Published in final edited form as:

Curr Drug Res Rev. 2019 ; 11(2): 92–110. doi:10.2174/1874473712666190114141157.

Alcohol Consumption, Risky Sexual Behaviors, and HIV in Nigeria: A Meta-Analytic Review

Uzoamaka J. Okoro, BA^{1,2,3}, Kate B. Carey, PhD³, Blair T. Johnson, PhD⁴, Michael P. Carey, PhD^{1,2,3}, Lori A. J. Scott-Sheldon, PhD^{1,2,3}

¹Centers for Behavioral and Preventive Medicine, The Miriam Hospital, Providence, RI, USA

²Alpert School of Medicine, Brown University, Providence, RI, USA

³Brown University School of Public Health, Providence, RI, USA

⁴Department of Psychology, University of Connecticut, Storrs, C`T, USA

Abstract

Background.—Alcohol consumption is associated with risky sex, which increases the risk of acquiring and transmitting HIV.

Objective.—To examine the prevalence of, and associations among alcohol, risky sex, and HIV, in Nigeria.

Method.—We searched electronic databases and reviewed reference sections of relevant papers to locate studies that sampled people living in Nigeria and assessed both alcohol and sexual risk behavior. We calculated effect sizes to determine (a) prevalence of alcohol and sex behaviors and (b) associations between alcohol consumption and risky sex, and examined moderators to determine if sample characteristics predicted behavioral or biological outcomes.

Results.—Of the 696 unique records identified, 35 manuscripts reporting on 42 separate studies met the inclusion criteria. Participants in these studies ($N = 83,350$; M age = 26 years; 48% women; 10% HIV-infected) reported high rates of heavy drinking (63%) and low rates of consistent condom use (24%). One-third of participants (30%) also reported using alcohol before sexual activity. Participants who consumed alcohol were more likely to report sexual activity ($OR = 3.66$, 95% $CI = 3.09, 4.33$), multiple partners ($OR = 3.22$, 95% $CI = 2.38, 4.36$), and condomless sex or inconsistent use of condoms ($OR = 2.30$, 95% $CI = 1.54, 3.43$).

Conclusion.—High rates of heavy drinking and low rates of condom use have been well-documented in Nigeria. Results from this meta-analysis can be used to inform critically needed alcohol-related HIV interventions.

Keywords

Nigeria; alcohol; sexual risk behaviors; HIV; meta-analysis

Contact: Lori A. J. Scott-Sheldon, PhD, The Miriam Hospital, Centers for Behavioral and Preventive Medicine, CORO West, Suite 309, 164 Summit Avenue, Providence, RI, USA 02906; lori_scott-sheldon@brown.edu; Facsimile number: (401) 739-8059.

Conflict of Interest

The authors declare that they have no conflict of interest.

1. Introduction

Nigeria has the second largest number of people living with HIV (PLWH) as well as one of the highest rates of alcohol consumption on the continent of Africa [1, 2]. Prior research shows that alcohol consumption influences sexual decision-making, engagement in risky sexual behaviors, and weakens the immune system [3–5]. To prevent the transmission of HIV in Nigeria, a clearer understanding of the patterns of alcohol use and sexual risk behaviors is needed. Therefore, the purpose of this meta-analysis is to document the (a) prevalence of and (b) associations among alcohol use, sexual risk behavior, and HIV in Nigeria. We also explore important differences in alcohol and sex behaviors among key affected regions and populations.

1.1 HIV in Nigeria

HIV is a major public health challenge in Nigeria with HIV/AIDS among the top three causes of death in this country. The prevalence of HIV among adults in Nigeria is 3% but the size of Nigeria's population means that the number of PLWH in Nigeria is 3.2 million [6]. Although the prevalence of HIV in the country has remained relatively stable over the past decade within the general population [7], Nigeria continues to have the second largest HIV population, following South Africa, with one out of every 10 PLWH in the world recently living in Nigeria [1]. The primary method of HIV transmission in Nigeria is unprotected heterosexual sex, accounting for approximately 80% of new HIV infections [7]. The remaining HIV infections occur in key populations such as commercial sex workers (CSW) and men who have sex with men (MSM) [8]. Sexual behaviors that increase the risk of HIV transmission are largely driven by cultural norms and beliefs about masculinity in Nigeria [9].

Nigeria's has been slow to mobilize effective prevention programs for its most vulnerable regions and populations. Although HIV prevalence was highest in the northern zones of Nigeria in the early 1990s, by the end of the 1990s and beginning of the 2000s, higher rates of HIV were observed in the southern zones of the country [7, 10]. The prevalence of HIV is now the highest in the South-South Zone [7]. Data show that women, youth, and people of lower education are most affected by HIV, with a rapid rise in the number of new infections among young women [7]. In response, the 2016–2020 National HIV Strategy for Adolescents and Young People calls for the promotion of safer sexual behaviors to prevent new infections specifically among adolescents and young people in Nigeria [11].

1.2 Alcohol in Nigeria

Alcohol consumption is also serious public health challenge in Nigeria. Nearly half of those aged 15 and older report drinking alcoholic beverages (i.e., beer, wine, and spirits) in the past year [2]. Socio-cultural norms and religious restrictions also influence alcohol consumption. Nigeria has one of the largest Muslim populations in the world, with most Muslims concentrated in the northern region of the country while Christians typically live in the southern regions [12]. Alcohol consumption is prohibited in Islam, and often discouraged in other religions. Consequently, patterns of alcohol consumption may vary considerably by region or religious beliefs.

In general, alcohol use is more prevalent among men, although rates of alcohol consumption among women are rising [2]. Among Nigerian men, drinking is highly variable but, among those who drink, they tend to drink more frequently and in larger quantities [6, 13, 14]. Heavy drinking is prevalent, with 55% of drinkers (68% men; 32% women) consuming five or more drinks on one occasion in the past month [2]. Nigerian men also experience higher rates of alcohol abuse or dependence than women [15]. In contrast, fewer Nigerian women engage in heavy episodic drinking, with 56% of women abstaining from alcohol [15].

Patterns of alcohol consumption have changed over the past several decades, especially among young people [16]. In the early 1960s, Guinness Brewery gradually began to establish breweries in Nigeria, and by 1984, every state had their own brewery, increasing general access to alcohol and changing attitudes toward alcohol consumption [16]. Alcohol consumption is no longer limited to ceremonies and rituals, or restricted by the elders [16]. People now drink at earlier ages and there has also been an increase in the overall burden of alcohol-related problems among younger persons [17]. Given that 60% of Nigerians are under the age of 25, and alcohol consumption norms among youth are increasing, this behavior has become an important public health concern [18]. Rapid changes in the patterns of alcohol consumption may also be associated with the rise in HIV among Nigerian youth [8].

1.3 Association among Alcohol, Risky Sex, and HIV

Alcohol is a central nervous system depressant that affects judgment, decision-making, and risk-benefit analysis [19]. According to the alcohol myopia model, cognitive capacity is restricted when consuming alcohol and causes people to attend to more immediate cues (e.g., physical attractiveness of a potential sexual partner) and less attention to distal cues (e.g., the possibility of acquiring HIV) [20]. Research supports this model, showing that increases in alcohol consumption are associated with impaired sexual decision-making [3]. In addition, alcohol-related outcome expectancies (i.e., perceived outcomes of drinking) and perceived social norms (i.e., beliefs about what people do while under the influence) may also potentiate hazardous behavior [21].

Many studies have demonstrated that intoxication can, under certain conditions, impair judgment and disinhibits behavior, thereby increasing the likelihood of unprotected sexual behavior [21]. Thus, alcohol consumption may *indirectly* increase the risk for HIV through sexual risk behavior, such as engaging in sex with multiple partners or failure to use condoms. Because unprotected heterosexual sex is the primary method of HIV transmission [7], the increasing rates of alcohol consumption—especially heavy drinking—may be an important factor fueling the HIV epidemic in Nigeria.

