of a person's working metabolic rate relative to the resting metabolic rate. Moderate-intensity activities were assigned 4 METs, while 8 METs were assigned to the time spent in vigorous-intensity activities.[43,44]

### Unhealthy Dietary

Defined as eating less than five servings of fruits and/or vegetables on an average day in the past 30 days preceding the data collection.[43] A serving of fruit was described using the following examples: one medium fruit (about the size of a fist), a quarter of a cup (about 60mL) of dried fruits, and half a cup (125mL) of fruit juice. A serving of vegetables was described as one cup (250mL) of raw leafy vegetables or half a cup (125mL) of vegetable juice or cooked vegetables.[45]

## Statistical Analysis

Data were entered into Microsoft Excel, cleaned, and analyzed using the Statistical Product and Service Solutions version 23 software. Statistical significance was set at $p < 0.05$. The normality of quantitative variables was assessed using the Shapiro-Wilk test.

Categorical variables were summarized as frequencies and proportions and compared using the Chi-square test. Numerical variables were presented as means ± SD or medians (IQR) for skewed data, with comparisons made using Student's *t*-test or the Mann-Whitney *U*-test, as appropriate.

The predictors of the NCD risk factors were determined using bivariate and multivariate methods. Bivariate logistic regression was used to assess associations between a variable and the outcome, and variables with $p < 0.05$ were included in the multivariate logistic regression models. Results were reported as crude and adjusted odds ratios (CORs and AORs) with 95% confidence intervals.

## Ethical Considerations

Ethical approval was obtained from the JUTH Health Research Ethics Committee (Ref: JUTH/DCS/IREC/127/XXX2125). Informed oral and written consent was obtained from all participants after explaining the study's purpose. Participation was voluntary, with the right to withdraw at any time. Interviews were conducted in private to ensure confidentiality and encourage honest responses. GOPD clients could decline HIV testing without consequence.

# Results

In total, 500 clients were enrolled in the study, with 250 per group. All the patients approached consented to participate in the study, giving a 100% response rate.

Table 1 shows that the two groups were similar in age and sex distribution. They however differed based on educational levels, marital status, employment status, ethnic groups, monthly income, place of residence, and household size. Thirty-five (14.0%) of the PLHIV had no formal education, while 61 (24.4%) HIV-negatives had no formal education. One hundred and fifty-nine (63.6%) PLHIV were married compared to 200 (80.0%) of the HIV-negatives. Fifty-four (21.6%) and 72 (28.8%) of respondents in the PLHIV and HIV-negative groups were unemployed. While 168

**Table 1** Sociodemographic Characteristics of PLHIV and HIV-Negative Respondents

| Characteristic | PLHIV (n=250) Frequency (%) | HIV-Negative (n=250) Frequency (%) | $\chi^2$ | *df* | p-value |
|---|---|---|---|---|---|
| **Age group (years)** | | | | | |
| 20–29 | 12 (4.8) | 12 (4.8) | 0.001 | 4 | 1.000 |
| 30 – 39 | 55 (22.0) | 55 (22.0) | | | |
| 40–49 | 97 (38.8) | 97 (38.8) | | | |
| 50 – 59 | 57 (22.8) | 57 (22.8) | | | |
| ≥ 60 | 29 (11.6) | 29 (11.6) | | | |

(*Continued*)

**Table 1** (Continued).

| Characteristic | PLHIV (n=250) Frequency (%) | HIV-Negative (n=250) Frequency (%) | $\chi^2$ | *df* | p-value |
|---|---|---|---|---|---|
| **Mean age ± SD** | 46.0 ± 10.7 years | 45.3 ± 10.9 years | **MD (95% CI)** 0.680 (−1.21; 2.57) | 498 | 0.480[+] |
| **Sex** | | | | | |
| Female | 165 (66.0) | 165 (66.0) | 0.001 | 1 | 1.000 |
| Male | 85 (34.0) | 85 (34.0) | | | |
| **Highest level of education** | | | | | |
| No formal education | 35 (14.0) | 61 (24.4) | 9.531 | 3 | 0.023* |
| Primary | 72 (28.8) | 63 (25.2) | | | |
| Secondary | 58 (23.2) | 58 (23.2) | | | |
| Tertiary | 85 (34.0) | 68 (27.2) | | | |
| **Marital status** | | | | | |
| Never married | 22 (8.8) | 23 (9.2) | 23.080 | 2 | < 0.001* |
| Others[a] | 69 (27.6) | 27 (10.8) | | | |
| Currently married | 159 (63.6) | 200 (80.0) | | | |
| **Employment status** | | | | | |
| Government employed | 62 (24.8) | 38 (15.2) | 9.130 | 3 | 0.028* |
| Non-government employed | 24 (9.6) | 20 (8.0) | | | |
| Self-employed | 110 (44.0) | 120 (48.0) | | | |
| Unemployed | 54 (21.6) | 72 (28.8) | | | |
| **Place of residence** | | | | | |
| Rural | 82 (32.8) | 42 (16.8) | 17.159 | 1 | < 0.001* |
| Urban | 168 (67.2) | 208 (83.2) | | | |
| **Ethnic group** | | | | | |
| Plateau indigenous | 163 (65.2) | 100 (40.0) | 31.838 | 1 | < 0.001* |
| Non-indigenous | 87 (34.8) | 150 (60.0) | | | |
| **Monthly income** | | | | | |
| < N30,000 | 129 (51.6) | 163 (65.2) | 9.517 | 1 | 0.002* |
| ≥ N30,000 | 121 (48.4) | 87 (34.8) | | | |
| **Median income (IQR)** | N23,500 (6750;60500) | N10,000 (0;50000) | Median difference 13,500 | | < 0.001*[#] |
| **Household size** | | | | | |
| ≤ 5 | 119 (47.6) | 96 (38.4) | 4.317 | 1 | 0.038* |
| > 5 | 131 (52.4) | 154 (61.6) | | | |

