THE PREVALENCE OF ALCOHOL USE DISORDERS AMONG UNIVERSITY STUDENTS IN DEVELOPING COUNTRIES: A SYSTEMATIC REVIEW AND META-ANALYSIS

A thesis submitted in fulfilment of the requirements for the degree of

MASTER'S IN CLINICAL PSYCHOLOGY

of

RHODES UNIVERSITY

by

PHILANI NDLOVU[a]

Supervised by Mr. Sizwe Zondo[b] and Prof. Charles Young[c]

January 2023

a) Mr. Philani Ndlovu, b) Mr. Sizwe Zondo, c) Prof. Charles Young. a) Master's candidate, Department of Psychology, Faculty of Humanities, Rhodes University, South Africa; b) Lecturer at Department of Psychology, Faculty of Humanities, Rhodes University, South Africa c) Professor Department of Psychology, Faculty of Humanities, Rhodes University, South Africa.

The corresponding author: Mr. Sizwe Zondo, Lecturer at the Department of Psychology, Faculty of Humanities, Rhodes University, South Africa.

Tel: +27 (0) 46 603 8503

Email: s.zondo@ru.ac.za

Declaration of conflicting interests: The authors declared no potential conflicts of interest concerning this research, authorship, and publication of this article.

Funding: n/a

CONTRIBUTION OF THE AUTHORS

The following researchers contributed to this dissertation:

Mr. Philani Ndlovu (master's candidate)

Responsible for conceptualizing the study, conducting literature searches, and writing the research manuscript. The candidate took part in data collection and was responsible for data analysis.

Sizwe Zondo (Supervisor)

He supervised all stages of compiling the manuscript and assisted with statistical analysis.

Prof Charles Young (Co-supervisor)

He provided recommendations on writing the manuscript and assisted with evaluating this study.

This statement of the authors confirms their contribution to this study and their permission that the manuscript may form part of this dissertation.

PLAGIARISM DECLARATION

1. I know that Plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

2. I have used the American Psychological Association formatting for citation and referencing. Each significant contribution to, and quotation in this thesis from the work or works of other people has been attributed, cited, and referenced.

3. This thesis is my own work.

4. I have not allowed and will not allow anyone to copy my work with the intention of passing it off as his or her own work.

Full Name : Philani Ndlovu

Signature **:**

Date : 18 January 2023

ABSTRACT

Background

High alcohol misuse is associated with many challenges, including (a) unsafe sex, problems with the criminal justice system, absenteeism, academic failure, death, injury, and alcoholrelated harm, both in the developing and developed world. Despite the above, no meta-analysis had been conducted in the literature to comprehensively study the prevalence of Alcohol Use Disorders (AUDs) amongst university students in the developing world. This study reviewed literature related to AUDs among university students in developing countries. It described the concept of AUD and the harmful effects of excessive alcohol use, including biological, cognitive, psycho-social, and economic impacts on the individual and the family.

Methods

A systematic review and meta-analysis were conducted to determine the prevalence of AUDs among university students in developing countries.

Results

Critical gaps emerging from the literature include findings that problematic alcohol usage is generally higher in developed countries than in developing countries. A total of 6 studies examined the prevalence of AUDs using the AUDIT tool. The expected prevalence for AUDs among university students in developing countries was 32.1% at 95% CI. Due to the heterogeneity of the data in the studies included, common risk factors for AUDs could not be determined. However, all studies reported peer pressure and gender as common risk factors for AUDs. A meta-analysis of 6 published results found an overall mean effect size of 0.108 (95% CI = 0.302 to 0.341, $p < 0.108$). Moderate heterogeneity was found across studies ($Q = 1356.329$, $p = 0.000$, $I^2 = 99.189$).

Conclusion

Reported AUDs among university students in developing countries are common and vary among different countries. The prevalence of AUDs was highest among population groups where one had a friend who uses alcohol, followed by mental distress. Future epidemiological studies on AUDs among university students should apply these in questionnaires to facilitate comparison.

KEYWORDS

Prevalence, Alcohol Use Disorders, University, Students, Developing Countries

INTRODUCTION

Alcohol use causes a variety of acute and chronic health problems. Alcohol is a psychoactive drug derived from ethanol. Pharmacologically, ethanol is a chemical compound produced from the fermentation of agricultural products such as sugarcane and maize [1]. Alcohol Use Disorder (AUDs) are responsible for injury-related health conditions and many diseases, both physical and psychological, including foetal alcohol syndrome (FAS), oncological diseases (such as liver cancer), and alcohol poisoning [2-3]. AUD is a condition in which one's ability to avoid or monitor their drinking, despite adverse social, occupational, or health effects, is compromised [4]. The term AUD is further defined as a condition by which the ability of an individual to monitor or avoid drinking behaviour is compromised, despite the negative consequences thereof [5]. AUDs are often catalysed by alcohol abuse, dependency, and addiction [6].

AUDs can be classified within a broad spectrum of 'severe,' 'moderate,' or 'mild. 'Severe,' AUD is characterized by a strong desire to seek out and consume alcohol, as well as a loss of control over consumption and an unwillingness to cut back on drinking despite unfavourable

consequences [7]. On the other hand, ‘mild’ AUD represents the presence of 2-3 symptoms within the spectrum being present, such as ‘wanting a drink so severely to the extent that one cannot think of anything else’ [7] (p.31) or drinking that cause problems with other people at work or home [7]. Lastly, ‘moderate’ is characterised by meeting 4–5 symptoms withing the criteria (e.g., fever, joint pains, headache, rash, and diarrhoea). Many scales have since been developed to assess AUDs, and these include the AUDs Identification Test [AUDIT] [8] and the Composite International Diagnostic Interview [CIDI] [9].

Alcohol use and consequences thereof

Alcohol usage has grown globally over the last three decades, and this trend is expected to continue in terms of prevalence and degree [10]. In 2016, it was reported that more than half of the global population aged 15 and older (57 percent, or 3.1 billion people) had not consumed alcohol in the previous 12 months, while 2.3 billion people in this age group were active drinkers [3]. It is further estimated that AUDs are among the most prevalent mental disorders, affecting 8.6% of men and 1.7% of women, with a total prevalence of 5.1% [3;11]. In the Americas, Europe, and the Western Pacific region, it is estimated that more than half of the population consumes alcohol [3]. Germane to my research study, the use of alcohol is linked to a myriad of consequences, including deleterious effects on cognition, economic stability, achieving developmental goals (i.e., behavioural, cognitive), and deterioration in health, to name a few.

Problem statement and research objectives

As noted above, the high level of alcohol misuse is associated with a myriad of challenges, including (a) unsafe sex [6]; (b) problems with the criminal justice system [12], (c) absenteeism and academic failure; (d) death and injury [51] and (e) alcohol-related harm,[13] in both the developing and developed world [12]. Despite the above, no meta-analysis has

been conducted in the literature to comprehensively study the prevalence of AUDs amongst university students in the developing and developed world. The achievement of conducting a meta-analysis on the prevalence of AUDs amongst university students in the developing world and developed has the potential to provide an accurate and summarised estimate and precise magnitude of the prevalence of AUDs among university students in developing countries.

Significance of the study

A study exploring the prevalence of alcohol use disorders among university students is important for several reasons. First, alcohol use disorders have significant negative consequences on the health and well-being of individuals, including increased risk of accidents, injuries, and chronic diseases [12, 13, 51]. Second, university students are a vulnerable population who may be at higher risk for developing alcohol use disorders due to the social and academic pressures they face [19]. Third, the findings of this study can inform the development of effective interventions and policies to address alcohol use disorders among university students. By understanding the prevalence of alcohol use disorders among this population, policymakers, and healthcare practitioners can tailor their efforts to prevent and treat alcohol use disorders effectively. Therefore, a study exploring the prevalence of alcohol use disorders among university students is critical to promoting the health and well-being of this population.

Response to the statement of the research problem and research objectives

Research Aims

The primary aim of my research study was to perform a meta-analysis of the prevalence of AUDs among university students in developing countries.

Research question: What is the prevalence of alcohol abuse disorders among university students in developing countries in published literature?

Further Context to the Primary Research Problem & Research Objectives

Alcohol consumption peaks between 18 and 25 years old, especially among university students in this age bracket [14]. According to Petit et al. [15], adolescence is marked by rapid biological changes, particularly in the prefrontal cortex and the mesocorticolimbic dopamine system, as well as dramatic alterations in the brain. This quick biological peak is noted to cause an increase in risk taking behaviours especially amongst adolescents, with alcohol consumption a byproduct of risk-taking behaviour within this age group.

