**Alcohol misuse and illicit drug use among occupational groups at high risk of HIV in sub-Saharan Africa: A systematic review**

**Abstract**

Key occupational groups in sub-Saharan Africa (SSA) are at increased risk of HIV, and may be at increased risk of substance use. In January 2018, we systematically searched for studies reporting prevalence of, and risk factors for alcohol misuse or illicit drug use and their association with HIV incidence or prevalence among fisherfolk, uniformed personnel, truckers, miners, motorcycle taxi riders and sex workers in SSA. Seventy-one studies published between 1983 and 2017 were included: 35 reported on alcohol misuse (19 using AUDIT, 5 using CAGE) and 44 on illicit drug use (eight reported both). Median prevalence of alcohol misuse based on AUDIT/CAGE was 32.8% (IQR 20.8%-48.5%). Prevalence of illicit drug use ranged from 0.1% (95% CI: 0.0%-0.2%) for injection drug use to 97.1% (95% CI: 85.1%-99.9%) for khat (among uniformed personnel). Among papers examining associations between substance use and HIV incidence (n=3) or prevalence (n=14), nine papers (53%) reported a significant positive association (2 with incidence, 7 with prevalence). Harm reduction interventions in occupational settings are urgently required to prevent new HIV infections.

**Key words**

Alcohol misuse, illicit drug use, HIV, key populations, sub-Saharan Africa

**INTRODUCTION**

HIV remains a major public health problem worldwide, despite substantial gains in sub-Saharan Africa (SSA), including a marked decline in incidence in Eastern and Southern Africa since 2010 (1, 2). Concurrent with the HIV epidemic, the SSA region also has the highest estimates of heavy episodic drinking per drinker globally, estimated at 25% (3). The prevalence of alcohol use disorders (defined by an Alcohol Use Disorders Identification Test (AUDIT) score ≥8) in the general adult (≥15 years) population is estimated at 4% globally and 3% in Africa, with men disproportionately affected (3). Our understanding of substance use in SSA remains limited, although there is some evidence that injection drug use may be increasing (4-6). Recent research from SSA illustrates the potential for rapid expansion of the HIV epidemic through unsafe injection drug use (7-9).

There is extensive evidence that alcohol misuse and illicit drug use are associated with higher HIV risk at societal, community and individual levels, stemming mainly from relationships between substance use and unprotected sex, and sexual and gender-based violence (10, 11). Alcohol misuse and illicit drug use impact clinical manifestation and management of HIV and may result in decreased retention in care (12), increased disease progression (13, 14), reduced antiretroviral treatment (ART) efficacy (11, 15), poor ART adherence (16) and mortality (11, 17, 18). However, recent findings show that problem drinking has no short term direct biological impact on CD4+ cell count, in ART-naïve Ugandans (19).

Key occupational groups, specifically sex workers (20-22), fishing communities (22, 23), uniformed personnel (24), miners (25, 26), motorcycle taxi riders (27), and truckers (28) have been identified as being at increased risk of HIV and other sexually transmitted infections (STIs), and may be at increased risk of alcohol misuse and illicit drug use. Proven HIV prevention strategies or harm reduction services are often not accessible for these groups. Occupational groups at high risk of HIV constitute important sub-populations because they tend to have extensive sexual networks, bridging into the general population (29, 30). Achieving the United Nations programme on HIV/AIDS 95-95-95 targets (31) will require prioritisation of harm reduction alongside other HIV prevention interventions, particularly among key population groups.

We hypothesise that occupation-related factors common to these high-risk groups might shape patterns of alcohol misuse and illicit drug use and other high-risk behaviour. Our conceptual framework (Figure 1) builds upon Scribner and colleagues’ ecological model (10). At societal and community levels, substance use risk factors may include belonging to a community in which alcohol misuse and illicit drug use are normalised, and weak substance use control policies. At family and individual levels, potential risk factors include the increased functionality required for prolonged working hours and consequent perceived need for a performance enhancer; and real and perceived workplace hazards or vulnerabilities such as the likelihood of violence or death (32). High mobility common to these populations could lead to prolonged separation from family and increased exposure to a flourishing sex industry, around the occupational group, increasing risk for substance use and for HIV infection.

Limited attention has been paid to the burden of alcohol misuse and illicit drug use in low and middle-income countries. A descriptive systematic review of African studies broadly examined the association between alcohol use and HIV infection in the general population and found that use of alcohol in sexual contexts, and the frequency and quantity of alcohol use were all positively associated with HIV prevalence (33). Another systematic review by Fisher et al. demonstrated that alcohol use had a crude dose–response relationship with HIV prevalence: this pooled analysis of 11 studies found that, compared with non-drinkers, the adjusted odds ratio (aOR) for association with HIV was 1.57 (95% confidence interval (CI): 1.33-1.86) among non-problem alcohol drinkers and 2.04 (95% CI: 1.61-2.58) among problem drinkers (34). However, neither systematic review examined the burden of alcohol misuse or illicit drug use among high-risk occupational groups. Two recent reviews―one addressing alcohol use among young people in East Africa (35) and another examining HIV and related risk behaviour among fishermen in Africa and Asia (36) were limited in scope regarding participant age and illicit drug use, and focus on fishermen, respectively. A better understanding of the patterns of alcohol misuse and illicit drug use in these high-risk groups is needed.

The objectives of this review are to (i) determine the prevalence of, and risk factors for, alcohol misuse and illicit drug use in select high-risk occupational groups, namely fishing communities, sex workers, miners, truckers, motorcycle taxi riders and uniformed personnel, in sub-Saharan Africa, and (ii) determine the association between HIV and alcohol misuse and illicit drug use in these groups. The review will help to inform development of HIV prevention and substance use reduction policies that leverage occupational field elements to address the unique needs of ‘high-risk’ occupational groups.

**METHODS**

We followed the Cochrane guidelines (37) to conduct the review and the PRISMA (38) reporting guidelines. The review protocol was registered ([http://www.crd.york.ac.uk/PROSPERO CRD42016053495](http://www.crd.york.ac.uk/PROSPERO%20CRD42016053495)).

**Search criteria**

We searched the following databases for publications prior to 16th January 2018: Medline, Embase, Global health, Web of Science, PsycINFO. No language restrictions were applied. The full database-specific search strategy is presented in the supplemental material, tables 1 and 2.

We searched additional sources including international organisation reports, country-level reports, and international conference abstracts including Conference on Retroviruses and Opportunistic infections (CROI), STD Prevention Conference, International AIDS Society Conference, International Conference on AIDS and STDs in Africa, Kettil Bruun Society, and the global state of harm reduction reports. We hand-searched reference lists of included papers and systematic reviews. We sent data requests to authors of studies for which relevant information might have been collected but not reported in their publications.

**Screening and selection**

The search results were exported to Endnote reference management software (Thomson Reuters, version X7.5) where duplicates were removed. Titles and abstracts were screened by two independent authors (MK and EW) to identify studies meeting inclusion criteria. We sought help to translate papers written in French and German.

We included epidemiological studies among high-risk occupational groups in sub-Saharan Africa that estimated at least one of the following: prevalence or frequency of alcohol misuse or illicit drug use; risk factors for alcohol misuse or illicit drug use; association of alcohol misuse or illicit drug use with HIV. There were no restrictions on participants’ age, study sample size or year of publication. Alcohol misuse was defined as any reported measure that used specific patterns and amounts of reported alcohol use, and/or standard scoring systems to classify participants.

We excluded articles that did not clearly identify the population, did not provide separate results for high-risk occupational groups, or that reported data from the same study participants as another included paper (with equivalent or less information included). We excluded studies where participants were selected for inclusion in the study on the basis of our outcomes of interest for this review i.e. studies where all participants were alcohol users, or drug users.

**Data extraction**

Two authors (MK and EW) independently examined full-text articles of potentially relevant studies to assess if they met the inclusion criteria. Both authors independently extracted data from each article and independently performed quality assessment on each article. We used a data extraction form to collect the following information: (i) article publication characteristics; (ii) country; (iii) study population; (iv) study design; (v) sample size; (vi) participant socio-demographic characteristics; (vii) measures for alcohol misuse; (viii) measures for illicit drug use; (ix) alcohol misuse prevalence; (x) prevalence of illicit drug use including drug types, quantity, frequency; (xi) risk factors for alcohol misuse; (xii) risk factors for illicit drug use; and (xiii) the association of alcohol misuse or illicit drug use, with HIV.

Discrepancies were discussed and consensus reached. Where confidence intervals (CIs) for prevalence estimates were not reported, we calculated them based on the figures provided (where possible) assuming simple random sampling. Inter-rater reliability between the two reviewers was assessed using the Kappa statistic. Differences of opinion were resolved and agreement reached.