**Notes**: [+]*T*-test, [a]Separated, divorced and widowed, *Statistically significant, [#]Mann–Whitney *U*-Test.
**Abbreviations**: MD, Mean difference; IQR, Interquartile Range.

(67.2%) of respondents in the PLHIV group lived in an urban area, it was 208 (83.2%) among the HIV-negative. The median monthly income was N23,500 (IQR - 6750;60500) and N10,000 (IQR - 0;50000) for the PLHIV and HIV-negative groups, respectively. One hundred and thirty-one (52.4%) of the PLHIV had a household size above five, while 154 (61.6%) HIV-negatives belonged to this category.

In Table 2, the two groups of respondents differed in their self-rated state of health ($p < 0.001$) as 205 (82.0%) of the PLHIV respondents reported a good state of health, while it was 147 (58.8%) among the HIV-negatives. Overall, the proportions of respondents who had ever received advice from a health worker on any of the behavioural risk factors differed significantly between the PLHIV - 250 (100%) - and HIV-negative - 238 (95.2%) groups. However, the groups did not differ significantly in the proportions that had previously received advice from a health worker on quitting/not

**Table 2** Clinical and Health-Related Information on PLHIV and HIV-Negative Respondents

| Characteristic | PLHIV (n=250) Frequency (%) | HIV-Negative (n=250) Frequency (%) | $\chi^2$ | *df* | p-value |
|---|---|---|---|---|---|
| **Self-rated state of health** | | | | | |
| Good | 205 (82.0) | 147 (58.8) | 34.587 | 2 | <0.001* |
| Fair | 43 (17.2) | 89 (35.6) | | | |
| Poor | 2 (0.8) | 14 (5.6) | | | |
| **Advised to quit/not start smoking** | | | | | |
| Yes | 227 (90.8) | 217 (86.8) | 2.011 | 1 | 0.156 |
| No | 23 (9.2) | 33 (13.2) | | | |
| **Advised on Alcohol consumption** | | | | | |
| Yes | 231 (92.4) | 222 (88.8) | 1.902 | 1 | 0.168 |
| No | 19 (7.6) | 28 (11.2) | | | |
| **Advised on physical activity** | | | | | |
| Yes | 235 (94.0) | 236 (94.4) | 0.037 | 1 | 0.848 |
| No | 15 (6.0) | 14 (5.6) | | | |
| **Advised on healthy eating** | | | | | |
| Yes | 240 (96.0) | 235 (94.0) | 1.053 | 1 | 0.305 |
| No | 10 (4.0) | 15 (6.0) | | | |
| **Advised on any of the behavioural risk factors** | | | | | |
| Yes | 250 (100.0) | 238 (95.2) | 12.295 | 1 | <0.001* |
| No | 0 (0.0) | 12 (4.8) | | | |
| **Time since HIV diagnosis** | | | | | |
| < 5 years | 28 (11.2) | | | | |
| ≥ 5 years | 222 (88.8) | | | | |
| **ART duration** | | | | | |
| < 2 years | 10 (4.0) | | | | |
| ≥ 2 years | 240 (96.0) | | | | |

**Note**:*Statistically significant.

starting smoking, not consuming too much alcohol, starting/doing more physical activity, and eating adequate servings of fruit and vegetables daily. Among the PLHIV, two hundred and twenty-two (88.8%) were diagnosed HIV positive ≥ 5 years preceding the study, all were ART-experienced, and 240 (96%) had spent two or more years on treatment (Table 2).

Table 3 shows that bivariate logistic regression found only ART duration to be associated with current smoking in the PLHIV group – smoking was 93% less likely among those on ART for at least two years. In the HIV-negative group, bivariate logistic regression found the place of residence and harmful alcohol use to be associated with smoking in the HIV-negative respondents. Smoking was 87% less likely among urban dwellers while harmful alcohol consumption caused a 20 times increase in the odds of smoking. In the multivariate logistic regression, smoking was 94% less likely among urban dwellers while the odds of smoking was 68 times higher among harmful alcohol users.

As shown in Table 4, bivariate logistic regression found only gender to be associated with harmful alcohol use among the PLHIV – females were 92% less likely lower of being harmful alcohol users. Smoking was associated with harmful alcohol use among those who were HIV-negative – smokers were 20 times more likely to engage in harmful alcohol consumption.