Globally, alcohol consumption continues to be prevalent, and research indicates that alcohol is the most used and abused psychoactive drug among university students [16]. Heavy alcohol drinking among university students has become a significant public health problem with high levels of alcohol-related mortality and morbidity [17]. According to the WHO [3], in 2016, more than 2.3 billion people of the global population aged 15 and older were active alcohol drinkers. The prevalence of heavy episodic drinking among young adults has rapidly increased in many developing countries, becoming a public health concern [14]. According to Glantz et al. [18], heavy alcohol use is responsible for 3.3 million deaths and 5.1 percent of disability adjusted life years worldwide. More than 200 diseases and injuries have been linked to drinking too much alcohol. Alcoholism, liver cirrhosis, malignancies, and injuries are only a few of the disorders related to hazardous alcohol consumption. Excessive alcohol consumption is the catalyst for many adverse social, economic, physiological, and psychological consequences [14].

It has been noted that excessive alcohol consumption is the third leading preventable risk factor contributing to the global burden of disease [19]. Moreover, the misuse of alcohol is

the fifth leading risk factor of premature death among the 15-to-49-year demographic. Of relevance, alcoholism is reported as being a strong predictor of university students' mental health [5]. For example, a study by Tembo et al. [20] explored the link between levels of alcohol consumption and mental health problems, and academic performance. University students in Australia reported that students who were consuming alcohol at hazardous levels were 1.2 times more likely to report psychological distress than those with lower levels of alcohol consumption. Pedrelli et al. [21] investigated whether alcohol consumption influences the risk of depression among university students in the USA. It was reported that depressive symptoms were associated with increased daily alcohol use and a greater risk for compulsive drinking.

Within the South African University fraternity, students are particularly at risk for AUDs due to excessive alcohol consumption compared to other South African individuals of the same demographic age range [14]. It has been suggested that AUDs are common in South African universities because students use drugs and alcohol for various reasons, including depression treatment, role modelling, loneliness relief, and self-doubt reduction [22]. According to Nkambule et al. [14] (p.30), the university years appear to be a period of heightened exposure to the risk of beginning to drink alcohol and a progression into regular drinking practices. Worryingly, it has been found that alcohol consumption increases during the transition from high school to university and is witnessed to plateau post-graduation [14].

The emergence of AUDs in student populations is often accompanied by abuse of other substances such as tobacco and other more illicit substances [5]. Although not well understood, it is thought that university student residence life is a strong predictor of AUD. For example, Mekonen et al. [19] indicate a strong correlation between living in residence and the emergence of AUDs. Interestingly, it has been found that students residing with

parents/guardians show a significantly negative correlation with the emergence of AUDs than students living at university residences [5]. The subsequent sections further details predictors of AUDSs amongst University students as cited in the reviewed literature.

Predictors of AUDs

Besides the university context, other predictors have been studied to explain the variance in predictors of AUDs. For example, socio-economic status has been cited as an emergent variable in AUDs amongst University populations [19]. For instance, Mekonen et al. [19] conducted a chi-square analysis and logistic regression analysis (95% confidence interval) (CI) to determine significant predictors that increase the risk of AUDs. Their study found that AUDs were significantly associated with higher socio-economic status [19]. Stated differently, students from a higher socio-economic status were found to consume more alcohol compared to those of a low socio-economic status.

On the other hand, socialisation has been found to be a key predictor for the emergence of AUDs amongst University students. To date, research has indicated that most university students cite social events and peer pressure as their rationale for alcohol consumption [5].

Linked to this, Mekonen et al state that students who socialize with friends who drink alcohol are two times more likely to develop alcohol-abusive behaviors than students who do not have alcohol-user friends [19]. Similarly, findings indicate that university living arrangements, especially environments where freshman, and, or sophomores have two or more roommates who partake in alcohol use, are likely to be influenced to consume alcohol, and this may lead to AUDs [5].

Consequences of AUDs

Alcohol use is linked to more than 60 diseases and non-communicable diseases, including cancer and cardiovascular diseases [23]. The consequences of AUDs extend to physiological, psycho-social, and economic domains and cognitive spheres. For example, excessive alcohol consumption among university students has been associated with increased depressive symptoms and alcohol dependence because alcohol is thought to change levels of serotonin and other neurotransmitters in the brain, leading to heightened levels of anxiety and depression [24]. Similarly, alcohol consumption among university students is thought to promote suicidal and aggressive behavior [19]. For example, a meta-analysis by Darvishi et al. [25] found a significant association between AUDs and suicidal ideation, suicide attempt, and completed suicide. The subsequent sections further highlight the consequences of AUDs, explicitly referring to biological, cognitive, psycho-social, and economic consequences.

Biological Consequences

The biological effects of alcohol are substantially reported in the nascent literature on alcohol and its consequences on the brain. These consequences include blackouts, hangovers, alcohol poisoning, and memory deficits [26]. Alcohol has been indicated in individuals who experience neurodegeneration [27]. More specifically, alcohol abuse may initiate the degeneration of regions in the brain responsible for learning and memory [27]. Hermens and Lagopoulos [28] explored how *in vivo* neurochemistry, using magnetic resonance spectroscopy (MRS) biomarkers can elucidate the influence of alcohol on neurotransmission. Findings indicated that alcohol consumption and binge drinking causes neurodegenerative loss in hippocampi tissue, and neurotransmission (glutamate and Gamma-Aminobutyric Acid (GABA) which is further associated with memory loss, and mild cognitive impairment. Given the above findings, expectedly, AUD has been found to impair student study habits leading to university drop out and lack of progressing into adulthood [28].

Among university cohorts, there has been evidence of individuals with AUDs having reduced activation of the prefrontal cortex and displaying lower white matter volumes [29]. In another study by Pandey et al. [30] who conducted voxel-and surface-based volumetric estimations using diffusion tensor imaging (DTI) coupled with neuropsychological assessment on 60 individuals (30 = individuals with AUDs (DSM-IV) and 30 healthy controls) found significant differences between the groups. The study found cortical and subcortical volume differences in the left pars orbitalis, right medial orbitofrontal, right causal middle frontal, and bilateral hippocampus regions, lower FA in nine white matter (WM) regions, and higher FA (fractional anisotropy) in the left thalamus, fractional anisotropy (FA) differences were noted, as well as axial and radial diffusivities (AD). Fractional anisotropy refers to a useful measure of connectivity in the brain derived from diffusion tensor imaging whilst radial diffusivities refer to the water diffusion coefficient in the direction perpendicular to the axonal fibres. In addition to neuroimaging findings, deficits in neuroimaging were correlated with difficulties in multiple assessments, including problem-solving as indicated by the Tower of London Test, working memory, is indicated by the Visual Span Test and attention skills as indicated by the Visual Span Test in AUD individuals compared to controls ($p < 0.05$). Interestingly, the study by De Bellis et al [29] found a higher prominence of neurological deficits among male individuals compared to female individuals resulting from alcohol use. In addition to frontal lobe perturbations, alcohol use has been indicated to weaken other brain structures including the cerebellum, where it has been found to lead to difficulties in postural adjustments and maintaining balance and learning in AUD [31].

Cognitive development and Negative Brain Plasticity

Negative brain plasticity has been reported to result from long-term changes in the brain caused by frequent alcohol abuse. Negative brain plasticity as opposed to positive brain

plasticity refers to aberrant neural plasticity, which also causes amongst other symptoms, autonomic dysreflexia, and detrimental effects on brain and spinal cord function. Negative neuroplasticity due to alcohol use has also been associated with personality disorder leading to socially unaccepted behaviour [33]. Negative plasticity related to AUDs has also been associated with adverse mental health conditions. For example, a study by McHugh and Weiss [34] investigated whether major depressive disorders, and personality disorders were linked to AUDs. The authors concluded that AUDs were significantly associated with depressive disorders. Moreover, AUDs have been implicated depression [35], post-traumatic stress disorder [36], and attention deficit hyperactivity disorder [37] and post-traumatic stress disorder and depression. Significantly for my research purposes, Peltzer and Pengpid [38] conducted a study to assess the association between varying levels of alcohol use and poor mental health (depression and PTSD symptoms) amongst university students from 26 low-, middle- and high-income countries in Africa, Asia, and the Americas. The authors found that AUDs were significantly associated with both depression and PTSD amongst University students in low- and middle-income countries.

Psycho-social consequences

Further consequences of AUDs on psycho-social factors are illustrated in a study by Taft et al.

