

NARRATIVE REVIEW

Adolescent Health Series – Alcohol, tobacco, and other drug use among adolescents in sub-Saharan Africa: A narrative review

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Abstract

Alcohol, tobacco, and other drug (ATOD) use by adolescents are major contributors to death and disability in sub-Saharan Africa (SSA). This paper reviews the extent of adolescents' ATOD use, risk and protective factors, and studies evaluating prevention interventions for adolescents in SSA. It also describes the harms associated with adolescents' ATOD use in SSA, which mainly include interpersonal violence, sexual risk behaviours, and negative academic outcomes. We use the socio-ecological model as our framework for understanding ATOD use risk and protective factors at individual, interpersonal, peer/school, and societal/structural levels. We used two strategies to find literature evaluating ATOD interventions for adolescents in SSA: (a) we sought systematic reviews of adolescent ATOD interventions in SSA covering the period 2000–2020; and (b) we used a comprehensive evidence review strategy and searched for studies that had evaluated ATOD interventions in all SSA countries between 2000 and 2020. Only two community interventions (a brief intervention and an HIV prevention intervention), out of four that were identified, were partially effective in reducing adolescent ATOD. Furthermore, only one school-based intervention (HealthWise), out of the six that we uncovered, had any effect on ATOD use among adolescents. Possible reasons why many interventions were not effective include methodological limitations, involvement of non-evidence-based education-only approaches in some studies, and shortcomings in adaptations of evidence-based interventions. The scale of ATOD and related problems is disproportionate to the number of evaluated interventions to address them in SSA. More ATOD interventions need to be developed and evaluated in well-powered and well-designed studies.

KEYWORDS

adolescents, alcohol, tobacco, and other drug use, interventions, sub-Saharan Africa

INTRODUCTION

In sub-Saharan Africa (SSA), just under 50% of adolescents use at least one psychoactive substance, and the prevalence of substance use varies by region and type of drug [1]. Alcohol is the most commonly used drug [1], and approximately 22.5 million adolescents (aged 12–19 years) are current drinkers [2]. About one third of adolescents have

used alcohol in their lifetime [1,2], and just over 50% of adolescent drinkers engage in heavy episodic drinking (HED) (consumption of 60 g of pure alcohol per sitting at least once per month [2]), which is particularly linked to acute alcohol problems, including violence and alcohol poisoning [3]. About one in four adolescents use tobacco [1], while inhalants and cannabis are less commonly used, and drugs such as cocaine and heroin are used by <5% of adolescents [1].

Sustainable Development Goals: No poverty; Zero Hunger; Good Health and Wellbeing; Quality Education; Gender equality; Reduced Inequalities.

TABLE 1 Socio-ecological influences on adolescent substance use

System level	Characteristics
Micro-system	The microsystems associated with adolescents commonly exist within their immediate family, peer, and school environments. Examples include, parental monitoring, parental substance use, peer substance use, and academic performance
Meso-system	The meso-system includes interactions among the adolescents' microsystems, e.g. communication in the family may influence peer group interaction or interaction at school, neighbourhood, or community contexts
Exo-system	The exo-system includes the larger contexts within which the individual operates, such as the social community, e.g. community attitudes toward substance use, neighbourhood organisation
Macro-system	The macro-system includes the broader systems that exert influence on the meso- and micro-systems of the adolescent, e.g. cultural beliefs and values about substance use, laws, taxation, poverty, unemployment

Adolescents' use of over-the-counter (OTC) and prescription drugs such as tramadol is an emerging problem in SSA [4].

Adolescent ATOD use is a major contributor to morbidity and mortality globally, particularly among older adolescents [5]. Alcohol was the leading risk factor for both death and disability adjusted life years (DALYS) among older adolescents (15–19 years) in 2013 [5]; and for younger adolescents (10–14 years), it was the 5th and 7th most important risk factor for death and disability, respectively. Drug use was the 8th and 5th most important risk factor for death and DALYS lost, respectively, among older adolescents, and the 14th most important risk factor for DALYS lost among younger adolescents [5].

Alcohol, tobacco, and other drug use by adolescents is associated with increased mortality both directly, due to overdose from alcohol or other drugs such as opiates [6], and indirectly, most notably due to increased risk of HIV acquisition [7,8], through condomless sex and less commonly, needle sharing. Alcohol compromises the immune system and adherence to antiretroviral therapy (ART) [9], thereby worsening health outcomes for adolescents living with HIV. Substance use also increases risks of unplanned pregnancy among adolescent girls, who often report late for antenatal services [10,11], and consequently have an increased risk of maternal complications, late ART initiation (when indicated), and poor birth outcomes [10,11].