Among the PLHIV, bivariate analysis did not reveal a significant association between unhealthy diet and the variables assessed. In the HIV-negative group, bivariate logistic regression found educational level and monthly income to be associated with unhealthy diet among the HIV-negative respondents. Persons with a tertiary level education and a monthly income of ≥N30,000 were 62% less likely and 70% less likely to eat unhealthily, respectively. While

**Table 3** Predictors of Smoking Among PLHIV and HIV- Negative Respondents

| Variable | PLHIV | | | HIV-Negative | | | |
|---|---|---|---|---|---|---|---|
| | Currently Smoking | | COR (95% CI) | Currently Smoking | | COR (95% CI) | AOR (95% CI) |
| | No f (%) | Yes f (%) | | No f (%) | Yes f (%) | | |
| **Age group** | | | | | | | |
| < 40 years | 64 (95.5) | 3 (4.5) | 1 | 65 (97.0) | 2 (3.0) | 1 | |
| ≥ 40 years | 180 (98.4) | 3 (1.6) | 0.36 (0.07–1.81) | 180 (98.4) | 3 (1.6) | 0.54 (0.09–3.32) | |
| **Sex** | | | | | | | |
| Male | 81 (95.3) | 4 (4.7) | 1 | 81 (95.3) | 4 (4.7) | 1 | |
| Female | 163 (98.8) | 2 (1.2) | 0.25 (0.05–1.39) | 164 (99.4) | 1 (0.6) | 0.12 (0.01–1.12) | |
| **Educational level** | | | | | | | |
| Below tertiary | 160 (97.0) | 5 (3.0) | 1 | 180 (98.9) | 2 (1.1) | 1 | |
| Tertiary | 84 (98.8) | 1 (1.2) | 0.38 (0.04–3.31) | 65 (95.6) | 3 (4.4) | 4.15 (0.68–25.42) | |
| **Marital status** | | | | | | | |
| Not currently married | 87 (95.6) | 4 (4.4) | 1 | 48 (96.0) | 2 (4.0) | 1 | |
| Currently married | 157 (98.7) | 2 (1.3) | 0.28 (0.05–1.54) | 197 (98.5) | 3 (1.5) | 0.37 (0.06–2.25) | |
| **Employment status** | | | | a | a | | |
| Employed | 192 (98.0) | 4 (2.0) | 1 | | | | |
| Unemployed | 52 (96.3) | 2 (3.7) | 1.85 (0.33–10.36) | | | | |
| **Monthly income** | | | | | | | |
| < N30,000 | 127 (98.4) | 2 (1.6) | 1 | 161 (98.8) | 2 (1.2) | 1 | |
| ≥ N30,000 | 117 (96.7) | 4 (3.3) | 2.17 (0.39–12.07) | 84 (96.6) | 3 (3.4) | 2.88 (0.47–17.54) | |
| **Ethnicity** | | | | | | | |
| Plateau Indigenous | 160 (98.2) | 3 (1.8) | 1 | 96 (96.0) | 4 (4.0) | 1 | |
| Non-indigenous | 84 (96.6) | 3 (3.4) | 1.91 (0.38–9.64) | 149 (99.3) | 1 (0.7) | 0.16 (0.02–1.46) | |
| **Household size** | | | | | | | |
| ≤ 5 | 117 (98.3) | 2 (1.7) | 1 | 94 (97.9) | 2 (2.1) | 1 | |
| > 5 | 127 (96.9) | 4 (3.1) | 1.84 (0.33–10.25) | 151 (98.1) | 3 (1.9) | 0.93 (0.15–5.69) | |
| **Place of residence** | | | | | | | |
| Rural | 80 (97.6) | 2 (2.4) | 1 | 39 (92.9) | 3 (7.1) | 1 | 1 |
| Urban | 164 (97.6) | 4 (2.4) | 0.98 (0.18–5.44) | 206 (99.0) | 2 (1.0) | 0.13 (0.02–0.78)* | 0.06 (0.01–0.63)* |
| **ART duration** | | | | b | b | | |
| < 2 years | 8 (80.0) | 2 (20.0) | 1 | | | | |
| ≥ 2 years | 236 (98.3) | 4 (1.7) | 0.07 (0.01–0.43)* | | | | |
| **Self-rated state of health** | | | | | | | |
| Good | 200 (97.6) | 5 (2.4) | 1 | 143 (97.3) | 4 (2.7) | 1 | |
| Fair/poor | 44 (97.8) | 1 (2.2) | 0.91 (0.10–7.98) | 102 (99.0) | 1 (1.0) | 0.35 (0.04–3.18) | |
| **Hypertension** | | | | | | | |
| No | 133 (97.1) | 4 (2.9) | 1 | 106 (97.2) | 3 (2.8) | 1 | |
| Yes | 111 (98.2) | 2 (1.8) | 0.60 (0.11–3.33) | 139 (98.6) | 2 (1.4) | 0.51 (0.08–3.10) | |
| **Physical activity** | | | | | | | |
| Adequate | 155 (96.9) | 5 (3.1) | 1 | 153 (97.5) | 4 (2.5) | 1 | |
| Inadequate | 89 (98.9) | 1 (1.1) | 0.35 (0.04–3.03) | 92 (98.9) | 1 (1.1) | 0.42 (0.05–3.78) | |
| **Diet** | | | | | | | |
| Healthy | 52 (94.5) | 3 (5.5) | 1 | 34 (97.1) | 1 (2.9) | 1 | |
| Unhealthy | 192 (98.5) | 3 (1.5) | 0.27 (0.05–1.38) | 211 (98.1) | 4 (1.9) | 0.65 (0.07–5.94) | |

