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# Tobacco and alcohol co-use among people with HIV (PWH) in Nairobi, Kenya

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## Abstract

**Introduction:** Although the majority of people living with HIV (PWH) in the world reside in sub-Saharan Africa, little is known about the syndemic of tobacco and alcohol use among PWH in that region. The purpose of this study was to describe tobacco and alcohol co-use behaviors among PWH in Nairobi, Kenya.

**Methods:** Between June and November 2021, 50 PWH with concurrent tobacco and alcohol use in Nairobi were assessed with a structured interview. Women were intentionally oversampled in order to constitute 50% of the group. Participants completed structured interviews administered by trained research assistants using standardized, culturally appropriate, tobacco and alcohol use questionnaires.

**Results:** Fifty PWH completed the study. All identified as African with a mean age of 40.3 years. All participants were engaged in HIV care and were receiving antiretroviral therapy (ART). Mean cigarettes smoked per day was 8.2, and 57% reported moderate/high cigarette dependence. The mean alcohol use disorder identification test (AUDIT) score was 18.6, and 84% reported drinking amounts in the hazardous range. Preferred alcoholic beverages were clear spirits (48%), beer (32%), and *changaa* (12%), a traditional home-brewed liquor made from millet, corn, or sorghum. Cigarette dependence was not significantly associated with higher AUDIT score in any of the two linear regression models that were tested. In Model 1 younger age ($\beta = -0.37$, $p = 0.002$) and higher depression score ($\beta = 0.49$, $p = 0.02$), and in Model 2, younger age ($\beta = -0.31$, $p = 0.01$) and higher anxiety score ($\beta = 1.05$, $p = 0.003$) were significantly associated with higher AUDIT scores.

**Conclusions:** Tobacco and alcohol co-use in PWH in Nairobi, Kenya is common. This syndemic may require culturally appropriate and tailored treatment approaches, especially those targeting younger health strata and those with comorbid mental illness, to improve health outcomes.

## Introduction

The Surgeon General implicated cigarette smoking as a cause of lung cancer in 1964 (Public Health Service, Department of Health, Education, and Welfare, 1964), and the World Health Organization (WHO) classified alcohol as a carcinogen in 1988 (WHO International Agency for Research on Cancer, 1988). A recent detailed analysis of the Global Burden of Disease, Injuries, and Risk Factors dataset demonstrates the importance of tobacco and alcohol use as the first and second leading causes of cancer globally. Tobacco use currently accounts for 36.3% of all cancer deaths among men and 12.3% among women, and alcohol use, the second most important carcinogen in terms of cancer-related mortality, currently accounts for 6.9% of all cancer deaths among men and 2.3% among women (GBD 2019 Cancer Risk Factors Collaborators, 2022; Sarfati &

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Gurney, 2022). Tobacco and alcohol are frequently interrelated, as cigarette smokers, on average, drink more and alcohol drinkers, on average, smoke more than their non-using counterparts (Falk et al., 2006; Verplaetse & McKee, 2017). Tobacco and alcohol co-use exerts synergistic effects on some cancer incidences, especially head and neck (Mello et al., 2019) and esophageal malignancies (Prabhu et al., 2014). Although research on tobacco and alcohol co-use predominantly originates from the United States and western Europe, the problem is global (GBD 2019 Cancer Risk Factors Collaborators, 2022).

At the time of the last WHO global status report on alcohol and health (2018), per capita consumption of alcohol was stable in the African region as compared to a 20.3% decrement in the European region (WHO, 2018). Current drinkers in Africa consumed an average of 20% more grams of alcohol per day than the international average, and the age-standardized alcohol-attributable burden of disease and injury was higher in Africa than in any other region of the world (WHO, 2018).