Adolescent ATOD use is also associated with violence, including bullying, intimate partner violence (IPV), and sexual assault [12,13]. Culbreth et al. [12] found that young people living in slum areas in Uganda who were non-problem drinkers and problem drinkers were 2.03 (1.15–3.57) and 2.65 (1.48–4.74) times, respectively, more likely than non-drinkers to report IPV perpetration and victimisation combined. In terms of unintentional injuries (such as vehicular crashes), as many as 40% of cases of adolescent transport-related deaths had positive blood alcohol concentrations (BACs) in a study in South Africa [14]. Substance use is often linked to suicidal ideation or a precursor of completed suicides [14–16]. One SSA study found that street children who had used cannabis were 17.06 (13.99–22.81) and 13.75 (8.54–15.01) more likely to report suicidal ideation or attempted suicide, respectively [16], and another revealed that

just under one in five suicidal deaths were alcohol positive [14]. Substance use can sometimes also contribute to truancy, school drop-out, or expulsion from school [17]. Mental health problems are also exacerbated by the use of alcohol and other drugs (AODs) [6], and sometimes, substance use disorders may develop during adolescence [6].

There is often a cyclical relationship between many factors described above as consequences of substance use and substance use itself, as they can be antecedents of substance use, consequences, and in some cases both.

RISK AND PROTECTIVE FACTORS FOR SUBSTANCE USE

The use of ATODs usually begins during adolescence, often for recreational purposes [6], but other motivations for use exist including coping motives in order to deal with social or mental health problems [18] or daily living for those in difficult circumstances on the streets or in conflict areas [19,20]. Multiple factors influence adolescent ATOD initiation, and prevention efforts have predominantly been rooted in a risk reduction/protection enhancement model [21]. This has meant understanding both risk factors, which increase adolescents' engagement in problem behaviour, and protective factors, which reduce the likelihood of problem behaviours (or may buffer the effects of risk factors). Risk and protective factors are understood to occur at the individual, interpersonal, and community and societal levels.

We have applied the socio-ecological model (SEM) as a basis for understanding risk and protective factors for adolescent ATOD use [22,23]. This model posits that environmental influences on behaviour fall into four broad domains: micro-system, meso-system, exo-system, and macro-system (Table 1), and interactions *within* and *between* these domains determine behaviour. Its effectiveness in identifying risk and protective factors for prevention planning and intervention has been demonstrated through numerous health behaviour studies [9,24–28]. However, most research on modifiable risk and protective factors to prevent adolescent ATOD use comes from the Global North. We summarise the salient risk and

TABLE 2 Overview of community and school-based interventions

References	Country	Intervention(s)	Primary focus of intervention	Setting	Communities
Carney et al. (2019)	South Africa	Substance use and sexual risk reduction	Substance use and sexual risk reduction	Community	Underserved communities
Carney et al. (2020)	South Africa	Reducing Alcohol and Drug Use (RAD-PAL)	Alcohol and other drug use	Community	Low-income community in with high levels of substance use, crime, and violence
Cluver et al. (2016)	South Africa	Sinovuyo parenting programme for child abuse	Reducing child abuse	Community	Six deprived rural and peri-urban communities
Jewkes et al. (2008)	South Africa	HIV prevention	HIV prevention	Community	Rural (villages) and Peri-urban (township) area
Cupp et al. (2008)	South Africa	HIV and Alcohol in Schools (HAPS)	HIV and alcohol use	School	Peri-urban (township) areas
Jemmott et al. (2011)	South Africa	Health promotion intervention and HIV/STD risk reduction intervention	Increasing fruit and vegetable consumption and physical activity	School	Peri-urban (township) area and rural area
Motamedi et al. (2016), Smith et al. (2008), Tibbit et al. (2011)	South Africa	HealthWise	Leisure, life skills, and sexuality education	School	Peri-urban (township) area

