

A Systematic Review and Meta-analysis of Alcohol Use Disorders and Its determinants in People Living with HIV in Africa: A Continent based Review and Meta-analysis study.

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Abstract

Background

Alcohol use disorder among people living with HIV/AIDS contributes to decreased adherence and effectiveness of antiretroviral medication, decreased help-seeking to HIV/AIDS care and treatment, increased load of the virus in the blood, and development of drug-resistant HIV strains. This study therefore aimed and assessed the pooled evidence on prevalence and associated factors of alcohol use disorder in retroviral infected patients in Africa.

Methods

We implemented our electronic data base search on PubMed, Scopus, EMBASE, and Psych-INFO libraries. In addition, WHO websites and Google scholar were also investigated for grey literatures. Moreover, we further investigated the reference lists of published articles. Stata-11 meta-prop package with 95% confidence interval was used. Subgroup and sensitivity analysis were also performed. Cochran's Q- and the I^2 test were used to check heterogeneity. Publication bias was evaluated with Egger's test and funnel plots.

Results

In this meta-analysis, we included 22 studies with a total of 16774 patients and the pooled prevalence of alcohol use disorder was 22.03% (95% CI: 17.18, 28.67). The average prevalence of AUD in South Africa (28.77%) was higher than in Uganda (16.61%) and Nigeria (22.8%). Besides, the average prevalence of AUD in studies published before 2011, 2011–2015, and after 2015 was found to be 13.47%, 24.93% and 22.88% respectively. Moreover, the pooled magnitude of AUD among studies which utilized a sample size > 450 was 16.71% whereas it was 26.46% among studies that utilized sample size < 450. Furthermore, the pooled estimated prevalence of hazardous, harmful and dependent drinking was 10.87%, 8.1%, and 3.12% respectively. Being male was an associated factor for alcohol use disorder (AOR = 5.5%; 95% CI: 1.10, 9.98). Moreover, the average odds ratio of cigarette smoking and chat chewing were found to be 3.95% (95% CI: 3.00, 4.89) and 3.34% (95% CI: 1.71, 4.96) respectively.

Conclusion

The average estimated prevalence of AUD in HIV/AIDS patients was high and factors such as being Male, cigarette smoking and chat chewing were associated with it. Early detection and appropriate management of AUD and the mentioned associated factors have to be a routine practice.

Background

Alcohol can be defined as a psychoactive drug which is capable of producing physiological as well as psychological dependence and its harmful use is associated with tremendous health, social and economic consequences(1–3). Alcohol use disorders (AUDs) contribute to 3.8% of the burden of disease globally(4) The global burden of deaths due to alcohol outweighs the synergized burden of deaths from acquired immunodeficiency syndrome (AIDS), human immunodeficiency virus (HIV), tuberculosis and violence(3). AUDs can be of harmful use, hazardous or dependence use(5). Harmful alcohol use is a pattern of use in control of the will of individual, Hazardous use which has risk of harmful social, physical and mental consequences and dependence is the most severe end of the AUD spectrum (4, 5).

The magnitude of alcohol use disorders in patients with retroviral infection has been evidenced higher than people without retroviral infection or the general public (6). A systematic review and meta-analysis study by Duko et al.2019(7) showed that the average worldwide prevalence of alcohol use disorder among patients with HIV/AIDS was found to be 29.8%. Earlier studies reported that the prevalence of alcohol use disorder ranges from 17–39.4% in Nigeria (8–10) ,1.4–33% in Uganda(11–14), 6.6–48.5% in south Africa (15–18), 5.4–33% in Kenya(19–22), and 14.8% in Zambia (23). There Exists a scarcity of data on alcohol use disorders in people with HIV in other African countries despite the high disease burden with many people living with HIV(24).

In Ethiopia studies conducted so far implied that AUD among HIV/AIDS patients was documented to be 32.6% in Jimma university specialized hospital (25), and 31.8% in Hawassa university comprehensive hospital(26), 14.2% in Bishoftu general hospital (27), 24.8% in Assela teaching hospital (28). Moreover, a systematic review and meta-analysis study of alcohol consumption in Ethiopia by Ayano et al.2019(29) reported that the prevalence of hazardous alcohol consumption was 8.96%.

Factors found to be associated with AUDs in these settings include male gender, psychological morbidity, smoking cigarettes, Christian religion, lower education, peer pressure, parental modeling and drinking in order to assist social interactions(9, 10, 30–32). Studies from Ethiopia also concluded that being male, smoking cigarettes and psychological distress were determinants of AUDs (25).Another study also reported that being male, poor social support, medication non-adherence, khat chewing and cigarette smoking had significant association with alcohol use disorder (26).

AUDs among PLHIV contributes to premature death(33, 34) due to enhancement of the toxicity of antiretroviral treatment (ART), damage to liver from concurrent infection, decreased adherence and effectiveness of antiretroviral medication leading to rising opportunistic diseases due to immune-compromization (35–39). Other studies also concluded AUD have been linked with adherence problem to ART drugs (3, 40–43), decreased help-seeking to HIV/AIDS care and treatment facilities(44), increased load of the virus (39, 42), with rapid decline of CD4 cells as well as fast HIV/AIDS disease progress and development of drug-resistant HIV strains (3, 39, 42). Besides, AUD contributes to risky sexual and non-sexual behaviors (34, 45–47). A study in USA approved that if an individual with HIV virus consumes alcohol once/week his life span will be shortened by two years and by 6.5 years if consumes alcohol

daily (48). In addition, such patients with AUD might be afraid of interaction between ART drugs and alcohol so that, skipping ART drugs during alcohol intake (9, 40).

Despite the fact that multiple studies have been performed and showed that retroviral infected patients have higher prevalence of alcohol use disorder than the general population, to date no published study in Africa per investigators knowledge reported the pooled prevalence and associated factors of alcohol use disorders in human immune-deficiency virus infected patients. Knowledge on pooled magnitude of alcohol use disorders and detecting its determinants would assist policy-makers and program implementers in deciding evidence-driven prevention and promotion and treatment activities in this area.

So, this systematic review and meta-analysis study is intended to review the existing pieces of evidences on alcohol use disorder and its risk factors and pooling them to have a synergized effect in human immune-deficiency virus infected patients in Africa.

Methods

This Preferred Reporting Items for Systematic Reviews and Meta-analysis Protocols (PRISMA-P) 2015 (49) had been used as an important guideline during the current study.

Data sources and search strategies

We conducted our search in the following libraries; EMBASE, Psych-Info and Scopus and PubMed with a systematic search approach. We conducted our search in PubMed with the following key terms and words: (Prevalence OR epidemiology OR magnitude OR incidence) AND (Alcohol use disorder OR alcohol abuse OR alcohol use) AND (HIV OR human immunodeficiency virus OR AIDS OR PLWHA OR ART) AND (factor OR risk OR risk factor OR determinant) AND (Southern Africa OR Central Africa OR East Africa OR North Africa OR Western Africa OR Sub-Saharan Africa). Besides, we thoroughly investigated WHO websites and Google scholar for non-published works. Moreover, the lists of references for an included study were searched adequately to further include unaddressed eligible literatures. For further clarification of unclear ideas, we contacted authors of included articles.

Inclusion criteria

All cross-sectional, case control and cohort studies which had reported the magnitude of alcohol use disorders and/or its determinants among human immune-deficiency virus infected patients in Africa were included. A research article was eligible for inclusion if:

- The study was of cross sectional, cohort and case control study.
- The study population were people living with HIV/AIDS
- Publication of the article should be purely in English language
- The research article had reported prevalence of alcohol use disorder in PLWHIV
- The research articles had identified risk factors of alcohol use disorders in PLWHIV

- The research article should have generated evidence for the specified target population in African countries.