## Data analysis

We used forest plots to display prevalence and 95% confidence interval estimates for alcohol misuse and illicit drug use. We calculated the median and interquartile range of prevalence estimates for alcohol misuse, by population group. We repeated these calculations, including only those studies that used validated and standardised measures, specifically AUDIT≥7 in women or ≥8 in men (39, 40), AUDIT-C (first three AUDIT questions inquiring quantity-frequency)≥4 (41) or CAGE (Cut down, Annoyed, Guilt, Eye-opener) tool≥2 (42). We also conducted meta-analysis of studies reporting alcohol misuse prevalence by standardised measures, assuming a random effects model, and report the pooled prevalence estimate with 95% CI, and heterogeneity I-square statistic. We did not conduct formal meta-analysis for alcohol misuse assessed by non-standardised measures, or for illicit drug use owing to the diversity in study methodologies, measures of alcohol misuse and illicit drug use, type of drugs reported, reporting timeframe for drug use, and source populations.

**Quality assessment**

We assessed the quality of included papers, based on the following characteristics: probability sampling, response rate, use of validated or standardised measures for alcohol misuse or illicit drug use, detailed reporting on illicit drug use types, clarity on the timeframe for alcohol misuse or illicit drug use, HIV measure used, and use of adjusted analysis when assessing associations.

## RESULTS

We identified a total of 5,692 papers from five databases (Figure 2). After removing duplicates, we screened a total of 3,155 unique titles and abstracts to identify potentially eligible studies. Of these, 228 papers were included in the full-text review. Inter-rater reliability for the full-text review indicated substantial agreement (kappa = 0.74).

After full-text review, 71 papers were included in the analysis. The primary reasons for exclusion were that papers did not report either alcohol misuse or illicit drug use (n=60) or did not include key occupational groups (n=36) (Figure 2).

A summary of the studies included, together with their key characteristics, is shown in supplementary table 3. The 71 eligible studies were conducted in 23 countries, including multiple studies from Kenya (n=15), Uganda (n=13), Nigeria (n=9), Ethiopia (n=9), South Africa (n=4), Mozambique (n=2), Angola (n=2) and Ghana (n=2). Sample sizes ranged from a minimum of 16 among truckers to a maximum of 26,912 among miners.

The majority of studies were conducted among sex workers (n=42) and uniformed personnel (n=14, one of which also included data from truckers). Others were conducted among fishing communities (n=6), truckers (n=6), miners (n=3) and motorcycle taxi drivers (n=1). Most of the studies were cross-sectional (n=62), with 8 cohort studies and one case-control study.

Seventeen studies recruited men only (predominantly studies among truckers, uniformed personnel and miners), while 36 studies recruited women only (all among sex workers). Around half (n=36) of studies were published since 2014. Thirty-five papers reported data on alcohol misuse or problem drinking, and 44 reported data on illicit drug use (eight papers reported data on both). Full extracted data on alcohol misuse and illicit drug use are shown in Tables 1 and 2, respectively.

**Alcohol misuse**

The 35 papers reporting data on alcohol misuse were distributed as follows: fishing communities (n=4), uniformed personnel (n=8), truckers (n=2), sex workers (n=17), miners (n=3) and motorcycle taxi riders (n=1) (Table 1). Of the 34 papers estimating alcohol misuse prevalence, 17 screened for alcohol misuse using AUDIT; however, cut-offs for alcohol misuse varied between AUDIT ≥8 (n=13), AUDIT ≥7 (n=3, all among women), AUDIT ≥20 (n=1). Two papers used the shortened AUDIT-C with a cut-off of ≥4. Five papers used the CAGE tool, with four of these using a cut-off of ≥2 while one used a cut-off of ≥1. One study reported both AUDIT and CAGE (Table 2).

Other measures used included the CIDI F10.2 (43) (n=1), Rapid Alcohol Problems Screen 4-Quantity-Frequency (RAPS4-QF) for alcohol dependence (40) (n=1), DSM IV alcohol abuse and dependence (44) (n=1), ICD-10 criteria for alcohol dependence, and psychosocial problems in alcohol dependence (42) (n=1), binge drinking 5+ drinks on one occasion (n=5), weekly restrictions in units/week (n=2), alcohol blood levels by alcometer AEDI (n=1), and Glutamic Oxaloacetic transaminase (GOT) reference interval≤45 U/L or Glutamic Pyruvic Transaminase (GPT) reference interval 8-40 IU/L (n=1) (Table 1).

Figure 3 displays study-specific prevalence and 95% CIs for those studies using CAGE≥2, AUDIT-C≥4, AUDIT≥7 or AUDIT≥8, by occupation group, and demonstrates the marked heterogeneity in prevalence estimates, both overall and within occupational groups. The median prevalence of alcohol misuse based on these standardised measures was 32.8% (interquartile range (IQR) 20.8%-48.5%). From meta-analysis, the overall pooled estimate of alcohol misuse prevalence based on these standardised measures was 35.7% (95% confidence interval: 24.2%, 47.2%), I-square 99.7%. Prevalence of alcohol misuse tended to be highest in sex workers (median prevalence 45.3%, IQR 25.1%-52.0%, 12 studies), and lowest in motorcycle taxi riders population (prevalence 6.2%, one study). Overall the median prevalence of alcohol misuse, regardless of the measure used, was 31.1% (IQR 19.3%-45.6%).

Seven papers reported on associations between alcohol misuse and HIV incidence (n=2) or HIV prevalence (n=5) (Table 1, Supplementary table 3). Of these, five reported a statistically significant positive association (OR/RR>1 with P-value<0.05), and two showed no evidence of association. Five papers reported significant positive associations between alcohol misuse and other factors, including age, number of traumatic events, involvement in combat, recruiting clients from bars, clubs or several sites; reporting rape as the first sex act; drug use; and intimate partner violence, among others.

**Illicit drug use**

Forty-four papers reported data on illicit drug use among fishing communities (n=3), uniformed personnel (n=6; one paper also reported data from truckers), truckers (n=5), and sex workers (n=31) (Table 2, Figure 4). Reported study sizes ranged from 16 to 2638 participants. Forty-two papers estimated prevalence, while two reported only associations with drug use. All prevalence estimates were based on self-report, and did not use validated measures except for one study that used the ASSIST tool (45). The reporting time-period for drug use was variable, ranging from current daily use to ever use. Time-periods for drug use were not reported or were unclear in 21 (50%) papers.

A quarter of studies giving data on illicit drug use did not present substance-specific estimates, instead reporting data only on “any drug use”. Marijuana, khat and injection drugs were the substances most commonly reported. Prevalence of any drug use was generally highest among uniformed personnel (mainly khat and marijuana), followed by sex workers. The highest prevalence of any illicit drug use reported was 97% for khat use among uniformed personnel in Uganda (46), with the highest single-study estimated prevalence of injection drug use (ever) reported as 40% among sex workers in Mauritius (47). Since the drug types and reporting timeframes were extremely variable, we did not combine estimates into a single summary measure.

Fourteen studies examined correlates of drug use (Table 2). Ten reported associations between illicit drug use and HIV, of which five reported no evidence of association, four reported a positive association i.e. OR/RR>1 with p-value<0.05 (three with marijuana use, one with IDU), and one reported an inverse association (with marijuana use) (Table 2). Other factors identified as being significantly positively associated with illicit drug use included being single; younger age at first sex and larger number of clients (for sex workers); low educational attainment; and post-traumatic stress disorder (Table 2).

**Quality assessment**

All included studies were administered face-to-face, except for one study that was administered using audio computer assisted technology. Table 3 summarises quality assessment metrics for included studies. Included papers were often of poor quality, with common methodological issues including small sample sizes and use of non-probability sampling in over half of studies (n=45, 63%). Only 27 (38%) papers reported a response rate, although this was over 90% for two thirds of these papers. Most studies reporting alcohol misuse used questionnaire tools with a small number (17%) using an objective measurement (AUDIT, CAGE). As noted above, 98% of studies reporting illicit drug use did not use validated tools, and 48% did not give a clear timeframe. Twenty-five papers reported on any association between either alcohol misuse or illicit drug use and HIV, or risk factors for alcohol misuse or illicit drug use, of which, 52% adjusted fully for confounders.

## DISCUSSION

Data from 71 studies, conducted in 23 countries in sub-Saharan Africa between 1983 and 2017, show that despite substantial growth in research examining substance use among occupational groups at high-risk of HIV in sub-Saharan Africa, the body of evidence remains limited. We found substantial variability in prevalence and patterns of alcohol misuse and illicit drug use, across and within occupational groups. The pooled estimate of alcohol misuse prevalence assessed using standardised tools was 35.7% (95% CI: 24.2%, 47.2%). Substance use was positively associated with HIV in the majority of studies that examined this relationship.

In studies using validated measures, the prevalence of alcohol misuse ranged from 6.2% (motorcycle taxi riders) to 89.0% (sex workers), and illicit drug use prevalence ranged from 0.1% (sex workers) to 97.1% (uniformed personnel). The heterogeneity in findings likely reflects regional and population level differences in patterns of substance use, which may be influenced by local contextual factors such as government policies, availability of substances and social norms.

Our random effects meta-analysis of alcohol misuse including only studies that used standardised measures, estimated a heterogeneity I-square statistic close to 100%. This level of heterogeneity limits the inference one can make from the pooled estimate. We did not conduct a meta-analysis or report a pooled prevalence estimate for illicit drug use given the heterogeneity of methods, tools, the drug types assessed for, and time periods over which drug use was reported—ranging from self-reported use in previous days to ever use. This level of heterogeneity makes it challenging to draw definitive conclusions.