(*Continued*)

**Table 3** (Continued).

| Variable | PLHIV | | | HIV-Negative | | | |
|---|---|---|---|---|---|---|---|
| | Currently Smoking | | COR (95% CI) | Currently Smoking | | COR (95% CI) | AOR (95% CI) |
| | No f (%) | Yes f (%) | | No f (%) | Yes f (%) | | |
| **Harmful alcohol use** | | | | | | | |
| No | 232 (97.9) | 5 (2.1) | 1 | 242 (98.4) | 4 (1.6) | 1 | 1 |
| Yes | 12 (92.3) | 1 (7.7) | 3.87 (0.42–35.75) | 3 (75.0) | 1 (25.0) | 20.17 (1.71–238.29)* | 67.67 (3.38–1355.12)* |
| **Advised on smoking** | | | | | | | |
| Yes | 222 (97.8) | 5 (2.2) | 1 | 213 (98.2) | 4 (1.8) | 1 | |
| No | 22 (95.7) | 1 (4.3) | 2.02 (0.23–18.06) | 32 (97.0) | 1 (3.0) | 1.66 (0.18–15.36) | |

**Notes**: *Statistically significant, [a]Some cells have a zero count, [b]Not applicable to HIV-negative.

**Table 4** Predictors of Harmful Alcohol Use Among PLHIV and HIV- Negative Respondents

| Variable | PLHIV | | | HIV-Negative | | |
|---|---|---|---|---|---|---|
| | Harmful Alcohol Use | | COR (95% CI) | Harmful Alcohol Use | | COR (95% CI) |
| | No f (%) | Yes f (%) | | No f (%) | Yes f (%) | |
| **Age group** | | | | | | |
| < 40 years | 65 (97.0) | 2 (3.0) | 1 | 66 (98.5) | 1 (1.5) | 1 |
| ≥ 40 years | 172 (94.0) | 11 (6.0) | 2.08 (0.45–9.63) | 180 (98.4) | 3 (1.6) | 1.10 (0.11–10.76) |
| **Sex** | | | | a | a | |
| Male | 74 (87.1) | 11 (12.9) | 1 | | | |
| Female | 163 (98.8) | 2 (1.2) | 0.08 (0.02–0.38)* | | | |
| **Educational level** | | | | | | |
| Below tertiary | 158 (95.8) | 7 (4.2) | 1 | 181 (99.5) | 1 (0.5) | 1 |
| Tertiary | 79 (92.9) | 6 (7.1) | 1.71 (0.56–5.27) | 65 (95.6) | 3 (4.4) | 8.35 (0.85–81.74) |
| **Marital status** | | | | | | |
| Not currently married | 88 (96.7) | 3 (3.3) | 1 | 49 (98.0) | 1 (2.0) | 1 |
| Currently married | 149 (93.7) | 10 (6.3) | 1.97 (0.53–7.35) | 197 (98.5) | 3 (1.5) | 0.75 (0.08–7.33) |
| **Employment status** | | | | | | |
| Employed | 184 (93.9) | 12 (6.1) | 1 | 175 (98.3) | 3 (1.7) | 1 |
| Unemployed | 53 (98.1) | 1 (1.9) | 0.29 (0.04–2.28) | 71 (98.6) | 1 (1.4) | 0.82 (0.08–8.03) |
| **Monthly income** | | | | | | |
| < N30,000 | 125 (96.9) | 4 (3.1) | 1 | 160 (98.2) | 3 (1.8) | 1 |
| ≥ N30,000 | 112 (92.6) | 9 (7.4) | 2.51 (0.75–8.38) | 86 (98.9) | 1 (1.1) | 0.62 (0.06–6.05) |
| **Ethnicity** | | | | | | |
| Plateau Indigenous | 153 (93.9) | 10 (6.1) | 1 | 97 (97.0) | 3 (3.0) | 1 |
| Non-indigenous | 84 (96.6) | 3 (3.4) | 0.55 (0.15–2.04) | 149 (99.3) | 1 (0.7) | 0.22 (0.02–2.12) |
| **Household size** | | | | | | |
| ≤ 5 | 114 (95.8) | 5 (4.2) | 1 | 94 (97.9) | 2 (2.1) | 1 |
| > 5 | 123 (93.9) | 8 (6.1) | 1.48 (0.47–4.67) | 152 (98.7) | 2 (1.3) | 0.62 (0.09–4.47) |
| **Place of residence** | | | | a | a | |
| Rural | 76 (92.7) | 6 (7.3) | 1 | | | |
| Urban | 161 (95.8) | 7 (4.2) | 0.55 (0.18–1.70) | | | |

(*Continued*)


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**Table 4** (Continued).