1.4 The Current Review

The purpose of this review is to systematically review the prevalence and associations of alcohol use and sexual risk behaviors, to enhance understanding of the extent to which alcohol use influences sexual behaviors and the HIV epidemic in Nigeria. Knowledge of the prevalence of sexual risk behaviors and the relationship between alcohol and sexual risk behaviors can be used to determine how to structure interventions to avert HIV.

In this meta-analysis, we expected to find (a) high rates of alcohol use and risky sex across all studies as well as a (b) associations between alcohol use and risky sexual behaviors within samples. We also expected that the prevalence of alcohol and sexual behaviors would differ by age, gender, religion, risk group, location, and drinking behaviors. Alcohol use and sexual risk behaviors were expected to differ by age given the increases in HIV infection among youth between the ages of 15 and 24. Because alcohol use in Nigeria is lower among women, we hypothesized that samples with more women would have lower rates of alcohol consumption and less risky behavior. Religious affiliation was also expected to influence alcohol use and sexual behavior such that Muslims would report lower alcohol use and fewer sexual partners given that alcohol consumption and sex outside of marriage are prohibited in Islam [22, 23]. Data show that risk groups such as CSW and MSM with men are disproportionately affected by HIV [15]. As a result, we expected to find higher rates of risky sexual behavior among samples of these groups. Furthermore, we examined patterns of alcohol and sexual risk behaviors by location using established geopolitical zones (e.g., Southwestern Nigeria), given the relevance of geography to HIV prevalence [7]. Finally, to further test for an association between alcohol use and sexual risk, we determined whether rates (proportion of alcohol users) and risks (proportion of heavy drinkers) of alcohol consumption predicted sexual risk behaviors.

2.0 Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [24] was used as a guide for the conduct and reporting of this meta-analysis. To be included in the review, studies had to (1) sample people living in Nigeria, (2) measure and report on alcohol use and sexual risk behaviors (e.g., sexual activity, number of sexual partners, condom use, association between alcohol and condom use), and (3) provide the summary statistics or other needed data to calculate effect sizes. Because our focus was on primary prevention of HIV, studies that sampled PLWH (i.e., 100% of the sample was HIV-positive) were excluded.

2.1 Search Strategy and Study Selection

Two sources were used to obtain relevant studies: (1) electronic bibliographic databases (EMBASE, PubMed, PsycINFO, CINAHL, The Cochrane Library, CORK, Dissertation Abstracts, ERIC, Global Health, SocIndex, and Web of Science) and (2) reference sections of relevant papers. The electronic database search retrieved records focused on alcohol, sex, HIV, and Nigeria. The search was developed with the assistance of a medical librarian and was modified (as needed) for each electronic database searched. For example, the search terms used for EMBASE were as follows: ('alcohol abuse'/exp OR 'alcoholism'/exp OR 'alcohol consumption'/exp OR 'alcohol intoxication'/exp OR 'drunk sensation'/exp) AND ('sexually transmitted disease'/exp OR 'Human immunodeficiency virus'/exp OR 'acquired immune deficiency syndrome'/exp OR 'condom'/exp OR 'condom use'/exp OR 'unsafe sex'/exp OR 'sexual behavior'/exp OR 'high risk behavior'/exp OR 'risk factor'/exp AND 'sex'/exp OR 'sexual behavior'/exp) AND ('Nigeria'/exp)). Reference sections of relevant papers retrieved from the electronic database searches were also reviewed to determine if

additional studies met the inclusion criteria. Manuscripts that met the criteria and were available by December 2014 were included in the meta-analysis.

2.2 Data Collection Process

Two independent coders extracted information from each of the studies, such as study design and measurement (e.g., recruitment method, method of assessments), sample characteristics (e.g., participant sex, age), and sexual risk behaviors (e.g., multiple partners, consistent condom use) using a structured data form (available from LAJSS upon request). Reliability was assessed separately for categorical and continuous variables [25, 26]. For the categorical variables, raters agreed on 76% of the judgments (mean $\kappa = 0.53$). Reliability for the continuous variables, which were calculated using the intra-class correlation coefficient (ρ), yielded an average ρ of 0.79. Coders reviewed their coding forms for each study for consistency; any discrepancies between coders were resolved through discussion. The final coding information with the agreed upon changes was used in the analyses.

2.3 Study Outcomes and Effect Size Calculations

Effect sizes were calculated to determine both the prevalence and association between alcohol use and sexual risk behavior. The prevalence of behavioral and biological outcomes was defined as the number of participants (or cases) reporting (or diagnosed with) the outcome divided by the total number of participants. Prevalence estimates (proportions) were converted to logits for the analyses. All transformed prevalence estimates (logits) were back-transformed to proportions, with corresponding confidence intervals, to facilitate interpretation. Prevalence outcomes were computed for alcohol consumption (any use, heavy drinking), sexual behaviors (sexual activity, multiple sexual partners, condom use, consistent condom use, condom use during the last sexual event), and alcohol use before sex. To avoid overestimating the prevalence of each outcome, studies were removed from the analyses if the sample was recruited or restricted based on that variable (e.g., studies sampling CSW were excluded from the analyses focusing on sexual activity and multiple sexual partners).

Both lifetime and recent alcohol or sexual risk behaviors were assessed. Three adjustments were made to the prevalence outcomes to increase clarity of the findings: (1) measures were coded as *lifetime use* (vs. *recent use*, defined as any use during the past 12 months) if a study did not indicate a specific timeframe for the measure (e.g., any alcohol use) and (2) only a single measure of condom use was included for each study that assessed condom use with multiple partner types (e.g., two separate items measuring condom use with steady or casual partners). If the study did not provide an overall measure of condom use, we selected the partner type that was likely to be riskier (e.g., casual vs. steady partners) to avoid violating the assumption of independence. Finally, we calculated Cohen's d (and ORs) to assess the association between alcohol use and sexual risk behaviors (sexual activity, multiple partners, and condom use) and HIV.

2.4 Statistical Analyses

All analyses were conducted with Stata 12.0 [27]. Random-effects models (using method of moments) were used to estimate all weighted mean effect sizes and the corresponding 95% confidence intervals (CIs). The homogeneity statistic, Q , was calculated to determine the

variation in study outcomes between studies. A significant Q indicates a lack of homogeneity and the influence of heterogeneity. The I^2 was calculated in order to determine the proportion of variability between studies rather than sample error, with higher values indicating greater levels of heterogeneity [28].

2.5 Predictors of Alcohol Use, Sexual Risk Behaviors, and HIV

Moderator tests were conducted to determine whether study or sample characteristics predicted alcohol use, sexual risk behaviors, or HIV. These analyses used meta-regression and the meta-analytic analogue to the ANOVA using random-effects models (using a method of moments approach). Continuous predictors included proportion women, mean age, proportion of Muslims, proportion of Christians, proportion of alcohol users, and proportion of heavy drinkers. Categorical predictors were created to assess age groups, geopolitical zones, and risk groups. First, we dichotomized ages of the samples into two categories and those that sampled populations with a mean age of 24 or younger were labeled as “1” while those studies sampling participants with a mean age of 25 or older were labeled as “0.” Second, we created categories for geopolitical zones (Southwest Nigeria vs. other zones) based on the established zones created and used by the Nigerian government [29]. The “other zones” include the following: North-Central, North-East, North-West, South-East, and South-South. The geopolitical zones compared Southwest Nigeria to “other zones” due to the limited number of studies representing the “other” zones. Finally, we created high- (1) and low-risk (0) groups; the “high-risk group” included samples of CSW, migrant workers, prisoners, street/out-of-school youths, and sexually transmitted infection (STI) clinic patients whereas the low-risk group included populations selected from the community, secondary school/university students, and samples from obstetrics clinics.