Prevalence of reported alcohol misuse was, on average, highest among sex workers, and lowest among motorcycle taxi riders, while prevalence of any drug use was highest among uniformed personnel, followed by sex workers, suggesting that these occupational settings may present particularly vulnerable risk environments for substance use. These findings emphasise a need to integrate substance use prevention and treatment into health care services offered to these key population groups.

Our pooled estimate of alcohol misuse prevalence in these key occupational groups is substantially higher than the general African adult population estimate of 4%, although participants included in reviewed studies were often younger than the general adult population. Sexual bridging between certain occupations, such as truckers, uniformed personnel, female sex workers and the general population is common (48), and may occur because of shared risk environments such as bars and brothels (49, 50) or because of migration that might shape patterns of substance use, and other high-risk behaviour (51).

The high pooled prevalence estimate (with wide confidence interval) may be partially driven by some outlier estimates of prevalence, for example one study reported a particularly high alcohol misuse prevalence (89%) among sex workers (52). While it is possible that this is an accurate estimate for this sub-population in this setting, it was not clear how screening for the study was conducted; it might have been biased towards women at risk of problem drinking, who were the trial’s target population.

The prevalence of reported injection drug use was generally much lower than for oral illicit drug use, but was not negligible. Unsafe injecting practises remain an important route for HIV and Hepatitis C transmission, further justifying the need for harm reduction services among high HIV risk occupation groups.

The variability in measuring tools mirrors the findings of a systematic review of alcohol misuse in young people in Africa (35). Use of standardised and validated tools and or biomarkers is critical for assessing substance use, for monitoring and evaluation of harm reduction interventions, and for facilitating comparison of prevalence across populations. Future research should consider using Phosphatidyl ethanol (PEth), a highly specific and reasonably sensitive biomarker for heavy alcohol consumption within the past 2-3 weeks. (53, 54). PEth levels vary depending on the amount and number of days or duration of alcohol consumption (55, 56). Screening for illicit drug use could benefit from use of drug-screening kits to assess current or recent drug use.

The review highlights the lack of literature about correlates of substance use among occupational groups at high risk of HIV in sub-Saharan Africa. Around a quarter of studies reviewed examined associations between substance use and HIV, and among these positive associations were frequently seen, particularly for alcohol misuse and marijuana use. Only 9 papers reported on risk factors and the range of factors considered or reported was quite limited and mostly inconsistent across papers. A consistently positive association with alcohol misuse and illicit drug use was seen for intimate partner violence, supporting results reported elsewhere in general population settings (57). Our review included papers from the 1980s onwards, a period during which the HIV epidemic and HIV treatment options have constantly evolved, and this may have impacted our findings on association with HIV incidence or prevalence. In the future, any association between HIV and substance use may be mitigated by the advent of increased HIV testing and treatment coverage, although to date coverage in most SSA countries remains suboptimal.

Strengths of our review include its wide-ranging and comprehensive literature search, using data from a broad range of high-risk population groups in sub-Saharan Africa; who have important social interactions as far as HIV-related risky behaviour is concerned. One limitation is that our search deliberately excluded terms for certain vulnerable groups such as facility workers, patrons, bar workers and, women or men engaging in transactional sex (apart from sex work) because they are not recognised as key population groups. Thus, our review may have missed some studies on populations with similar characteristics to those included. The different tools or cut-offs might have affected the generalisability of our findings.

Ideally, the data presented for purposes of comparison would have included the general population of the countries where the studies on key populations were conducted, dis-aggregated by gender; however, most countries only had a small number of papers included and often, general population data were not found. Nevertheless, our review is helpful for understanding differences in dynamics between various settings, and highlights substantial gaps in evidence.

**CONCLUSIONS**

The studies reviewed demonstrate a high prevalence of alcohol misuse and illicit drug in high HIV risk occupational groups in sub-Saharan Africa. There was some evidence for positive associations between substance use and HIV infection.

**Recommendations**

Future epidemiological and ethnographic research should (i) explore substance use in these groups, using standardised and validated tools such as AUDIT, and biomarkers such as PEth and drug testing kits; (ii) explore occupational related factors, including factors common to different occupational groups, and how they influence substance use. This work should be done not only within specific high-risk occupational groups but also for general population comparison groups, to inform implementation of interventions that are responsive to the common occupation-related risk factors.

As the bulk of existing research has focused on prevalence, future work should examine correlates of substance use more broadly. Illicit drug use measures should be specific to individual drug types rather than unspecified drug use. Longitudinal studies or repeat cross-sectional studies could be beneficial, and could examine population level patterns and trends of substance use including different drug types, and routes of drug administration, over time.

**Authors’ contribution**

All authors have made substantial contributions to the work reported in the manuscript. MOK devised the project, MOK, JAS, AK, HAW, SC, and EW contributed to the design of the research, MOK and EW to the data extraction and analysis of the results and to the writing of the manuscript. JAS, AK, HAW, and SC discussed the results and contributed to the manuscript.

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**Figures and tables**

**Figure 1 Conceptual framework:** The role of occupation-related factors in alcohol and illicit drugs in HIV/AIDS among high-risk groups.



**Figure 2** Data extraction flow chart

\*One of the papers appears twice, containing data from both uniformed personnel and truckers (Ihunwo), hence the total adds up to 72 but there were 71 papers.

† We sourced a thesis on fishing communities from an author (Sileo, 2017).

**Figure 3** Prevalence of alcohol misuse among high-risk occupational groups, among studies using validated measures (AUDIT (18 studies), CAGE (5 studies))



**Figure 4** Prevalence of self-reported illicit drug use among high-risk occupational groups



**Table 1:** Alcohol misuse prevalence, risk factors and association with HIV incidence or prevalence, by occupational group, among studies included in the systematic review