There are high rates of tobacco use among people living with HIV (PWH) across the world with an especially troubling trajectory in sub-Saharan Africa (WHO, 2021). Sub-Saharan Africa is also home to 67% of the world's PWH (Moyo et al., 2023). Throughout sub-Saharan Africa, PWH, both men and women, smoke cigarettes at higher rates than people without HIV (Murphy et al., 2019). Kenyan PWH smoke at higher rates than PWH in any other East African country: 26% of men and 1% of women (Murphy et al., 2019). Studies conducted within sub-Saharan Africa have found that both tobacco smoking (95% CI [1.6, 4.3]) and alcohol drinking (95% CI[1.9, 4.4]) are associated with loss of clinical care follow-up and non-adherence to antiretroviral therapy (ART; Kebede et al., 2021).

This growing body of evidence attests to the importance of studying tobacco and alcohol co-use in PWH in sub-Saharan Africa, the region with the largest overlap of HIV infection with these substances in the world. With the goal of better understanding the co-use of tobacco and alcohol in this region, in particular the drinking patterns in PWH who smoke, and the level of association of alcohol use with tobacco and nicotine dependence, we collected detailed information on tobacco and alcohol use behaviors in a group of Kenyan PWH in the course of conducting a tobacco use treatment trial, and we report our findings herein.

## Methods

This was a cross-sectional interview study of PWH who both smoked cigarettes and consumed alcoholic beverages in Nairobi, Kenya. Study candidates were referred from selected HIV clinics, as well as methadone treatment clinics, or self-referred via pre-approved flyers posted in waiting rooms at HIV treatment sites throughout Nairobi. A sample size of 50 participants was selected, and all of these individuals completed structured interviews in English (three participants), Swahili (40 participants), or a combination of the two languages (seven participants) to learn about beliefs and practices pertaining to alcohol consumption in PWH who smoked cigarettes in Kenya. Women, who smoke at much lower rates than men in Nairobi (Murphy et al., 2019), were intentionally oversampled in order to constitute 50% of the participant group and allow for meaningful descriptive analyses of both sexes. Participants were screened in clinics on scheduled screening visit days with inclusion/exclusion criteria as listed below. These participants were co-enrolled into an ongoing smoking cessation treatment trial (NCT03342027).

Inclusion criteria: For inclusion in the study, patients were required to be 18 years or older with a chart diagnosis of HIV, self-reported cigarette smoking of at least one puff in the last 7 days, and any reported alcohol use in the last 30 days. Additionally, participants were required to receive care at one of the assigned recruitment sites and to provide informed consent to participate. Exclusion criteria: Potential participants were excluded if study physicians believed they were not medically stable as determined by review of past medical history and current medical status, if they had plans to relocate or travel for more than two consecutive months during the smoking cessation trial, or if their expected survival was less than six months.

Eligible patients were assisted by trained research assistants with consent in writing for participation in either Swahili or English according to the patient's preference.

Table 1 summarizes the tobacco and alcohol use scales that we administered (Abrams & Biener, 1992; Bohn et al., 1995; Fagerstrom & Schneider, 1989; Keyson M, n.d.; Kiluk et al., 2013; Leigh & Stacy, 1993; McKiernan et al., 2011; Saunders et al., 1993). In addition to these, we used individual items from the Centers for Disease Control Question Inventory on Tobacco (Centers for Disease Control and Prevention, 2023) and questions of our own design to collect culturally relevant information from the study sample. The latter questions were reviewed, edited, and approved by native Nairobi residents who were members of the investigative team and included such items as *changaa* and *kumi-kumi* among the choices of alcohol consumed. Most common alcohol used was stratified by first generation (e.g. Smirnoff), second generation (e.g. Kenya Cane), and traditional brew (e.g. Busaa). The Alcohol Use Disorders Identification Test (AUDIT) is a widely endorsed 10-item screening test for alcohol use disorder (AUD; O'Connor et al., 2018), with outcome categories of low risk for AUD (scores = 0–7), medium risk (8–15), high risk (16–19), and addiction likely (20–40). The AUDIT scale has been deployed in Kenyan populations (Luchters et al., 2011), and it has served as an outcome variable in analyses of predictors and correlates of AUD in prior research (Murphy & Garavan, 2011). Other illicit drug use, including marijuana, cocaine, heroin, amphetamines, glue, and prescription drugs, was also assessed, as was methadone treatment status, for both current exposure (i.e. past 30 days) and lifetime exposure. Finally, mental health was addressed with questions pertaining to depression (Center for Epidemiologic Studies Short Depression Scale [CES-D 10]) and anxiety (Generalized Anxiety Disorder 7-item [GAD-7]), both of which have been associated with tobacco and alcohol use behaviors in PWH (Garey et al., 2015; Mdodo et al., 2015; Zyambo et al., 2015). Quantitative data were collected and stored via Research Electronic Data Capture