3.0 Results

3.1 Study Selection

Figure 1 depicts the study selection process. Comprehensive electronic database searches identified 775 potentially relevant records. Twenty-four studies were identified through other sources (e.g., reference sections of relevant review papers), creating a total of 799 records. Of the 799 records, 103 were duplicates and 574 were excluded based on their titles and abstracts because they did not meet any of the inclusion criteria. The remaining 122 full-text reports were screened for eligibility; of these, 62 were excluded because they did not (a) assess (or report) alcohol or sexual risk behaviors, (b) provide sufficient data for statistical analysis, (c) use precise measurement (e.g., assessed combined substance use rather than alcohol separately), (d) report quantitative data, qualitative, (e) sample exclusively Nigerians (i.e., sample included Nigerians and non-Nigerians), and (f) respond to inquiries from the authors to gain critical information. Of these 60 reports, 25 described the same sample. If a study sample was reported in multiple manuscripts, the supporting manuscript(s) was labeled as a supplemental manuscript and the manuscripts were represented using a single study identification number. Therefore, the final sample included 35 reports including 42 studies with an additional 25 supplemental manuscripts.

3.2 Methodological Quality

Methodological quality of each study was evaluated using 7 items adapted from validated measures [30–32]. The proportion of methodological quality criteria met ranged from 50% to 88% ($M = 65\%$, $SD = 12\%$) indicating that the studies had moderate to strong methodological quality. All studies clearly described the study objective(s) (100%) and used an appropriate study design (100%) to address the research objective(s). Regarding sampling methods, 29% of studies randomly sampled potential participants and 33% of the studies sampled participants that were representative of the population from which they were recruited. Most studies (93%) used validated self-report measures that were accurate and reliable but only 14% of the studies used an objective measure (e.g., blood samples for HIV testing). Finally, studies used appropriate data analytic approaches to assess the primary outcomes but less than half (48%) controlled for characteristics of the sample.

3.3 Study and Sample Characteristics

Table 1 provides descriptive information regarding the study and sample characteristics of the included studies. Studies were typically published in journals (86%) between 1997 and 2014 ($M = 2009$, $SD = 4$). Most of the studies were conducted in the southern states of Nigeria (78%), with the most common states being Lagos State (33%) and Oyo State (21%); the remaining studies were conducted in northern states (5%; e.g., Nasarawa) or across multiple locations (17%) (see Figure 2).

Nigerians were sampled from schools or universities (27%), community (14%), clinics (12%), military (7%), and other settings: high-risk community (e.g., brothels; 5%), prison (2%), place of employment (7%), or multiple settings (26%). The study samples ranged from 24 to 48,871 participants (total sample = 83,350 across all studies), including both men (53%) and women (47%) with a mean age of 26 ($SD = 7$; range = 15–45; $k = 30$). Religious affiliation was most often Christian ($M = 77\%$, $SD = 17$); 21% ($SD = 17$) were Islamic; and 2% ($SD = 3$) reported another religion (e.g., Traditional). One-third of participants reported being married (36%; $k = 30$) and most (74%; $k = 39$) reported being sexually active; average age at first sex was 18 ($SD = 2$; range = 16–20; $k = 10$). Of the studies that reported sexual orientation, twelve included MSM (<1%) and nine included women who have sex with women (1%). Few studies measured and/or reported sex trading or working; of these, one-third of the samples engaged in sex trading (29%; $k = 16$) and 63% of samples included CSWs ($k = 8$). Few participants (15%; $k = 21$) reported drug use (excluding alcohol); 10% used cannabinoids ($k = 15$).

3.4 Prevalence of Alcohol Use, Sexual Risk Behaviors, and HIV

Table 2 contains a complete list of all prevalence estimates for alcohol use, sexual risk behaviors, and sexually transmitted infections, including HIV.

Alcohol Use.—The prevalence of recent alcohol use in the studies was 37% (95% CI: 28, 47, $k = 16$). Among drinkers, more than half (63%; 95% CI = 43, 81, $k = 9$) reported heavy drinking. Of the two studies reporting on alcohol use disorders, 30% of participants met criteria for alcohol abuse or dependence (95% CI = 0.01, 0.92).

Sexual Risk Behavior.—The prevalence of lifetime sexual activity was 63% (95% CI: 51, 74, $k=14$) while recent sexual activity was 57% (95% CI = 39, 73, $k=10$). The prevalence of having multiple sexual partners within the past 12 months was 34% (95% CI: 23, 47, $k=14$). For condom use, the prevalence of recent and consistent condom use was 55% (95% CI: 7, 95, $k=3$) and 24% (95% CI: 13, 40, $k=11$), respectively. The prevalence of condom use during the last sexual event was 56% (95% CI: 49, 62, $k=12$). Finally, the prevalence of alcohol use before or during sex was 30% (95% CI: 20, 43, $k=16$).

Sexually Transmitted Infections (STIs).—HIV infection was diagnosed in 10% (95% CI: 4, 21, $k=3$) of the samples. Self-reported HIV and STIs was 3% (95% CI: 2, 4, $k=8$) and 8% (95% CI: 5, 13, $k=7$), respectively.

3.5 Associations between Alcohol Use and Sexual Risk Behaviors

Five studies ($n=5,321$) provided sufficient information to assess the association between alcohol consumption and sexual activity [33–37]. Alcohol use was associated with sexual activity such that participant who consumed alcohol were nearly four times as likely to have had sex (OR = 3.66, 95% CI = 3.09, 4.33; $d+ = 0.71$, 95% CI = 0.62, 0.81; $Q = 1.06$, $p = .90$, $df = 4$; $I^2 = 0$, 95% uncertainty limits = 0, 58). Similarly, alcohol use was associated with multiple sex partners such that participants who consumed alcohol were three times as likely to have had multiple sexual partners (OR = 3.22, 95% CI = 2.38, 4.36; $d+ = 0.64$, 95% CI = 0.48, 0.81; $Q = 0.33$, $p = .90$, $df = 2$; $I^2 = 0$, 95% uncertainty limits = 0, 87; $n = 1,100$; [37–39]). Alcohol use was negatively associated with condom use such that participants who consumed alcohol were two times as likely to have condomless sex or use condoms inconsistently (OR = 2.30, 95% CI = 1.54, 3.43; $d+ = 0.46$, 95% CI = 0.24, 0.68; $Q = 0.89$, $p = .64$, $df = 2$; $I^2 = 0$, 95% uncertainty limits = 0, 96; $n=895$; [37–39]). Finally, alcohol use was not associated with HIV (OR = 1.10, 95% CI = 0.49, 2.48; $d+ = 0.05$, 95% CI = -0.40, 0.50; $Q = 7.24$, $p = .03$, $df = 2$; $I^2 = 72$, 95% uncertainty limits = 7, 92; $n=1,956$; [40–42]) but the Q and I^2 tests suggests substantial heterogeneity between studies.

3.6 Predictors of the Prevalence of Alcohol Use, Sexual Risk Behaviors, and HIV

Moderator tests were conducted to determine whether study or sample characteristics (e.g., proportion women, age, religious affiliation, proportion alcohol users, and geopolitical zone) were associated with the variability in calculated prevalence rates. Results from the moderator analyses for continuous and categorical variables can be found in Table 3 and Table 4, respectively.

Alcohol Use—Alcohol use was associated with age such that younger samples (32%) were less likely to report consuming alcohol (lifetime) compared to older samples (55%), $p = .05$. The proportion of the sample engaging in recent alcohol use was significantly lower when the study samples included fewer Muslims ($B = -4.30$, $p = .016$) but higher when study samples included more Christians ($B = 4.18$, $p = .013$). Recent alcohol use was significantly associated with belonging to a high-risk group (46%) compared to low-risk groups (26%), $p < 0.01$. Heavy drinking was also greater in high-risk (83%) vs. low-risk samples (43%), $p < 0.01$. The proportion of the sample engaging in heavy drinking, among those who drink, also

tended to be higher when more women were included in the sample ($B = 1.52$), $p = .082$. No other continuous or categorical moderators were associated with sexual activity.

Sexual Activity—Age was a significant predictor of sexual activity such that sexual activity (lifetime) was higher when older participants were included in the sample ($B = .11$), $p = .045$. Samples recruited from high-risk populations also reported higher rates of recent sexual activity (74%) compared to those samples recruited from low-risk groups (37%), $p = 0.01$. The proportion of the sample reporting recent sexual activity was higher when more alcohol users were included in the sample ($B = 3.68$), $p = .046$. No other continuous or categorical moderators were associated with sexual activity.