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author, year of publication | Country | Study year  | Study design | Sex and age distribution | Sample size | Alcohol misuse | Association between HIV and substance useOther associations | HIV test | HIV prevalence (95% CI) |
| Measure | Prevalence (95% CI) |
| Fishing communities  |
| Kebede, 2005 (58)  |  Ethiopia | 1998 | Cross-sectional | 45% female; 70% <40 years  | 1714 | Alcohol dependence(CIDI F10.2)  | 1.5% (0.9%-2.1%) |   |  |  |
| Sileo, 2015 (59) | Uganda | Not given | Cross-sectional | 44% male; age distribution not given | 300  | AUDIT | Not given | Positive association between higher AUDIT scores and HIV (OR 1.11; 95%CI: 1.04-1.18) | Self-report | 23% positive,10% unknown |
| Tumwesigye, 2012 (60) |  Uganda | Not given | Cross-sectional | 64% male; 91% <40 years  | 475 | AUDIT ≥8 | 32.2% (28.0%-36.6%) |   |   |   |
| Sileo, 2017(45) | Uganda | 2016-2017 | Cross-sectional | 100% male; mean age 37 (SD 8.6) years | 200 | AUDIT ≥8 | 30.7% (25.5%-36.2%) |  |  |  |
| Uniformed personnel |
| Bing, 2008 (61) | Angola | 2003-2004 | Cross-sectional | All male; mean age 31.5 years  | 1710 | AUDIT ≥8 | 42.4% (39.9%-44.9%) |  |  |  |
| Cheng, 2012 (62) | Angola | 2008 | Cross-sectional | All male; mean age 28.5 (SD 5.4) years | 568 | AUDIT ≥8; binge drinking in last year | AUDIT ≥8: 35% (31.1%-39.1%) Binge drinking: 26.2% (22.7%-30.0%) | AUDIT≥8 positively associated with age, number of traumatic events, poor mental health, increased socialising with family and friends, and inversely associated with frequency of attending religious services.  | - | - |
| Courtney, 2017 (63) | South Sudan | 2010, 2012 | Cross-sectional | 96.7% male; mean age 34.8 years | 1063 | RAPS4-QF | 37.4% (30.9%-44.4%) | - | Rapid test | 5.0% (3.6%-6.9%) |
| Djibo, 2013 (64) |  Sierra Leona | 2013 | Cross-sectional | 88.9% male; mean age 38.5 years  | 1157 | AUDIT ≥8 | 15.3% (13.3%-17.5%) | No association between AUDIT≥8 and HIV (crude OR 1.33 ; 95% CI 0.52-3.43)) | Rapid test | 3.3% (2.3%-4.3%)  |
| Harbertson, 2011 (65) | Rwanda | 2008-2010 | Cross-sectional | All male; mean age 30.9 (SD 5.6) years | 1307 | AUDIT ≥8  | 10.2% (8.5%-11.9%) | HIV positively associated with AUDIT ≥8 (p = 0.02)  | Rapid test | 2.6 % (1.8%–3.7%) |
| Ijomanta, 2016 (66) | Nigeria | Not given | Cross-sectional | 90.1% male; median age 32 years | 223 | DSM IV alcohol abuse and dependence | Lifetime abuse: 21.1% (15.7%-26.4%) Lifetime dependence: 4.0% (1.9%-7.5%) Lifetime ICD-10 harmful use: 16.6% (11.7%-21.5%) Alcohol dependence: 2.7% (1.0%-5.8%)  | Predictors of lifetime alcohol abuse were Hausa/Fulani ethnicity (OR=2.22, 95% CI: 1.03-6.99) and involvement in combat (OR=2.04, 95% CI 1.12-6.81) | - | - |
| Ovuga, 2006 (67) | Uganda | 2002 | Cross-sectional | 95.0% male; mean age 34.3 (SD 5.9) years | 104 | ICD-10 criteria | Alcohol use disorder: 19.2% (11.7%-26.8%)Alcohol use psychosocial problems: 26.0% (17.5%-34.4%) | - | - | - |
| Tran, 2013 (68) | Botswana | Not given | Cross-sectional | All male; mean age 25.1 (SD 2.4) years | 211 | AUDIT ≥8 | 58.9% (52.1%-65.4%) |   |   |   |
| Truckers |
| Bello, 2010 (69) | Nigeria | 2009 | Cross-sectional | All male; mean age 38.5 (SD 9.5) years; 63.3% long-distance | 360  | AUDIT ≥8 | 23.3% (19.0%-27.7%) |  |  |  |
| Botao, 2016 (70) | Mozambique | 2012 | Cross-sectional | All male; 45.3% (aged 31-40) years | 322 | AUDIT-C ≥4 | 33.3% (28.2%-38.5%) |  | Rapid test + confirmatory test | 15.4% (11.4%-19.4%) |
| Motorcycle taxi riders |
| Tumwesigye, 2016 (71) | Uganda | 2014 | Matched case control | All male; 56% aged 25–34 | 578  | AUDIT≥8 | Controls: 6.2% (3.7%-9.7%) | - | - | - |
| Sex workers |   |   |   |   |   |   |   |   |   |   |
| Atalay, 2006 (72)  | Ethiopia | 2001-2002 | Cross-sectional | All female; aged 15-49 years | 2487 | CAGE≥2 | 31.4% (29.6%-33.4%) |  |  |  |
| Augusto, 2016 (73) | Mozambique | 2011-2012 | Cross-sectional | All female; aged ≥15 years | 1241  | AUDIT-C ≥4 | Maputo: 44.5% (38.0%–51.9%)Beira: 50.0% (44.0%–56.0%)Nampula: 41.3% (34.1%–48.1%) | AUDIT-C ≥4 associated with HIV infection only in Nampula (OR 4.6, 95% CI: 2.7-8.0) | Rapid test + confirmatory testing | Maputo 31.2%, Beira 23.6%, Nampula 17.8 %  |
| Vandepitte, 2011 (29) | Uganda | 2008-2009 | Cross-sectional (cohort baseline) | All female; mean (SD) age 26 (5.7) years | 1027 | CAGE≥2 | 55.7% (52.7%-58.7%) | CAGE≥2 associated with HIV (adjusted OR 1.64, 95% CI: 1.13-2.38, p=0.005).From Weiss, CAGE ≥2 associated with being divorced/separated/widowed, less education,recruiting clients at bars/clubs, and forced sex at first sexual experience. | Rapid test + confirmatory testing | 37% (34%-40%) |
| Weiss, 2016 (20) | Uganda | 2008-2013 | Cohort\* | All female, mean (SD) age 25 (5.7) years | 721  | AUDIT≥8 | 46.0% (42.4%-49.8%)AUDIT 8-15: 27% (23.8%-30.4%) AUDIT 16-19: 8% (6.2%-10.3%)AUDIT ≥20: 11% (8.8%-13.5%)  | Factors associated withAUDIT ≥8: younger age, meeting clients in bars/clubs, number ofclients, using drugs and HSV-2 infection.  | Rapid test + confirmatory testing | Prevalence 37% at enrolment; HIV incidence 2.77/100 pyr |
| Chersich, 2014 (28) | Kenya | 2006-2007 | Cohort | Not given | 400 | AUDIT≥8 | 26.8% (22.5%-31.5%)AUDIT 8-15: 17.3%; (13.5%-21.0%)AUDIT ≥16: 9.5% (6.6%-12.4%)\* RDS sampling  | AUDIT 8-15 positively associated with HIV acquisition (p=0.04) | Rapid test |  |
| Chersich, 2007 (74) | Kenya. | 2005-2006 | Cross-sectional | All female; mean (SD) age 30.4 (8.4) years | 719 | Binge drinking (5+ drinks in one occasion) | 33.0% (29.5%-36.6%) | HIV prevalence was higher among women having ever drunk (39.9%) than lifetime abstainers (23.2%; P<0.001), but was notassociated with drinking patterns. | Rapid test | 37.3% in bingedrinkers; 41.8% in non-binge drinkers; 23.2%in lifetime-alcohol abstainers |
| Lancaster, 2016}(75) | Malawi | Not given | Cross-sectional | All female; median age 26 (IQR 23-30) years.  | 138 | AUDIT≥7 | AUDIT≥7: 55.1% (46.4%-63.5%)AUDIT 7-15: 28.3% (20.9%-36.5%)AUDIT 16-19: 12.3% (7.3%-19.0%)AUDIT ≥20: 14.5% (9.1%-21.5%) |  | Rapid test | 69% |
| L’Engle, 2014 (52) | Kenya |  Not given | Cross-sectional ¥  | All female; no information on age |  818 | AUDIT≥7 | 89.0% (87.0%-90.4%) |   |   |   |
| Lemma, 2015 (76) | Ethiopia | 2010 | Cross-sectional  | All female; mean (SD) age 21.9 (4.1) years | 474 | CAGE≥1 | 24.3% (20.4%-28.1%) |   |   |   |
| Luchters, 2011 (77) | Kenya | 2008 | Cross-sectional | All male; mean (SD) age 24.6 (5.2) years | 442 | AUDIT≥8; binge drinking | AUDIT≥8: 49.3% (44.6%-54.1%)AUDIT 8-15: 24.0% (20.0%-28.0%);AUDIT 16-19: 10.6% (7.8%-13.5%);AUDIT 20-40: 14.7% (11.4%-18.0%)Binge drinking: 38.9% (34.3%-43.6%) | - | - | - |
| Magni, 2015 (78) | South Africa | 2012 | Cross-sectional | All female; 16-55 years | 225 | CAGE≥2, binge drinking (≥4 drinks on one occasion) | CAGE ≥2: 9.6% (8.7%-10.6%)Binge drinking: 14.9% (13.7%-16.1%) | - | - | - |
| Muraguri, 2015(79) | Kenya | 2010 | Cross-sectional | All male; 34.4% 18-24 years | 273 | AUDIT≥20 | 22.7% (16.2%-30.3%) |  |  |  |
| Mooney, 2013 (80) | Ethiopia | 2009-2010 | Cross-sectional | All female; 46.3% 20-25 years | 311 | CAGE≥2 | 51.0% (45.2%-56.4%) | - | - | - |
| Nouaman, 2015(81) | D’Ivoire | 2013 | Cross-sectional | All female; median age 29 (IQR 23-36) years | 249 | AUDIT≥8 | 19.7% (14.7%-24.6%) |  | Routine testing | 33.7% (27.8%-39.6%) |
| Odukoya, 2013 (82) | Nigeria | 2011 | Cross-sectional | All female; mean (SD) age 28.1 (6.8) years | 323 | Weekly restrictions for women (14 pints/week) | 89% (84.9%-93.2%) | - |  | - |
| Richter, 2013 (83) | South Africa | 2010 | Cross-sectional | 91.9% female, 4.8% male, 3.3% transgender; mean (SD) age 29.7 (6.5) | 1799  | Binge drinking daily, weekly | Any binge drinking (daily or weekly): 45.9% (43.5%-48.3%)Daily binge drinking 19.6% (17.8%-21.6%)Weekly binge drinking 26.3% (24.2%-28.4%).  |  |  | - |
| Wilson, 2016 (84) | Kenya | 2012-2013 | Cross-sectional €  | All female; median age 39 (IQR 33-44) years | 356 | AUDIT≥7 | 19.9% (15.9%-24.4%) |  | Not clear | All participants living with HIV |
| Miners |   |   |   |   |   |   |   |   |   |   |
| Buchanan, 1988 (85) | Zambia | 1983-1984 | Cross-sectional | All male; no age information given | 95 | Alcohol blood level, measured by alcolmeter AEDI ≥ 17.8 mmol/l | 9.5% (4.4%-17.2%) | - | - | - |
| Clift, 2003 (86) | Ghana | 1986, 1988 | Cross-sectional | All male; mean age 33.9 years | 117 | GOT, GPT | GOT: 15% (8.7%-22.2%)GPT: 17% (12.9%-28.0%) |   |   |   |
| Lewis, 2013 (87) | South Africa | 2006 - 2009 | Cross-sectional | 95% male; 64% aged 35-54 years | 26912 | > 28 units/week for men; >21 units/week for women | 1.6% (1.4%-1.7%)  |   |   |   |
| Abbreviations: CI: confidence interval; RAPS4-QF: Rapid Alcohol Problems Screen 4-Quantity-Frequency for alcohol dependence; AUDIT (Alcohol Use Disorder Identification Test); CAGE (Screening test for problem drinking); GOT (Glutamic Oxaloacetic transaminase); GPT (Glutamic Pyruvic Transaminase) ; RDS (Respondent driven sampling); CIDI (Composite International Diagnostic Interview) : IQR (Interquartile range) : SD (Standard Deviation)\*Overlap with Vandepitte et al, 2011 |

