Effective school-based preventive interventions for alcohol use in Africa: a systematic review

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Abstract

Background: Despite recognition of the risks of alcohol use and importance of prevention from an early age, the effectiveness of school-based interventions in Africa has not been clarified.

Objective: We aimed to identify effective school-based alcohol use prevention interventions in Africa.

Methods: We searched eight databases for peer-reviewed articles published until February 3, 2019 that reported on randomized controlled trials, cluster randomized controlled trials, controlled clinical trials, pre-post quasi-experimental studies, cohort studies, and case-control studies. The full-texts of relevant studies were searched.

Results: Four of 2797 papers met our eligibility criteria. All reported interventions targeted secondary school students in South Africa and were incorporated in the school curriculum. The interventions comprised multi-component activities with participatory and peer educational methods, and applied modified programs originally developed in the US. However, intervention effects were inconsistent among studies, although the interventions tended to have a positive effect on non-drinkers at baseline, with stronger effects in girls.

Conclusion: interventions had positive effects on students that were non-drinkers at baseline, especially girls. Although we could not find robust evidence that school-based interventions changed attitudes, frequency/quantity of drinking, and intentions to use alcohol, one intervention showed an increase in students' alcohol refusal self-efficacy.

Keywords: School-based preventive interventions, alcohol use, Africa, systematic review.

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Introduction

The World Health Organization (WHO) reported that the harmful use of alcohol is a component cause of more than 200 disease and injury conditions in individuals [1]. Globally, about 3.3 million deaths in 2012 (5.9% of all deaths) were attributable to alcohol consumption. The alcohol-attributable burden of disease is increasing in Africa, with 6.4% of deaths attributed to harmful use of alcohol in 2012 compared with 2.1% in 2000. Alco-

hol consumption has a major impact on the burden of disease and mortality in Africa [2,3].

Early initiation of alcohol use is a predictor of impaired health status because it is associated with increased risks for alcohol dependence and abuse in later life [4-8], alcohol-related motor vehicle crashes [9,10], and other unintentional injuries [11,12]. In addition, alcohol use results in an increased risk for non-communicable diseases (NCDs), meaning that preventive interventions in childhood are more important to reduce health risks than later interventions among adults. The critical role of schools in providing a foundation to ensure healthy growth in children and adolescents was emphasized by the Global Strategy for Women's, Children's, and Adolescents' Health, and the WHO Global Action Plan for the Prevention and Control of NCDs 2013–2020[13,14].

Previous systematic reviews confirmed the effectiveness of school-based interventions in preventing alcohol use [15-19]. One review reported that certain generic psychosocial and developmental prevention programs may be effective [16]. Another review indicated school-based preventive interventions reduced the frequency of drinking, and a program that combined substance abuse was effective [19]. It has also been reported that interactive programs to prevent alcohol use that actively involved students as peer leaders were effective [15].

However, few studies on school-based interventions to prevent alcohol use have been conducted in Africa, and effective school-based approaches adapted to the African context have not been clarified. Therefore, we aimed to identify effective school-based alcohol use prevention interventions in Africa.a search for relevant papers published until February 3, 2019 (with no limitation of publication year) using eight databases: PubMed, Web of Science, SCOPUS, ERIC, PsycINFO, CINAHL, Popline, and the Cochrane Central Register of Controlled Trials. We also searched for eligible papers in the Cochrane Library and four relevant academic journals: Journal of School Health, Health Education Research, Health Promotion International, and Tropical Medicine & International Health. We defined keywords as search terms and used these terms for searching all databases, although the formula for each database differed depending on the database syntax. For example, the formula used in PubMed was: school* AND (child* OR adolescen* OR student* OR pupil*) AND ("Africa" OR "Algeria" OR "Angola" OR "Benin" OR "Botswana" OR "Burkina Faso" OR "Burundi" OR "Cabo Verde" OR "Cameroon" OR "Central African Republic" OR "Chad" OR "Comoros" OR "Congo" OR "Republic of the Congo" OR "Democratic Republic of the Cote d'Ivoire" OR "Djibouti" OR "Egypt" OR "Equatorial Guinea" OR "Eritrea" OR "Ethiopia" OR "Gabon" OR "Gambia" OR "Ghana" OR "Guinea" OR "Guinea-Bissau" OR "Kenya" OR "Lesotho" OR "Liberia" OR "Libya" OR "Madagascar" OR "Malawi" OR "Mali" OR "Mauritania" OR "Mauritius" OR "Morocco" OR "Mozambique" OR "Namibia" OR "Niger" OR "Nigeria" OR "Rwanda" OR "Sao Tome and Principe" OR "Senegal" OR "Seychelles" OR "Sierra Leone" OR "Somalia" OR "South Africa" OR "South Sudan" OR "Sudan" OR "Swaziland" OR "Tanzania" OR "Togo" OR "Tunisia" OR "Uganda" OR "Zambia" OR "Zimbabwe") AND (alcohol*).