Multiple Sex Partners—The proportion of the sample reporting recent multiple sexual partners was lower when fewer Muslims ($B = -3.02$, $p = .077$) were included in the sample but higher when study samples included more Christians ($B = 3.04$, $p = .080$). No other continuous or categorical moderators were associated with having multiple sexual partners.

Condom Use—The proportion of the sample reporting condom use (lifetime) was lower when fewer Muslims ($B = -4.69$, $p = .018$) were included in the sample but higher when study samples included more Christians ($B = 4.66$, $p = .020$). Studies sampling people living in Southwest Nigeria were more likely to report using a condom during the last sexual event (61%) than those studies sampling Nigerians in other locations (47%), $p = 0.01$. No additional continuous or categorical moderators were associated condom use.

Alcohol Use Before Sex—The proportion of the sample engaging in alcohol use before sex was higher when the sample was older (continuous age: $B = .15$, $p = .013$; categorical age: $Q_B = 7.97$, $p < .01$). No additional continuous or categorical moderators were associated condom use.

HIV and Other STIs—No continuous or categorical moderators were associated with self-reported diagnoses of HIV or STIs.

4.0 Discussion

This meta-analysis examined the prevalence of, and the association between, alcohol use and sexual risk behaviors in Nigeria – the country with the second largest number of PLWH in the world. Although recent alcohol consumption was moderately prevalent (37%), the rates of heavy drinking, among drinkers, were high at 63%, indicating that the way Nigerians use alcohol may be more significant than the number of total drinkers. The prevalence of alcohol before sex was 30%, indicating that alcohol is regularly used in conjunction with sexual activity. The prevalence of HIV was approximately 10%, which is significantly higher than the national rate of 3% [6]. This elevated prevalence may be a consequence of the proportion of high-risk groups, such as CSW, prisoners, and migrant workers that were included in the analysis. In the studies included in this meta-analysis, high rates of recent sexual activity, alcohol use (current), and heavy drinking—well-known risk factors for HIV transmission—were common in the high-risk groups.

High-risk populations such as CSWs and MSM have proven to have significant impact on the HIV epidemic in Nigeria [1]. These groups account for only 1% of the adult population but estimates indicate that persons from high-risk populations and their partners contribute as much as 40% of the new HIV infections in Nigeria [8]. Our study showed that high-risk groups were more likely to engage in sexual activity than those in the low risk group. We also showed that high-risk groups engaged in significantly higher rates of heavy drinking (83%) than low risk groups (43%). Consequently, Nigeria must strive to develop interventions targeted for high-risk groups who carry a significant weight of the HIV burden. These interventions must address the alcohol use in the context of sex. Comprehensive interventions for people at high-risk for HIV infection should also consider including pre-exposure prophylaxis (PrEP) to address the HIV epidemic in Nigeria [43].

The prevalence of HIV among Christians in the southern regions remain higher than Muslims in the northern regions [44]. Alcohol consumption is prohibited in Islam, and sex outside of marriage is also forbidden. Islam values procreation within marriage, and condom use is often discouraged. Christianity also discourages sex outside of marriage although attitudes toward condom use are varied [45]. In spite of these teachings, Muslims and Christians engage in risky alcohol and sexual behaviors that put them at risk for HIV [46]. This meta-analysis confirmed that studies sampling more Muslims were less likely to report alcohol consumption (recent), multiple sexual partners (recent), or condom use (lifetime). In contrast, Christians were more likely to report alcohol consumption (recent), multiple sexual partners (recent), and condom use (lifetime). Interventions to reduce the risk of HIV transmission must consider the religious and cultural influences of Islam and Christianity to effectively target attitudes and beliefs associated with alcohol use and risky sexual behaviors.

Our prevalence data shows that individuals 25 years of age and older were more likely to have consumed alcohol than their younger counterparts, and were also more likely to report a history of sexual activity. These results were expected because older people simply have had more exposure to alcohol, and more time to engage in sex. In addition, respondents age 25 years or older (37%) were more likely than those below 25 years (9%) to report drinking alcohol before sex. Interventions designed for older populations that include content focused on reducing alcohol consumption may improve sexual decision-making. These interventions could target drinking venues (e.g., beer parlors, bars, hotels) where many older alcohol users drink, and are frequently patronized by sex workers [47].

Alcohol use was significantly associated with sexual behavior such that participants who consumed alcohol were more likely to report being sexually active, having multiple sex partners, and condomless sex or inconsistent use of condoms. Further exploration of these findings shows that these studies sampled youth alone suggesting that alcohol use is an important risk factor in the transmission of HIV for young people living in Nigeria. These findings are consistent with prior research showing that alcohol use is associated with increased sexual risk in young people [3, 48, 49], especially at sexual debut [50]. Future research should explore when alcohol consumption might increase risky sexual behavior among youth in Nigeria.

4.2 Limitations

As with any meta-analysis, we were limited by the number of studies, their methods, and the data reported in the original studies. For example, we found only a few studies that tested participants for HIV, limiting our ability to compare responses across different population subgroups, to determine the relation between study characteristics and the magnitude of ES, and to generalize beyond the participants, sites, and regions investigated. We were also limited to the data available in the individual studies which prevented us from exploring potentially relevant mediators and moderators (e.g., alcohol- and/or sex-related attitudes, social norms, drinking environment) that may explain some of our findings. Most of the data summarized in this review were obtained by self-report, which can be influenced by social and cognitive biases, such as response bias and social desirability bias [51].

Another limitation in the primary literature involves the representativeness of the findings. Even though there were a few nationally representative government surveys included in the analysis, none of the studies included focused specifically on populations in northwest or northeast Nigeria. Understanding alcohol and sexual risk behaviors among Nigerians located in northern Nigeria is important, especially when considering the religious and cultural differences between the north and south/central Nigeria. Furthermore, it would have been beneficial to conduct moderator tests that compare behaviors between multiple geopolitical zones (e.g., Southeast vs. North-Central). Our review was limited to samples recruited from the Southwest vs. other zones due to the limited number of studies that recruited samples from areas other than Southwestern Nigeria (see Figure 2). Finally, studies rarely provided information on sexual orientation. Of those studies that did report sexual orientation of the sample, the low base rates of MSM limited our ability to evaluate sexual orientation as a predictor of our outcomes.

4.2 Implications for Interventions

Vulnerable, high risk populations, which carry a significant burden of the HIV epidemic, need comprehensive alcohol and sexual health interventions. Interventions should emphasize condom use and partner reduction because both risk reduction strategies can help to decrease HIV transmission. High-risk groups (e.g., CSW, MSM) should be targeted because they were more likely to engage in sexual activity and were also more likely to report high rates of heavy drinking. Prior research has indicated that behavioral HIV interventions in Nigeria have rarely included information about alcohol use [52]. Comprehensive health education programs that include tailored elements that address the additional risks associated with alcohol use are needed.

5.0 Conclusion

Our analysis has demonstrated the significant association between alcohol use and sexual behaviors, elevated rates of heavy drinking, vulnerability of high-risk populations, and the overall low rates of condom use throughout all subgroups. These findings suggest that risk reduction strategies in Nigeria should target low levels of condom use. Further research must be done to investigate the complex relation between alcohol and sexual risk among Nigerians, considering the high rates of heavy drinking. Researchers should consider

developing behavioral interventions to increase awareness of the effects of alcohol use on sexual decision-making. Additional research must be done to determine how interventions can be tailored specifically to at-risk populations. Furthermore, additional data on sexual risk and alcohol use in the northern and central states of Nigeria must be collected to determine the recent status of sexual risk practices and alcohol use in that part of the country and its overall contribution to the HIV epidemic.