Exclusion criteria

- We excluded letters, reviews, interventional studies, commentaries and editorials
- Studies duplicated were also excluded to avoid being doubled in the analysis

Selection of studies for inclusion in the review

Articles retrieved from the search databases were stored, managed and used in an EndNote reference manager. Two review authors (MN, AB) reviewed each studies title and abstracts stored in an EndNote reference manager independently and any disagreements between them whether to include or exclude the study for analysis was solved through discussion with the third author (YG).

Data extraction and management techniques

Using a standardized data extraction form, three authors (MN, AB and YG) extracted data from included studies independently. The following elements were components of the data extraction form. First author last name, year of publication, study setting, sample size, number of events, data on prevalence of alcohol use disorder, tool used for assessment, associated factors, and odds ratio (OR) with 95% confidence intervals (CI).

Quality assessment methods

Two review authors (MN and AB) assessed the quality of all included studies independently. Discrepancies between these review authors were fixed by a third reviewer (MN). The modified version of Newcastle-Ottawa Quality Assessment tool (50) was used as guide line for quality appraisal of included studies. Representativeness and size of sample, comparability between study subjects, ascertainment of alcohol use disorder symptoms, and statistical quality were the dimensions of Newcastle-Ottawa scale in assessing the quality of each study.

Data synthesis and analysis

The pooled magnitude of alcohol use disorder and the pooled odds ratios (OR) of identified risk factors for alcohol use disorders with 95% CI were calculated through random-effects(51) and quality-effects models(52). Heterogeneity between the studies was investigated with both Cochran's Q statistic and the I² statistics. I² value greater than 50% will be classified as implication of substantial heterogeneity between studies(53).

Subgroup analyses and sensitivity analysis were also performed to explore the sources of heterogeneity. All statistical analyses had been performed using Meta-XL version 5.3(54) and STATA11 Meta-prop package(55). Publication bias was assessed with funnel plot (56) and eggerts regression test.

Results

Identification of studies

A total of 1357 articles were identified in our electronic search of the specified data bases. Furthermore, a manual search for the reference lists other articles also resulted in 5 additional articles. This makes the overall search result to be 1362 articles. Of these 28 were duplicates and so removed. After a detailed screening of the remaining articles, only 62 articles were reviewed their full text for eligibility. Finally, only twenty two articles were included in the analysis by fulfilling our pre-specified inclusion criteria (Fig. 1)

Characteristics of included studies

A total of 22 studies in Africa continent that investigated alcohol use disorder in 16774 patients who were on anti-retroviral therapy in Africa have been integrated into this systematic review and meta-analysis study (7–23, 27, 28, 57–60). Considering the type of study design, 18 studies were cross-sectional type and the other four studies (11, 17, 21, 22) were cohort in design. Among the 22 studies in the meta-analysis (7–23, 27, 28, 57–60), 5 were from Ethiopia (7, 27, 28, 57, 59), 3 were from Nigeria (8–10), 4 were from Uganda (11–14), another 4 were from south Africa (15–18) and the remaining 6 studies were from Kenya, Namibia and Zambia (19–23, 60). Besides, of all included studies, three were published before 2011(9, 12, 15), eight were published b/n 2011–2015(10, 13, 14, 19, 21–23, 59), and the remaining eleven were published after 2015 (7, 8, 11, 17, 18, 20, 27, 28, 57, 58, 60). Moreover, considering the sample size utilized in the study, 10 studies (8, 13–15, 18, 21–23, 27, 60) assessed > 450 participants and the remaining 12 studies (7, 9–12, 16, 17, 19, 20, 28, 57, 59) takes a sample of < 450 participants (Table 1)

Quality Of Included Studies

In general, the summary quality assessment result of 22 included studies integrated in the current meta-analysis ranges from 7 to 10 according to the scoring system of Newcastle Ottawa quality assessment. Amongst the 22 included studies, 19 were found to have good quality and the remaining 3 were having moderate quality. However, there was no study found to have poor quality (**Additional file 1**)

The pooled prevalence of alcohol use disorder among HIV/AIDS patients who were on anti-retroviral therapy in Africa

Twenty two studies had been included in the final meta-analysis to determine the pooled magnitude of alcohol use disorder among patients on anti-retroviral therapy in Africa (7–23, 27, 28, 57–60). The reported magnitude of alcohol use disorders among studies included in the current review and meta-analysis ranges from as low as 1.4% in Uganda (12) to as high as 48.5% in south Africa(16). The average prevalence of alcohol use disorder among patients on anti-retroviral therapy in Africa using the random effect model was 22.03%(95% CI: 17.18, 28.67). This average prevalence has been influenced by a

significant heterogeneity ($I^2 = 99.8\%$, $p\text{-value} = 0.000$) from the difference between the incorporated studies (Fig. 2).

The pooled prevalence of hazardous alcohol use among HIV/AIDS patients who are on anti-retroviral therapy in Africa

Among the 22 studies included in the final analysis, Data regarding hazardous drinking was described in seven studies (8, 10, 19, 22, 27, 57, 59). The aggregate prevalence of hazardous drinking in these studies was 10.87% (95% CI: 4.82, 16.93). This average result was with considerable heterogeneity ($I^2 = 99.6\%$, $P = 0.00$) (Fig. 3). The pooled prevalence of hazardous drinking was 10.87% (95% CI: 0.89, 20.47) in studies that utilized a sample of > 400 (8, 22, 27, 59), and 11.15% (95% CI: 10.40, 11.90) in studies that used smaller sample (10, 19, 57).

The pooled prevalence of harmful alcohol use among HIV/AIDS patients on anti-retroviral therapy in Africa

Seven studies had reported the information regarding prevalence of harmful drinking in HIV/AIDS patients (8, 10, 19, 22, 27, 57, 59). The pooled prevalence of harmful drinking among the indicated studies was obtained to be 8.1% (95% CI: 1.04, 15.17) and was having a significant heterogeneity ($I^2 = 99.5\%$, $P = 0.00$) (Fig. 4). Consequently, we performed a subgroup of harmful drinking based on sample size used. The Prevalence of harmful drinking among studies that used relatively larger sample (> 400) (8, 22, 27, 59) was found to be 4.08 (95% CI: 1.14, 7.02) whereas it was 13.47% (-2.97, 29.91) in studies which used sample size < 400 (10, 19, 57).

The pooled prevalence of dependent drinking among HIV/AIDS patients who are on anti-retroviral therapy in Africa

Moreover, the 7 studies (8, 10, 19, 22, 27, 57, 59) also illustrated information concerning dependent drinking among HIV/AIDS patients on anti-retroviral therapy. The average magnitude of dependent drinking was obtained to be 3.12% (95% CI: 1.45, 6.70) and an obvious heterogeneity has also been detected in the result ($I^2 = 99.6\%$, $P = 0.00$) (Fig. 5). The average magnitude of dependent drinking among studies that utilized sample of more than 400 (8, 18, 22, 27, 59) was 1.76% (1.16, 3.68) whereas it was 6.56% (95% CI: 2.51,17.64) among smaller sample studies(19, 57).

Subgroup analysis of the prevalence of alcohol use disorders among HIV/AIDS patients on ART therapy in Africa

Since the pooled prevalence of alcohol use disorder was influenced by a significant heterogeneity, a subgroup analysis has been implemented based on country where the study was conducted. Based on this among the 22 studies integrated in the meta-analysis (7–23, 27, 28, 57–60), 5 were from Ethiopia (7, 27, 28, 57, 59), 3 were from Nigeria (8–10), 4 were from Uganda (11–14), another 4 were from south Africa (15–18) and the remaining 6 studies were from Kenya, Namibia and Zambia (19–23, 60).