[39]. The authors examined the risk factors for perpetration of intimate partner violence among

European and American men in treatment for AUDs. The study found a significant relationship between AUDs and the perpetration of intimate partner violence. Additionally, according to König et al. [40], the psycho-social consequences of alcohol extend beyond individuals who consume alcohol and engage in binge drinking. Alcohol use has been associated with increased crime and violence rates, and other pressing concerns such as family dysfunction, motor vehicle accidents, occupational productivity losses, and medical

and mental health costs that plague society [41]. Linked to medical health, AUDs and alcohol abuse have been linked to greater levels of depression, lowered self-esteem, compromised concentration, and diminished coping mechanisms in daily life [42]. Lastly, in terms of university populations, AUDs have been implicated in demotivation, which hampers academic success, leads to absenteeism, and lower preparation for university assessments, this compromising academic achievement and eventual tertiary success [42].

Economic consequences

Lastly, AUD has been associated with adverse economic consequences for nations. Thavorncharoensap et al. [43] conducted a systematic review to illustrate the effect of AUDs on national economies. The systematic review included twelve countries from developed and developing nations. The study reported that the economic burden of alcohol use was between 0.45 and 5.44 % of the GDP. The findings were uniform across the countries included. Morojele and Ramsoomar [44] state that besides the direct consequences of AUD on the economy, AUDs have a passive burden on the economy due to their adverse linkage to, for example, traffic-related accidents, deaths, criminal and social injustice, and health-related comorbidity. These associations often result in individuals from lower socio-economic status bearing the brunt of the economic consequences of AUDs [44].

The former sections have provided the definition of AUDs and highlighted the negative consequences linked to AUDs, particularly among university students. In the subsequent sections, the literature review will describe the prevalence of AUDs among university students in general and subsequently focus on prevalence within developing countries.

The prevalence of AUDs among student populations

In the subsequent sections, the literature review will describe the prevalence of AUDs among university students in developed and developing countries and provide a rationale for my

research objectives. Firstly, it is worth noting that according to the Organisation for Economic Co-operation and Development [OECD] [47], there is no conventional agreement for the designation of "*developed*" and "*developing*" countries. Nonetheless, the OECD [47] conceptualises a 'developed' country as a sovereign state that, compared to less industrialized states, has a high standard of living, a strong economy, and a cutting-edge technological infrastructure. On the other hand, a developing country is a sovereign nation that is less developed economically and has a lower Human Development Index (HDI)[1] compared to other countries. In general, countries such as Japan, Canada, the United States of America, Australia and New Zealand in Oceania, and most countries in Europe are considered "developed" regions [47]. In term of international trade, the Southern African Customs Union states are considered as semi-developed [47]. Other countries emerging from the former Yugoslavia are regarded as developing whereas countries of Eastern Europe and the former Union of Soviet Socialist Republics (USSR) are neither strictly 'developed' nor 'developing' countries. This study adopted the OECD definitions of developing and developed countries.

Prevalence of AUDs amongst University Students in Developed Countries

As highlighted in previous sections, compared to non-college attending counterparts, there is evidence to suggest that young adults in colleges and universities have a clinically significant alcohol problem in many developed countries [12]. A cross-sectional survey by Heather et al. [48] sought to determine the prevalence of AUDs among university students using the Alcohol Use Disorder Identification Test (AUDIT). A study comprised of a sample of 770 undergraduate students from seven universities across England. The study reported that 61% of the sample (65% men; 58% women) scored positive (8+) on the AUDIT, further broken down into 40 % hazardous drinkers, 11% harmful drinkers, and 10% with probable

[1] The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions.

dependence. In another study Chang et al. [49] surveyed 29000 university students in Canada and reported that male students had a high-risk prevalence for alcohol use (4.74%) compared to females (3.37%). Further analysis from the study indicated that among the three academic majors of study, engineering students (8.96%) had the lowest prevalence of risky levels of alcohol use compared to business students (23.29%) and healthcare professional students (21.54%). According to Chang et al. [49], heavy drinking was associated with psychological distress.

Another study by Kim et al. [50] investigated the relationship between depression, problematic alcohol use, and non-suicidal self-injury during COVID-19 lockdown among university students in five South Korea cities. The study also examined the moderating role of uncontrollable alcohol use and the link between depression and non-suicidal self-injury. Overall, results showed that 58.1% of the students engaged in binge drinking, and that 33.3% of the students engaged in non-suicidal self-injury in the past six months. Among university students, depression was positively correlated with non-suicidal self-harm [50].

Prevalence of AUDs amongst University Students in Developing Countries

Data on the prevalence of AUDs amongst university students is slowly emerging in developing countries (e.g., Brazil, India, South Africa, Cameroon, Nigeria, Ethiopia). Lasebikan et al. [51] explored the prevalence of AUDs among students in Nigeria and reported a prevalence of approximately 40%. Religion, place of residence, and cigarette smoking were reported to be the main predictors of AUDs in the study. Similarly, Ajayi et al. [52] conducted another study among university students in Nigeria, where they explored the prevalence, correlates, and frequency of alcohol use. The study reported the prevalence of alcohol use to be 44% among males and 31 % among females. Moreover, the study reported an average frequency of alcohol use to be three times out of ten days. Another study explored

310 the prevalence of alcohol dependence among Cameroonian university students, and factors
311 related to alcohol use, and reported that 25.1% of male students and 17.1% of female students
312 in Cameroon consumed alcohol [53].

313 High consumption rates of alcohol use amongst university students have been reported in
314 other developing countries, including Brazil, where it was found that 89.2% of university
315 students reported having used alcohol in the last three months [54]. Key findings from the
316 study by Silveira et al. [54] indicated that university students who consumed alcohol
317 compared to nondrinkers, tended to experience more blackouts and academic challenges.
318 Moreover, these students tended to act impulsively and were often involved in violent
319 altercations.

320 Verenkar and Vaz [55] studied the prevalence of alcohol consumption and AUDs among
321 university students in India. The study, contrary to other findings on gender and AUDs, found
322 that alcohol consumption was approximately 40 %, amongst females (40.6 %) and 38%
323 amongst males. Within the whole sample, 82.3% of the alcohol consumers were deemed as
324 'light drinkers' (AUDIT <8), while 17.7% were identified as 'heavy drinkers.

325 In a study conducted in Ethiopia to assess the prevalence of AUDs, it was reported that
326 approximately 11.4% of the university students were problematic alcohol users, of which
327 6.8% had 'medium level' problems, and 4.6% had 'high level' problems as measured by the
328 AUDIT [19]. In the above study, significant predictors of AUDs were linked with social
329 phobia, lifetime use of substances, and having a close friend who uses alcohol [19].

330 Alemu et al. [56] conducted a study in Ethiopia and reported an AUDs prevalence of 26.5%
331 among university students. The study found an association between AUDs, and being single,
332 having a history of mental illness, and peer pressure influence alcohol use. In another study,
333 Lemma et al. [45] investigated the prevalence of AUD among undergraduate students at an

Ethiopian university (University of Gondar) and reported a prevalence of AUDs to be approximately 62%. The authors state having friends who use alcohol and being male as antecedents to AUDs. Similar findings were reported in a study conducted in Zimbabwe by Machanja [57], who used the AUDIT to assess the prevalence of AUDs. Results from the study indicated a prevalence of 70% amongst Zimbabweans student in the study, with most participants scoring 8+ on the AUDIT, indicative of harmful or hazardous drinking. Machanja [57] states peer pressure and stress from academic pressure as the main contributors to AUDs.

Kamulegeya et al. [58] conducted a study investigating AUDs using the AUDIT in Uganda. The study reported a high prevalence of maladaptive alcohol use patterns among university students. Respectively, the study found low-risk drinking, heavy episodic drinking, and alcohol misuse to be 31%, 17.3%, and 4.5% respectively. According to Kamulegeya et al. [58], male students were more likely to misuse alcohol and reported greater levels of depressive symptoms compared to female students. The high prevalence of AUDs in the above study is like those reported among university students in Malawi by Zverev [70], who reported a prevalence rate of approximately 72%. Lastly, it has been noted that within the sub-Saharan region, South Africa has one of the highest alcohol consumption rates per capita amongst individuals aged 15- 29-year-old [59]. One study by Mandela and Ter Goon [60] reported a prevalence of 60%

AUDs among university students.

RESEARCH METHODOLOGY

Research methods, procedures, and techniques

Research Design

The study followed a systematic review of the literature and a meta-analysis approach. Systematic reviews are a thorough, precise method for searching, evaluating, and synthesizing data from all available sources [69]. According to Xiao and Watson [61], a systematic review concentrates on all available literature on a particular topic, adding perspective to what is already known. As such, the reviews help update previous reviews and synthesis studies and provide a concise summary of the state of a research topic of interest [62]. The resources examined and included in systematic reviews tend to focus on a particular research question of interest, which necessitates clearly defined inclusion criteria [63]. Additionally, systematic reviews may omit literature based on the study's language, publishing date, location, and context [63]. For this research study, only studies conducted in developing countries that included university students and users of the AUDIT tool were included in the analysis.