Inclusion criteria

Type of study

We identified randomized controlled trials (RCTs) including cluster RCTs (C-RCTs), and non-randomized controlled studies including controlled clinical trials (CCTs) and pre-post quasi-experimental studies, cohort studies, and case-control studies. We selected relevant papers that were peer-reviewed.

Types of participants and study area (population)

Target participants were children and young people aged 4–18 years attending school or college. The study area was limited to Africa.

Types of interventions

We targeted school-based interventions. In this paper, we used "school-based" to indicate schools as the setting in which activities were conducted.

Exclusion criteria

Studies were excluded if the interventions did not meet all of the above inclusion criteria. Language was not an exclusion criterion. We excluded hospital-, family-, and community-based studies.

Types of Outcome measures

Outcome measures were direct self-reported or objective measures of children's alcohol use, alcohol refusal self-efficacy, attitudes about alcohol, and perceived peer drinking.

Data collection and analysis

Two independent reviewers completed broad screening of the titles and abstracts of all identified papers. Next,

those reviewers independently assessed the full-texts of all potentially relevant articles that passed the initial title/abstract screening. Differences in opinion arising at either screening level were resolved through discussion. A flow chart of the review process is presented in Figure 1.

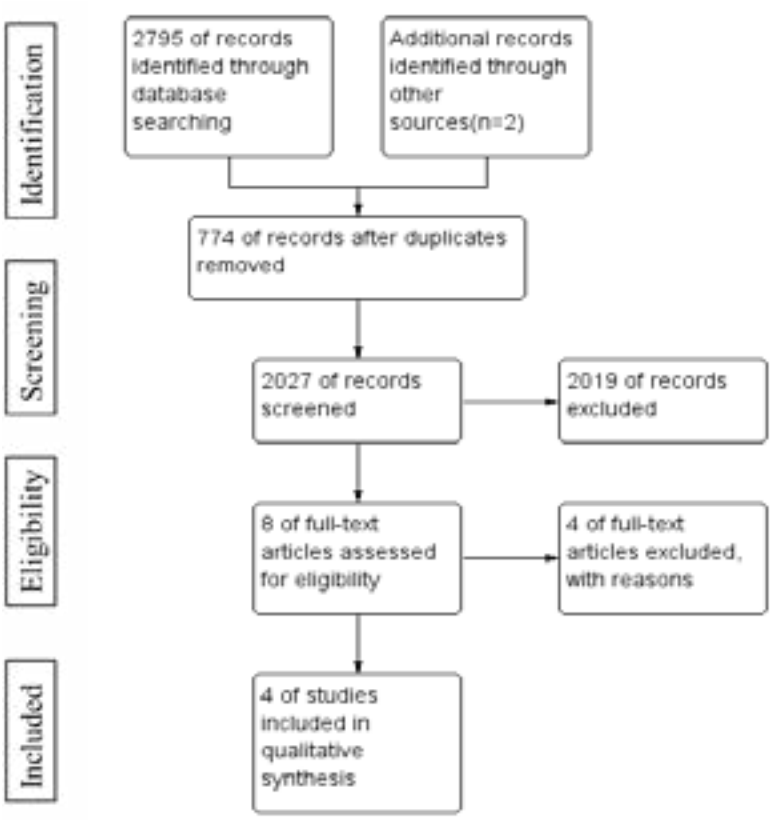

Figure1. Flow chart of the review

Assessment of risk of bias in included studies

For each study, tTwo reviewers independently assessed the risk of bias for each study using the Cochrane Collaboration tool for RCTs and C-RCTs [22,23] (Figure 2). The risk of bias in non-RCTs was assessed with the ROBINS-I tool [24] (Figure 3).