The average prevalence of alcohol use disorder among patients on ART in Ethiopia was 23.36% (95% CI: 17.53, 31.19) with ($I^2 = 98.6\%$, p -value < 0.001). The pooled prevalence of AUD in South Africa was also found to be 28.77% (95% CI: 10.39, 47.16) with ($I^2 = 99.2\%$, $p < 0.001$). Besides, the average magnitude of AUD in Uganda and Nigeria were 16.61% (95% CI: 6.86, 26.36) ($I^2 = 99.8\%$, $p < 0.001$) and 22.8% (95% CI: 6.83, 38.77) ($I^2 = 99.5\%$, $p < 0.001$) respectively.

Besides, the average prevalence of AUD in studies which were published before 2011 (9, 12, 15), 2011–2015 (10, 13, 14, 19, 21–23, 59), and after 2015 (7, 8, 11, 17, 18, 20, 27, 28, 57, 58, 60) was found to be 13.47% (95% CI: 0.20, 26.75), 24.93% (95% CI: 15.10, 34.77) and 22.88% (95% CI: 17.71, 28.25) respectively. Moreover, the average magnitude of AUD among studies which utilized a sample size > 450 (8, 13–15, 18, 21–23, 27, 60) was obtained to be 16.71% (95% CI: 10.30, 23.12) ($I^2 = 98.5\%$, p -value < 0.001) whereas it was found to be 26.46% (95% CI: 20.21, 32.72) ($I^2 = 99.20\%$, p -value < 0.001) among studies that utilized sample size < 450 (7, 9–12, 16, 17, 19, 20, 28, 57, 59) (Table 2).

Sensitivity analysis

To detect further the source of heterogeneity that influences the average prevalence of AUD in patients, we also investigate a one study leave out at a time sensitivity analysis. The result from the sensitivity analysis revealed that the average estimated magnitude of AUD obtained when each individual study were left out from analysis was within the 95% confidence interval of average alcohol use disorder when all studies were pooled together. Therefore, the result of the average magnitude of AUD in HIV patients can be plausible. Moreover, the one study leave out at a time sensitivity analysis result revealed that the average AUD prevalence ranges between 20.77% (95% CI: 16.33, 25.31) and 22.98% (95% CI: 18.05, 27.91) when each individual studies were excluded (Table 3).

Publication bias

We carried out an Egger's publication bias plot to detect the presence of a publication bias but it is near the origin and the result of Egger's publication bias plot had insignificant p -value ($P = 0.22$) on condition that no substantial publication bias for the prevalence AUD in Africa. Moreover, a visual inspection from a funnel plot for a Logit event rate of prevalence of AUD in HIV/AIDS patients against its standard error suggests an additional evidence for the absence of a small study effect (Fig. 6).

Narrative description of the associated factors for Alcohol use disorders

Of 22 included studies, 12 studies that reported associated factors for alcohol use disorder among HIV/AIDS patients were included in our narrative analysis (8–10, 16, 17, 20, 21, 27, 28, 57, 59, 61) (Table 4). Seven of the included studies (7, 9, 10, 16, 28, 57, 59) reported an association between being male and alcohol use disorder. Cigarette smoking was also reported as a related factor for AUD in four (7, 27, 57, 59) studies. Furthermore, family history of alcohol use(27, 28), missing ART medication(21, 27), mental distress(59), chat chewing (7, 27, 57), educational status(10, 27), low CD4 count(57), low income(10), orthodox religion(59), protestant religion(59) had a strong and significant association with alcohol use disorder in people with HIV/AIDS in Africa.

The association between male sex and alcohol use disorder in HIV/AIDS patients on ART therapy

Information concerning the association of being male and higher risk of alcohol use disorder in HIV/AIDS patients was reported in seven of the included studies (7, 9, 10, 16, 28, 57, 59). The average adjusted odds ratio of increased risk of having alcohol use disorder was 5.5 (95% CI: 1.10, 9.98) ($I^2 = 90\%$, $P < 0.01$). This implied that male HIV/AIDS patients who were on ART were 5.5 times at higher risk of having alcohol use disorder as compared to female patients who were on ART therapy.

The association between cigarette smoking and chat chewing with alcohol use disorder

Among the 22 studies incorporated in the current meta-analysis(7–23, 27, 28, 57–60), four (7, 27, 57, 59) had reported cigarette smoking as an independent factor for alcohol use disorder in HIV patients. The average odds ratio of cigarette smoking in these studies was found to be 3.95% (95% CI: 3.00, 4.89) ($I^2 = 96.2\%$, $P < 0.01$). This result suggested that patient's on ART who were smoking a cigarette were on average 4 times at increased risk of developing alcohol use disorder than patients who were not smoking cigarette. Similarly, three of the above indicated studies (7, 27, 57) had also reported chat chewing as a risk factor for alcohol use disorder. The average odds ratio of chat chewing among these studies was found to be 3.34% (95% CI: 1.71, 4.96) ($I^2 = 98.2\%$, $P < 0.01$). Therefore, patients who were chewing chat were on average 3.3 times more likely to have alcohol use disorder than patients who were not chewing chat.

Discussion

To date as per the knowledge of investigators, this review and meta-analysis on the magnitude of alcohol use disorders and its associated factors in patients who are on anti-retroviral therapy is the first of its kind in Africa. This study from its beginning aimed and assessed the prevalence of alcohol use disorder and its associated factors in African population. Consequently, the information generated from this meta-

analysis on average magnitude and associated factors for alcohol use disorder in HIV/AIDS patients would be significant evidence to diverse stakeholders planning to design strategy in the area.

Twenty two studies that assessed AUD in HIV patients in Africa were incorporated in the final analysis. The average prevalence of alcohol use disorder in the current meta-analysis was high 22.03% higher than the pooled prevalence of hazardous alcohol use in the general population(29). This high magnitude in such vulnerable population publicized AUD as an important community health problem.

The prevalence of AUD in this study was lower as compared to the result of a systematic review and meta-analysis study by Duko et al.2019(7) in which that the average worldwide prevalence of AUD among patients with HIV/AIDS was found to be 29.8%. This could be due to the disparities in the principal economic, social and cultural factors in which alcohol use behaviors are favorably higher in developed countries than African countries.

This pooled prevalence of AUD in our study was considerably higher in South Africa (28.8%) than the pooled prevalence estimate in Uganda (16.6%). South Africa is a relatively economically advanced nation than Uganda so individuals would have ability to afford alcohol.

As expected, the pooled estimated prevalence of AUD in studies that studied a relatively higher sample (> 450) was significantly lower (16.7%) than pooled estimated prevalence for studies which assessed smaller sample (< 450) which was 26.5%. This could be due to the decreases in the probability of a standard error when using larger sample size and so providing a more precise and reliable result with strong power.

In addition, pooled estimated prevalence of AUD was higher among studies done in 2011 and after (22.9–24.9%) than pooled estimate of AUD in studies which were done before 2011(13.5%). The increased availability of alcohol and alcohol advertising programs at current times could bring such variation.

The pooled estimated magnitude of hazardous alcohol use, harmful alcohol use and dependent drinking in this study was found to be 10.87%, 8.1%, and 3.12% respectively. The pooled estimated prevalence of AUD was 4% in studies that used larger sample size (> 400) and is lower than the pooled estimated prevalence in studies that assessed relatively smaller sample size (< 400) (13.5%). Furthermore, the pooled estimated prevalence of dependent drinking was also higher in smaller sample studies (6.7%) than larger sample studies (1.8%).

Concerning the associated factors for AUD, being male (7, 9, 10, 16, 28, 57, 59), Cigarette smoking (7, 27, 57, 59), family history of alcohol use(27, 28), missing ART medication(21, 27), mental distress(59), chat chewing (7, 27, 57), educational status(10, 27), low CD4 count(57), low income(10), orthodox religion(59), protestant religion(59) had a strong and significant association with AUD in people with HIV AIDS in Africa.