On the other hand, "A Meta-analysis refers to the statistical analysis of the data from independent primary studies focused on the same question, which aims to generate a quantitative estimate of the studied phenomenon, for example, the effectiveness of the intervention'' [64] (p, 33).

Data sorting and literature search

The researchers searched MEDLINE (via EBSCOhost). Studies that explored the prevalence of AUDs among university students in developing countries were included in the systematic review and meta-analysis. All relevant English studies published before June 2022 were included. Grey data was excluded, but the researcher identified other potentially eligible studies by searching the reference list of identified studies and existing review articles relevant to the systematic reviews and meta-analysis. Medical Subject Headings (MeSH)

were used for each search term and outcome measure. All searches were done by the student researcher experienced in search strategies to ensure a lower risk of inclusion bias. The following search strings were used: (alcohol use OR disorder) AND (university OR college OR students) AND (Developing countries) AND AUDIT tool. Even though some of the countries included in the study could also be regarded as Low- and Middle-Income Countries (LMIC), for the purpose of this study the researchers did not include LMIC as part of the search terms.

Selection of studies

A total of seven electronic databases were searched to identify published literature, and the same search strategy was applied to all databases. To appropriately determine search terms, the MeSH terms were identified and used. As a measure to include a significant number of studies, all fields were searched. Searches were limited to only English articles; only English and human studies were analyzed. Two review authors independently assessed the titles and abstracts of the citations retrieved by the searches for relevance. After this initial assessment, the researcher obtained full-text copies of all potentially relevant studies. Two review authors (the student researcher and study leader) independently checked the full papers for eligibility; disagreements were resolved by discussion and, where required, by a third review author (co-study leader).

Data extraction and management

The researcher made use of a data extraction form to collect the following information from each eligible article: (i) country; (ii) year the study was conducted; (iii) year of publication; (iv) study population (the general population, university students, female, bar and university, alcohol; (v) sample size; (vi) definition of alcohol use disorder; (vii) prevalence of AUDs (AUDs as classified by AUDIT); (viii) factors associated with the initiation and persistence of

404 alcohol use; (ix) AUDs screening questionnaires applied, and (x) complications associated
405 with alcohol abuse. A descriptive quality assessment of the final papers included in the meta-
406 analysis was conducted using the modified quality assessment tool for systematic reviews of
407 observational studies (QATSO) [65] (Please see Appendix A). The original QATSO tool, as
408 noted in Francis et al. [65], is composed of five quality categories that include external
409 validity (sampling strategy used), reporting (response rate and objectivity of measurement),
410 confounding factors, bias (privacy) and a final score based on the mentioned parameters. The
411 primary outcome of this review was the prevalence of alcohol abuse disorder, and the
412 reported response rate was modified to include three categories (>80%, 60–80%, <60%),
413 similar to Francis et al. [65].

414 **Assessment of risk of bias in included studies.**

415 Assessment of the risk of bias was conducted independently by two review authors.
416 Disagreements were resolved by discussing or consulting the third review author. The risk of
417 bias was allocated according to the criteria in the Cochrane risk of bias tool. A low risk of
418 bias was allocated if all domains were satisfied, whereas a high risk of bias was allocated if
419 one or more of the domains were inadequate.

420 **Statistical analysis.**

421 Two types of meta-analysis exist, *fixed* and *random* effect meta-analysis [65]. This study used
422 random effects meta-analysis because inferences could be drawn from population data using
423 the random-effects model under the premise of normal distribution. The random-effects
424 model presupposes that the effects that are unique to a particular person are unrelated to the
425 independent variables. Cohen's criteria were applied when assessing magnitudes of effect
426 sizes, namely large ($r = 0.5$; $r^2 = 0.14 \geq 0.26$) or moderate ($r = 0.3$; $r^2 = 0.03 \geq 0.13$) and small

427 (r =0.1; r^2 =0 ≥ 0.02) [67]. The prevalence meta-analysis was performed on Comprehensive
428 Meta-Analysis (CMA) software [66]. Effect sizes for the studies were calculated by dividing
429 the two population mean differences by their standard deviation.

430 **Study selection**

431 Nine (9) published study citations from seven databases were identified. Nine (9) abstracts
432 were screened for initial eligibility to identify studies conducted in developing countries. Six
433 (6) relevant abstracts which reported on AUDs among university students in developing
434 countries were identified. All six (6) studies used the AUDIT alcohol use screening
435 questionnaire [19; 45-53; 56-57; 60]. Further screening was done for studies reporting on
436 AUDs and identified six abstracts for full article review. Thus, we reviewed six full-text
437 papers and identified six eligible for inclusion in the review. The main reasons for exclusion
438 were that some articles did not report information on alcohol use disorder and the tools
439 applied were not the AUDIT tool, or that the study population did not include university
440 students in developing countries (Figure 1). The final six eligible studies (Table 1) reported
441 AUDs among university students in developing countries and used the AUDIT tool for data
442 collection [19; 45-53; 5657; 60]. All the studies included were cross-sectional. Two of the
443 studies (n=2) were conducted in Ethiopia, India (n = 1), Uganda (n = 1), Zimbabwe (n=1) and
444 South Africa (n=1). The study from Cameroon was excluded because it did not report on the
445 overall prevalence of AUDs (*see* Table 1).

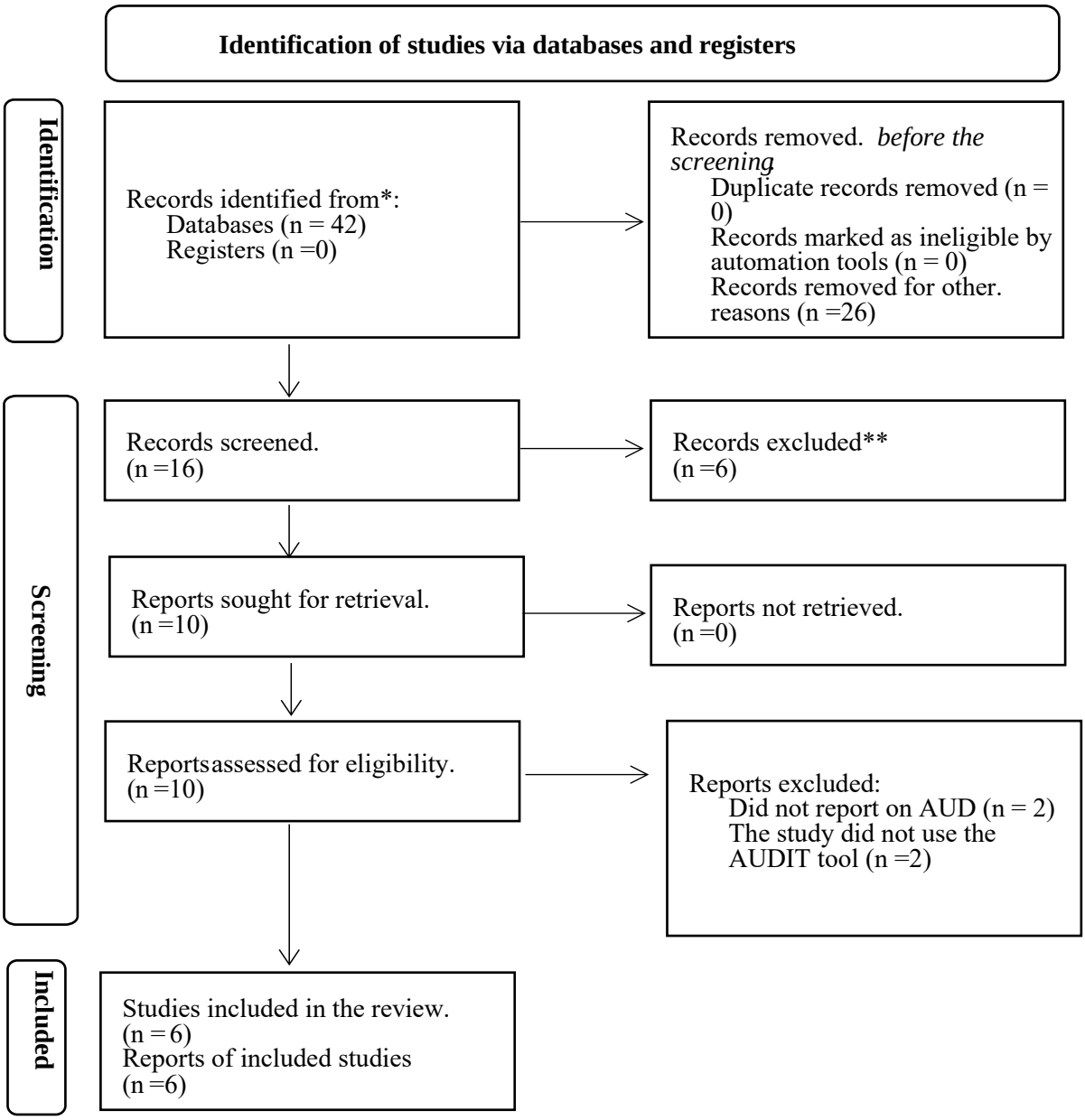

Figure 1. Flow diagram illustrating the process for selecting articles to include in the systematic review.