| Variable | PLHIV | | | HIV-Negative | | |
|---|---|---|---|---|---|---|
| | Harmful Alcohol Use | | COR (95% CI) | Harmful Alcohol Use | | COR (95% CI) |
| | No f (%) | Yes f (%) | | No f (%) | Yes f (%) | |
| **Self-rated state of health** | | | | a | a | |
| Good | 194 (94.6) | 11 (5.4) | 1 | | | |
| Fair/poor | 43 (95.6) | 2 (4.4) | 0.82 (0.18–3.84) | | | |
| **Hypertension** | | | | | | |
| No | 133 (97.1) | 4 (2.9) | 1 | 108 (99.1) | 1 (0.9) | 1 |
| Yes | 104 (92.0) | 9 (8.0) | 2.88 (0.86–9.61) | 138 (97.9) | 3 (2.1) | 2.35 (0.24–22.89) |
| **Physical activity** | | | | | | |
| Adequate | 148 (92.5) | 12 (7.5) | 1 | 155 (98.7) | 2 (1.3) | 1 |
| Inadequate | 89 (98.9) | 1 (1.1) | 0.14 (0.02–1.08) | 91 (97.8) | 2 (2.2) | 1.70 (0.24–12.30) |
| **Diet** | | | | | | |
| Healthy | 53 (96.4) | 2 (3.6) | 1 | 34 (97.1) | 1 (2.9) | 1 |
| Unhealthy | 184 (94.4) | 11 (5.6) | 1.58 (0.34–7.37) | 212 (98.6) | 3 (1.4) | 0.48 (0.05–4.76) |
| **Currently smoking** | | | | | | |
| No | 232 (95.1) | 12 (4.9) | 1 | 242 (98.8) | 3 (1.2) | 1 |
| Yes | 5 (83.3) | 1 (16.7) | 3.87 (0.42–35.75) | 4 (80.0) | 1 (20.0) | 20.17 (1.71–238.29)* |

**Notes**: *Statistically significant, [a]Some cells have a zero count.

multivariate logistic regression found only monthly income to be a predictor of an unhealthy diet – an unhealthy diet was 63% less likely among persons earning ≥ N30,000 (Table 5).

As shown in Table 6, bivariate analysis found physical inactivity to be associated with gender, marital status, and self-rated state of health among the PLHIV. Females and persons perceiving their health to be fair/poor were three times more likely and two times more likely to be physically inactive. Physical inactivity was 49% less likely among the married respondents. Multivariate logistic regression showed gender and self-rated state of health to be predictors of physical inactivity – the odds were three times and two times more likely among females and individuals who rated their health as fair or poor. Among the HIV-negative, age group and self-rated state of health were associated with physical inactivity. Age ≥ 40 years and fair/poor perceived health status increased the odds of physical inactivity by three times and two times, respectively.

**Table 5** Predictors of Unhealthy Diet Among PLHIV and HIV- Negative Respondents

| Variable | PLHIV | | | HIV-Negative | | | |
|---|---|---|---|---|---|---|---|
| | Unhealthy Diet | | COR (95% CI) | Unhealthy Diet | | COR (95% CI) | AOR (95% CI) |
| | No f (%) | Yes f (%) | | No f (%) | Yes f (%) | | |
| **Age group** | | | | | | | |
| < 40 years | 11 (16.4) | 56 (83.6) | 1 | 9 (13.4) | 58 (86.6) | 1 | |
| ≥ 40 years | 44 (24.0) | 139 (76.0) | 0.62 (0.30–1.29) | 26 (14.2) | 157 (85.8) | 0.94 (0.41–2.12) | |
| **Sex** | | | | | | | |
| Male | 20 (23.5) | 65 (76.5) | 1 | 17 (20.0) | 68 (80.0) | 1 | |
| Female | 35 (21.2) | 130 (78.8) | 1.14 (0.61–2.14) | 18 (10.9) | 147 (89.1) | 2.04 (0.99–4.21) | |

(*Continued*)