Association between male sex and alcohol use disorder was identified in this study. The pooled estimated odds ratio of being male as risk factor for AUD was 5.5 in this study. This showed that male patients with HIV were 5, 5 times more vulnerable to develop AUD than female patients. Supportive evidence for this existed in a meta-analysis study(7). Factors related to variation in neurochemistry could be responsible for this. This can be illustrated by a US study that revealed that higher rate of dopamine release was observed in men than women despite the same level of alcohol intake(62) that can further reinforce the alcohol seeking behavior and heighten the risk of AUD. Besides, some culture restrict alcohol consumption in women which could further reduce the risk of AUD in women and also other factors in the environment may have additive role for the difference(63).

The pooled estimated odds ratio of cigarette smoking and chat chewing in this study were 3.9 and 3.3. Patients who were smoking cigarette and chewing chat were nearly 4 times and 3.3 times more likely to develop AUD than patients who were not smoking cigarette and chewing chat. These substances have similar mechanism of action with alcohol(64) and therefore one can potentiate the rewarding effect of the other(65).

Difference between studies incorporated in the current review and meta-analysis study

This meta-analysis study on prevalence of AUD and its related factors in HIV AIDS patients in Africa had a significant heterogeneity from the variance between the incorporated studies. Therefore we further perform a sub-group analysis to explore the source of such substantial heterogeneity. The subgroup analysis revealed that the setting at which the study was done, and the sample size variation between the studies and study period were responsible for the variance in prevalence of alcohol use disorder between included studies. On top of this we conducted a one study leave out sensitivity analysis but the result showed that the overall pooled estimated prevalence of AUD was not under the influence of a single particular study. This meta-analysis study on AUD has limitations to be considered in using its result. The primary limitation is that it was under the influence of a significant heterogeneity. Furthermore, at some sub-groups we integrate few numbers of studies so that the precision of estimate might be affected.

Conclusion

This review and meta-analysis study found a high pooled magnitude of AUD in African population living with HIV; nearly one in five (22%). This average estimated prevalence of AUD substantial heterogeneity. This pooled prevalence of AUD was considerably higher in South Africa (28.8%) than the pooled prevalence estimate in Uganda (16.6%). Besides, the pooled estimated prevalence of AUD in studies that studied a relatively higher sample (> 450) was significantly lower (16.7%) than pooled estimated prevalence for studies which assessed smaller sample (< 450) which was 26.5%. In this study the pooled estimated magnitude of hazardous alcohol use, harmful alcohol use and dependent drinking were also 10.87%, 8.1%, and 3.12% respectively. Factors such as being male, Cigarette smoking, chat chewing, family history of alcohol use, missing ART medication, mental distress, low CD4 count, and low income

were some of the associated factors with AUD in people with HIV AIDS in Africa. Therefore, service delivery to HIV/AIDS patients should primarily focus on early detection and integrated management of AUD and the aforementioned factors.

Abbreviations

AIDS: Acquired Immune Deficiency Syndrome; AUD: Alcohol Use Disorder; ART: Anti-Retro viral Therapy; CI: Confidence Interval; HIV: Human Immune-Deficiency Virus; OR: Odds Ratio; PLWHIV: People Living with Human Immune-Deficiency Virus; PRISMA-P: Preferred Reporting Items for Systematic Reviews and Meta-analysis; USA: United States of America; WHO: World Health Organization.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not Applicable

Availability of data and materials

All data regarding this research work is incorporated in the paper

Competing interests

No competing interests existed for this work.

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Authors' contributions

MN conceived and designed this systematic review and meta-analysis. MN and AB developed the search strategy. MN prepared the first draft of manuscript. All authors critically reviewed and approved the final draft of manuscript.

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Tables

Table 1: Characteristics of studies on alcohol use disorders among HIV/AIDS patients on ART which are incorporated in the narrative as well as meta-analysis according to author first name, year of publication, setting of study, design, sample size, assessment instrument, study population and magnitude of alcohol use disorder.

Author, year	Study setting	Study design	Sample size	Assessment tool	Study population	AUD (%)	Number of cases with AUD (n)	Hazardous Drinker (%)	Harmful Drinker (%)	Dependent drinker (%)
Assefa et al (14)(1)	Ethiopia	CS	401	AUDIT	HIV/AIDS patients	32.6	127	24.7(96)	2.8	5.1(20)
Adenomon et al (17)(2)	Nigeria	CS	1187	CIDI	HIV/AIDS patients	17	202	7.0	7.8	2.2
Adenomon et al (11)(3)	Nigeria	CS	160	AUDIT	HIV/AIDS patients	39.4	63	10.6%	28.8	0
Adenomon et al (14)(4)	Nigeria	CS	222	AUDIT	HIV/AIDS patients	12	47	NA	NA	NA
Adenomon et al (18)(5)	Ethiopia	CS	527	AUDIT	HIV/AIDS patients	14.2	75	10.8	2.5	0.8
Adenomon et al (19)(6)	Ethiopia	CS	195	AUDIT	HIV/AIDS patients	31.8	62	NA	NA	NA
Adenomon et al (17)(7)	Ethiopia	CS	418	AUDIT	HIV/AIDS patients	24.8	104	NA	NA	NA
Adenomon et al (2019)(8)	Ethiopia	CS	332	AUDIT	HIV/AIDS patients	18.4	62	11.4	1.8	0.9
Adenomon et al (18)(9)	Uganda	Cohort	446	AUDIT	HIV/AIDS patients	30	133	NA	NA	NA
Adenomon et al (15)(10)	Uganda	CS	725	AUDIT	HIV/AIDS patients	33	293	NA	NA	NA
Adenomon et al (18)(11)	Uganda	CS	421	AUDIT	HIV/AIDS patients	1.4	6	NA	NA	NA

Table 1: Characteristics of studies on alcohol use disorders among HIV/AIDS patients on ART which are incorporated in the narrative as well as meta-analysis according to author first name, year of publication, setting of study, design, sample size, assessment instrument, study population and magnitude of alcohol use disorder(Continued).

Author, year	Study setting	Study design	Sample size	Assessment tool	Study population	AUD (%)	Number of cases with AUD (n)	Hazardous Drinker (%)	Harmful Drinker (%)	Dependent drinker (%)
Chingwa et al (12)	Zambia	CS	649	AUDIT	HIV/AIDS patients	14.8	96	NA	NA	NA
Munyuli et al (13)	Uganda	CS	500	AUDIT	HIV/AIDS patients	2	10	NA	NA	NA
Wanjau et al (14)	Kenya	CS	272	AUDIT	HIV/AIDS patients	14	38	NA	NA	NA
Munyuli et al (15)	Kenya	CS	164	AUDIT	HIV/AIDS patients	33	54	11	9.8	12.2
Witwit et al (16)	South Africa	Cohort	136	NA	HIV/AIDS patients	33	45	NA	NA	NA
Witwit et al (16)	South Africa	CS	1388	AUDIT	HIV/AIDS patients	6.6	93	NA	NA	0.3
Witwit et al (18)	South Africa	CS	465	AUDIT	HIV/AIDS patients	27	126	NA	NA	NA
Witwit et al (19)	South Africa	CS	303	AUDIT	HIV/AIDS patients	48.5	147	NA	NA	NA
Witwit et al (20)	Namibia, Kenya, Tanzania	Cohort	3538	AUDIT	HIV/AIDS patients	15.7	184	NA	NA	NA
Witwit et al (21)	Namibia	CS	787	AUDIT	HIV/AIDS patients	30	237	NA	NA	NA
Witwit et al (22)	Namibia, Kenya, Tanzania	cohort	3538	AUDIT	HIV/AIDS patients	5.4	184	0.2	3.2	2