Intervention characteristics	Key findings	Comments
Two group workshops, involving: (a) Workshop 1: provision of HIV/AIDS, STI, pregnancy and sexual risk behavioural knowledge and condom negotiation and correct condom use skills and (b) Workshop 2: AOD use, gender power and violence education	No evidence of effectiveness, and an increase in methaqualone use at 1-month follow-up	The authors attributed the null findings to limited power
A cognitive-behavioural/motivational interviewing Brief Intervention involving (a) two (two-hourly) sessions <i>for adolescents</i> focused on reducing substance use, increasing peer pressure and problem solving skills, and assessing adolescents' motivation to change; and (b) one (1-hour) parent session on parenting skills, parent-child relationship, and information on substances	There were significant reductions in: (1) frequency of alcohol use; (2) number of drinks containing alcohol; (3) frequency of cannabis use; and (4) positive biological test for cannabis. However, there were no significant reductions in (1) other drug use and (2) positive biological test for other drug use	The authors attributed the null results on drug use to the small samples
A 12-session, weekly parenting support programme	Caregiver substance use significantly decreased following the intervention, but adolescent substance use did not change significantly	–
Thirteen (hour long) single-sex group sessions over 6–8 weeks to adolescents and young adults (15–26 years). Includes participatory discussion workshops, role plays, and dramas. Topics included gender-based violence, relationships, behaviour in relation to sexual behaviour (safer sex and condom use), reproductive health matters, and communication skills	There was reduced problem drinking among men (but not women) at 12 months only; but not at 24 months	The intervention effects did not persist over time (24 months)
A total of 15 units (30–40 min each), delivered over approximately 8 weeks	Intervention effect was only found for one mediating alcohol-related variable, alcohol refusal self-efficacy. No significant intervention effects for ever using alcohol or attitudes to alcohol use or intention to use alcohol	–
A cognitive behavioural health promotion intervention	No significant effects on smoking cigarettes, drinking alcohol or binge drinking in the past 30 days over the follow-up periods. Also no intervention effects on attitude towards using alcohol or drugs or intention to use alcohol or drugs	Too few participants reported smoking dagga to permit analysis
A leisure, life skills, and sexuality education intervention consisting of 12 sessions in Grade 8 and 6 booster sessions in Grade 9 delivered during usual life orientation classes. Key elements included teaching life skills such as refusal skills, relationship skills and self-management skills (self-awareness, emotion regulation and decision making, anxiety and anger management) The intervention also targets the positive use of free time (e.g. beating boredom, overcoming leisure constraints, leisure motivation). These were complemented by specific lessons on attitudes, knowledge, and skills surrounding substance use and sexual risk (e.g., relationships and sexual behavior, condom use, realities and myths of drug use). The sessions also focused on provision of correct alcohol and sexual risk behavioural norms	<p><i>Alcohol use:</i> HealthWise was effective in reducing past month alcohol use and heavy drinking among all participants; reducing heavy drinking among non-baseline drinkers (Smith et al., 2008). It did not delay initiation of drinking or reduce past month drinking among baseline non-drinkers.</p> <p><i>Cigarette smoking:</i> HealthWise was effective in reducing past month smoking and heavy smoking among all participants, and in reducing past month smoking in baseline non-smokers. It did not delay initiation of cigarette smoking or reduce past month smoking among baseline non-smokers.</p> <p><i>Cannabis use:</i> There were no effects of HealthWise on marijuana use for all participants and for non-users at baseline, but it reduced marijuana use initiation for girls but increase marijuana use initiation for boys.</p> <p><i>Poly drug use:</i> HealthWise slowed the onset of frequent poly drug use among non-users at baseline and slowed the increase in poly drug use among all participants; it was not effective with respect to past month poly drug use</p>	HealthWise was generally more effective among girls than boys

(Continues)

TABLE 2 (Continued)

References	Country	Intervention(s)	Primary focus of intervention	Setting	Communities
Odukoya et al. (2014)	Nigeria	Anti-smoking health education awareness programme	Prevention of cigarette smoking and cessation among smokers	Six schools (3 intervention and 3 control schools) in Lagos state, Nigeria	Urban areas
Raji et al. (2014)	Nigeria	Anti-smoking health education intervention	Prevention of cigarette smoking and cessation among smokers	School	Metropolitan local government areas
Resnicow et al. (2008)	South Africa	Harm Minimisation and Skills Training	Tobacco smoking	School	Different communities

protective factors that have been examined, acknowledging that this is not an exhaustive list.