**Table 5** (Continued).

| Variable | PLHIV | | | HIV-Negative | | | |
|---|---|---|---|---|---|---|---|
| | Unhealthy Diet | | COR (95% CI) | Unhealthy Diet | | COR (95% CI) | AOR (95% CI) |
| | No f (%) | Yes f (%) | | No f (%) | Yes f (%) | | |
| **Educational level** | | | | | | | |
| Below tertiary | 35 (21.2) | 130 (78.8) | 1 | 19 (10.4) | 163 (89.6) | 1 | 1 |
| Tertiary | 20 (23.5) | 65 (76.5) | 0.88 (0.47–1.64) | 16 (23.5) | 52 (76.5) | 0.38 (0.18–0.79)* | 0.61 (0.27–1.40)* |
| **Marital status** | | | | | | | |
| Not currently married | 21 (23.1) | 70 (76.9) | 1 | 7 (14.0) | 43 (86.0) | 1 | |
| Currently married | 34 (21.4) | 125 (78.6) | 1.10 (0.60–2.05) | 28 (14.0) | 172 (86.0) | 1.00 (0.41–2.44) | |
| **Employment status** | | | | | | | |
| Employed | 48 (24.5) | 148 (75.5) | 1 | 24 (13.5) | 154 (86.5) | 1 | |
| Unemployed | 7 (13.0) | 47 (87.0) | 2.18 (0.92–5.14) | 11 (15.3) | 61 (84.7) | 0.86 (0.40–1.87) | |
| **Monthly income** | | | | | | | |
| < N30,000 | 25 (19.4) | 104 (80.6) | 1 | 14 (8.6) | 149 (91.4) | 1 | 1 |
| ≥ N30,000 | 30 (24.8) | 91 (75.2) | 0.73 (0.40–1.33) | 21 (24.1) | 66 (75.9) | 0.30 (0.14–0.62)* | 0.37 (0.16–0.84)* |
| **Ethnicity** | | | | | | | |
| Plateau Indigenous | 31 (19.0) | 132 (81.0) | 1 | 16 (16.0) | 84 (84.0) | 1 | |
| Non-indigenous | 24 (27.6) | 63 (72.4) | 0.62 (0.33–1.14) | 19 (12.7) | 131 (87.3) | 1.31 (0.64–2.70) | |
| **Household size** | | | | | | | |
| ≤ 5 | 29 (24.4) | 90 (75.6) | 1 | 17 (17.7) | 79 (82.3) | 1 | |
| > 5 | 26 (19.8) | 105 (80.2) | 1.30 (0.71–2.37) | 18 (11.7) | 136 (88.3) | 1.63 (0.79–3.34) | |
| **Place of residence** | | | | | | | |
| Rural | 16 (19.5) | 66 (80.5) | 1 | 6 (14.3) | 36 (85.7) | 1 | |
| Urban | 39 (23.2) | 129 (76.8) | 0.80 (0.42–1.54) | 29 (13.9) | 179 (86.1) | 1.03 (0.40–2.66) | |
| **ART duration** | | | | | | | |
| < 2 years | 2 (20.0) | 8 (80.0) | 1 | b | b | | |
| ≥ 2 years | 53 (22.1) | 187 (77.9) | 0.88 (0.18–4.28) | | | | |
| **Self-rated state of health** | | | | | | | |
| Good | 41 (20.0) | 164 (80.0) | 1 | 24 (16.3) | 123 (83.7) | 1 | |
| Fair/poor | 14 (31.1) | 31 (68.9) | 0.55 (0.27–1.14) | 11 (10.7) | 92 (89.3) | 1.63 (0.76–3.50) | |
| **Hypertension** | | | | | | | |
| No | 29 (21.2) | 108 (78.8) | 1 | 15 (13.8) | 94 (86.2) | 1 | |
| Yes | 26 (23.0) | 87 (77.0) | 0.90 (0.49–1.64) | 20 (14.2) | 121 (85.8) | 0.97 (0.47–1.99) | |
| **Physical activity** | | | | | | | |
| Adequate | 33 (20.6) | 127 (79.4) | 1 | 24 (15.3) | 133 (84.7) | 1 | |
| Inadequate | 22 (24.4) | 68 (75.6) | 0.80 (0.43–1.49) | 11 (11.8) | 82 (88.2) | 1.35 (0.63–2.89) | |
| **Currently smoking** | | | | | | | |
| No | 52 (21.3) | 192 (78.7) | 1 | 34 (13.9) | 211 (86.1) | 1 | |
| Yes | 3 (50.0) | 3 (50.0) | 0.27 (0.05–1.38) | 1 (20.0) | 4 (80.0) | 0.65 (0.07–5.94) | |
| **Harmful alcohol use** | | | | | | | |
| No | 53 (22.4) | 184 (77.6) | 1 | 34 (13.8) | 212 (86.2) | 1 | |
| Yes | 2 (15.4) | 11 (84.6) | 1.58 (0.34–7.37) | 1 (25.0) | 3 (75.0) | 0.48 (0.05–4.76) | |

(*Continued*)

**Table 5** (Continued).

| Variable | PLHIV | | | HIV-Negative | | | |
|---|---|---|---|---|---|---|---|
| | Unhealthy Diet | | COR (95% CI) | Unhealthy Diet | | COR (95% CI) | AOR (95% CI) |
| | No f (%) | Yes f (%) | | No f (%) | Yes f (%) | | |
| **Advised on healthy eating** | a | a | | | | | |
| Yes | | | | 31 (13.2) | 204 (86.8) | 1 | |
| No | | | | 4 (26.7) | 11 (73.3) | 0.42 (0.13–1.40) | |