(REDCap) allowing for encrypted patient information compliant with Health Insurance Portability and Accountability Act of 1996 guidelines. Participants were compensated with 500 Kenyan Shillings to facilitate travel to complete the study visit.

**Table 1**

***Tobacco and Alcohol Use Measures***

| Measure | #Items | Range [Interpretation] | Ref |
|---|---|---|---|
| **Tobacco measures** | | | |
| Fagerstrom test for cigarette dependence | 6 | 0-10 (higher score = greater dependence) | Fagerstrom & Schneider, 1989 |
| Abrams-Biener readiness to quit ladder | 1 | 1-10 (higher score = greater motivation to quit) | Abrams & Beiner, 1992 |
| **Alcohol measures** | | | |
| AUDIT | 10 | 0-40 (higher score = higher risk for alcohol use disorder) | Saunders et al., 1993 |
| Alcohol Outcome Expectancies questionnaire | 34 | 1-6 (Positive subscales: social facilitation/fun/sex/tension reduction. Higher score=greater expectancy. Negative subscales: social/emotional/physical/cognitive performance. Higher score=greater expectancy) | Leigh & Stacy, 1993 |
| Short Inventory of Problems | 15 | Total score 0-45<br>All subscales 0-9<br>(Higher score = more frequent occurrence of problem) | Kiluk et al., 2013 |
| Alcohol Urge Questionnaire | 7 | 7-49 (Higher score = greater urge) | Bohn et al., 1995 |
| Alcohol abstinence self-efficacy | 12 | 1-5 (Total score and subscales: positive affect/negative affect/craving/physical. Higher score = greater self-efficacy) | McKiernan et al., 2011 |
| Drinking-related internal-external locus of control | 25 | Internal 1-42<br>External 1-42<br>Fate 1-21<br>(Higher score=greater estimation of control) | Keyson, n.d. |

Continuous variables were summarized with means and standard deviations. Comparisons of means were accomplished using Student's *t*-test and bivariate correlation of continuous variables was accomplished with Pearson's product moment correlation. In order to evaluate predictors of higher levels of alcohol use and risk for alcohol use disorder, we employed multiple linear regression with AUDIT score as the outcome variable, and all measures having statistically significant associations with AUDIT score on bivariate analyses were included in the model. Statistical analyses were completed using the SAS 9.4M7 software package.

All aspects of the study were approved and overseen by the University of Maryland Institutional Review Board and the Ethics and Research Committee of the Kenyatta National Hospital/University of Nairobi.

## Results

We enrolled 50 participants into this trial of pharmacologic and/or behavioral cessation therapy between June and November 2021. The sociodemographic and clinical characteristics of the cohort and their scores on the various scales relating to cigarette and alcohol use are summarized in Table 2. The mean age of participants was 40.3 ± 10.2 years, 50% were male, and 50% were female. The majority of participants, 84%, did not complete secondary education, 63% worked full-time outside of the home, and 92% reported stable housing, i.e. living in one's own apartment or house as opposed to being hosted temporarily by family or friends or to being undomiciled. Approximately one-third of participants were married. The majority of participants reported HIV exposure and infection from heterosexual contact, and all reported currently taking ART medications. Fifteen of the participants were receiving methadone maintenance therapy.