Individual factors

Globally and in SSA, prevention planners and practitioners have focused predominantly on the role of individual and intrapersonal factors [29–32] for understanding and preventing adolescent substance use. Previous research in SSA has found increased sensation seeking and impulsivity [33] and childhood depression [34] to be associated with adolescent substance use. Furthermore, twin and adoption studies (mostly from the Global North) have found that 40%–70% of alcohol use disorders have their roots in heritability [35]. While individual factors form an important basis for understanding adolescent substance use, many influences on individual factors can be found in their environmental contexts, necessitating a multi-level approach to addressing them [13].

Interpersonal factors

Adolescents exist within social networks (friends/peers, family, school) which either place them at risk or protect them from engaging in substance use or misuse, with friend/peer influence being particularly salient during this stage.

Friend/peer environments

Previous research has found that adolescents who perceived their friends to use substances [36], socialised with substance-using peers, and used ATODs for coping or fun [37] were

at increased risk of alcohol use and misuse. Similarly, adolescents who sought out friends who drink [38], had friends who used substances [39], and were offered a first drink by a friend [40] were more likely to use or misuse alcohol. These studies led to adaptations of peer-led ATOD prevention interventions in SSA; however, as discussed below, they proved only moderately successful in preventing the onset and/or progression of adolescent alcohol use [41].

Family environments

Parents can influence their adolescent children's substance use directly (through offering or making substances available) and indirectly (through holding permissive attitudes towards substance use, their own substance use, and low monitoring) [39,42,43]. Conversely, parental bonding, monitoring of, and involvement with, their children, and their substance use-specific communication can protect children from substance use [44–46].

School and academic environments

School environments contribute significantly to adolescent ATOD. A growing body of literature focuses on school connectedness and school climate as substance use determinants [47–49]. Academic performance often has a less direct, and sometimes reciprocal, effect on adolescent substance use. For example, low school commitment and school disengagement have been associated with increased risk for substance use [50–52]. However, the role of the school environment is often mediated or moderated by family and peer influences [47]. Previous SSA studies have focused mainly on in-school

Intervention characteristics	Key findings	Comments
Health talks on the effects of smoking, second hand smoking, social and peer influences (e.g. advertising and marketing) and on how to resist pressure to smoke. The talks were delivered on two occasions, 1 week apart, and supplemented by information leaflets and posters that were displayed across the school while the study was ongoing	There were significant intervention effects at 3-months in terms of increased knowledge, attitude, desire to quit, and likelihood of trying to quit in the next year. There were no effects on any smoking outcomes (ever smoke, current, recency, frequency, and number of cigarettes smoked daily), or attempt to quit in the last 3 months	–
The health education intervention consisted of two sessions involving a health education lecture and video showing the harmful effects of tobacco smoking, interactive discussions, supplemented by posters and ‘hand bills’	The participants were followed up 3 months after the intervention. There were significant changes in intervention participants in tobacco-related knowledge, attitudes, reports that they would leave a public place where people are smoking, and purchasing of cigarettes in the past 30 days. There were no changes in intervention participants’ cigarette smoking in the past 30 days	–
Skills training/peer resistance programme and a harm minimisation programme	No significant differences between the three groups on past month use of cigarettes, lifetime cigarette use, frequent cigarette use, past month marijuana use, past month binge drinking, and past month illicit drug use	Null findings were attributed to sample size calculation limitations (Resnicow et al., 2010)

youth, although their out-of-school counterparts are also at risk of ATOD use [16,51].

Community and societal level factors

Research findings on community level factors related to adolescent substance use in SSA have been mixed. Some studies identify community level factors (such as availability of substances) as strongly associated with alcohol, tobacco, or cannabis use [43,52–54]. Other studies have found community influence to be directly and indirectly linked to substance use [36,54]. For example, one study among South African adolescents found community factors (environmental stressors such as violence victimisation, and legal and illegal drug availability) to be both directly and indirectly (via low well-being) linked to alcohol and tobacco use [54].

Structural factors, such as alcohol and drug policies and regulations, are associated with adolescent initiation and use of substances. These include price controls, taxation, access laws, advertising and marketing, limiting alcohol availability (hours/days of sale, purchase limits, alcohol outlet density), enactment of drink-driving laws, and BAC limits. Longitudinal studies confirm associations between exposure to alcohol marketing and adolescent alcohol drinking [55,56], as have some cross-sectional studies in SSA [57,58].

INTERVENTIONS FOR ADDRESSING ATOD USE

In this section, we describe studies that have evaluated individual level adolescent ATOD interventions. We then

describe alcohol-industry intervention approaches for preventing under-age drinking in order to illustrate how such interventions, which are widely implemented, are generally industry-serving and not evidence-based.