Key: CS: Cross-sectional, AUDIT: Alcohol use disorder identification test, ART: Anti-retroviral therapy, CIDI: Composite International Diagnostic Interview,

Table 2: A subgroup analysis of the prevalence of alcohol use disorder among HIV AIDS patients on ART in Africa with its 95% confidence interval

Subgroup		Number of studies	Estimates		Heterogeneity		
			Prevalence (%)	95% CI	I ²	Q(DF)	P-value
Country	Ethiopia	5	23.36	17.53, 31.19	98.6%	195.17(4)	P <0.001
	Nigeria	3	22.8	6.83, 38.77	99.5%	2037.2(2)	P <0.001
	Uganda	4	16.61	6.86, 26.36	99.8%	2120(3)	P <0.001
	South Africa	4	28.77	10.39, 47.16	99.2%	1246.23(3)	P <0.001
	Kenya, Namibia & Zambia	6	18.82	10.09, 27.54	97.8%	123.2(5)	P <0.001
Study design used	Cross-sectional	18	22.25	17.13, 27.37	98.8%	921.57(17)	P <0.001
	Cohort	4	21.02	9.26, 32.79	99.6%	742.86 (3)	P <0.001
Sample size studied	< 450	12	26.46		99.2%	1242.12 (11)	P <0.001
	> 450	10	16.71	10.30, 23.12	98.5%	735.25(9)	P <0.001
Year of publication	Before 2011	3	13.47	0.20, 26.75	96.5%	108.32(2)	P <0.001
	2011-2015	8	24.93	15.10, 34.77	97.9%	135.8(7)	P <0.001
	After 2015	11	22.88	17.71, 28.25	99.8%	2120(10)	P <0.001

Key; DF: Degree of Freedom, CI: Confidence Interval

Table 3: a sensitivity analysis of the prevalence of alcohol use disorder among HIV AIDS patients on ART in Africa when each indicated studies are removed at a time with its 95% confidence interval.

No	Study excluded	Prevalence of Alcohol use disorder	95% Confidence interval
1	Soboka et al.2014	21.53%	16.53, 26.52
2	Egbe et al.2017	22.27%	17.25, 27.29
3	Bultum et al	22.4%	17.39, 27.41
4	Duko et al.2019	21.56%	16.58, 26.55
5	Segni et al.2017	21.9%	16.82, 26.97
6	Gebrie, 2019	22.20%	17.02, 27.38
7	Goar et al.2011	21.20%	16.31, 26.10
8	Farley et al.2010	22.51%	17.54, 27.48
9	Hahn et al.2018	21.65%	16.60, 26.69
10	Wandera et al.2015	21.51%	16.52, 26.49
11	Martinez et al.2008	23.01%	18.07, 27.95
12	Chishinga et al.2011	22.37%	17.34, 27.40
13	Nakimuli et al.2011	22.98%	18.05, 27.91
14	Kibera et al.2017	22.41%	17.43, 27.40
15	Kiyunyu et al	21.51%	16.53, 26.48
16	Cichiwoti et al.2017	21.51%	16.54, 26.48
17	Cerruti et al.2016	22.76%	17.94, 27.59
18	Myer et al.2008	21.79%	16.71, 26.88
19	Morojele et al.2014	20.77%	16.33, 25.31
20	Medley et al.2014	22.33%	17.21, 27.45
21	Tang et al.2019	21.65%	16.55, 26.75
22	Seth et al.2014	22.82%	18.30, 27.34

Table 4: Characteristics of associated factors for alcohol use disorder among HIV AIDS patients in Africa by their Odds ratio, Confidence interval, association strength, author and year of publication.

Associated factors	Odds ratio(AOR)	95% CI	Strength of association	Author, year of publication	Remark
Lower ducational status	8.5	1.70,42.99	Strong and positive	Bultum et al.2018	
Cigarette smoking	3.49	1.01,12.13	Strong and positive	Bultum et al.2018	
Chat chewing	5.11	1.60,16.33	Strong, positive	Bultum et al.2018	
Family history of alcohol use	3.58	15.2,8.47	Strong and positive	Bultum et al.2018	
Missing ART drugs	3.05	1.30,7.12	Strong and positive	Bultum et al.2018	
Being Male	3.48	1.27, 9.59	Strong , positive	Gebrie, 2019	
Cigarette smoking	5.12	4.02, 8.61	Strong and positive	Gebrie, 2019	
Chat chewing	3.23	2.06, 6.89	Strong and positive	Gebrie, 2019	
CD4 count of 0-200	19.49	1.74, 218.4	Strong and positive	Gebrie, 2019	
Being male	14.1	5.84, 33.87	Strong and positive	Segni et al.2017	
Family history of substance use	2.66	1.15, 6.13	Strong and positive	Segni et al.2017	
Missing a dose of HIV medications	2.04	1.67, 2.49	Strong and positive	Medley et al.2014	
Inconsistent condom use	1.49	1.23, 1.79	Moderate and positive	Medley et al.2014	
Commercial sex	1.57	1.06, 2.32	Moderate and positive	Medley et al.2014	
STI	1.40	1.10, 1.77	Moderate and positive	Medley et al.2014	

Characteristics of associated factors for alcohol use disorder among HIV AIDS patients in Africa by their Odds ratio, Confidence interval, association strength, author and year of publication (continued).

Associated factors	Odds ratio(AOR)	95% confidence interval	Strength of association	Author, year of publication	Remark
Male sex	2.43	1.76, 5.76	Strong and positive	Duko et a;,2019	
Poor social support	1.34	1.12, 6.73	weak and positive	Duko et a;,2019	
Being medication non-adherent	1.78	1.33, 6.79	Strong and positive	Duko et a;,2019	
Chat chewing	1.67	1.16, 5.45	Strong and positive	Duko et a;,2019	
Cigarette smoking	3.76	2.16, 7.54	Strong and positive	Duko et a;,2019	
Male sex	$\chi^2 = 17.999$	P=0.000	Strong and positive	Goar et al.2011	
Lower education	$\chi^2 = 9.86$	P=0.000	Strong and positive	Goar et al.2011	
low income	$\chi^2 = 13.68$	P=0.002	Strong and positive	Goar et al.2011	
Male sex	5.2	2.48, 11.22	Strong and positive	Farley et al.2010	
Orthodox religion	2.3	1.22,4.31	Strong and positive	Soboka et al.2016	
Protestant religion	2.3	1.23,4.34	Strong and positive	Soboka et al.2016	
Male sex	2.23	1.30, 3.83	Strong and positive	Soboka et al.2016	
Cigarette smoking	3.4	1.38-8.40	Strong and positive	Soboka et al.2016	
Mental distress	2.24	1.40, 3.64	Strong and positive	Soboka et al.2016	
Being female	0.1	0.05,0.19	Strong and negative	Egbe et al. 2017	Harmful alcohol use
Being Christian	3.44	1.43,8.27	Strong and positive	Egbe et al. 2017	Harmful alcohol use
Being female	0.32	0.13, 0.76	Strong and negative	Egbe et al. 2017	Dependent drinking

Additional File Legends

Additional file 1: A table showing the quality assesment result of included studies.