**Notes**: *Statistically significant, [a]Some cells have a zero count, [b]Not applicable to HIV-negative.

**Table 6** Predictors of Low Physical Activity Among PLHIV and HIV- Negative Respondents

| Variable | PLHIV | | | | HIV-Negative | | | |
|---|---|---|---|---|---|---|---|---|
| | Low Physical Activity | | COR (95% CI) | AOR (95% CI) | Low Physical Activity | | COR (95% CI) | AOR (95% CI) |
| | No f (%) | Yes f (%) | | | No f (%) | Yes f (%) | | |
| **Age group** | | | | | | | | |
| < 40 years | 45 (67.2) | 22 (32.8) | 1 | | 55 (82.1) | 12 (17.9) | 1 | 1 |
| ≥ 40 years | 115 (62.8) | 68 (37.2) | 1.21 (0.70–2.19) | | 102 (55.7) | 81 (44.3) | 3.64 (1.83–7.25)* | 3.28 (1.63–6.60)* |
| **Sex** | | | | | | | | |
| Male | 66 (77.6) | 19 (22.4) | 1 | 1 | 49 (57.6) | 36 (42.4) | 1 | |
| Female | 94 (57.0) | 71 (43.0) | 2.62 (1.45–4.76)* | 2.45 (1.29–4.64)* | 108 (65.5) | 57 (34.5) | 0.72 (0.42–1.23) | |
| **Educational level** | | | | | | | | |
| Below tertiary | 111 (67.3) | 54 (32.7) | 1 | | 114 (62.6) | 68 (37.4) | 1 | |
| Tertiary | 49 (57.6) | 36 (42.4) | 1.51 (0.88–2.59) | | 43 (63.2) | 25 (36.8) | 0.98 (0.55–1.74) | |
| **Marital status** | | | | | | | | |
| Not currently married | 49 (53.8) | 42 (46.2) | 1 | 1 | 34 (68.0) | 16 (32.0) | 1 | |
| Currently married | 111 (69.8) | 48 (30.2) | 0.51 (0.30–0.86)* | 0.63 (0.36–1.12) | 123 (61.5) | 77 (38.5) | 1.33 (0.69–2.57) | |
| **Employment status** | | | | | | | | |
| Employed | 129 (65.8) | 67 (34.2) | 1 | | 118 (66.3) | 60 (33.7) | 1 | |
| Unemployed | 31 (57.4) | 23 (42.6) | 1.43 (0.77–2.64) | | 39 (54.2) | 33 (45.8) | 1.66 (0.95–2.91) | |
| **Monthly income** | | | | | | | | |
| < N30,000 | 80 (62.0) | 49 (38.0) | 1 | | 99 (60.7) | 64 (39.3) | 1 | |
| ≥ N30,000 | 80 (66.1) | 41 (33.9) | 0.84 (0.50–1.40) | | 58 (66.7) | 29 (33.3) | 0.77 (0.45–1.33) | |
| **Ethnicity** | | | | | | | | |
| Plateau Indigenous | 100 (61.3) | 63 (38.7) | 1 | | 66 (66.0) | 34 (34.0) | 1 | |
| Non-indigenous | 60 (69.0) | 27 (31.0) | 0.71 (0.41–1.24) | | 91 (60.7) | 59 (39.3) | 1.26 (0.74–2.13) | |
| **Household size** | | | | | | | | |
| ≤ 5 | 71 (59.7) | 48 (40.3) | 1 | | 58 (60.4) | 38 (39.6) | 1 | |
| > 5 | 89 (67.9) | 42 (32.1) | 0.70 (0.42–1.17) | | 99 (64.3) | 55 (35.7) | 0.85 (0.50–1.43) | |
| **Place of residence** | | | | | | | | |
| Rural | 53 (64.6) | 29 (35.4) | 1 | | 31 (73.8) | 11 (26.2) | 1 | |
| Urban | 107 (63.7) | 61 (36.3) | 1.04 (0.60–1.81) | | 126 (60.6) | 82 (39.4) | 1.83 (0.87–3.85) | |
| **ART duration** | | | | | | | | |
| < 2 years | 9 (90.0) | 1 (10.0) | 1 | | b | b | | |
| ≥ 2 years | 151 (62.9) | 89 (37.1) | 5.31 (0.66–42.57) | | | | | |

(*Continued*)

**Table 6** (Continued).

| Variable | PLHIV | | | | HIV-Negative | | | |
|---|---|---|---|---|---|---|---|---|
| | Low Physical Activity | | COR (95% CI) | AOR (95% CI) | Low Physical Activity | | COR (95% CI) | AOR (95% CI) |
| | No f (%) | Yes f (%) | | | No f (%) | Yes f (%) | | |
| **Self-rated state of health** | | | | | | | | |
| Good | 137 (66.8) | 68 (33.2) | 1 | 1 | 105 (71.4) | 42 (28.6) | 1 | 1 |
| Fair/poor | 23 (51.1) | 22 (48.9) | 1.93 (1.01–3.70)* | 2.25 (1.13–4.45)* | 52 (50.5) | 51 (49.5) | 2.45 (1.45–4.15)* | 2.19 (1.28–3.76)* |
| **Hypertension** | | | | | | | | |
| No | 90 (65.7) | 47 (34.3) | 1 | | 72 (66.1) | 37 (33.9) | 1 | |
| Yes | 70 (61.9) | 43 (38.1) | 1.18 (0.70–1.98) | | 85 (60.3) | 56 (39.7) | 1.28 (0.76–2.16) | |
| **Currently smoking** | | | | | | | | |
| No | 155 (63.5) | 89 (36.5) | 1 | | 153 (62.4) | 92 (37.6) | 1 | |
| Yes | 5 (83.3) | 1 (16.7) | 0.35 (0.04–3.03) | | 4 (80.0) | 1 (20.0) | 0.42 (0.05–3.78) | |
| Diet | | | | | | | | |
| Healthy | 33 (60.0) | 22 (40.0) | 1 | | 24 (68.6) | 11 (31.4) | 1 | |
| Unhealthy | 127 (65.1) | 68 (34.9) | 0.80 (0.43–1.49) | | 133 (61.9) | 82 (38.1) | 1.35 (0.63–2.89) | |
| **Harmful alcohol use** | | | | | | | | |
| No | 148 (62.4) | 89 (37.6) | 1 | | 155 (63.0) | 91 (37.0) | 1 | |
| Yes | 12 (92.3) | 1 (7.7) | 0.14 (0.02–1.08) | | 2 (50.0) | 2 (50.0) | 1.70 (0.24–12.30) | |
| **Advised on physical activity** | | | | | | | | |
| Yes | 149 (63.4) | 86 (36.6) | 1 | | 149 (63.1) | 87 (36.9) | 1 | |
| No | 11 (73.3) | 4 (26.7) | 0.63 (0.20–2.04) | | 8 (57.1) | 6 (42.9) | 1.28 (0.43–3.82) | |