**Table 2:** illicit drug use prevalence, risk factors and association with HIV incidence or prevalence, among studies included in the systematic review

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author, year of publication | Country | Year of study | Study design | Age and sex distribution | Sample size | Drug use prevalence (%), 95% CIBy self-report | Associations of alcohol misuse or illicit drug use with HIV and other risk factors | HIV test | HIV prevalence (95% CI) |
| Fishing communities |  |  |  |  |  |  |  |  |
| Kiwanuka, 2013 (88) | Uganda  | 2011-2013 | Cross-sectional  | 51% male, mean (SD) age 29.7 (7.6) years | 2191 | Marijuana: 13.8% (12.3-15.2%)  | Marijuana use positively associated with HIV (PPR 1.40 (11, 1.76) | Rapid test + ELISA confirmation | 26.7% |
| Seeley, 2012(89) | Uganda | 2009 | Cohort | 54.4% male, median age 28 years (IQR 23–34) | 919 | - | Drug use positively associated with HIV acquisition (aHR 2.9 (1.0-8.0), p=0.045  | Rapid test + confirmatory testing  | Incidence 4.9 (95% CI 3.8–6.3) per 100 pyr |
| Sileo, 2017(45) | Uganda | 2016-2017 | Cross-sectional | 100% male, mean age 37 ( SD 8.6) years | 300 | Cannabis: 0.7% (0.1%-2.4%); Kuber: 2.3% (0.9%-4.7%); Sisha: 1.7% (0.5%-3.8%); Khat: 1.0% (0.2%-2.9%) |  |  |  |
| Uniformed personnel |
| Essien, 2007 (90) | Nigeria | 2003 - 2004 | Cross-sectional | 87% male, 55% 18-29 years  | 2,213 | Marijuana, last 6 weeks: 23.6% (21.8%-25.3%) |   |   |   |
| Ihunwo, 2004 (46) | Uganda  | Not given | Cross-sectional | 71% male, 52% aged 21-25\*  | 35  | Khat, ever: 97.1% (85.1%-99.9%) | - | - | - |
| Mion, 1998 (91) | Djibouti | Not given | Cross-sectional | 99% male, mean (SD) age 31 (1) years  | 100 | Khat: 84.0% (75.3%-90.6%) |   |  |  |
| Odenwald, 2009 (92) | Somalia | 2003 | Cross-sectional | 89% male, mean (SD) age 37.3 (2.1) years | 8124 | Khat, last week: 36.4%(19.3%–57.7%) |   |  |  |
| Argaw, 2012 (93) | Ethiopia | 2010 | Cross-sectional (mixed methods) | 91.3% male, median (SD) age 29 (7.5) years  | 135 | Khat: 66.7% (59.3%-74.0%) | - | - | - |
| Okulate, 2008 (94) | Nigeria | 1990-1994 | Cross-sectional | All male; 46.6% <30 years of age | 1131 | Cannabis use: no data on prevalence | PTSD was associated with cannabis use Chi Square 60.9, p<0.00 |  |  |
| Truckers |  |  |  |  |  |  |  |  |  |
| Adejugbagbe, 2015 (95) | Nigeria | 2013 | Cross-sectional | All male, median age 42 years (range 22-73) | 592 | Kola nut: 38.5% (34.7%-42.5%)  | - | - | - |
| Adjei, 2016 (96) | Ghana | 2013 | Cross-sectional | All male, mean (SD) age 40.6 (11.6) years  | 106 | Any illicit drug use:5.7% (0.2%-11.9%) |   | Rapid test + confirmatory testing | 0.9% (0.02%-5.1%) |
| Botao, 2016 (73) | Mozambique | 2012 | Cross-sectional | All male, 45.3% 31–40 years | 322 | Illicit drug (marijuana, cocaine and heroin) use, last year: 1.9% (0.4%–3.3%) | - | Rapid test + confirmatory testing | 15.4% (11.4%–19.4%) |
| Ihunwo, 2004 (46) | Uganda  | Not given | Cross-sectional | 71% male, 52% aged 21-25\* | 16  | Khat, ever: 68.8% (41.3%-89.0%) | - | - | - |
| Okpataku, 2016 (97) | Nigeria | 2012 | Cross-sectional | All male, mean (SD) age 43.4 (10.2) years | 274 | Cannabis: 9.4% (6.0%-13.0%)Opioids 4.3% (2.3%-7.5%)Anxiolytics 2.1% (0.8%-4.7%)Kola nuts 50.0% (44.1%-55.9%)Solvents 1.1% (0.2%-3.2%)Cocaine 0.3% (0.01%-2.0%) | Cannabis use predictors: not having a spouse, aged < 45 years;  |  | - |
| Sex workers |   |   |   |   |   |   |   |   |   |
| Alemayehu, 2015 (98) | Ethiopia  | 2013 | Cross-sectional | All female, mean (SD) age 24 (4.3) years  | 250 | Khat: 45.6% (39.4%-51.8%)Drug use: 32% (26.6%-38.2%) | - | - | - |
| Atalay, 2006 (72) | Ethiopia | 2001-2002 | Cross-sectional | All female, 15-49 years | 2487 | Khat : 49.3% (47.2%-51.4%)Any substances (including Khat): 58.6% (56.5%-60.6%) | - | - |   |
| Chersich, 2014 | Kenya | 2006-2007 | Cohort | All female, mean (SD) age 25.1 (5.2) years | 400 | Cannabis, last week: 7.5% (5.1%-10.6%)Khat, last week: 18.5% (14.9%-22.7%) |  |  |  |
| Cheuk, 2016 (99) | Kenya | Not given | Cross-sectional | All female, aged 14-24 years | 408 | Injection drug use: 1.5% (0.5%-3.2%) |  |  |  |
| Decker, 2016 (100) | Cameroon | Not given | Cross-sectional | All female, 39.6% 24-30 years | 1817 | Injection drug use ever1.5% (0.9%-2.1%) | - | Self-report | 5.1% (4.0%-6.2%) |
| Hladik, 2017 (101) | Uganda | 2008-2009 | Cross-sectional | All female, median age 26 years | 942 (RDS) | Any drug use: 23.4% (20.8%-26.3%) Injection drug use: 4.5% (3.3%-6.1%) | No association with HIV prevalence for any drug use (OR1.05 (0.82–1.34)) or IDU (OR 1.24 (0.80–1.91)) | Rapid test | 33.0% (29.7%–36.6%) |
| Kerrigan, 2017 (102) | Tanzania |  Not given | Cross-sectional (baseline of cohort) | All female, median (SD) age 27 (6.7) years | 496 | Any illicit drug use: 6.9% (4.8%-9.4%)Illicit drug use, past 6 months: 3.0% (1.7%-4.9%) |  | Rapid test + confirmatory testing | 40.9% (36.6%-45.4%) |
| Niama, 2017 (103) | Congo | 2011-2012 | Cross-sectional | All female, mean (SD) age 28.3 (9.1) years | 805 | Any drug use: 15.2% (12.7%-17.8%)Injection drug use: 3.4% (2.2%-4.8%) | No association with HIV prevalence for any drug use OR 1.1 (0.5, 2.8) or IDU OR 0.5 (0.1, 3.5) | Rapid test + confirmatory testing  | 7.5% |
| Vandepitte, 2011 (29) | Uganda | 2008-2009 | Cross-sectional  | All female, mean (SD) age 26 (5.7) years | 1027 | Marijuana and/or khat, ever: 8.2% (6.0%-9.2%)Injected heroin, ever: 0.2% (0.02%-0.7%)  |  | Rapid test + confirmatory testing  | 37% (34%-40%) |
| Bukenya, 2013 (104) | Uganda | 2008-2009 | Cross-sectional  | All female, median age 26 (IQR 22-30) years | 905 | Overall any use 21.2% (18.6%-23.9%) |  - |  - |  - |
| Francis, 2016 (105) | Uganda | 2008-2011 | Cohort - GHWP | All female, median age (baseline) 26 years | 1027 | Overall 23% illicit drug use in last 3 months‡ |  - |  - | - |
| Bugssa, 2015 (106) | Ethiopia | 2013 | Cross-sectional | All female, mean age 24 (SD 5.7) years | 319 | Any drug use: 16.6% (12.5%-20.0%) | No association between HIV association and drug use, OR 0.8 (0.2, 2.5) | Rapid test | 11.9% |
| Fawole, 2014 (107) | Nigeria | 2009 | Cross-sectional | All female, mean age 27.4 ( SD 5.7) years | 305 | cigarette or Indian hemp, before sex: 56.4% (53.3%-64.6%) | - | - | - |
| Fonck, 2000 (108) | Kenya | 1998 | Cross-sectional (RCT baseline ) | All female, mean age 32 (range 18-57) years | 318 | Intravenous drug use: 3.0% (1.5%-5.7%) | Intravenous drug use not associated with HIV | Rapid test + confirmatory testing  | 27% |
| Gallo, 2011 (109) | Kenya | 2004-2005 | Cohort | All female, median age 30 years (range 18-55) | 140 | Bhang/cannabis during sex: 9.2% (5.03%-15.4%) |  |   |  |
| Johnston, 2013 (47) | Mauritius | 2010 | Cross-sectional | All female, median (range) age 31 (16-56) years | 299 | Injection drug use, ever: 40% (29.6%-45.8%)  | IDUs (ever ) more likely to be HIV positive: adjusted OR 5.3 (2.2-12.3) | Rapid test + confirmatory testing  |   |
| Kayembe, 2008 (110) | DRC | 2005-2006 | Cross-sectional | All female, 76% aged between 20-44 years | 2638 | Marijuana, ever: 22.2% (22.6%-23.8%)Cocaine, ever: 2.5% (1.9%-3.1%) |  - |  - |  - |
| Lancaster, 2016 (111) | Malawi | 2014 | Cross-sectional | All female, median age 26 years (IQR 23–30). Data on drug use for HIV+ only. | 200 | Cannabis: 20.8% (13.2%-30.3%) | - | Rapid test | 69% |
| Longo, 2017 (112) | Central African Republic | 2013 | Cross-sectional  | Al female, median age 21 years (range 14–36 years) | 112 | Cannabis, every day: 8.9% (4.4%-15.8%)Glue, every day: 9.8% (5.0%-16.8%)  |  | Rapid test |  |
| McKinnon, 2014 (113) |  Kenya |  Not given | Prospective cohort | All male, median age 27 years (IQR 24-31) | 507 | Marijuana current use 11.8% (9.0%-14.6%) | Marijuana use associated with reduced HIV prevalence at enrolment (OR=0.40 (95% CI: 0.18, 0.90), p=0.027); not associated with HIV acquisition | Not clear |  - |
| Micheni, 2015 (114) | Kenya | 2005-2014 | cohort | All female, median age 26 years | 367 | 0.05% (0.0%-0.2%) |  - |  - |  - |
| Cheuk, 2016 (115) | Kenya |  | Cross-sectional | All female, 14-24 years | 408 | Injection drug use 1.5% (0.3%-4.9%) |  |  |  |
| Muraguri, 2015 (79) | Kenya | 2010 | Cross-sectional | Male, 34.4% 18-24 years | 273 (RDS) | Illicit drug use, past 12 months: 77.5% (68.5%-85.0%) |  - |  - |  - |
| Nouaman, 2015 (81) | Cote D'ivore | 2013 | Cross-sectional | All female, median age 29 years (IQR 23–36) | 249 | Marijuana, past 12 months: 2.4% (0.9%-5.2%) | - | Routine testing | 33.7% (27.8% – 39.6%) |
| Okafor, 2017 (116) | Nigeria | 2010 | Cross-sectional | All female, aged 15-24 years | 1796 | Injection drug use: 7.8% (6.50%-9.1%) |  |  |  |
| Peltzer, 2004 (117) | South Africa | 2003-2004 | Cross-sectional | All female, mean (SD) age 26.6 (5.5) years  | 70 | Cannabis, past 12 months: 10% (4.1%-19.5%)Injected drugs, past 12 months: 2.9% (0.3%-9.9%) | - | - | - |
| Rishan, 2015 (118) | Mekelle | 2014 | Cross-sectional | all female, mean age 22.6 years (SD 4.98) | 346 | Drug use, last 2 years 23.7% (19.2%-28.2%) |  |  - |  - |
| Tegang, 2010 (119) | Kenya | 2007 | Cross-sectional | All female, median age 25 years (IQR 21-29) | 297 | Khat, ever use: 71% (65.9%-76.2%), Marijuana, ever use: 34% (28.6%-39.4%)Heroin, cocaine, glue or petrol: 6% (3.3%-8.8%). | Marijuana positively associated with age ( p<0.01, OR=2.10 (1.28, 3.45). Khat users more likely to have younger age at first paid sex. Coke/heroin/glue users more likely to have 2+ sex partners in last working day | - | - |
| Van der Elst, 2009 (120) | Kenya | 2008 | Cross-sectional | 65% male. Male median age 27 (IQR 23-43), female median age 28 years (24-32) | 398  | WOMEN: Marijuana, daily: 12.3% (6.8%-17.7%)IV drugs, past 3 months 4.4% (1.6%-9.2%) MEN: Marijuana, daily: 23.2% (18.0%-28.3%)IV drugs in past 3 months 10.8% (7.0%-14.6%) | - | - | - |
| Vandenhoudt, 2013 (121) | Kenya | 2008 | Cross-sectional | All female, median age 26 years (IQR 20–30) | 481 | IDU ever use 7.3% (5.0%-9.6%) | No association with HIV prevalence: OR 1.1 (0.5-2.3), p=0.78 | Confirmatory test | 56.5% (52%-61.6) |
| Wilson, 2014 (122) | Kenya | 2006-2011 | Cross-sectional  | All female, median age 29 years (IQR 25-35) | 474 | Marijuana: 3.4% (1.9-5.4%) Cocaine: 0.3% (0.05-1.5%)  |  - | Rapid and confirmatory test | 29.3% (26.3%-33.6%) |
| Tadesse, 2016 (123) | Ethiopia | 2015 | Cross-sectional | All female, mean age 23.4 years (SD 6.4) | 380 | Any substance use: 58.2% (53.0%-63.2%)Khat: 51.8% (46.7-57.0%)Shisha: 25.8% (21.5%-30.5%) | Substance use among female sex workers was significantlyassociated with marital status, educational status, monthly income, andrisky sexual behaviour |  |  |