Table 1. Description of studies included in the systematic review and meta-analysis.

First Author	Country	Sample size	Prevalence	Alcohol screening tool	Gender
Adewuya et al. (2007)	Nigeria	2 658		Mini International Neuropsychiatric Interview (MINI).	Both
Machanja (2015)	Zimbabwe	100	70%	AUDIT	Both
Mekonen et al. (2017)	Ethiopia	725	11.4%	AUDIT	Both
Verenkar and Vaz (2018)	India	700	46.7%	AUDIT	Both
Njabe & Peters (2019)	Cameroon	600	Did not report	AUDIT	Both
Ajayi et al. (2019)	Nigeria	784	31.1%	None	Both
Mandeya and Ter Goon (2019)	South Africa		60%	AUDIT	Both
Alemu et al. (2020)	Ethiopia	741	25%	AUDIT	Both
Lemma et al. (2021)	Uganda	1200	61.5 %	AUDIT	Both

RESEARCH RESULTS

Prevalence and risk factors of AUDs

A total of 6 studies examined the prevalence of AUDs using the AUDIT tool. The expected prevalence of AUDs among university students in developing countries was 32.1%. Due to the heterogeneity of the data in the studies included, common risk factors for AUDS could not be determined. Again, the prevalence of AUDs differed significantly across the studies included due to several factors specific to the study's context. For example, three studies conducted in the same country, Ethiopia reported the following prevalence of AUDs among university students: Alemu et al. [56] reported an overall AUD prevalence of AUDs among undergraduate students of 26.5%. According to Alemu et al. [56], there is a positive association between

AUDs and being single AOR= 1.98, 95% CI [1.21, 3.22], having a history of mental illness AOR= 1.98, 95% CI [1.04, 3.75], having a history of suicidal attempt AOR= 3.63, 95% CI [1.18, 11.11], smoking cigarette AOR= 5.04, 95% CI [2.02, 12.57], having peer pressure to drink alcohol AOR= 2.72, 95% CI [1.76, 4.19] and presence of mental distress AOR= 2.81, 95% CI [1.83, 4.32]. In another study from Ethiopia, Mokonen et al. [19] and reported the prevalence of AUDs to be 11.4%. Significantly associated variables with AUDs were the presence of social phobia (AOR = 1.7, 95% CI: 1.0, 2.8), lifetime use of any substance (AOR = 6.9, 95% CI: 3.8, 12.7), higher score in students cumulative grade point average (AOR = 0.6, 95% CI: 0.4, 0.9), and having an intimate friend who uses alcohol (AOR = 2.2, 95% CI: 1.3, 3.8). Lastly, within Ethiopia Lemma et al. [45] reported a prevalence rate of 61.8% among university students. According to Lemma et al. [45], AUDs were associated with chewing khat (AOR =3.26, CI (1.30, 8.15), male sex (AOR = 1.65, 95 CI (1.02, 2.67), and having intimate friends who use alcohol (AOR = 1.603, CI (1.03, 2.50). AUDs were also

associated with being a second-year student (AOR = 0.39, CI (0.17, 0.94), third-year student (AOR = 0.30 CI (0.14, 0.66), fourth-year student (AOR = 0.39, CI (0.18, 0.85).

In general, the prevalence of AUDs was higher among male students, except for a study conducted in India, where the prevalence of AUDs was 39.4%. Prevalence among females was slightly higher (40.6%) compared to males (38%) [55]. Of the studies that were included from Southern Africa, the results of the prevalence rate of alcohol use were 58.2%, and the prevalence rate of risky alcohol use was 42.7%; both alcohol use and risky alcohol use can lead to health consequences and may develop into AUDs [55]. Health knowledge was generally low among alcohol users (Z=-2.7; p=0.0074) and significantly higher among those whose parents had a post-matric education (X^2=6.4; p=0.0410) and employment (Z=-2.7; p=0.0064). All studies included in the meta-analysis reported peer pressure and gender as common risk factors for AUD.

According to the forest plot (Figure 2), most of the studies are on the right-hand side of the null effect meaning the prevalence of reported AUDs was generally highest among male university students. High heterogeneity was found across studies (Q = 1356.329, p = 0.000, I^2= 99.189), which was more than 50%. The subgroup analysis was to compare the prevalence of AUDs between male and female students. A meta-analysis of 6 published results found an overall mean effect size of 0.321 (95% CI = 0.302 to 0.341, p < 0.108: Table 2). However. Due to the high heterogeneity of the studies the researchers could not report the pooled prevalence of AUDs among the university students in developing countries.

Figure 2. Prevalence of AUDs among studies included in the systematic review and meta-analysis.

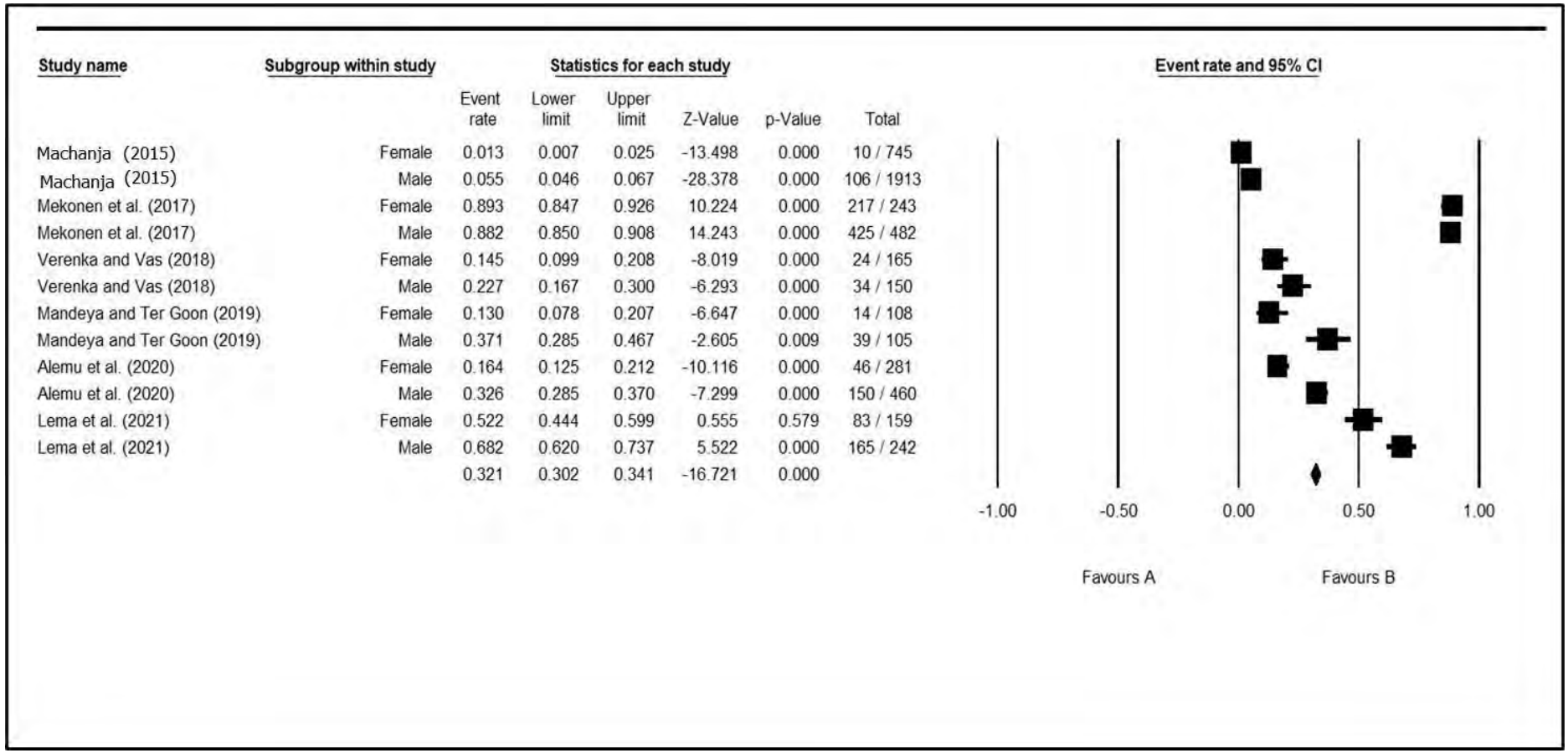

Table 2. Overall effect size model

		Effect size and 95% CI			Test of null (2 tail)		Heterogeneity				Tau squared		
Model	Number of studies	Point estimate	Lower Limit	Upper Limit	Z value	P value	Q value	Df (Q)	P value	I squared	Tau Squared	Standard error	Variance	Tau
Fixed	6	0.321	0.302	0.341	-16.721	0.000	1356.329	11	0.000	99.189	3.083	1.589	2.589	1.756
Random	6	0.306	0.139	0.545	-1.609	0.108								