**Notes**: *Statistically significant, [b]Not applicable to HIV-negative.

## Discussion

Among PLHIV, a shorter duration of ART was associated with higher odds of smoking. This may reflect limited exposure to smoking cessation messages often received during health education sessions, which new enrollees might not have yet accessed. While this finding aligns with existing literature, it suggests that early engagement in smoking reduction interventions is essential for newly diagnosed clients. In the HIV-negative group, rural residence and harmful alcohol use were associated with smoking. This supports findings from sub-Saharan Africa,[46] though contrasts with studies in other low and middle-income settings reporting higher odds among urban dwellers.[47] The disparity may stem from variations in study design and sociocultural contexts. The co-occurrence of smoking and alcohol use observed reinforces the need for integrated interventions, as addressing alcohol misuse could indirectly reduce smoking.[48] The higher smoking rates among rural dwellers may be linked to weaker smoking regulations and easier access to tobacco products, as smoke-free laws and health promotion campaigns are likely to be less prevalent in rural areas. Hence, there is a need for targeted smoking cessation interventions in rural communities.

Harmful alcohol use among PLHIV was predicted by the male gender, while among the HIV-negative individuals, it was associated with smoking. These findings are consistent with previous studies across diverse settings.[25,49–53] The higher risk among men may reflect both biological tolerance to high alcohol levels compared to females and sociocultural norms that promote alcohol use as a masculine behaviour.[54] Alcohol reduction strategies should consider this gendered influence.

While fruit and vegetable intake were not significantly associated with sociodemographic or clinical factors among PLHIV, among the HIV-negative individuals, low income significantly increased the odds of inadequate intake. This aligns with existing evidence linking socioeconomic status to poor dietary habits,[55] particularly in the face of rising food costs. Food security interventions targeting affordability may be essential for improving dietary behaviours.

Self-rated health status emerged as a common predictor of low physical activity in both groups. Participants with fair or poor self-perceived health were less likely to engage in physical activity, likely due to the link between poor perceived

health and negative effects on psychological state.[56] Individuals low on their state of mind may be lacking in motivation and self-efficacy to engage in physical activities. Among PLHIV, females were more likely to be physically inactive, consistent with previous studies.[57,58] This may be a reflection of prior evidence describing low drive, motivation, and self-efficacy as partly responsible for women's inability to engage in physical activity.[59] By contrast, some studies have reported higher physical inactivity among males,[60,61] likely due to differences in contexts and the study tool used.

Consistent with a previous study,[62,63] older age was linked to physical inactivity among the HIV-negative participants, which may reflect the natural decline in physical strength and function with age. Although, higher physical inactivity has been previously reported among younger adults.[64,65] Health promotion programs targeting physical activity among PLHIV should prioritize women and those with self-rated health, while interventions for older adults should consider age-appropriate strategies.

## Limitations of the Study

The reliance on self-reported data for sensitive behaviours like alcohol and tobacco use may have introduced social desirability bias, potentially leading to underreporting. Although interviews were conducted in private settings with trained interviewers using neutral, non-judgmental language to minimize this effect, some level of bias may have persisted.

Additionally, recall bias could have affected responses, as participants were asked to report behaviours over the previous 12 months. While this timeframe was necessary to capture habitual behaviour patterns, it may have led to inaccuracies, especially in estimating the frequency or quantity of behaviour. Despite efforts to mitigate these biases, such as interviewer training and question framing, the findings should be interpreted with these limitations in mind.

## Conclusion and Recommendations

Among PLHIV, predictors of behavioural risk factors included duration of ART use, gender, and self-rated health status. In the HIV-negative group, age, gender, place of residence, income, and self-rated health were significant predictors. A notable overlap between smoking and harmful alcohol use was observed, with each serving as a predictor of the other.

Health promotion strategies targeted at the risk factors should adopt a human-centred design approach, actively involving patients in the planning and evaluation of interventions. This participatory method ensures that interventions align with the real-world experiences, motivations, and constraints of the individuals they aim to serve, thereby increasing effectiveness and sustainability.

## Data Sharing Statement

Data used in this study cannot be made publicly available in this study due to the privacy and confidentiality of the study participants. However, data can be provided on an individual basis upon request through the corresponding author.

## Declaration

This study complies with the Declaration of Helsinki.

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## Disclosure

The authors declare no competing interests in this work.

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