\*Includes students as well.

‡ We did not estimate 95% CI assuming simple random sampling because this is repeated visit data.

**Table 3. Quality assessment of included papers**

|  |  |  |
| --- | --- | --- |
| **Quality measure** | **Category** | **N (%)** |
| Probability sample | Yes | 26 (37%) |
|  | No | 45 (63%) |
| Response rate reported | Yes | 27 (38%)1 |
|  | No | 44 (62%) |
| Alcohol misuse measure2 | Standardised questionnaire tool | 29 (83%) |
|  | Objective measure | 6 (17%) |
| Alcohol misuse timeframe2 | Described | 30 (86%) |
|  | Not described | 5 (14%) |
| Illicit drug use measure3 | Self-report | 43 (98%) |
|  | Objective measure | 1 (2%) |
| Illicit drug use reporting3 | Individual drugs reported | 29 (66%) |
|  | Some individual and some grouped drugs reported | 4 (9%) |
|  | Drugs grouped (no individual drug information given) | 11 (25%) |
| Illicit drug use timeframe3 | Described | 23 (52%) |
|  | Not described or unclear | 21 (48%) |
| HIV measure4 | Objective | 17 (94%) |
|  | Self-report | 1 (6%) |
| Adjustment for confounders5 | Fully adjusted | 13 (48%) |
|  | Partially adjusted | 3 (11%) |
|  | Not adjusted or unclear | 11 (41%) |

1Response rate>90% for 19 (70%) studies where response rate was reported; 235 studies reported alcohol misuse; 344 studies reported illicit drug use; 418 studies reported HIV; 527 studies reported associations with HIV or with risk factors