Participants on average were 20.0 ± 6.8 years old when they first started smoking tobacco cigarettes, and 87.8% of participants reported they were current, everyday smokers. The average number of cigarettes per day was 8.2 ± 6.9. On the Fagerstrom Test for Cigarette Dependence (FTCD; Fagerstrom & Schneider, 1989), 14.9% had low dependence, 27.7% had low-moderate dependence, 53.2% had moderate dependence, and 4.3% had high nicotine dependence. Motivation to quit was high with 67.4% in the preparation stage, 30.6% in the contemplation stage, and 2.0% in the precontemplation stage on the Abrams-Biener Readiness to Quit Ladder (Abrams & Biener, 1992).

Participants on average were 22.2 ± 6.2 years old when they first began to drink alcohol. Most commonly participants reported consumption of first (32%) and second (48%) generation alcohol containing beverages (see Table 2 for definitions of alcohol generation categories), as well as *changaa* (14%), a traditional home-brewed liquor made

from millet, corn, or sorghum. Preferred beverages included clear spirits (48%), beer (32%), and *changaa* (12%). On the AUDIT scale, eight (16%) were at low risk (scores = 0–7), eleven (22%) were at medium risk (8–15), and six (12%) were at high risk (16–19) for alcohol use disorder; and the remaining 25 (50%), the highest score stratum, were classified as "addiction likely" (20–40; WHO, 2001).

**Table 2**

***Sociodemographic, Clinical, and Behavioral Characteristics of the Study Sample***

| Characteristic or Measure | | *n* (%) or Mean±SD |
|---|---|---|
| Age (years) | | 40.3±10.2 |
| Sex | Male | 25 (50%) |
| | Female | 25 (50%) |
| Ethnicity | Kikuyu | 29 (58%) |
| | Kamba | 9 (18%) |
| | Luo | 4 (8%) |
| | Other or multiple[a] | 8 (16%) |
| Religion | Catholic | 25 (50%) |
| | Protestant | 17 (34%) |
| | Muslim or other[b] | 8 (16%) |
| Marital status | Married/living with partner | 15 (30%) |
| | Single | 11 (22%) |
| | Separated or divorced | 20 (40%) |
| | Widowed | 4 (8%) |
| Housing status | Stable | 46 (92%) |
| | Transitional or homeless | 4 (8%) |
| Employment status | Full-time | 14 (30.4%) |
| | Part-time | 29 (63.0%) |
| | Unemployed | 3 (6.5%) |
| Educational attainment | Completed some primary education | 15 (30%) |
| | Completed primary education | 9 (18%) |
| | Completed some secondary education | 15 (30%) |
| | Completed secondary education ± college education | 8 (16%) |
| | No education | 3 (6%) |
| Mode of HIV acquisition | Heterosexual contact | 26 (52%) |
| | Same-sex contact | 4 (8%) |
| | Injection drug use | 9 (18%) |
| | Other/unknown | 11 (22%) |
| Daily cigarette consumption | | 8.2±6.9 |
| Fagerstrom test for cigarette dependence | | 4.5±2.2 |
| Most common type of alcohol consumed | 1st generation (most expensive)[d] | 16 (32%) |
| | 2nd generation (less expensive)[e] | 24 (48%) |
| | *Changaa* | 7 (14%) |
| | Other traditional brews[f] | 3 (6%) |
| Preferred category of alcohol consumed | Clear spirits (e.g. rum, gin, tequila) | 24 (48%) |
| | Beer | 16 (32%) |
| | *Changaa* | 6 (12%) |
| | Whiskey, wine, or champagne | 4 (8%) |
| Most common location of alcohol consumption | Bar or nightclub | 30 (60%) |
| | Home | 10 (20%) |
| | Other[c] | 10 (20%) |
| AUDIT | | 18.6 ± 9.8 |
| Alcohol outcome expectancies (subscales) | Social facilitation | 4.0±1.2 |
| | Improved sexual experience | 3.1±1.5 |
| | Fun | 4.1±1.1 |
| | Tension reduction | 4.1±1.2 |
| Short Inventory of Problems | | 20.7±13.3 |
| Alcohol Urge Questionnaire | | 20.6±12.4 |
| Alcohol abstinence self-efficacy | | 2.7±1.0 |