Acknowledgements

This research was supported in part by Brown University (2014 Summer Research Assistantship to Uzoamaka Okoro); The National AIDS Memorial Grove (2015 Pedro Zamora Young Leaders Scholarship to Uzoamaka Okoro); Lifespan/Tufts/Brown Center for AIDS Research from the National Institute of Allergy and Infectious Diseases of the National Institute of Health under award number P30AI042853 (2015 Summer Student Internship to Uzoamaka Okoro); and the National Institute on Alcohol Abuse and Alcoholism of the National Institutes of Health under award number 5R01AA021355 to Lori A. J. Scott-Sheldon. The content is solely the responsibility of the authors and does not necessarily represent the official views of Brown University, The National AIDS Memorial Grove, or the National Institutes of Health.

This research presented in this manuscript was submitted in partial fulfillment of the Honors Track in the Public Health concentration in the Brown University School of Public Health. We thank the authors who provided additional study information and/or data as well as the Meta-Analyses of Alcohol, Sexual Risk Behaviors, and HIV (MASH) team members who assisted with this project (Brittany McCauley, BS, Tyler S. Kaiser, BA, and Jennifer M. Knight, MPH).

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Figure 1.
Study Selection Process for the Meta-analysis

Figure 2.

Location of the study samples included in the meta-analysis.

Note. Red dots represent the location of the studies included in the meta-analysis. National studies [35, 81] are not represented on this map [102].

Table 1.

Summary of the 42 Studies Included in the Meta-Analysis of Studies Alcohol Consumption, Risky Sexual Behaviors, and HIV/STIs in Nigeria

Citation	Sample	Location and Recruitment	% Alcohol	% Sexual Behaviors	% HIV/STIs
Adeyemi et al. [53]	$N = 2,965$; 100% F; 15 years of age; 100% CSW	Unknown; CSWs recruited from brothels and non-brothels	31% ALC (recent)	100% sexually active (lifetime) 100% MSP (lifetime) 41% CDM (last event) 25% CDM (consistent)	33% HIV+ (SR)
Adoga et al. [40]	$N = 300$; 0% F; $M_{age} = 29$; 100% Prisoners	North-Central Nigeria: Nasarawa State; inmates at a medium-security prison	60% ALC (lifetime)	100% sexually active (lifetime) 67% MSP (lifetime)	18% HIV+ (D)
Bamidele et al. [38]	$N = 368$; 39% F; 17 years of age; 63% Christian; 35% Muslim	Southwestern Nigeria: Ede, Osun State; university students	41% ALC (lifetime) 17% ALC (recent) 53% HD	88% sexually active (lifetime) 68% MSP (lifetime) 25% MSP (recent) 46% CDM (lifetime) 29% CDM (consistent)	NR
Brahmbhatt et al. [33]; <i>Linked studies</i> [54–62]; Ibadan Subsample	$N = 449$; 51% F; $M_{age} = 16$	Southwestern Nigeria: Ibadan, Oyo State; RDS with seed respondents from multiple venues (e.g., youth centers, parks, churches)	26% ALC (lifetime) 12% ALC (recent) 26% HD	26% sexually active (lifetime)	NR
Dada et al. [63]	$N = 280$; 100% F; $M_{age} = 20$; 61% Christian; 38% Muslim	Southwestern Nigeria: Ikorodu, Lagos State; trade apprentices from local businesses	7% ABS	71% sexually active (lifetime) 70% sexually active (recent) 44% MSP (lifetime) 24% MSP (recent) 14% CDM (last event)	NR
Eke [64] Eke [64]	$N = 640$; 43% F; $M_{age} = 16$	Southeastern Nigeria: Anambra State; Enugu State; senior secondary schools	57% ALC (lifetime)	45% sexually active (lifetime) 57% MSP (lifetime) 22% CDM (lifetime)	NR
Essien et al. [65]; <i>Linked studies</i> [66–69]	$N = 2,209$; 13% F; $M_{age} = 31$	Southwestern Nigeria: Lagos State; Nigeria Uniformed Services personnel from two regiments	57% ALC (recent)	52% sexually active (recent) 10% CDM (recent) 8% CDM (consistent)	1% HIV+ (SR)
Essien et al. [70]; <i>Linked studies</i> [71–73]	$N = 346$; 100% F; 18 years of age; 75% Christian; 24% Muslim; 100% military personnel	Southwestern Nigeria; military personnel recruited from military and non-military community locations (e.g., apartments, recreational areas, CBOs)	12% ABS	95% sexually active (recent) 43% MSP (recent) 63% CDM (consistent) 68% CDM (last event)	8% history of STIs
Eukumana et al. [41]	$N = 350$; 100% F; $M_{age} = 27$	North-Central Nigeria: Zawan, Plateau State; patients attending a prenatal care clinic	13% ALC (lifetime)	100% sexually active (lifetime) 67% MSP (lifetime) 20% CDM (lifetime)	11% HIV+ (D) 15% history of STIs
Ezugwu et al. [42]	$N = 1,306$; 100% F; $M_{age} = 29$	Southeastern Nigeria: Enugu State; patients attending a prenatal care clinic	29% ALC (lifetime)	100% sexually active (lifetime) 25% MSP (lifetime)	5% HIV+ (D)
Ibighami [74]	$N = 385$; 47% F; $M_{age} = 21$; 79% Christian; 14% Muslim	Southwestern Nigeria: Ile-Ife, Osun State; university students	30% ALC (lifetime) 6% AAD	23% CDM (recent)	NR

Citation	Sample	Location and Recruitment	% Alcohol	% Sexual Behaviors	% HIV/STIs
Imaledo et al. [34]	$N = 300$; 57% F; $M_{age} = 21$; 97% Christian; 3% Muslim	Southeastern Nigeria: Port Harcourt, Rivers State; students at the University of Port Harcourt	65% ALC (lifetime) 56% ALC (recent)	52% sexually active (lifetime) 32% CDM (lifetime)	NR
Isiugo-Abanihe et al. [75]; <i>Linked studies</i> [76]	$N = 1,033$; 53% F; 15 years of age; 63% Christian; 37% Muslim	South-Southern Nigeria: Cross River State & Oyo State; households	23% ABS	100% sexually active (lifetime) 8% MSP (recent) 56% CDM (lifetime) 67% CDM (last event) 9% CDM (consistent)	NR
Iyaniwura and Mautin [77]	$N = 376$; 48% F; $M_{age} = 26$; 63% Christian; 37% Muslim	Southwestern Nigeria: Sagamu, Ogun State; National Youth Service Corps Orientation Camp	38% ALC (recent) 15% ABS	79% sexually active (lifetime) 74% sexually active (recent) 48% MSP (lifetime) 86% CDM (lifetime) 54% CDM (last event) 40% CDM (consistent)	NR
Lawal et al. [78]; <i>Linked studies</i> : [47]; <i>Linked studies</i> : [47]	<i>Sample 1. HDA—Beer Drinkers</i> : $N = 106$; 0% F; $M_{age} = 37$; 79% Christian; 18% Muslim; 12% CSW	Southwestern Nigeria: Lagos State; street outreach/snowball sampling in Local Government Areas (LDA of Lagos Island and Ikoyi and HDA of Agege)	100% ALC (recent) 76% ABS 48% HD	37% MSP (recent) 56% CDM (lifetime)	8% HIV+ (SR)
	<i>Sample 2. LDA—Beer Drinkers</i> : $N = 109$; 0% F; $M_{age} = 33$; 86% Christian; 14% Muslim; 32% CSW		100% ALC (recent) 79% ABS 48% HD	63% MSP (recent) 82% CDM (lifetime)	4% HIV+ (SR)
	<i>Sample 3. HDA—CSW</i> : $N = 29$; 100% F; $M_{age} = 27$; 90% Christian; 7% Muslim; 100% CSW		45% ALC (lifetime) 100% MSP (lifetime) 94% MSP (recent) 77% CDM (lifetime)	100% sexually active (lifetime) 100% MSP (lifetime) 94% MSP (recent) 77% CDM (lifetime)	0% HIV+ (SR)
	<i>Sample 4. LDA—CSW</i> : $N = 33$; 100% F; $M_{age} = 25$; 97% Christian; 3% Muslim; 100% CSW; 7% WSW		52% ALC (lifetime) 100% MSP (lifetime) 57% ABS 88% HD	100% sexually active (lifetime) 100% MSP (lifetime) 61% MSP (recent) 65% CDM (lifetime)	0% HIV+ (SR)
	<i>Sample 5. STI Clinic Patients</i> : $N = 53$; 15% F; $M_{age} = 31$; 72% Christian; 26% Muslim; 8% CSW		81% ALC (lifetime) 8% ABS (casual) 14% ABS (steady) 70% HD	18% MSP (recent) 15% CDM (lifetime)	0% HIV+ (SR) 100% STIs (D)
	<i>Sample 6. HDA—Wine Drinkers</i> : $N = 24$; 0% F; $M_{age} = 45$; 33% Christian; 67% Muslim		100% ALC (recent) 63% ABS 55% HD	44% MSP (recent) 29% CDM (lifetime)	NR
Mbakwem-Aniebo et al. [79]	$N = 92$; 46% F; 16–25 years of age; 100% Christian; 0% Muslim	Southeastern Nigeria: Port Harcourt, Rivers State; students at the University of Port Harcourt	46% ALC (recent)	59% sexually active (lifetime) 8% MSP (lifetime) 85% CDM (lifetime)	NR
Mboto et al. [80]	$N = 113$; 58% F; $M_{age} = 38$	South-Southern Nigeria: Uyo, Akwa-Ibom State; health care workers at a tertiary teaching hospital	36% ALC (lifetime)	33% MSP (lifetime)	NR
National Population Commission [81]; <i>Linked studies</i> [82, 83]	$N = 48,871$; 68% F; $M_{age} = 30$; 52% Christian; 46% Muslim	Multiple Sites	1% ABS	80% sexually active (lifetime) 74% sexually active (recent) 5% MSP (recent)	2% history of STIs