Evaluated interventions

We used two search approaches to find literature on evaluated ATOD interventions for adolescents. We sought (a) systematic reviews of ATOD use prevention interventions for adolescents in SSA and (b) primary studies conducted in each of the 48 countries in SSA. We searched Medline, PsychINFO, PsyArticles, ERIC, African Journals Online, and Sabinet African Journals. Eligibility criteria included (a) adolescents, aged 10–19 years; (b) substance use as primary or secondary outcome; (3) randomised controlled trial (RCT), quasi-experimental or before-after design; and (4) publication period: 2000–2020.

We located two systematic reviews of adolescent ATOD interventions in SSA: one focused on school-based tobacco prevention [59] and the other on school-based alcohol prevention interventions [60]. Our comprehensive evidence review yielded studies of four community interventions [61–64] and four school-based interventions [33,65–69]. Taken together our two search approaches yielded four community interventions and six school-based interventions for this review. We did not find studies of interventions exclusively in health or family settings (settings identified as also ideal for implementing ATOD interventions [70]) nor of any societal-level interventions. The key features of the identified studies are shown in Table 2, and their main results are described in the next section.

Community interventions

All four community interventions identified were conducted in South Africa [61–64], only two of which [62,63] were partially effective in reducing adolescent substance use. Carney et al. [62] evaluated a brief intervention. This intervention included (a) an adolescent component, involving a motivational interviewing/cognitive behavioural approach and skills building for addressing peer pressure and problem solving, and (b) a parent component, involving parenting skills and parent-child relationship enhancement activities, and provision of substance use information. There were significant reductions in adolescents': (1) frequency of alcohol use; (2) number of drinks containing alcohol; (3) frequency of cannabis use; and (4) positive biological tests for cannabis. However, there were no significant reductions in other drug use or positive biological tests for other drug use.

Stepping Stones is an HIV prevention intervention for young men and women that included participatory discussion workshops, role plays, and dramas. The study found reduced alcohol use among adolescent boys and young men in community settings at 12 months but not 24 months [63].

Cluver et al. [64] evaluated the Sinovuyo parenting programme for reducing child abuse. They found that caregiver substance use decreased significantly after the intervention, whereas adolescent substance use did not.

Carney et al. [61] conducted a community cluster RCT of an intervention involving 100 females aged 16–21 years who had dropped out from school, and reported at least weekly AOD use and condomless sex at least once in the past 90 days. They reported no intervention effects for any substance use outcomes (binge drinking, and methamphetamine and marijuana use), and increased methaqualone use at one-month follow-up.

School-based interventions

Only one of the six school-based programmes, the HealthWise intervention [66,68,69], had any effect on substance use among young people while the other interventions had no effects or only affected mediating variables. Based on an evidence-based life skills intervention [71], HealthWise is a leisure, life skills, and sexuality education intervention that was evaluated using a matched control design in four intervention schools and four comparison schools (with one back-up school) in Cape Town. The intervention involved 12 sessions in Grade 8 and 6 booster sessions in Grade 9, delivered during usual life orientation classes. Participants were enrolled in Grade 8 and followed-up in Grade 10. The intervention's effects mainly involved reduced alcohol, tobacco, and polydrug use, but it was less effective with respect to cannabis use prevention.

The HIV and Alcohol in Schools (HAPS) programme was evaluated in schools in South Africa [33] using a cluster RCT among 1095 9th grade students who were followed up

at 4–6 months and 15–18 months. An intervention effect was found for one mediating alcohol-related variable, alcohol refusal self-efficacy, but not for ever using alcohol, attitudes to alcohol use or intention to use alcohol.

Jemmott et al. [65] conducted a cluster RCT of a cognitive behavioural health promotion intervention in 18 Eastern Cape Province schools among 1057 grade 6 students who were followed up at 3, 6, and 12 months, post intervention. Primary outcomes were fruit and vegetable consumption and physical activity. Substance use-related attitudes, intention, and behaviour were secondary outcomes. Despite improvements in fruit and vegetable consumption and physical activity, there were no significant intervention effects on past 30-day cigarette use, alcohol consumption or binge drinking (cannabis users were too few for analyses to be conducted), or on attitude or intention with respect to alcohol or drug use over the follow-up period.