| Characteristic or Measure | | *n* (%) or Mean±SD |
|---|---|---|
| Drinking-related internal-external locus of control (subscales) | Internal | 23.1±10.4 |
| | External | 28.6±9.2 |
| | Fate | 12.1±4.0 |
| Other substance use | Marijuana/bhang/K2/hashish/THC | |
| | Ever | 30 (60%) |
| | Past 30 days | 17 (34%) |
| | Cocaine[g] | 10 (20%) |
| | Heroin[h] | 13 (26%) |
| | Amphetamines/uppers/ecstasy/miraa/khat | |
| | Ever | 33 (66%) |
| | Past 30 days | 17 (34%) |
| | Sniffed glue | |
| | Ever | 4 (8%) |
| | Past 30 days | 4 (8%) |
| CES-D[i] | | 7.6±6.5 |
| GAD-7[i] | | 3.5±3.7 |

***Notes:***
[a] Includes: Luhya (2), Meru (1), Somali (1), Taita (1), other or multiple (3)
[b] Includes: Muslim (6), other or no religion (2)
[c] Includes: Restaurant (1), work (1), home of friend or relative (1), other (7)
[d] E.g. Amarula, Viberov, Smirnoff, Richot, Tusker, Pilsner, Guinness.
[e] E.g. Senator Keg, Kenya Cane, Iceberg, Konyagi, Marry Cane
[f] E.g. *Pombe za kitamaduni*, *kama*, *busaa*, *muratina*, or other type of alcohol
[g] No participants reported cocaine use within the past 30 days.
[h] One participant reported heroin use within the past 30 days.
[i] CES-D=Center for epidemiologic studies – depression scale; GAD-7=General anxiety disorder – 7 scale.

Bivariate correlations (Pearson's) were completed to evaluate associations of age, nicotine dependence, CES-D and GAD-7 scores, with AUDIT scores. Significant relationships were discovered between age, depression, anxiety, and AUDIT scores in our sample, as listed in Table 3.

**Table 3**

***Bivariate Correlation and Multiple Linear Regressions evaluating Relationships between Variables with AUDIT Score***

| Variable | Pearson's r | *p* | | |
|---|---|---|---|---|
| Age (years) | -0.49 | <0.001 | | |
| Cigarette dependence | 0.27 | 0.058 | | |
| CES-D | 0.48 | <0.001 | | |
| GAD-7 | 0.55 | <0.001 | | |
| **Multiple Linear Regression: Model 1** | | | | |
| **Covariate** | **β[a] [95% C.I.]** | ***p*** | **$R^2$** | |
| Age (years) | -0.37 [-0.61, -0.14] | 0.002 | 0.24 | |
| Cigarette dependence[b] | 0.58 [-0.51, 1.67] | 0.29 | 0.07 | 0.38 |
| CES-D | 0.49 [0.10, 0.88] | 0.02 | 0.23 | |
| **Multiple Linear Regression: Model 2** | | | | |
| Age (years) | -0.31 [-0.55, -0.07] | 0.01 | 0.24 | |
| Cigarette dependence[b] | 0.77 [-0.24, 1.78] | 0.13 | 0.07 | 0.42 |
| GAD-7 | 1.05 [0.37, 1.73] | 0.003 | 0.31 | |

***Notes:***
AUDIT=Alcohol use disorders identification test; C.I.=confidence intervals.
Model 1 includes age, cigarette dependence and CES-D score as covariates. Model 2 includes age, nicotine dependence, and GAD-7 score as covariates.
[a] The regression coefficient is calculated for a one-unit change for each covariate.
[b] Nicotine dependence is derived from the Fagerstrom test for cigarette dependence (Fagerstrom & Schneider, 1989).