Citation	Sample	Location and Recruitment	% Alcohol	% Sexual Behaviors	% HIV/STIs
				18% CDM (lifetime) 5% CDM (last event)	
Nigeria Federal Ministry of Health [35]; <i>Linked studies</i> Nigeria Federal Ministry of Health [35]; <i>Linked studies</i> [84]	$N = 10,081$; 54% F; $M_{age} = 30$; 51% Christian; 47% Muslim	Multiple Sites	19% ALC (recent)	77% sexually active (lifetime) 85% sexually active (recent) 14% MSP (recent) 28% CDM (lifetime) 56% CDM (last event)	NR
Okonofua [85]; <i>Linked studies</i> [86] [Study 3 Only]	$N = 300$; 0% F; $M_{age} = 37$	South-Southern Nigeria: Benin City, Edo State; Reproductive Health Clinic of the Women's Health and Action Research Center	77% ALC (lifetime)	100% sexually active (recent) 49% MSP (recent)	NR
Okulate and Olayinka [87]*	<i>Sample 1.</i> $N = 205$; 0% F; 18 years of age	Southwestern Nigeria: Yaba, Lagos State; soldiers recruited from the Nigerian Army Reference Hospital	53% ALC (recent)	9% MSP (lifetime) 68% CDM (last event)	NR
	<i>Sample 2.</i> $N = 731$; 0% F; 18 years of age		45% ALC (recent)	30% MSP (lifetime) 83% CDM (last event)	NR
	<i>Sample 3.</i> $N = 467$; 0% F; 18 years of age		51% ALC (recent)	27% MSP (lifetime) 75% CDM (last event)	NR
Okulate et al. [88]	$N = 914$; 16% F; 18 years of age	Southwestern Nigeria: Yaba, Lagos State; soldiers recruited from the Nigerian Army Reference Hospital	50% ALC (recent) 61% ABS	17% CDM (consistent)	NR
Oladebo and Fayemi [89]	$N = 420$; 48% F; $M_{age} = 15$; 83% Christian; 17% Muslim	Southwestern Nigeria: Ibadan, Oyo State; secondary school students in public schools	NA	12% sexually active (lifetime)	NR
Olaleye and Ajuwon [90]; <i>Linked studies</i> : [91]	$N = 594$; 59% F; $M_{age} = 23$	Southwestern Nigeria: Ibadan, Oyo State; students recruited from The Polytechnic, Ibadan	34% ALC (lifetime) 9% ALC (recent)	56% sexually active (lifetime)	NR
Olley [92]	$N = 169$; 11% F; $M_{age} = 18$; 49% CSW	Southwestern Nigeria: Ibadan, Oyo State; street youth	69% AAD	67% sexually active (lifetime)	22% history of STDs
Olley [93]; <i>Linked studies</i> : [94]	$N = 2290$; 53% F; 15–20 years of age; 64% Christian; 36% Muslim	Southwestern Nigeria: Ibadan, Oyo State; senior secondary students recruited from public schools	9% ALC (lifetime)	33% sexually active (lifetime) 21% sexually active (recent) 95% CDM (last event)	4% history of STDs
Olley [95]	$N = 583$; 39% F; $M_{age} = 21$	Southwestern Nigeria: Ibadan, Oyo State; first year students recruited from the University of Ibadan	47% ALC (recent) 11% ABS	31% sexually active (recent) 95% CDM (last sex event) 53% CDM (last event)	NR
Owoaje and Uchendu [39]	$N = 818$; 31% F; $M_{age} = 20$	Southwestern Nigeria: Ibadan, Oyo State; street youth	29% ALC (recent) 10% ABS	79% sexually active (lifetime) 75% sexually active (recent) 57% MSP (recent) 54% CDM (last event) 25% CDM (consistent)	NR
Oye-Adeniran et al. [36]	$N = 2408$; 100% F; $M_{age} = 22$; 64% Christian; 25% Muslim	Southwestern Nigeria: Ibadan, Oyo State; students recruited from universities	23% ALC (lifetime)	13% sexually active (recent)	NR
Sekoni et al. [96]; <i>Linked studies</i> : [97]	$N = 323$; 100% F; $M_{age} = 28$; 95% Christian; 5% Muslim; 100% CSW	Southwestern Nigeria: Ojo; Badagry, Lagos State; CSW's recruited from brothels	75% ALC (lifetime)	100% sexually active (lifetime) 100% MSM (lifetime)	NR

Citation	Sample	Location and Recruitment	% Alcohol	% Sexual Behaviors	% HIV/STIs
			68% ALC (recent) 89% HD		
Sekoni et al. [37]	$N = 240$; 60% F; $M_{age} = 20$	Southwestern Nigeria: Idi Iroko, Lagos State; Seme, Ogun State; out-of-school youth	18% ALC (lifetime)	60% sexually active (lifetime) 57% sexually active (recent) 29% MSP (recent) 21% CDM (consistent)	NR
Sunmola et al. [98]; <i>Linked studies</i> : [99]	$N_1 = 936$; 0% F; 18 years of age; 90% Christian; 9% Muslim	Unknown; migratory workers recruited from the Brewery Organization	43% ABS	100% sexually active (lifetime) 61% MSP (lifetime) 82% CDM (lifetime) 46% CDM (last event)	4% history of STIs 2% HIV+ (SR)
	$N_2 = 93$; 100% F; $M_{age} = 28$; 90% Christian; 6% Muslim			100% sexually active (lifetime) 12% MSP (lifetime) 8% CDM (consistent)	3% history of STIs 0% HIV+ (SR)
Sunmola et al. [100]	$N = 717$; 52% F; $M_{age} = 26$; 87% Christian; 10% Muslim	Southwestern Nigeria: Ibadan, Oyo State; college graduates from local government areas	22% ABS	100% sexually active (lifetime) 25% MSP (lifetime) 54% CDM (last event) 9% CDM (consistent)	10% history of STIs 3% HIV+ (SR)
Tobin-West et al. [101]	$N = 810$; 53% F; $M_{age} = 22$; 96% Christian; 2% Muslim	South-Southern Nigeria: Port Harcourt, Rivers; students at the University of Port Harcourt	29% ALC (lifetime)	73% sexually active (lifetime) 65% sexually active (recent) 40% MSP (recent) 83% CDM (recent) 79% CDM (consistent)	NR

Note. N , number who participated in the study; F , proportion women in the sample; M_{age} = mean age of the sample; CSW, commercial sex worker; LDA, low density areas; HDA, high density areas; CBO, community-based organization; ALC, alcohol use; ABS, alcohol use before/during sex; AA/D, alcohol abuse/dependence; HD, heavy drinking (among alcohol users only); MSP, multiple sexual partners; CDM, condom; HIV, human immunodeficiency virus; STI, sexually transmitted infection; RDS, respondent driven sampling; NR, not reported; NA, not available.