Figures

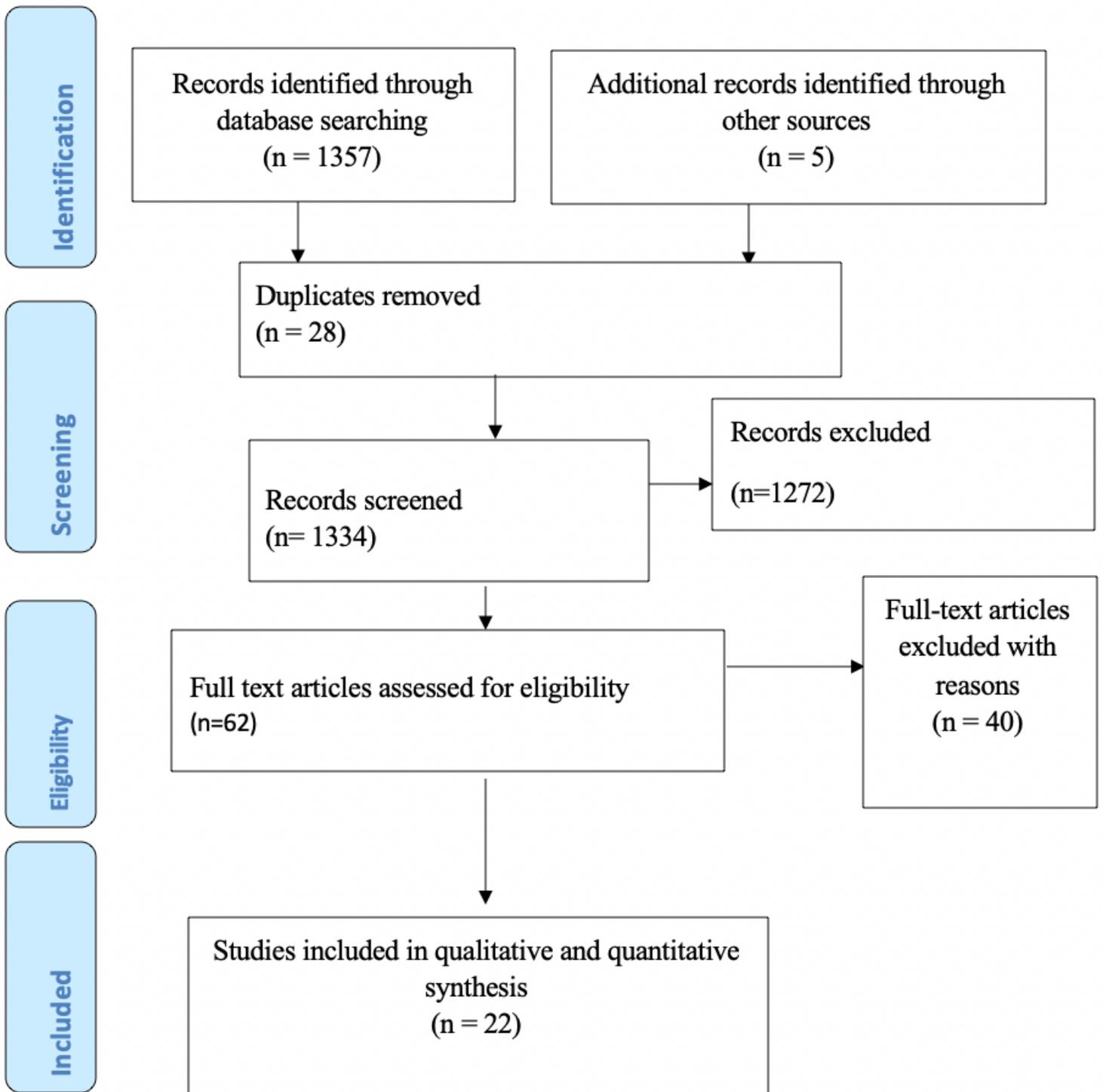


Figure 1

PRISMA flow chart for the review search process

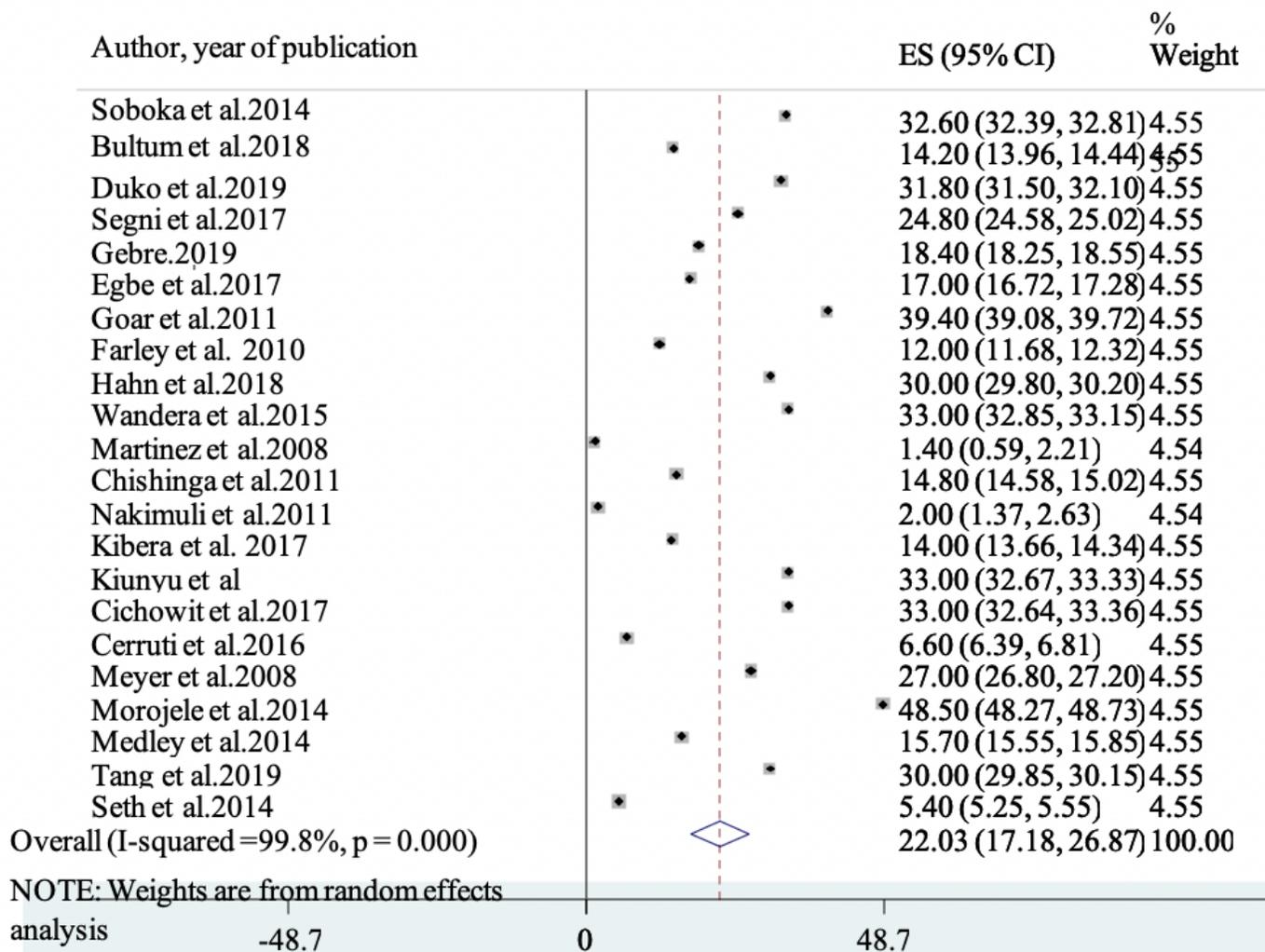


Figure 2

A forest plot for the prevalence of AUD among HIV patient in Africa