Resnicow et al. [67] conducted an RCT to compare the efficacy of a skills training/peer resistance programme with a harm minimisation programme and a no-treatment comparison group. They included 36 public schools in KwaZulu-Natal and Western Cape provinces, with 5266 students at baseline. At 24-month follow-up, there were no significant differences between the three groups on past month use of cigarettes, lifetime cigarette use, frequent cigarette use, past month marijuana use, past month binge drinking, and past month illicit drug use.

Odukoya et al. [72] conducted a health education/anti-smoking awareness intervention in three intervention and three control schools in Lagos state among 973 males (47.5%) and females (52.5%). There were significant intervention effects at three-month follow-up in terms of increased knowledge, attitude, desire to quit, and likelihood of trying to quit in the next year (among smokers), but no effects on any smoking behaviour outcome (ever smoke, current, recency, frequency, and number of cigarettes smoked daily) or on smokers' quit attempts in the last three months.

Raji et al. [73] used a quasi-experimental design to evaluate a peer-led health education programme in intervention and control schools in Sokoto State, Nigeria (114 students in each intervention arm). There were significant changes after three months in intervention participants' tobacco-related knowledge, attitudes, reported likelihood of leaving a public place where people are smoking, and their purchasing of cigarettes in the past 30 days, but no significant changes in reported past 30-day cigarette smoking.

In sum, of the ten interventions included in our review, seven included ATOD use as primary outcomes and the remaining three interventions included ATOD as secondary outcomes. Only three showed some promise with respect to adolescent ATOD use prevention, all of which were individual-level interventions. The interventions seem to be most effective in terms of reducing the use of alcohol but not tobacco or other drugs. Those that were at least partially effective in terms of change in ATOD use were adaptations of evidence-based interventions [62,63,66,68,69]. For example, Carney et al.'s [62] intervention was an adaptation of

an evidence-based brief intervention –Teen *Intervene* [75] – which is one of the few brief interventions for adolescents identified by a systematic review to be effective, albeit in school settings [76]. The effective interventions also included some of the key ingredients identified as effective, including one or more areas of skills training and incorporation of multiple components and sessions [74]. For example, Carney et al.'s [62] intervention focused on parenting skills and relationship building, as well as on adolescent-focused activities.

There are several possible reasons why most of the interventions were not effective. These could relate to the intervention approaches themselves and/or methodological issues. For example, all three tobacco-focused school-based interventions had no effect in terms of tobacco use prevention, although changes in some mediating variables were observed [67,72,73]. The two smoking prevention interventions conducted in schools in Nigeria [72,73] may not have been effective as they involved awareness-raising and education activities, despite recognition in the literature that such approaches are ineffective when used alone [74]. In contrast, Resnicow and colleagues speculated that possible shortcomings in the adaptation of the evidence-based interventions that they implemented in their study may have contributed to their null finding [67].

In terms of methodological limitations, many studies had small samples to which the authors sometimes attributed their null findings [e.g. 61,65,67]. In the health promotion intervention study, which found significant improvements in physical activity and fruit and vegetable consumption (primary outcomes), participants' rates of alcohol, tobacco, and marijuana use at baseline were considered too low for significant effects to be detectable at follow-up [65].

The failure to observe positive intervention effects was also attributed to the duration of the follow-up periods employed [e.g. 61]. Carney and colleagues [61] postulated that one month might have been too short a time following their intervention for change to have been initiated by their participants (young female adolescents who had dropped out of school).

Interventions with substance use as secondary outcomes were generally not effective in reducing substance use behaviours [64,65]. For example, in Cluver et al.'s study [64], involving an intensive (12-week) parenting programme for reducing child abuse, there were no observed changes in substance use. However, they did find significant improvements in most of the other outcomes (e.g. adolescent problem behaviour and depression, and parenting behaviours) which would be expected to be associated with reduced substance use among adolescents.

Most studies involved adolescents in schools and community settings. However, their applicability to adolescents in other settings (including former child soldiers and children living on the street) is not clear.