Table 2.

Prevalence Estimates

Variable	Proportion	95%CI	I^2	95% UL	k
<i>Behavioral Outcomes</i>					
Alcohol use					
Alcohol use (lifetime)	0.42	0.30, 0.55	99	99, 99	17
Alcohol use (recent)	0.37	0.28, 0.47	99	99, 99	16
Heavy Drinking	0.63	0.43, 0.81	93	88, 95	9
Sexual Behavior					
Sexually active (lifetime)	0.63	0.51, 0.74	99	99, 99	14
Sexually active (recent)	0.57	0.39, 0.73	100	99, 100	10
Multiple sexual partners (lifetime)	0.36	0.27, 0.47	98	98, 99	15
Multiple sexual partners (recent)	0.34	0.23, 0.47	99	98, 99	14
Condom use (lifetime)	0.57	0.41, 0.72	98	98, 99	13
Condom use (recent)	0.55	0.07, 0.95	100	98, 100	2
Condom use (consistent)	0.24	0.13, 0.40	99	99, 99	11
Condom use (last event)	0.56	0.49, 0.62	97	96, 98	12
Alcohol Before Sex	0.30	0.20, 0.43	98	97, 98	16
<i>Biological Outcomes</i>					
HIV+ diagnosed	0.10	0.04, 0.21	96	92, 98	3
HIV+ self-reported	0.03	0.02, 0.04	0	0, 65	8
History of STIs	0.08	0.05, 0.13	96	93, 97	7

Note. Method of moments was used to estimate effect sizes. All variables were examined for outliers; outliers were removed for lifetime alcohol use [36, 42], heavy drinking [33, 78, 96], lifetime sexual activity [40, 75, 81, 85, 89], recent sexual activity [35, 81], recently having sex with multiple partners [78, 81], lifetime [35, 81] and recent [65] condom use, consistent condom use [53], condom use at last sex event, alcohol use before sex [81], self-reported HIV status [53, 65], and self-reported history of STIs [81]. The overall prevalence estimates including outliers were as follows: lifetime alcohol use (0.40, 95% CI = 0.31, 0.50; $k = 19$), lifetime (0.40; 95% CI = 0.63, 0.78; $k = 19$) and recent (0.61; 95% CI = 0.46, 0.74; $k = 12$), sexual activity, recently having sex with multiple partners (0.34, 95% CI = 0.23, 0.47; $k = 14$), heavy drinking (0.62, 95% CI = 0.45, 0.76; $k = 9$), lifetime (0.52, 95% CI = 0.40, 0.56; $k = 15$) and recent (0.35, 95% CI = 0.05, 0.85; $k = 3$) condom use, consistent condom use (0.24, 95% CI = 0.15, 0.36; $k = 12$), condom use at last sex event (0.53, 95% CI = 0.35, 0.70; $k = 15$), alcohol before sex (0.25, 95% CI = 0.12, 0.45; $k = 17$), self-reported HIV status (0.04, 95% CI = 0.01, 0.15; $k = 10$), and self-reported history of STIs (0.06, 95% CI = 0.03, 0.13; $k = 8$). UL, uncertainty limits.

Table 3.

Results from Meta-Regression Analyses – Continuous Variables

Outcomes	Moderator	B (SE)	95% CI	p	k	I ² Residual
<i>Behaviors</i>						
Alcohol Use						
Alcohol use (lifetime)	% women	−1.12 (.85)	−2.94, 0.69	.206	17	99
	Age	.06 (.04)	−.02, .15	.131	15	98
	% Muslim	−2.92 (2.97)	−9.94, 4.09	.357	9	99
	% Christian	2.93 (2.88)	−3.88, 9.74	.343	9	99
Alcohol use (recent)	% women	−.55 (.75)	−2.15, 1.05	.476	16	99
	Age	.08 (.08)	−.11, .27	.335	9	100
	% Muslim	−4.30 (1.07)	−7.28, −1.32	.016	6	93
	% Christian	4.18 (0.97)	1.48, 6.88	.013	6	91
Heavy drinking	% women	1.52 (.73)	−.27, 3.30	.082	8	86
	Age	.00 (.06)	−.14, .14	.992	8	94
	% Muslim	−1.94 (2.05)	−7.21, 3.34	.389	7	92
	% Christian	1.96 (2.06)	−3.33, 7.25	.385	7	92
Sexual Behavior						
Sexually Active (lifetime)	% women	−.49 (1.36)	−3.46, 2.48	.726	14	99
	Age	.11 (.05)	.00, .22	.045	11	97
	% Muslim	0.89 (2.33)	−4.81, 6.58	.716	8	99
	% Christian	−1.11 (2.29)	−6.72, 4.50	.645	8	99
	% alcohol users	.16 (1.74)	−3.71, 4.04	.928	12	99
Sexually Active (recent)	% women	.53 (1.57)	−3.10, 4.16	.746	10	100
	Age	.01 (.13)	−.32, .33	.962	8	100
	% Muslim	−3.22 (6.37)	−20.91, 14.46	.639	6	100
	% Christian	5.04 (6.03)	−11.70, 21.77	.450	6	99
	% alcohol users	3.68 (1.52)	−.08, 7.27	.046	9	99
Multiple partners (lifetime)	% women	−.13 (.74)	−1.72, 1.47	.866	15	98
	Age	−.04 (.05)	−.17, .08	.456	9	98
	% Muslim	5.40 (2.80)	−1.80, 12.59	.112	7	98
	% Christian	−5.63 (2.75)	−12.72, 1.45	.096	7	98
	% alcohol users	−1.16 (1.94)	−5.43, 3.11	.561	13	99
Multiple partners (recent)	% women	−.41 (.76)	−2.06, 1.25	.601	14	99
	Age	.01 (.04)	−.09, .10	.839	11	98
	% Muslim	−3.02 (1.51)	−6.43, 0.40	.077	11	94
	% Christian	3.04 (1.55)	−0.45, 6.54	.080	11	94
	% alcohol users	1.40 (.72)	.18, 2.99	.077	13	98
	% heavy drinking	.41 (2.83)	−7.45, 8.28	.891	6	91
Condom use (lifetime)	% women	−.31 (1.01)	−2.53, 1.91	.764	13	97

Outcomes	Moderator	B (SE)	95% CI	p	k	I ² Residual
	Age	.00 (.07)	-.17, .18	.971	9	97
	% Muslim	-4.69 (1.63)	-8.38, -1.00	.018	11	87
	% Christian	4.66 (1.65)	0.94, 8.38	.020	11	87
	% alcohol users	.22 (1.21)	-2.44, 2.88	.860	13	98
	% heavy drinkers	-.45 (3.35)	-9.07, 8.17	.899	7	89
Condom use (consistent)	% women	1.04 (1.46)	-2.26, 4.34	.494	11	99
	Age	-.17 (.14)	-.53, .19	.282	7	99
	% Muslim	-2.40 (4.89)	-14.96, 10.17	.645	7	99
	% Christian	2.61 (5.06)	-10.41, 15.63	.628	7	99
	% alcohol users	1.67 (1.56)	-1.93, 5.37	.316	10	99
Condom use (last sex)	% women	-.47 (.46)	-1.48, .55	.333	12	96
	Age	.03 (.04)	-.09, .15	.485	6	91
	% Muslim	1.91 (1.08)	-0.87, 4.70	.138	7	93
	% Christian	-1.99 (1.08)	-4.78, 0.79	.125	7	93
	% alcohol users	.39 (.66)	-1.09, 1.86	.571	12	97
Alcohol use before sex	% women	-1.32 (.81)	-3.04, .41	.124	16	97
	Age	.15 (.05)	.04, .25	.013	12	88
	% Muslim	-1.43 (2.47)	-6.87, 4.00	.573	13	95
	% Christian	1.83 (2.56)	-3.81, 7.47	.490	13	95
<i>Biological Outcomes</i>						
HIV+ (self-reported)	% women	.20 (.46)	-.93, 1.34	.676	8	0
	Age	.07 (.06)	-.08, .22	.278	7	0
	% Muslim	3.14 (3.37)	-5.11, 11.38	.388	8	0
	% Christian	-3.45 (3.33)	-11.61, 4.70	.340	8	0
	% alcohol users	.38 (.58)	-1.12, 1.87	.546	7	0
	% heavy drinkers	-3.08 (2.79)	-11.96, 5.80	.350	5	0
STI (self-reported)	% women	-.06 (.86)	-2.28, 2.15	.947	7	96
	Age	-.13 (.09)	-.49, .24	.279	4	85
	% Muslim	-.44 (2.61)	-8.75, 7.87	.877	5	91
	% Christian	.33 (2.87)	-8.79, 9.45	.915	5	91
	% alcohol users	-.07 (.98)	-3.19, 3.05	.947	5	97