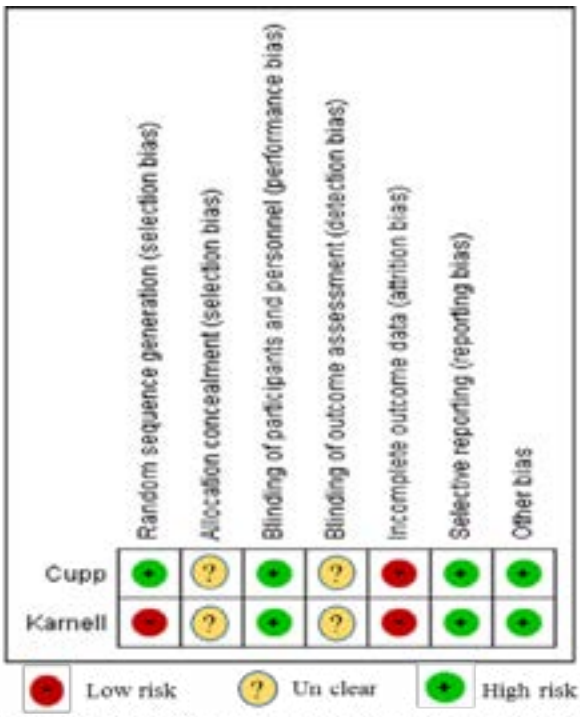

Figure2. Risk of bias summary for RCT study

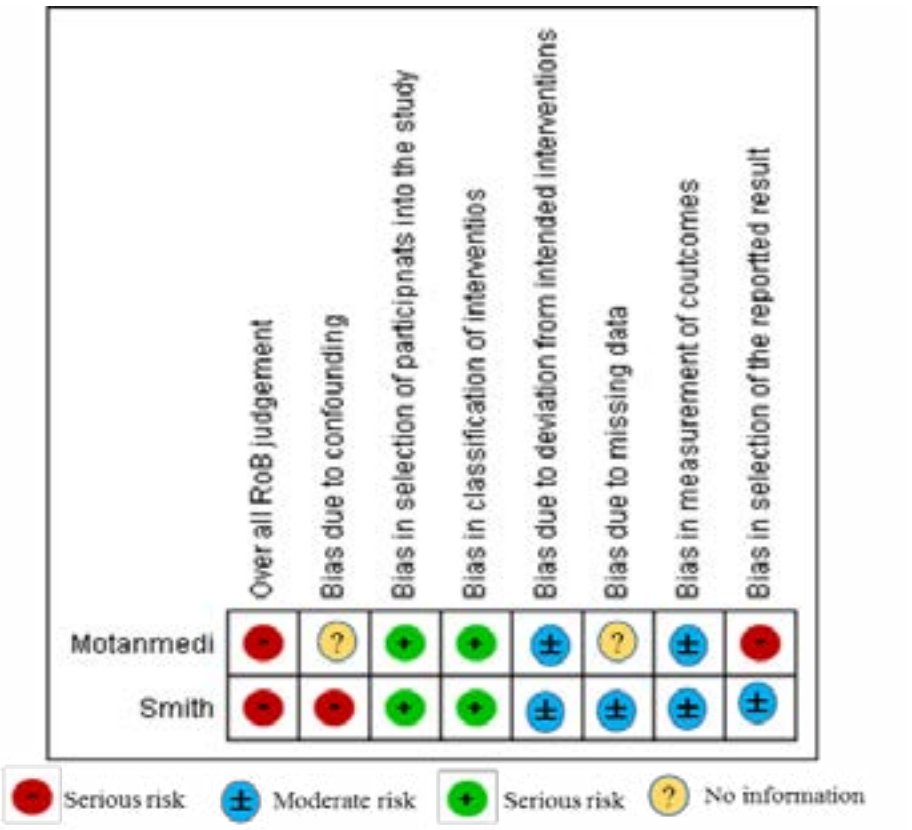

Figure3. Risk of bias summary for non-RCT study

Results

Characteristics of included studies

In total, Four of 2797 retrieved papers met the eligibility criteria [25-28]. Table 1 presents an outline of these four papers. Two studies were C-RCTs [27,28] and two were CCTs [25,26]. All studies were conducted in South Africa and targeted secondary school students. Two studies used a modified "HealthWise" program, which was originally developed in the US. HealthWise is a school-based prevention program for reducing substance use and risky sexual behavior that targets youths' leisure time (positive use of free time) and developing their social-emotional skills [27,28]. This program comprised 12 lessons in grade 8 and six lessons in grade 9. Lessons were provided in English and Afrikaans by a manualized curriculum that fit within the existing life orientation curriculum. The remaining two studies used another modified program ("Our Times, Our Choices"), which was also developed in the US[25,26]. Our Times, Our Choices aimed to prevent alcohol use and reduce HIV-related risky sexual behaviors. This program applied a participatory approach involving student peer leaders. Peer leaders received training on the program alongside the teachers involved, and helped to lead group discussions. The peer leaders assisted with interactive activities and encouraged others to participate in the lessons. A series of monologues by fictional teenagers delivered via CD and audio vignettes were used as the basis for class discussion and group assignments. All four interventions were conducted with mixed methods: components on alcohol use prevention and reduction of risky sexual activity in HealthWise, and alcohol use prevention and HIV/AIDS prevention in Our Times, Our Choices. Moreover, all interventions were incorporated in existing life skills education classes.