DISCUSSION AND CONCLUSION

Discussion

Among young people in developing countries, AUDs are common, and the prevalence varies between specific populations and settings. Due to the high heterogeneity between studies, we did not report a pooled prevalence. The prevalence of reported AUDs was generally highest among male university students in Zimbabwe (70%), Uganda (61.5%), South Africa (60%), Ethiopia (32.6%) and India (16.8%). Generally, reported AUDs were highest among groups with a friend who uses alcohol, followed by mental distress. Individuals attending or engaging in religious practices seemed to have the lowest prevalence.

One of the factors contributing to the variability of the prevalence of AUDs among university students in some developing countries is the availability and affordability of alcohol. In some developing countries, alcohol is easily accessible and affordable, leading to increased consumption among university students [5]. Furthermore, the lack of strict enforcement of alcohol policies in developing countries may contribute to the high prevalence of AUDs among university students [10]. Additionally, cultural, and social norms may play a role in the variability of the prevalence of AUDs among university students in developing countries. In some cultures, alcohol consumption is widely accepted, and there is little or no social stigma attached to drinking. This can lead to a normalization of alcohol use and increase the risk of developing AUDs. Moreover, social pressure to conform to peer group behaviours may also contribute to increased alcohol use among university students.

Economic development of a country contributes to the variability of AUDs. As countries become more developed, they tend to experience an increase in alcohol consumption, which can lead to a higher prevalence of alcohol abuse disorder. This is because alcohol becomes

more readily available and affordable, and cultural attitudes towards alcohol consumption may also change.

Another factor that may contribute to the variability of the prevalence of AUDs among university students in developing countries is the lack of mental health services and resources [24]. Many developing countries have limited resources for mental health services, which can make it difficult for university students struggling with AUDs to receive the necessary support and treatment.

Despite these factors, there are also many individual and environmental factors that may contribute to the lower prevalence of AUDs among university students in developing countries. For example, some university students in developing countries may have stronger social support networks and family ties, which can provide a protective buffer against alcohol abuse. Additionally, some universities in developing countries may have stricter alcohol policies and provide education and prevention programs aimed at reducing alcohol abuse among students [9]. The varied prevalence of reported AUDs for specific countries and the associated risk factors implies that the need for alcohol interventions is not uniform for all university students in developing countries.

It is thus suggested that interventions should address the specific needs of a targeted group. For example, in the Southern African context, there may need to develop specific strategies to reduce AUDs. For instance, in South Africa, AUD is witnessed to correlate with mental health, domestic violence, teenage pregnancy, social relationships, HIV status, and other pressing issues [68].

Alcohol has an active role in approximately half of all non-natural deaths in South Africa. These statistics include being responsible for about 75% of homicides, 60% of motor vehicle accidents (MVA's), and 24% of all MVA-related injuries and death [68]. Moreover, within

South Africa, death and disability are strongly correlated to AUDs, and excessive alcohol consumption is recognized as the third leading contributor to sexually transmitted infections (STIs) and interpersonal violence [24]. These factors are mainly due to the disinhibiting nature of alcohol on sexual/violent behavior. University students with AUDs may respond better to interventions focusing on the symptoms that enhance the perception of the need for treatment, such as accompanying emotional issues or the inability to curb alcohol usage. It may be possible to identify people who use alcohol harmfully, by providing alcohol-related information and referring individuals to treatment service programs by increasing the accessibility and availability of community- and university-based alcohol screening programs.

Limitations of the study

This review was complicated by its focus on prevalence when the field of systematic review is more aligned to intervention studies, particularly those using randomized control trial designs. All the studies included were all cross-sectional studies and the researchers had to do sub-group analysis.

The lack of studies for the review was the primary limitation of the research study. Studies included in this review were of good quality, based on the criteria stipulated by Cochrane's risk of bias tool. However, about two-thirds conducted face-to-face interviewing approaches, an approach prone to social desirability bias that could lead to poor reporting of AUDs. Prevalence studies in developing countries are scarce due to poor funding. Poor funding is a major limitation for conducting prevalence studies in developing countries. Prevalence studies are essential in understanding the burden of diseases and health conditions within a population, and they provide valuable data for policymakers and healthcare practitioners to develop appropriate interventions and policies. However, the high cost of conducting these

studies makes it difficult for researchers in developing countries to obtain the necessary funding to conduct them.

Another important finding of this review was the lack of consistent use of effective and validated instruments for the screening and assessment of alcohol to guide research and evaluate interventions. AUDIT is validated and recommended by WHO for use in primary healthcare settings and the assessment of AUDs in developing countries; however, the instrument is not widely used to assess AUDs among university students in different countries. In this review, only six studies used the internationally recommended AUDIT alcohol screening questionnaire included in the meta-analysis [19; 45-53; 56-57; 60].

Conclusion

It was found that the prevalence rate of AUDs in developing countries was 32.1% at 95% CI. Reported AUDs among university students in developing countries are common and vary among different countries. The prevalence of AUDs was highest among population groups where one had a friend who consumed alcohol, followed by mental distress. It was further noted that only a few of the studies reviewed used internationally recommended and validated screening questionnaires such as AUDIT. Future epidemiological studies on AUDs among university students should apply these questionnaires to facilitate comparison. However, such questionnaires have not been evaluated among young people in developing countries, and studies closing this knowledge gap are therefore also required. Future studies should also determine risk factors for alcohol use. There is an urgent need for targeted interventions for groups of university students, given the high prevalence rate of 32.1% as summarised in our current study.

REFERENCES

[1] Manochio, C., Andrade, B. R., Rodriguez, R. P., & Moraes, B. S. (2017). Ethanol from biomass: A comparative overview. Renewable and Sustainable Energy Reviews, 80, 743– 755.

[2] Griswold, M. G., Fullman, N., Hawley, C., Arian, N., Zimsen, S. R., Tymeson, H. D., ... & Farioli, A. (2018). Alcohol use and burden for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet, 392(10152), 1015-1035

[3] World Health Organization. (2019). Global status report on alcohol and health 2018. World Health Organization.

[4] National Institute on Alcohol Abuse and Alcoholism. (2020). Alcohol use disorder. NIH.

[5] Yi, S., Ngin, C., Peltzer, K., & Pengpid, S. (2017). Health and behavioural factors associated with binge drinking among university students in nine ASEAN countries. Substance abuse treatment, prevention, and policy, 12(1), 1-10.

[6] Zima, T. (2018). Alcohol abuse. The Journal of The International Federation of Clinical Chemistry and Laboratory Medicine, 29(4), 285–289.

[7] Crowe, S. F., Cammisuli, D. M., & Stranks, E. K. (2020). Widespread cognitive deficits in Alcoholism persistent following prolonged abstinence: an updated meta-analysis of studies that used standardized neuropsychological assessment tools. Archives of Clinical Neuropsychology, 35(1), 31–45.

672 [8] Higgins-Biddle, J. C., & Babor, T. F. (2018). A review of the AUDs Identification Test
673 (AUDIT), AUDIT-C, and USAUDIT for screening in the United States: Past issues and
674 future directions. The American Journal of Drug and Alcohol Abuse, 44(6), 578–586.

675 [9] Rehm, J. (2016). How should the prevalence of AUDs be assessed globally?
676 International
677 Journal of Methods in Psychiatric Research, 25(2), 79–85.

678 [10] Manthey, J., Shield, K. D., Rylett, M., Hasan, O. S. M., Probst, C., & Rehm, J. (2019).
679 Global alcohol exposure between 1990 and 2017 and forecasts until 2030: a modeling
680 study. The Lancet, 393(10190), 2493–2502.

681 [11] Shield, K., Manthey, J., Rylett, M., Probst, C., Wettlaufer, A., Parry, C. D. H., & Rehm,
682 J. (2020). National, regional, and global burdens of disease from 2000 to 2016
683 attributable to alcohol use: a comparative risk assessment study. The Lancet Public
684 Health, 5(1), e51– e61.