Note. Moderators in **boldface** are statistically significant.

Table 4.

Moderator Results – Categorical Variables

Outcome	Moderator	Proportion	95% CI	k	Q _B	P
<u>Behaviors</u>						
Alcohol Use						
Lifetime	<i>Geopolitical Zones^a</i>					
	Southwest Nigeria	.47	.25, .55	10	0.43	.513
	Other Zones	.39	.29, .66	7		
	<i>Risk Groups^b</i>					
	High Risk Group	.55	.34, .74	6	2.27	.132
	Low Risk Group	.35	.23, .50	11		
	<i>Age Group</i>					
	24	.32	.20, .47	9	3.76	.053
	25	.55	.37, .71	8		
Recent	<i>Geopolitical Zones</i>					
	Southwest Nigeria	.37	.29, .46	12	0.01	.925
	Other Zones	.36	.22, .53	4		
	<i>Risk Groups</i>					
	High Risk Group	.46	.37, .56	9	8.59	.003
	Low Risk Group	.26	.18, .35	7		
	<i>Age Group</i>					
	24	.27	.17, .42	7	3.19	.074
	25	.45	.32, .59	9		
Heavy Drinking	<i>Risk Groups</i>					
	High Risk Group	.83	.72, .90	4	21.07	<.001
	Low Risk Group	.43	.32, .56	4		
Sexual Behavior						
Sexually Active (lifetime)	<i>Geopolitical Zones</i>					
	Southwest Nigeria	.64	.49, .76	9	0.03	.859
	Other Zones	.62	.42, .78	5		
	<i>Risk Groups</i>					
	High Risk Group	.72	.50, .87	4	1.01	.314
	Low Risk Group	.59	.44, .72	10		
	<i>Age Group</i>					
	24	.56	.48, .71	12	1.70	.192
	25	.65	.52, .92	2		
Sexually Active (recent)	<i>Geopolitical Zones</i>					
	Southwest Nigeria	.62	.42, .79	8	1.44	.231
	Other Zones	.34	.09, .74	2		

Outcome	Moderator	Proportion	95% CI	k	Q _B	P
	<i>Risk Groups</i>					
	High Risk Group	.74	.54, .88	5	6.10	.014
	Low Risk Group	.37	.20, .59	5		
	<i>Age Group</i>					
	24	.46	.25, .69	7	2.86	.091
	25	.79	.47, .94	3		
Multiple Partners (lifetime)	<i>Geopolitical Zones</i>					
	Southwest Nigeria	.34	.21, .49	7	0.22	.638
	Other Zones	.39	.26, .54	8		
	<i>Risk Groups</i>					
	High Risk Group	.33	.20, .49	7	0.25	.617
	Low Risk Group	.39	.25, .54	8		
	<i>Age Group</i>					
	24	.42	.24, .62	4	0.38	.540
	25	.34	.24, .46	11		
Multiple Partners (recent)	<i>Geopolitical Zones</i>					
	Southwest Nigeria	.39	.26, .53	10	1.84	.175
	Other Zones	.24	.11, .42	4		
	<i>Risk Groups</i>					
	High Risk Group	.41	.24, .60	5	0.85	.356
	Low Risk Group	.30	.19, .44	9		
	<i>Age Group</i>					
	24	.34	.19, .54	5	0.01	.920
	25	.33	.21, .48	9		
Condom use, lifetime	<i>Geopolitical Zones</i>					
	Southwest Nigeria	.59	.37, .78	8	0.09	.767
	Other Zones	.54	.28, .78	5		
	<i>Risk Groups</i>					
	High Risk Group	.68	.48, .83	5	1.89	.170
	Low Risk Group	.50	.34, .66	8		
	<i>Age Group</i>					
	24	.52	.22, .80	3	0.14	.705
	25	.59	.40, .75	10		
Condom use, consistent	<i>Geopolitical Zones</i>					
	Southwest Nigeria	.23	.11, .43	8	0.01	.933
	Other Zones	.25	.07, .60	3		
	<i>Risk Groups</i>					
	High Risk Group	.22	.09, .44	7	0.07	.786
	Low Risk Group	.26	.09, .58	4		

Outcome	Moderator	Proportion	95% CI	k	Q _B	P
	<i>Age Group</i>					
	24	.38	.15, .67	4	1.90	.168
	25	.17	.08, .34	7		
Condom use, last sex	Geopolitical Zones					
	Southwest Nigeria	.61	.54, .68	7	6.43	.011
	Other Zones	.47	.39, .56	5		
	Risk Groups					
	High Risk Group	.58	.49, .67	7	0.73	.392
	Low Risk Group	.52	.41, .63	5		
	<i>Age Group</i>					
	24	.46	.33, .60	3	2.36	.125
	25	.59	.51, .66	9		
Alcohol use before sex	Geopolitical Zones					
	Southwest Nigeria	.31	.18, .48	13	0.06	.799
	Other Zones	.27	.08, .61	3		
	Risk Groups					
	High Risk Group	.27	.15, .44	9	.41	.523
	Low Risk Group	.35	.18, .56	7		
	<i>Age Group</i>					
	24	.09	.03, .24	3	7.97	.005
	25	.37	.26, .50	13		
Biological Outcomes						
HIV, self-reported	Geopolitical Zones					
	Southwest Nigeria	.03	.02, .05	6	2.33	.127
	Other Zones	.02	.01, .03	2		
	Risk Groups					
	High Risk Group	.02	.01, .03	5	2.37	.123
	Low Risk Group	.03	.02, .05	3		
STIs, self-reported	Geopolitical Zones					
	Southwest Nigeria	.09	.04, .19	4	0.39	.532
	Other Zones	.06	.02, .16	3		
	Risk Groups					
	High Risk Group	.07	.03, .16	4	0.04	.851
	Low Risk Group	.08	.03, .19	3		
	<i>Age Group</i>					
	24	.09	.03, .26	2	0.14	.706
	25	.07	.03, .15	5		

Note. Moderators in bold font statistically significant at the $p = .05$ level. Tests for moderation was unable to be conducted for some outcomes due to the limited number of studies available for comparison and are not reported.

^a Geopolitical zones were coded as southwest Nigeria (1) and other zones (0). Southwest Nigeria includes the following states: Oyo, Ogun, Ekiti, Lagos, Ondo and Osun.

^b Risk groups were coded as high-risk (1) and low-risk (0). High-risk groups include commercial sex workers, migrant workers, military personnel, prisoners, street/out-of-school youths, and STI clinic patients. The low risk group includes all other participants (e.g., university students) not included in the “high-risk” category.

^c Age groups were coded as ≤ 24 (1) if the mean age of the sample was 24 years of age or less or the largest proportion of participants were under the age of 24 (when mean age was not provided). The samples with participants ≥ 25 years of age were coded as 0.