Table 1. Characteristics of included studies

Author (year)	Country (area)	Study design	Target and control populations	Intervention	Outcomes	Main findings
Karnell (2006)	South Africa (Pietermaritzburg)	C-RCT	Intervention: 325 students in 9th grade Control: 336 students in 9th grade	The program used was a modified version of a program originally developed in the USA. The program comprised 10 units of 30 minutes and duration of the intervention was about eight weeks. Teachers of the schools involved in the study received 2 days of training. A series of monologues of four fictional teenagers was used as a basis for discussions and assignments. Four peer leaders in each class who had received 2 day training were responsible for the discussion. About half of the curriculum focused on alcohol-related issues and the other half concerned HIV-related issues.	(1) Experience of alcohol use (2) Frequency of alcohol use (3) Quantity of alcohol use (4) Four-item alcohol problem scale (5) Extent of positive attitudes toward alcohol use (6) Respondents' perceived abilities to refuse alcohol	No significant direct intervention effects were found on any of the alcohol-related outcomes (alcohol-related behavioral, frequency and quantity of alcohol use, and alcohol-related problems). Similarly, no intervention effects were found on any of the mediating alcohol-related variables, including alcohol-related self-efficacy and attitudes about alcohol. However, students in the intervention group who had not had sex at the time of the pretest were less likely to drink or indicated that their partners were not drinking before or during the last time they had sex.
Smith (2008)	South Africa (Mitchell's Plain)	CCT	Intervention: 901 students in 9th grade (Girls 52%) Control: 1,275 students in 8th grade (Girls 51%)	The program used was a modified version of a program originally developed in the USA. The program consisted of 12 lessons in 8th grade, followed by six booster lessons in 9th grade. Each lesson required two to three class periods. Lesson topics covered social-emotional skills programs (e.g., anxiety and anger management, decision making, self-awareness) and also targeted the positive use of free time. These lessons 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 curriculum was provided in either English or Afrikaans.	(1) Lifetime alcohol use (2) Alcohol use in the past 4 weeks (3) Intensity of alcohol use in the past 4 weeks (Heavy use: four or more drinks/week; light use: 1–3 drinks/week)	No difference between the control and intervention groups was found in the initiation of alcohol use. Alcohol use in the past month among all participants showed positive effects in both sexes, but the effect was especially strong for girls. Among the subsample of baseline non-drinkers, girls in the intervention group showed a positive effect on past month drinking, but there was no effect for boys. Among all participants, the control group had a significantly larger increase in rates of heavy past-month alcohol use. Among the subsample who had not tried alcohol before the study, the main effect indicated a positive effect in intervention group on past-month heavy drinking; the sex interaction was not significant. The control group had steeper increases in recent (OR 1.4, 95% CI 1.1–1.8) and heavy use of alcohol (OR 1.6, 95% CI 1.2–2.2).
Cupp (2008)	South Africa (Pietermaritzburg)	C-RCT	Total: 1095 students in 9th grade (Girls 54%). Intervention: students from four schools. Control: students from four schools.	The program used was a modified version of a program originally developed in the USA. The program comprised 15 units (30–40 min), and was delivered over about eight weeks. About 40% of the curriculum focused on alcohol-related issues, and the remainder on reducing risky sexual activity. Teachers in intervention schools received 3 days of the training and teachers in the controls received single day of training. The intervention drew on peer assistants who received 2 day training. Peer assistants helped lead group discussions, assisted with interactive activities, and encouraged others to participate in the lessons. The intervention featured a series of monologues by four fictional township teenagers delivered via CD. Ten of the 15 lessons featured these audio vignettes, which often served as the basis of class discussion and group assignments.	(1) Experience of alcohol use (2) Attitude toward alcohol use (3) Alcohol refusal self-efficacy	The intervention groups were less likely to indicate intention to use alcohol with sex during the next 3 months ($p < 0.05$). The intervention groups showed a greater increase in their ability to refuse alcohol and alcohol refusal self-efficacy ($p < 0.01$ and $p < 0.05$, respectively). There were no intervention effects with regard to attitudes and intention to use alcohol. Alcohol-related behavioral outcomes showed no significant intervention effects for ever using alcohol. The effects of the intervention on alcohol refusal self- efficacy were greater in boys than in girls, and effects on intention to use alcohol with sex were greater in girls.
Motanmedi (2016)	South Africa (Mitchell's Plain)	CCT	5610 students who had baseline data (63 % in control and 37 % in intervention)	The program used was a modified version of a program originally developed in the USA. The program aimed to reduce substance use and risky sexual behavior. It comprised 12 lessons in 8th grade and six lessons in 9th grade; lessons were provided in English or Afrikaans by a manualized curriculum that fit with existing life orientation curriculum.	(1) Initiation of alcohol use (rate of students who started using alcohol at two time points 8th and 10th grades)	Students in the intervention group who were non-drinkers at baseline showed a moderate effect on preventing alcohol use by the start of the tenth grade (log OR 0.58, $p < 0.01$). In particular, the intervention reduced the likelihood of initiating alcohol use among girls who were non-drinkers at baseline (OR 0.76, $p = 0.02$) but not for boys (OR 1.23, $p = 0.13$).