In the multivariate analysis, depression and anxiety scores demonstrated a high degree of collinearity, and thus separate models were created including depression score (and excluding anxiety score) and including anxiety score (and

excluding depression score). In the adjusted model that included depression score, only age (β = -0.37, 95% CI [-0.61, 0.14], $p$ = 0.002) and depression (β = 0.49, 95% CI[-0.10, 0.88], $p$ = 0.02) retained their significant associations with AUDIT score (Table 3). In the adjusted model that included anxiety score, only age (β = -0.31, 95% CI[-0.55, 0.07], $p$ = 0.01) and anxiety (β = 1.05, 95% CI[0.37, 1.73], $p$ = 0.003) retained their significant positive associations with AUDIT score (Table 3).

## Discussion

The literature exploring and describing strategies to treat tobacco use and alcohol use as individual behaviors is voluminous and spans many decades. However, although the interrelationships among various substance uses are extensive, profoundly affecting the outcomes of treatment efforts, the literature on the management of substance co-use, including tobacco and alcohol co-use, is sparse. Although the interactions between these two substances have been recognized since (at least) the early 19th century (Fowler, 1842), modern research sheds light on the physiological and sociological interactions between tobacco and alcohol use and acknowledges the obstacle that addiction to one substance presents when attempting to reduce or quit the other one (Frie et al., 2022).

In the present study we describe a sample of PWH from Nairobi, who were both current cigarette smokers and alcohol drinkers. Participants smoked an average of eight cigarettes per day with moderate nicotine dependence, and motivation to quit was high, albeit in a sample of individuals expressing interest in a smoking cessation trial. Our survey of alcohol use patterns revealed that 84% of participants scored in the hazardous drinking range on the AUDIT scale. Generally, participants preferred clear spirits and beer, and second generation (less expensive) beverages were consumed most often.

Younger age, anxiety, and depression were all found to be predictive of higher AUDIT scores. These results are consistent with earlier literature describing research conducted in other regions including one study that correlated moderate/severe anxiety with higher AUDIT scores and older age with lower AUDIT scores and alcohol severity (Silverberg et al., 2018). Another study found similar evidence of higher AUDIT scores associated with anxiety, depression, and other drug use (Khan et al., 2020). Efforts to treat tobacco use in PWH have met with limited success to date, and it is possible that failing to account for co-use of other substances, such as alcohol, and the behavioral and psychological correlates of such co-use may be contributing to this ongoing public health challenge.

Our study has certain limitations deserving of mention. The sample size was comparatively small, and this could have limited our ability to define certain summary variables with precision or to detect differences between subgroups, in particular the association between nicotine dependence and AUDIT score. The paper and pencil interview format conducted in the presence of research staff could have led to social desirability bias in responses. Since participants were being screened for inclusion in a smoking cessation trial, the sample was preselected for interest in quitting. The characteristics of unmotivated tobacco and alcohol co-users may differ from our sample. Finally, we enrolled in one large urban center in sub-Saharan Africa, and our findings may not be generalizable to other cities, countries, or regions.

The enormous human tragedy caused by the HIV epidemic continues in Sub-Saharan Africa, and the gains achieved by expanded access to antiretroviral therapy are being partially offset by various substance uses, especially tobacco and alcohol. Tobacco and alcohol co-use is common and is associated with younger age and with higher levels of depression and anxiety. Effective treatments for tobacco use and for alcohol use disorder should pay heed to the characteristics of co-users, consider the inclusion of mood management strategies for heavier drinkers, and craft their content to target the appropriate age strata. Public health priorities in much of the world have begun to focus on the burden of non-communicable diseases among PWH, and our research supports the inclusion and implementation of tobacco, alcohol, and substance use treatment together with mental health screening and management as vital components of comprehensive HIV care.

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