685 [12] Bedendo, A., Andrade, A. L. M., Opaleye, E. S., & Noto, A. R. (2017). Binge drinking:
686 a pattern associated with a risk of problems of alcohol use among university students.
687 Revista Latino-Americana de Enfermagem, 25(0) https://doi.org/10.1590/1518-8345.18
688 91.2925.

689 [13] Htet, H., Saw, Y. M., Saw, T. N., Htun, N. M. M., Lay Mon, K., Cho, S. M., ... &
690 Hamajima, N. (2020). Prevalence of alcohol consumption and its risk factors among
691 university students: A cross-sectional study across six universities in Myanmar. PLoS
692 One, 15(2), e0229329.

693 [14] Nkambule, N. R., Bhayat, A., & Madiba, T. K. (2018). Knowledge, attitude and
694 practices of alcohol and smoking among undergraduate oral health students at a South
695 African University. South African Dental Journal, 73(1), 27-30.

[15] Petit, G., Kornreich, C., Verbanck, P., Cimochowska, A., & Campanella, S. (2013). Why is adolescence a key period of alcohol initiation, and who is prone to develop long-term problem use? A review of currently available data. Socio-Affective Neuroscience & Psychology, 3(1), 21890.

[16] Lamberti, M., Napolitano, F., Napolitano, P., Arnese, A., Crispino, V., Panariello, G., & Di Giuseppe, G. (2017). Prevalence of AUDs among under-and post-graduate healthcare students in Italy. PloS One, 2(4), e0175719. https://doi.org/10.1371/journal.pone.0175719

[17] Verhoog, S., Dopmeijer, J. M., de Jonge, J. M., van der Heijde, C. M., Vonk, P., Bovens, R. H. L. M., de Boer, M. R., Hoekstra, T., Kunst, A. E., & Wiers, R. W. (2020). The use of the AUDs identification test–consumption as an indicator of hazardous alcohol use among university students. European Addiction Research, 26(1), 1–9.

[18] Glantz, M. D., Bharat, C., Degenhardt, L., Sampson, N. A., Scott, K. M., Lim, C. C., ... & WHO World Mental Health Survey Collaborators. (2020). The epidemiology of alcohol use disorders cross-nationally: Findings from the World Mental Health Surveys. Addicti ve behaviors, 102,106128. https://doi.org/10.1016/j.addbeh.2019.106128.

[19] Mekonen, T., Fekadu, W., Chane, T., & Bitew, S. (2017). Problematic Alcohol Use among University Students [Original Research]. Frontiers in Psychiatry, 8. https://doi.org/10.3389/fpsyt.2017.00086.

[20] Tembo, C., Burns, S., & Kalembo, F. (2017). The association between levels of alcohol consumption and mental health problems and academic performance among young university students. PLoS One e0178142, https://doi.org/10.1371/journal.pone.0178142.

720 [21] Pedrelli, P., Farabaugh, A. H., Zisook, S., Tucker, D., Rooney, K., Katz, J., ... & Fava,
721 M. (2011). Gender, depressive symptoms and patterns of alcohol use among college
722 students. Psychopathology, 44(1), 27-33.

723 [22] Kyei, K. A., & Ramagoma, M. (2013). Alcohol consumption in South African
724 universities: Prevalence and factors at the University of Venda, Limpopo province.
725 Journal of Social Sciences, 36(1), 77-86.

726 [23] Olashore, A. A., Ogunwobi, O., Totego, E., & Opondo, P. R. (2018). Psychoactive
727 substance uses among first-year students in a Botswana University: pattern and
728 demographic correlates. BMC Psychiatry, 18(1), 1–9.

729 [24] Duko, B., Ayalew, M., & Ayano, G. (2019). The prevalence of alcohol use disorders
730 among people living with HIV/AIDS: a systematic review and meta-analysis. Substance
731 Abuse Treatment, Prevention, and Policy, 14(1), 1-9.

732 [25] Darvishi, N., Farhadi, M., Haghtalab, T., & Poorolajal, J. (2015). Alcohol-related risk of
733 suicidal ideation, suicide attempt, and completed suicide: a meta-analysis. PloS one,
734 10(5), e0126870.

735 [26] Carvalho, A. F., Heilig, M., Perez, A., Probst, C., & Rehm, J. (2019). Alcohol use
736 disorders. The Lancet, 394(10200), 781-792.

737 [27] Edenberg, H. J., & McClintick, J. N. (2018). Alcohol dehydrogenases, aldehyde
738 dehydrogenases, and alcohol use disorders: a critical review. Alcoholism: Clinical and
739 Experimental Research, 42(12), 2281-2297.

740 [28] Hermens, D. F., & Lagopoulos, J. (2018). Binge drinking and the young brain: A
741 minireview of the neurobiological underpinnings of alcohol-induced blackout. Frontiers
742 in Psychology, 9, 12. https://doi.org/10.3389/fpsyg.2018.00012.

743 [29] De Bellis, M. D., Morey, R. A., Nooner, K. B., Woolley, D. P., Haswell, C. C., &
744 Hooper, S. R. (2019). A pilot study of neurocognitive function and brain structures in
745 adolescents with alcohol use disorders: does maltreatment history matter? Child
746 Maltreatment, 24(4), 374-388.

747 [30] Pandey, A. K., Ardekani, B. A., Kamarajan, C., Zhang, J., Chorlian, D. B., Byrne, K. N.
748 H., ... & Porjesz, B. (2018). Lower prefrontal and hippocampal volume and diffusion
749 tensor imaging differences reflect structural and functional abnormalities in abstinent
750 individuals with alcohol use disorder. Alcoholism: Clinical and Experimental Research,
751 42(10), 1883-1896.

752 [31] Duke, A. A., Smith, K. M. Z., Oberleitner, L. M. S., Westphal, A., & McKee, S. A.
753 (2018). Alcohol, drugs, and violence: A meta-meta-analysis. Psychology of Violence,
754 8(2), 238– 249.

755 [32] Hebb, D. O. (1949). The organization of behavior; a neuropsychological theory. A
756 Wiley
757 Book in Clinical Psychology, 62, 335. United States of America.

758 [33] Kuźma, E., Llewellyn, D. J., Langa, K. M., Wallace, R. B., & Lang, I. A. (2014).
759 History of AUDSs and risk of severe cognitive impairment: a 19-year prospective cohort
760 study. The American Journal of Geriatric Psychiatry, 22(10), 1047–1054.

761 [34] McHugh, R. K., & Weiss, R. D. (2019). Alcohol use disorder and depressive disorders.
762 Alcohol Research: Current Reviews, 40(1),1-8.

763 [35] Grant, B. F., Goldstein, R. B., Saha, T. D., Chou, S. P., Jung, J., Zhang, H., Pickering, R.
764 P., Ruan, W. J., Smith, S. M., & Huang, B. (2015). Epidemiology of DSM-5 alcohol use
765 disorder: results from the National Epidemiologic Survey on Alcohol and Related
766 Conditions III. JAMA Psychiatry, 72(8), 757–766.

[36] Newton-Howes, G., & Boden, J. M. (2016). Relation between the age of first drinking and mental health and alcohol and drug disorders in adulthood: evidence from a 35-year cohort study. Addiction, 111(4), 637–644.

[37] Verhulst, B., Neale, M. C., & Kendler, K. S. (2015). The heritability of AUDs: a metaanalysis of twin and adoption studies. Psychological Medicine, 45(5), 1061–1072.

[38] Peltzer, K., & Pengpid, S. (2015). Extent of alcohol use and mental health (depressive and post-traumatic stress disorder symptoms) in undergraduate university students from 26 low-, middle-and high-income countries. South African Journal of Psychiatry, 21(2), 39-43.

[39] Taft, C. T., O'Farrell, T. J., Doron-LaMarca, S., Panuzio, J., Suvak, M. K., Gagnon, D. R., & Murphy, C. M. (2010). Longitudinal risk factors for intimate partner violence among men in treatment for AUDs. Journal of Consulting and Clinical Psychology, 78(2), 285289.

[40] König, C., Skriver, M. V., Iburg, K. M., & Rowlands, G. (2018). Understanding educational and psycho-social factors associated with alcohol use among adolescents in Denmark, implications for health literacy interventions. International Journal of Environmental Research and Public Health, 15(8), 1671. https://doi.org/10.3390/ijerph15081671.

[41] Satre, D. D., Hirschtritt, M. E., Silverberg, M. J., & Sterling, S. A. (2020). Addressing problems with alcohol and other substances among older adults during the COVID-19 pandemic. The American Journal of Geriatric Psychiatry, 28(7), 780-783.