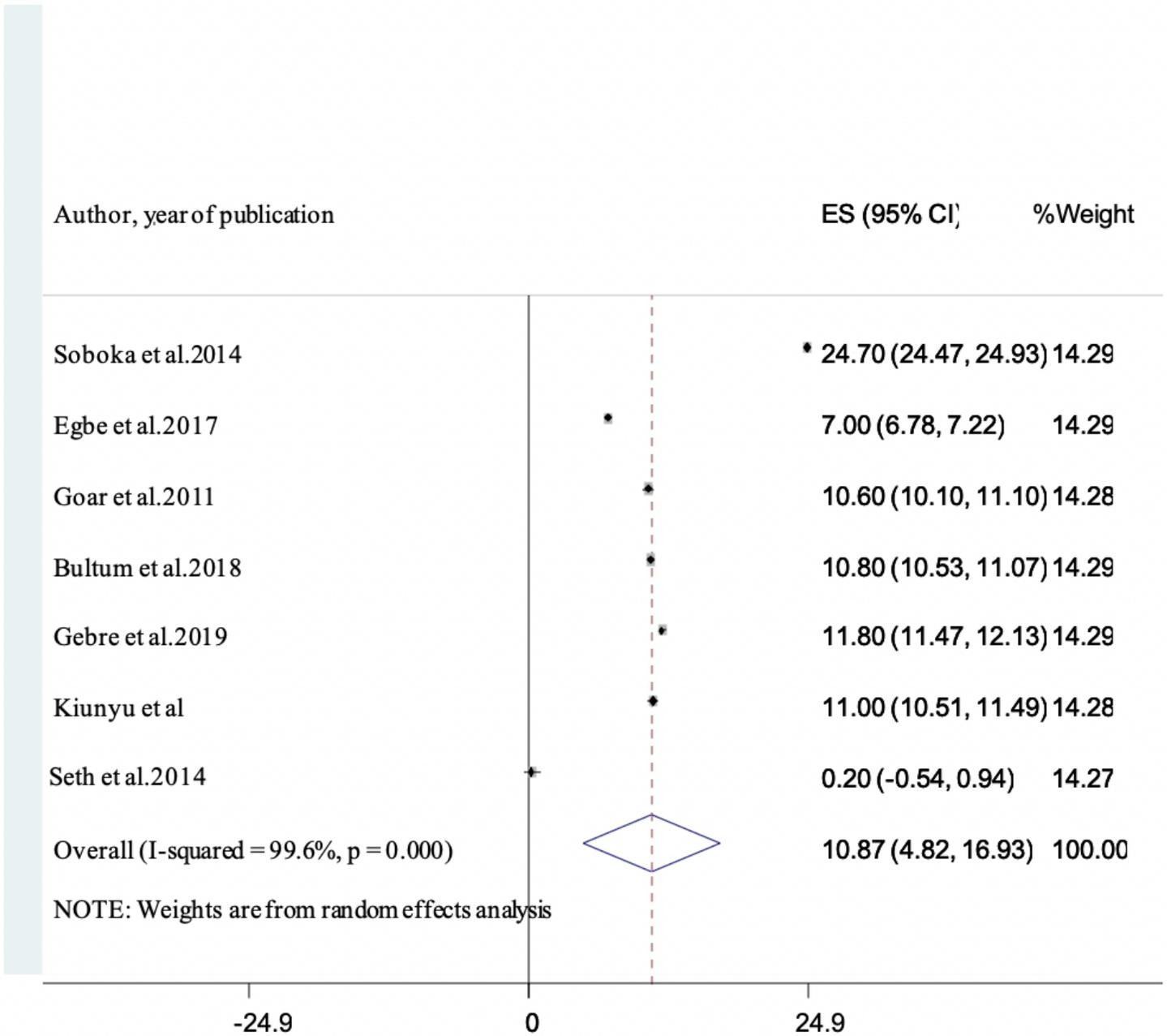


Figure 3

A forest plot for hazardous alcohol use among HIV patients

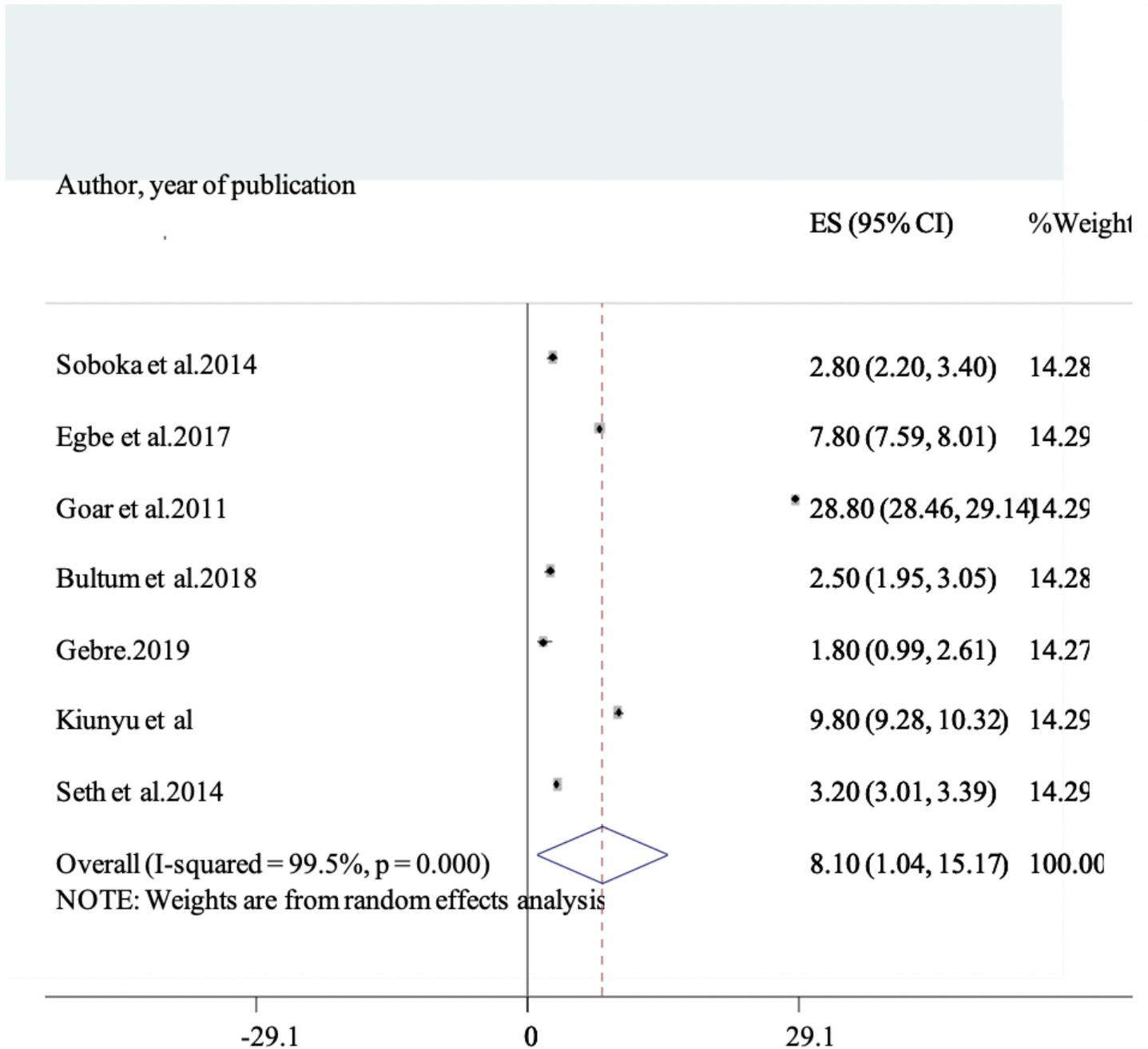


Figure 4

A forest plot for harmful alcohol use among HIV patients

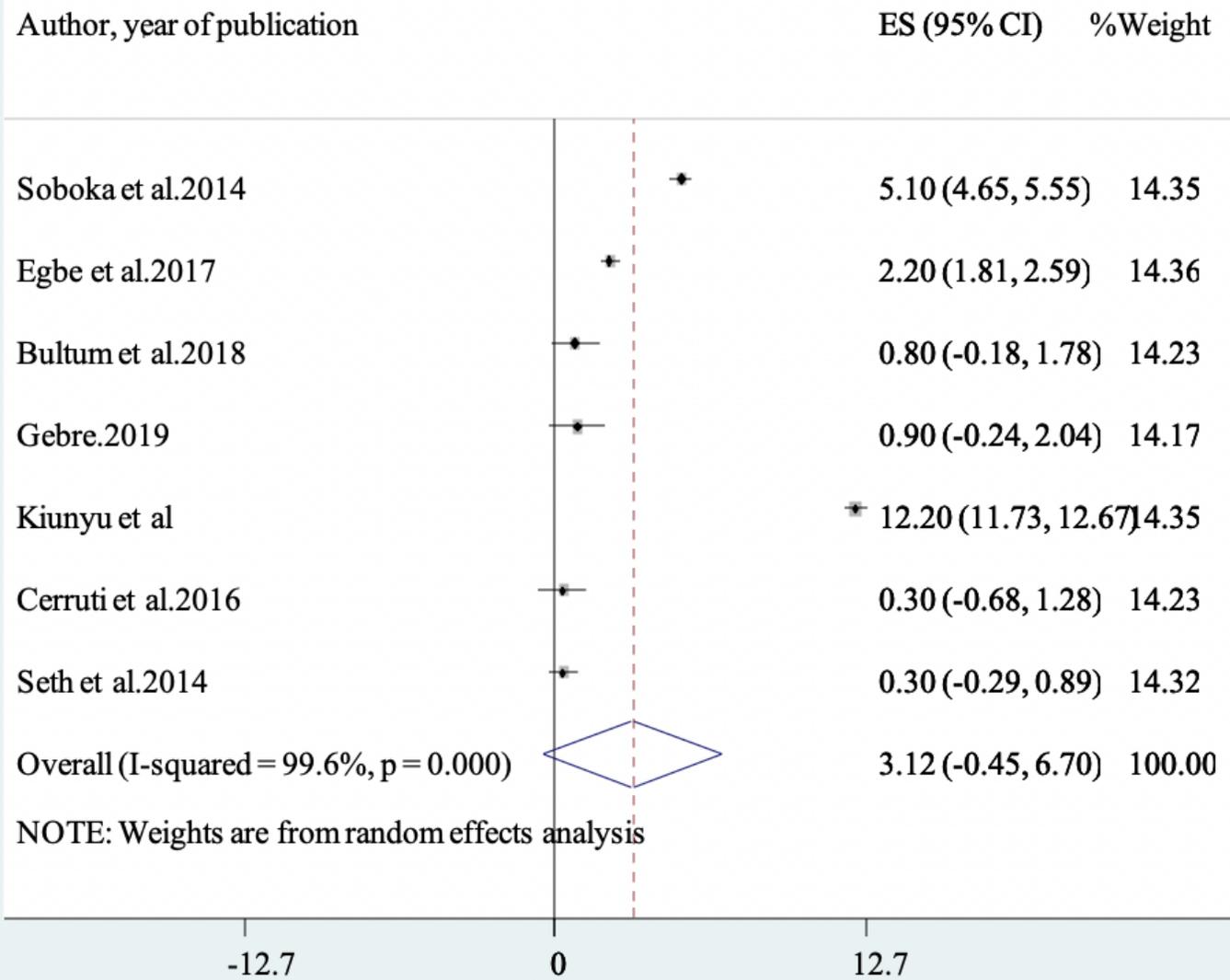