**Supplementary material**

**Supplementary table 1: Search terms and synonyms for Medline, Embase, Global health, PsycINFO databases**

|  |  |  |
| --- | --- | --- |
| Search number | Search topics  | Search terms and synonyms |
| Combined search |  | (1 OR 2) AND (3 OR 4 OR 5 OR 6 OR 7 OR 8) AND 9 |
| 1 | Alcohol | ExP alcohol drinking/**OR**((ethyl alcohol OR alcohol\* OR ethanol OR beer or wine OR lager OR spirit\* OR drink) adj3 (consum\* OR unit\* OR purchas\* or use\* or misuse or dependency or intake or binge or disorder) OR drink\* rate\* OR drunk\* OR alcohol dependency OR alcohol problems OR alcohol related harm OR drinking problems OR problem drinking OR alcohol liver disease OR alcohol-related liver disease OR alcohol syndrome OR (substance ADJ1 use\*))  |
| 2 | Illicit drug use | (illicit ADJ1 drug ADJ1 use\*) OR (drug ADJ1 use\*) OR (intravenous ADJ1 drug ADJ1 use\*) OR (injection ADJ1 drug ADJ1 use\*) OR (injection drug OR drug injecting OR opiods OR opiates OR marijuana OR khat OR qat OR heroin OR crystal methamphetamine\* OR amphetamine\* OR prescription drug\* OR cannabis OR cocaine OR cannabinoids OR bath salts OR ecstasy OR MDMA OR ketamine OR hallucinogens OR inhalants OR psychostimulants OR psychoactive substances) |
| 3 | Fishing communities | (fish\* OR fishing communities OR landing sites OR islands OR fisher-folk OR fisher folk OR seamen OR boatmen OR seafarers OR artisanal fisheries OR lake OR delta OR river OR ocean OR great lakes region)  |
| 4 | Uniformed personnel | (military OR military personnel OR military population OR enlisted military personnel OR military veterans OR soldier OR uniformed personnel OR army OR armed services OR armed forces OR armed forces soldier\* OR air force OR National Guard OR active duty OR navy OR naval personnel OR marine OR reservist OR reserves OR troop\* OR squad OR legion or troupe defence OR combatants OR police OR corps OR defen#e OR security OR security personnel OR service men OR service personnel) |
| 5 | Truckers | (trucker\* OR truck drivers OR long distance drivers OR "long distance truck drivers” OR “highway drivers" OR lorry OR lorry driver OR commercial vehicles OR large good vehicles OR large vehicles OR heavy vehicles OR long vehicles OR trucking industry OR haul transport) |
| 6 | Sex workers | (sex work\* OR sex worker OR sell sex OR prostitute\* OR commercial sex OR commercial sex work\* transactional sex OR sex trade OR female sex work\* OR whore\* OR street girls OR sex trade OR male clients of female sex worker\* OR clients of female sex worker\*) |
| 7 | Miners | (miners OR mine workers OR mineworkers OR gold mine\* OR coal mine\* OR mining OR mining industry mining sector OR migrant miners) |
| 8 | Motor cycle riders | (motorcycle ride\* OR cyclists OR motor bike OR motorcycle taxi\* OR bicycle taxi\* OR bike taxi OR taxi bike OR motorbike taxi\* OR cycle taxi\* OR motorcycle taxi drivers OR okada OR zemidjan OR alalok OR kabu kabu OR boda-boda OR boda boda OR bajaj OR achaba OR going OR inaga OR [Oleyia](https://en.wikipedia.org/w/index.php?title=Ol%C3%A9yia&action=edit&redlink=1) OR [Phen-Phen](https://en.wikipedia.org/wiki/Phen-Phen) OR moto-taxi or Moto) |
| 9 | Sub-Saharan Africa | (sub-Saharan Africa OR "sub Saharan Africa" OR Africa OR African Union OR East\* Africa OR West\* Africa OR central Africa OR South\* Africa OR Benin OR Angola OR Cabo Verde OR Cape Verde OR "Central African Republic" OR Chad OR Comoros OR Botswana OR Burkina Faso OR Cameroon OR Congo OR "Cote D’ivoire" OR Brazzaville OR "Democratic Republic Congo" OR Congo republic OR "DRC Kinshasa" OR Zaire OR Ethiopia OR Ghana OR Guinea OR Equatorial Guinea OR Guinea-Bissau OR Ivory Coast OR Gabon OR Gambia OR the Gambia OR Liberia OR Kenya OR Lesotho OR Madagascar OR Malawi OR Eriteria OR Mauritius OR Mali OR Burundi OR Somalia OR South Sudan OR Sudan OR Mozambique OR Zimbabwe OR Namibia OR Niger OR Nigeria OR Rwanda OR Senegal OR Sierra Leone OR Swaziland OR Tanzania OR Togo OR Uganda OR Zambia OR Zimbabwe OR Nyanza OR Nyanza province OR Kisumu OR Turkana OR Mauritania OR "Sao Tome and Principe" OR Seychelles) |

**Supplementary table 2: Search terms and synonyms for Web of science database**

|  |  |  |
| --- | --- | --- |
| Search number | Search topics  | Search terms and synonyms |
| Combined search |  | (1 OR 2) AND (2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8) AND 9  |
| 1 | Alcohol | TS=((ethyl alcohol OR alcohol\* OR ethanol OR beer or wine OR lager OR spirit\* OR drink) adj3 (consum\* OR unit\* OR purchas\* or use\* or misuse or dependency or intake or binge or disorder) OR drink\* rate\* OR drunk\* OR alcohol dependency OR alcohol problems OR alcohol related harm OR drinking problems OR problem drinking OR alcohol liver disease OR alcohol-related liver disease OR alcohol syndrome OR (substance ADJ1 use\*))  |
| 2 | Illicit drug use | TS=((illicit ADJ1 drug ADJ1 use\*) OR (drug ADJ1 use\*) OR (intravenous ADJ1 drug ADJ1 use\*) OR (injection ADJ1 drug ADJ1 use\*) OR (injection drug OR drug injecting OR opiods OR opiates OR marijuana OR khat OR qat OR heroin OR crystal methamphetamine\* OR amphetamine\* OR prescription drug\* OR cannabis OR cocaine OR cannabinoids OR bath salts OR ecstasy OR MDMA OR ketamine OR hallucinogens OR inhalants OR psychostimulants OR psychoactive substances)) |
| 3 | Fishing communities | TS=(fish\* OR fishing communities OR landing sites OR islands OR fisher-folk OR fisher folk OR seamen OR boatmen OR seafarers OR artisanal fisheries OR lake OR delta OR river OR ocean OR great lakes region)  |
| 4 | Uniformed personnel | TS=(military OR military personnel OR military population OR enlisted military personnel OR military veterans OR soldier OR uniformed personnel OR army OR armed services OR armed forces OR armed forces soldier\* OR air force OR National Guard OR active duty OR navy OR naval personnel OR marine OR reservist OR reserves OR troop\* OR squad OR legion or troupe defence OR combatants OR police OR corps OR defen$e OR security OR security personnel OR service men OR service personnel) |
| 5 | Truckers | TS=(trucker\* OR truck drivers OR long distance drivers OR "long distance truck drivers” OR “highway drivers" OR lorry OR lorry driver OR commercial vehicles OR large good vehicles OR large vehicles OR heavy vehicles OR long vehicles OR trucking industry OR haul transport) |
| 6 | Sex workers | TS=(sex work\* OR sex worker OR sell sex OR prostitute\* OR commercial sex OR commercial sex work\* transactional sex OR sex trade OR female sex work\* OR whore\* OR street girls OR sex trade OR male clients of female sex worker\* OR clients of female sex worker\*) |
| 7 | Miners | TS=(miners OR mine workers OR mineworkers OR gold mine\* OR coal mine\* OR mining OR mining industry mining sector OR migrant miners) |
| 8 | Motor cycle riders | TS=(motorcycle ride\* OR cyclists OR motor bike OR motorcycle taxi\* OR bicycle taxi\* OR bike taxi OR taxi bike OR motorbike taxi\* OR cycle taxi\* OR motorcycle taxi drivers OR okada OR zemidjan OR alalok OR kabu kabu OR boda-boda OR boda boda OR bajaj OR achaba OR going OR inaga OR [Oléyia](https://en.wikipedia.org/w/index.php?title=Ol%C3%A9yia&action=edit&redlink=1) OR [Phen-Phen](https://en.wikipedia.org/wiki/Phen-Phen) OR moto-taxi or Moto) |
| 9 | Sub-Saharan Africa | TS=(sub-Saharan Africa OR "sub Saharan Africa" OR Africa OR African Union OR East\* Africa OR West\* Africa OR central Africa OR South\* Africa OR Benin OR Angola OR Cabo Verde OR Cape Verde OR "Central African Republic" OR Chad OR Comoros OR Botswana OR Burkina Faso OR Cameroon OR Congo OR "Cote D’ivoire" OR Brazzaville OR "Democratic Republic Congo" OR Congo republic OR "DRC Kinshasa" OR Zaire OR Ethiopia OR Ghana OR Guinea OR Equatorial Guinea OR Guinea-Bissau OR Ivory Coast OR Gabon OR Gambia OR the Gambia OR Liberia OR Kenya OR Lesotho OR Madagascar OR Malawi OR Eriteria OR Mauritius OR Mali OR Burundi OR Somalia OR South Sudan OR Sudan OR Mozambique OR Zimbabwe OR Namibia OR Niger OR Nigeria OR Rwanda OR Senegal OR Sierra Leone OR Swaziland OR Tanzania OR Togo OR Uganda OR Zambia OR Zimbabwe OR Nyanza OR Nyanza province OR Kisumu OR Turkana OR Mauritania OR "Sao Tome and Principe" OR Seychelles) |

**Supplementary table 3:** Summary of papers reporting alcohol misuse, illicit drug use and associated risk factors respectively, by population group