There was no evidence of any societal-level or structural interventions having been implemented in SSA, although such interventions have been shown to be effective among young people elsewhere [e.g. 74]. The three 'Best Buys' that

have been identified as effective for preventing the harmful use of alcohol, in general, include increasing excise taxes, having restrictions or bans on alcohol advertising, and reducing the physical availability of alcohol [77]. For tobacco, the 'Best Buys' include increased taxes, plain packaging or graphic warnings, bans on tobacco advertising and promotion and on exposure to second-hand smoke, and mass media campaigns [77]. For adolescents specifically, reviews of studies outside of SSA have found the following regulatory interventions to have moderate to large meaningful benefits [74]: taxation (for reducing alcohol use, problematic use of alcohol, and problematic use of tobacco); banning or regulating tobacco advertising (for reducing use and problematic use of tobacco); and public consumption bans (for reducing use and problematic use of tobacco). There has been a small effect of increasing the minimum legal age of alcohol use on problematic use of alcohol and alcohol-related harms among adolescents. However, evidence on the effectiveness of regulatory interventions for preventing other drug use is less strong [74].

Alcohol prevention through alcohol-industry corporate social responsibility activities

While multi-national alcohol companies (e.g. Diageo –the parent company of Guinness) market alcohol to adolescents, they also deliver alcohol prevention programmes for 'under age' teenagers, as part of their corporate social responsibility (CSR) activities [78,79]. However, such programmes tend to not be evidence-based and tend to glamourise alcohol [80]. One such programme is the *Diageo-sponsored SMASHED* 'responsible drinking' education initiative [81]. Developed in the UK [82,83], the programme has been launched in Ethiopia, Mozambique, Nigeria, and Seychelles. Smashed provides alcohol education to young people via a theatre production and interactive workshops, and also has special resources for teachers and parents.

'Guinness Nigeria' (a subsidiary of Diageo) launched *Smashed* in Nigeria in 2018, promising to reach 5000 students and teachers in 28 secondary schools in Lagos state (Western region) [84]. In 2019, 'Guinness Nigeria' stated that *Smashed* would reach 14,000 students in Edo (South), Anambra, and Enugu states (Eastern region) [85], and promised to extend it to six other Nigerian states in 2020, with the aim of 'breaking the culture of underage drinking and reducing alcohol-related harm among Nigerian youth' [84,85]. They further stated that the Federal Ministry of Health endorsed the *Smashed* programme, and that it had received huge support from the local (states) education and health sectors [85]]. During the launch of the Lagos event, the programme's developer –Collingwood Learning –stated that the programme had been successful in other countries [81]. Therefore, it was launched in Nigeria [84]. Collingwood Learning's website states that 'every *Smashed* project is rigorously evaluated, meaning that we can accurately report our educational impact by project, by continent, and globally'

[83]. However, recent evidence shows that *Smashed* has not undergone independent evaluations [82].

DISCUSSION

Adolescent ATOD is a significant public health problem in SSA, and rates of ATOD use and associated harms among adolescents continue to be high across the continent. Despite signs of minor reductions in HED among adolescents in SSA [2] that have also been observed globally [86], interventions to reduce ATOD use and mitigate harms during this developmental period are urgently needed. Effective interventions may be delivered in varied settings (including schools, communities, family, and health care sectors [70]), but in reality, they seldom are. Very few ATOD-specific interventions have been evaluated in SSA, and even fewer have been found to be effective, which is unfortunate given the extent of adolescent substance use throughout the continent, and the resultant challenges that they face. Our review finding that school-based interventions in SSA are largely ineffective concurs with empirical evidence suggesting that the effectiveness of information-/education-based alcohol education programmes is weak in countries where they have been implemented and evaluated [87]. However, school-based interventions can be effective as long as they focus on particular activities, such as skills building. Alcohol and tobacco – both legal drugs – are marketed heavily to young people [58,88,89] and in the absence of effective interventions to counter the alcohol and tobacco industries' influence, increased use may be expected.

The findings of this review have numerous implications for further research on substance use interventions among adolescents in SSA. They suggest a need for high quality RCTs of ATOD-specific interventions that are sufficiently powered to detect intervention effects. They also suggest that priority should be given to the cultural adaptation of evidence-based interventions, which should then be implemented with fidelity and tested in SSA contexts. Further research is also needed to test multi-component interventions in multiple contexts, including schools and communities as well as family and health care settings. Such interventions would address risk factors at multiple levels, given the evidence that multi-component interventions tend to show the most promise [70]. The scale up of effective interventions would be a very important next step once such effective interventions have been identified. Finally, due to the limited adolescent ATOD use interventions – a problem identified by several authors almost a decade ago [41] – we recommend that societal level interventions and policy responses, which are often more effective than individual level interventions [90] should be implemented and evaluated in SSA.

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