[42] Tulu, S. K., & Keskis, W. (2015). Assessment of causes, prevalence, and consequences of alcohol and drug abuse among Mekelle University, CSSL 2nd year students. American Journal of Applied Psychology, 3(3), 47-56.

[43] Thavorncharoensap, M., Lertpitakpong, C., Yothasamut, K., Neramitpitagkul, P., Teerawattananon, Y., & Chaikledkaew, U. (2008). A Study on Costs of Social. Health and Economic Consequences of Alcohol Consumption in Thailand. Available from URL: Http://Kb. Hsri. or. Th/Dspace/Handle/11228/2298.

[44] Morojele, N. K., Ramsoomar, L., Dumbili, E. W., & Kapiga, S. (2021). Adolescent Health Series–Alcohol, tobacco, and other drug use among adolescents in sub-Saharan Africa: A narrative review. Tropical Medicine & International Health, 26(12), 1528-1538.

[45] Lemma, A., Salelew, E., Demilew, D., Tesfaye, W., Shumet, S., & Kerebih, H. (2021). Alcohol use disorder and associated factors among University of Gondar undergraduate students: A cross-sectional study. Journal of Substance Abuse Treatment, 129, 108373. https://doi.org/10.1016/j.jsat.2021.10837.

[46] Manthey, J., Shield, K. D., Rylett, M., Hasan, O. S. M., Probst, C., & Rehm, J. (2019). Global alcohol exposure between 1990 and 2017 and forecasts until 2030: a modeling study. The Lancet, 393(10190), 2493–2502.

[47] The organization of Economic Co-operation and Development (OECD). (2021). Developed, Developing Countries.

[48] Heather, N., Partington, S., Partington, E., Longstaff, F., Allsop, S., Jankowski, M., Wareham, H. and St Clair Gibson, A., 2011. AUDs and hazardous drinking among undergraduates at English universities. Alcohol and Alcoholism, 46(3),270-277.

[49] Chang, W. P., Stuart, H., & Chen, S. P. (2021). Alcohol Use, Drug Use, and Psychological Distress in University Students: Findings from a Canadian Campus Survey. International Journal of Mental Health and Addiction, 20, 2366–2381.

[50] Kim, I. H., Jeong, Y. W., & Park, H. K. (2021). Korean University Students' Problematic Alcohol use, Depression, and Non-Suicidal Self-Injury During COVID-19 Lockdown. Chronic Stress, 5, 247054702110530 https://doi.org/10.1177/24705470211053042.

[51] Lasebikan, V. O., Ayinde, O., Odunleye, M., Adeyefa, B., Adepoju, S., & Fakunle, S. (2018). Prevalence of alcohol consumption and AUDs among outdoor drinkers in public open places in Nigeria. BMC Public Health, 18(1), 1–10.

[52] Ajayi, A. I., Owolabi, E. O., & Olajire, O. O. (2019). Alcohol use among Nigerian university students: prevalence, correlates, and frequency. BMC Public Health, 19(1), 1–11.

[53] Njabe, E. E., & Peters, B. (2019). Alcohol Use Disorder among University Students in Cameroon and Its Related Harms. International Research Journal of Public Health, 1–8. https://doi.org/10.28933/irjph-2019-11-2305.

[54] Silveira, C. M., Wang, Y.-P., Andrade, A. G., & Andrade, L. H. (2007). Heavy episodic drinking in the São Paulo epidemiologic catchment area study in Brazil: gender and sociodemographic correlates. Journal of Studies on Alcohol and Drugs, 68(1), 18–27.

[55] Verenkar, Y. J., & Vaz, F. S. (2018). Prevalence and pattern of alcohol consumption using alcohol use disorder identification test among students at a medical college in Goa, India. Int J Community Med Public Health, 5(7), 2935-2938.

[56] Alemu, D., Soboka, M., Tesfaye, E., Ahmed, G., & Tesfaye, Y. (2020). Alcohol Use Disorder and Associated Factors Among Jimma University Undergraduate Students. Psychology Research and Behavior Management, 13, 609-618.

[57] Machanja, M. (2015). Prevalence of AUDs; a case of Bindura University of Science

837 Education (Doctoral dissertation, BUSE).

838 [58] Kamulegeya, L. H., Kitonsa, P. J., Okolimong, E., Kaudha, G., Maria, S., & Nakimuli
839 Mpungu, E. (2020). Prevalence and associated factors of alcohol use patterns among
840 university students in Uganda. Pan African Medical Journal, 37.https://doi.org/10.11604
841 /pamj.2020.37.339.21136.

842 [59] Davis, E. C., Rotheram-Borus, M. J., Weichle, T. W., Rezai, R., & Tomlinson, M.
843 (2017). Patterns of alcohol abuse, depression, and intimate partner violence among
844 township mothers in South Africa over five years. AIDS and Behavior, 21(2), 174-182.

845 [60] Mandeya, A., & Ter Goon, D. (2019). The relationship between patterns of alcohol use
846 and knowledge of alcohol-attributable health conditions: a survey among students at a
847 South African University. The Open Public Health Journal, 12(1), 455-464.

848 [61] Mandeya, A., & Ter Goon, D. (2019). The relationship between patterns of alcohol use
849 and knowledge of alcohol-attributable health conditions: a survey among students at a
850 South African University. The Open Public Health Journal, 12(1), 455-464

851 [62] Okoli, C. (2015). A guide to conducting a standalone systematic literature review.
852 Communications of the Association for Information Systems, 37(1), 879-910.

853 [63] Bettany-Saltikov, J. (2016). EBOOK: How to do a Systematic Literature Review in
854 Nursing: A step-by-step guide.

855 [64] Gopalakrishnan, S., and Ganeshkumar, P. (2013). Systematic reviews and meta-analysis:
856 understanding the best evidence in primary healthcare. Journal of Family Medicine and
857 Primary Care, 2(1), 9. https://doi.org/10.4103/2249-4863.109934.

[65] Francis, J.M., Grosskurth, H., Changalucha, J., Kapiga, S.H. and Weiss, H.A., 2014. Systematic review and meta-analysis: prevalence of alcohol use among young people in eastern Africa. Tropical Medicine & international Health, 19 (4), 476-488.

[66] Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2021). Introduction to meta-analysis. John Wiley & Sons. United States of America.

[67] Sedgwick, P. (2015). What is publication bias in a meta-analysis? British Medical Journal, h4419. https://doi.org/10.1136/bmj.h4419.

[68] Davis, E. C., Rotheram-Borus, M. J., Weichle, T. W., Rezai, R., & Tomlinson, M. (2017). Patterns of alcohol abuse, depression, and intimate partner violence among township mothers in South Africa over five years. AIDS and Behavior, 21(2), 174-182.

[69] Adewuya, A. O., Ola, B. A., Aloba, O. O., Mapayi, B. M., Ibigbami, O. I., & Adewumi, T. A. (2007). AUDs among Nigerian university students: Prevalence and sociodemographic correlates. Nigerian Journal of Psychiatry, 5(1), 5-9.

[70] Zverev, Y. (2008). Problem drinking among university students in Malawi. Collegium Antropologicum, 32(1), 27-31.

Additional File 1. Quality assessment checklist for observational studies (QATSO Score) concerning AUDs prevalence among university students in developing countries.

1. Was the sampling method representative of the population intended to the study?
   - A. Non-probability sampling (including purposive, quota, convenience, and snowball sampling) — 0
   - B. Probability sampling (including simple random, systematic, stratified g, cluster, two-stage, and multi-stage sampling) — 1

2. Was the measurement of AUDs objective (if the article is focusing only on risk behaviour amongst students in developing countries, please select "Not applicable" for this question)?
   - A. By questionnaires (Self-reported) — 1
   - B. By clinical records or lab tests — 0
   - C. Not applicable — N

3. Did the study report any response rate? (If the reported response rate is below 60%, the question should be answered "No".)
   - A. No — 0
   - B. Yes — 1

4. Did the investigator(s) control for confounding factors (e.g., stratification/ matching/ restriction/ adjustment) when analysing the associations (if the study contains purely descriptive results, no association and prediction tests were conducted in the test, please select "Not applicable")?
   - A. No — 0
   - B. Yes — 1
   - C. Not applicable — N

5. Was privacy or sensitivity of the nature of AUDs considered when the survey was conducted e.g., if conducted in a non-AUDs or general clinic setting?
   - A. No — 0
   - B. Yes — 1

Scoring method: Total score divided by total number of all applicable items.

Grading of the QACO score:

0% -33%	33%- 66%	67% -100%
Bad	Satisfactory	Good