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author, year** | **Country** | **Study year** | **Study design** | **Gender** | **Alcohol misuse prevalence**  | **Association between alcohol misuse and HIV** | **Risk factors for alcohol misuse** | **Illicit drug use prevalence**  | **Association between illicit drug use and HIV** | **Risk factors for illicit drug use** |
| **Fishing communities** |  |  |  |  |  |  |  |  |  |  |
| Kebede, 2005 | Ethiopia | 1998 | Cross-sectional | Mixed | Yes, CIDI |   |   |   |   |   |
| Kiwanuka, 2013 | Uganda | 2011-2013 | Cohort(cohort baseline) | Mixed |   |   |   | Yes | Yes |   |
| Seeley, 2012 | Uganda | 2009 | Cohort | Mixed |   |   |   |  | Yes |   |
| Sileo, 2015 | Uganda | Not given | Cross-sectional | Mixed |   | Yes, using AUDIT |   |   |   |   |
| Sileo, 2017 | Uganda | 2016-2017 | Cross-sectional | Male | Yes, AUDIT |  |  | Yes |  |  |
| Tumwesigye, 2012 | Uganda | Not given | Cross-sectional | Mixed | Yes, AUDIT |   |   |   |   |   |
| **Miners** |  |  |  |  |  |  |  |  |  |  |
| Buchanan, 1988 | Zambia | 1983-1984 | Cross-sectional | Male | Yes, alcohol blood level |   |   |   |   |   |
| Gunga, 1991 | Ghana | 1986, 1988 | Cross-sectional | Male | Yes, GOT and GPT |   |   |   |   |   |
| Lewis, 2013 | South Africa | 2006-2009 | Cross-sectional | Mixed | Yes, units per week |   |   |   |   |   |
| **Motorcycle taxi riders** |  |  |  |  |  |  |  |  |  |  |
| Tumwesigye, 2016 | Uganda | 2014 | Matched case control | Male | Yes, AUDIT |   |   |   |   |   |
| **Sex workers** |  |  |  |  |  |  |  |  |  |  |
| Alemayehu, 2015 | Ethiopia | 2013 | Cross-sectional | Female |   |   |   | Yes |   |  |
| Atalay, 2006 | Ethiopia | 2001-2002 | Cross-sectional | Female | Yes, CAGE |   | Yes | Yes |   |  |
| Augusto, 2016 | Mozambique | 2011-2012 | Cross-sectional | Female | Yes, AUDIT-C | Yes |   |   |   |   |
| Buggsa, 2015 | Ethiopia | 2013 | Cross-sectional | Female |   |   |   | Yes | Yes |   |
| Bukenya, 2013 | Uganda | 2008-2009 | Cross-sectional | Female |   |   |   | Yes |   |  |
| Chersich, 2007 | Kenya. | 2005-2006 | Cross-sectional, non-probabilistic sampling | Female | Yes, binge drinking | Yes | Yes |   |   |   |
| Chersich, 2014 | Kenya | 2006-2007 | Cohort | Mixed | Yes, AUDIT | Yes |  | Yes |   |   |
| Cheuk, 2016 | Kenya | Not given | Cross-sectional | Female |   |   |   | Yes |   |   |
| Decker, 2016 | Cameroon | Not given | Cross-sectional | Female |   |   |   | Yes |   |   |
| Fawole, 2014 | Nigeria | 2009 | Cross-sectional | Female |   |   |   | Yes |   |   |
| Fonck, 2000 | Kenya | 1998 | Cross-sectional | Female |   |   |   | Yes | Yes |   |
| Francis, 2016 | Uganda | 2008-2011 | Cohort | Female |   |   |   | Yes |   |  |
| Gallo, 2011 | Kenya | 2004-2005 | Cohort | Female |   |   |   | Yes |   |  |
| Hladik, 2017 | Uganda | 2008-2009 | Cross-sectional | Female |   |   |   | Yes | Yes |   |
| Johnston, 2013 | Mauritius | 2010 | Cross-sectional | Female |   |   |   | Yes | Yes |   |
| Kayembe, 2008 | DRC | 2005-2006 | Cross-sectional | Female |   |   |   | Yes |   |   |
| Kerrigan, 2017 | Tanzania | Not given | Cross-sectional | Female |   |   |   | Yes |   |   |
| Lancaster, 2016 | Malawi | Not clear | Cross-sectional | Female | Yes, AUDIT |   | Yes | Yes |   |  |
| Lemma Derseh, 2015 | Ethiopia | 2010 | Cross-sectional (single time point in cohort)) | Female | Yes, CAGE |   |   |   |   |   |
| L'Engle, 2014 | Kenya |   | Cross-sectional ¥  | Female | Yes, AUDIT |   |   |   |   |   |
| Longo, 2017 | CAR | 2013 | Cross-sectional | Female |   |   |   | Yes | Yes |   |
| Luchters, 2011 | Kenya | 2008 | Cross-sectional | Male | Yes, AUDIT and binge drinking |   |   |   |   |   |
| Magni, 2015 | South Africa | 2012 | Cross-sectional | Female | Yes, CAGE and binge drinking |   |   |   |   |   |
| McKinnon, 2014 | Kenya |   | Cohort | Male |   |   |   | Yes | Yes |   |
| Micheni, 2015 | Kenya | 2005-2014 | Cohort | Female |   |   |   | Yes |   |   |
| Mooney, 2013 | Ethiopia | 2009-2010 | Cross-sectional | Female | Yes, CAGE |   |   |   |   |   |
| Muraguri, 2015 | Kenya | 2010 | Cross-sectional | Male | Yes, AUDIT |   |   | Yes |   |   |
| Niama, 2017 | Congo | 2011-2012 | Cross-sectional | Female |   |   |   | Yes | Yes |   |
| Nouaman, 2015 | Cote D’Ivoire | 2013 | Cross-sectional | Female | Yes, AUDIT |   |   | Yes |   |   |
| Odukoya, 2013 | Nigeria | 2011 | Cross-sectional | Female | Yes, weekly units |   |   |   |   |   |
| Okafor, 2017 | Nigeria | 2010 | Cross-sectional | Female |   |   |   | Yes |   |   |
| Peltzer, 2004 | South Africa | 2003-2004 | Cross-sectional | Female |   |   |   | Yes |   |   |
| Richter, 2013 | South Africa | 2010 | Cross-sectional | Mixed | Yes, binge drinking |   | Yes |   |   |   |
| Rishan, 2015 | Ethiopia | 2014 | Cross-sectional | Female |   | - |   | Yes |   |   |
| Tegang, 2010 | Kenya | 2007 | Cross-sectional | Female |   |   |   | Yes |   | Yes |
| Tadesse, 2016 | Ethiopia | 2015 | Cross-sectional | Female |   |   |   | Yes |   | Yes |
| Van der Elst, 2009 | Kenya | 2008 | Cross-sectional | Mixed |   |   |   | Yes |   |   |
| Vandenhoudt, 2013 | Kenya | 2008 | Cross-sectional | Female |   |   |   | Yes | Yes |   |
| Vandepitte, 2011 | Uganda | 2008-2009 | Cross-sectional (cohort baseline) | Female | Yes, CAGE | Yes | Yes | Yes |   |   |
| Weiss, 2016 | Uganda | 2008-2013 | Cohort | Female | Yes, AUDIT |   | Yes |   |   |   |
| Wilson, 2014 | Kenya | 2006-2011 | Cross-sectional | Female |   |   |   | Yes |   |   |
| Wilson, 2016 | Kenya | 2012-2013 | Cross-sectional €  | Female | Yes, AUDIT |   | Yes |   |   |   |
| **Truckers** |  |  |  |  |  |  |  |  |  |  |
| Adejugbagbe, 2015 | Nigeria | 2013 | Cross-sectional | Male |   |   |   | Yes |   |   |
| Adje, 2013 | Ghana | 2013 | Cross-sectional | Male |   |   |   | Yes |   |   |
| Bello, 2010 | Nigeria | 2009 | Cross-sectional | Male | Yes, AUDIT |   |   |   |   |   |
| Botao, 2016 | Mozambique | 2012 | Cross-sectional | Male | Yes, AUDIT-C |   |   | Yes |   |   |
| Ihunwo, 2014 | Uganda | Not given | Cross-sectional | Mixed |   |   |   | Yes |   |   |
| Okpataku, 2016 | Nigeria | 2012 | Cross-sectional | Male |   |   |   | Yes | No | Yes |
| **Uniformed personnel** |  |  |  |  |  |  |  |  |  |  |
| Argaw, 2012 | Ethiopia | 2010 | Cross-sectional | Mixed |   |   |   | Yes |   |   |
| Bing, 2008 | Angola | 2003-2004 | Cross-sectional | Male | Yes, AUDIT |   |   |   |   |   |
| Cheng, 2012 | Angola | 2008 | Cross-sectional | Male | Yes, AUDIT and binge drinking |   | Yes |   |   |   |
| Courtney, 2017 | South Sudan | 2010, 2012 | Cross-sectional | Mixed | Yes. RAPS4-QF |   |   |   |   |   |
| Djibo, Audrey Marie-Delphine (thesis), 2015 | Sierra Leona | 2013 | Cross-sectional | Mixed | Yes, AUDIT | Yes |   |   |   |   |
| Essien, 2007 | Nigeria | 2003-2004 | Cross-sectional | Mixed |   |   |   | Yes |   |   |
| Harbertson, 2011 | Rwanda | 2008-2010 | Cross-sectional | Male | Yes, AUDIT | Yes |   |   |   |   |
| Ihunwo, 2014 | Uganda | Not given | Cross-sectional | Mixed |   |   |   | Yes |   |   |
| Ijomanta, 2016 | Nigeria | Not given | Cross-sectional | Mixed | Yes, DSM IV |   | Yes |   |   |   |
| Mion, 1998 | Djibouti | Not given | Cross-sectional | Mixed |   |   |   | Yes |   |   |
| Odenwald, 2009 | Somalia | 2003 | Cross-sectional | Mixed |   |   |   | Yes |   |   |
| Okulate, 2006 | Nigeria | 1990-1994 | Cross-sectional | Male |   |   |   |   |   | Yes |
| Ovuga, 2006 | Uganda | 2002 | Cross-sectional | Mixed | Yes, ICD-10 |   |   |   |   |   |
| Tran, 2013 | Botswana | No year | Cross-sectional | Male | Yes. AUDIT |   |   |   |   |   |