Figure 5

A forest plot for dependent alcohol use among HIV patients

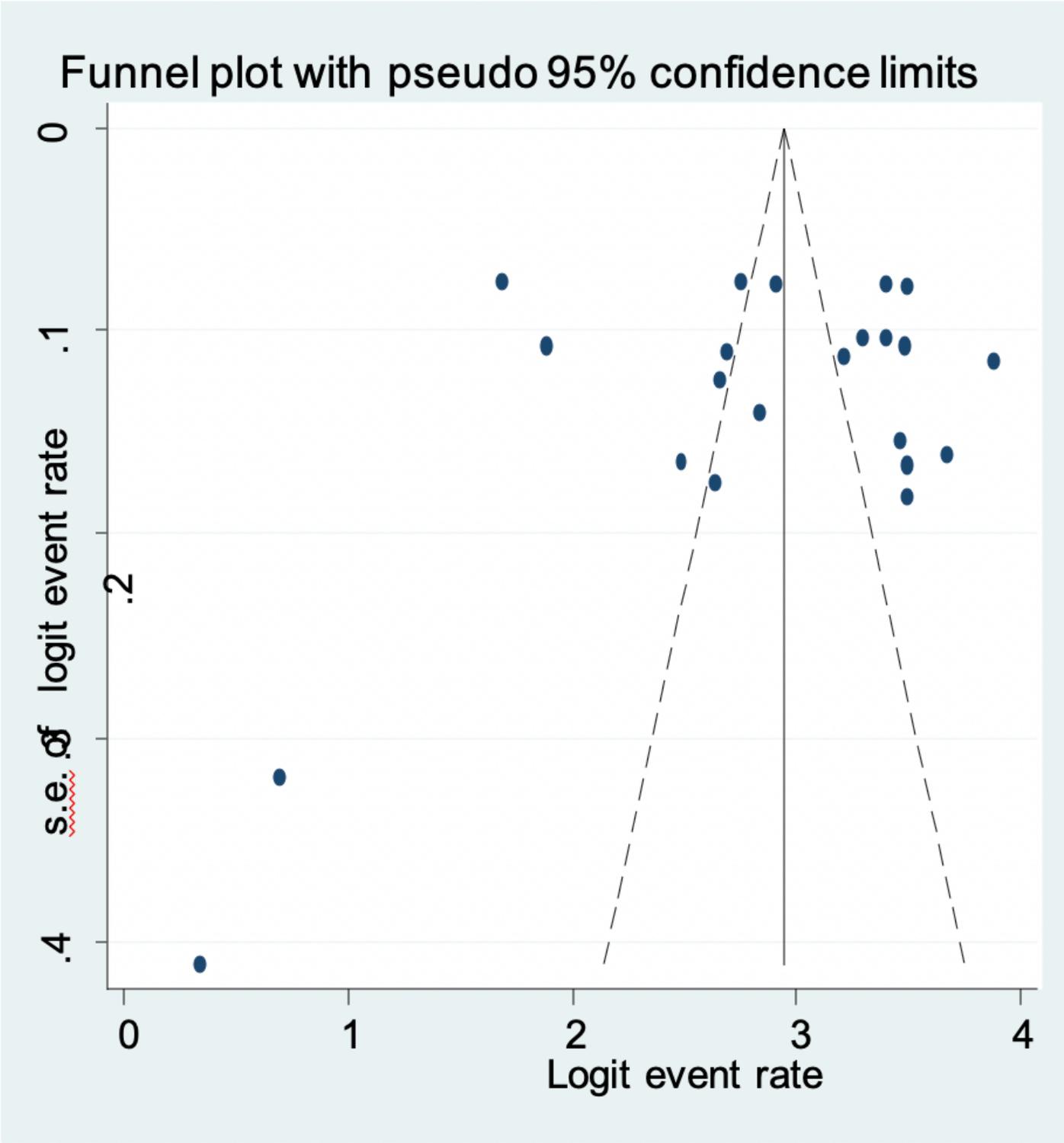


Figure 6

A funnel plot of publication bias for alcohol use disorder

Supplementary Files

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