CCT, controlled clinical trial; CI, confidence interval; C-RCT, cluster randomized controlled trial; OR, odds ratio

Intervention effects

Analysis of the selected papers revealed inconsistent intervention effects among the reviewed studies. However, the interventions tended to have a positive effect on students who were non-drinkers at baseline, with this effect being stronger in girls. We did not find robust evidence that school-based interventions improved attitudes to alcohol use or reduced the frequency/quantity of drinking or intentions to use alcohol. However, one intervention showed increased alcohol refusal self-efficacy.

Karnell et al. [25] reported that their intervention neither contributed directly to reducing alcohol-related behaviors nor improved alcohol-related variables, including alcohol related self-efficacy. Smith et al.[27] reported strong intervention effects on past month drinking in girls, and positive effects in both sexes; however, among the subsample of baseline non-drinkers, only girls showed a positive intervention effect [27]. Cupp et al. [26] reported that the intervention groups showed a greater increase in alcohol refusal self-efficacy compared with the control groups, with this effect being greater in boys than girls. However, no intervention effects were reported for attitudes and intentions to use alcohol and ever using alcohol [26]. Moreover, Cupp et al. [26] reported high attrition, and noted that students who stayed in the study until the end of the intervention exhibited safer attitudes and behavior than at baseline. These results indicated that the program might have been ineffective for students at higher risk [26]. Finally, Motamedi et al. [29] reported their intervention reduced the likelihood of initiating alcohol use among girls who were non-drinkers at baseline.

Quality of studies

The results of the risk of bias assessments are shown in Figures 2 and 3. The percentages of attrition were 19% for Karnell et al. [25], 38% for Smith et al. [27], 55% for Cupp et al. [26], and 10% for Motamedi et al. [28].

We found the quality of included studies was poor, especially in terms of random sequence generation and completing outcome data. Information about allocation concealment and blinding of outcome assessment was unclear in the two C-RCTs [27,28]. In addition, the two CCT studies were evaluated as having a serious risk in the overall risk of bias judgment [25,26]. The four selected studies did not share the same study design or the same outcome indicators. Moreover, it was difficult to consider the studies as homogeneous because of insufficient information on study participants and the languages used in questionnaires, as well as minor differences in intervention methods (e.g., peer leader training). Because of the above-mentioned heterogeneity, the results could not be integrated, and a meta-analysis could not be performed.

Discussion

Results of our review suggested that multi-component interventions using participatory approaches targeted at secondary school students who have not started drinking may be effective for school-based alcohol use prevention in South Africa.

Interventions tended to have a positive effect on students who were non-drinkers at baseline, with this effect being stronger in girls. Motamedi et al. [28] noted that providing additional leisure options as a measure to prevent substance use in a low resource setting may offer a promising break from the typical limited activities that may bore girls compared with boys (who tend to engage in more fun activities such as sports or hanging out with friends). Interventions that include components focused on leisure activities as a measure to prevent substance use, especially among girls, may fit with the African context.

Programs modified from those developed in other countries may be applicable in Africa. Using modified programs may also contribute to saving costs and efforts in developing intervention programs, provided cultural differences are considered. HealthWise was developed by combining three separate interventions that had been implemented independently in the US [29]. One of these three interventions included elements of a life skills training program [30], the second was an evidence-based leisure education intervention [31], and the third used an integrated approach drawn from various sexuality curricula [29]. Wegner et al. [29] noted that combining the three interventions into one package allowed an integrated approach to broader based social skills (e.g., managing risk), and addressed issues such as shortage of teaching time, language problems, and lack of different resources. For example, to address the shortage of teaching time, the program was divided into grades 8 and 9 to secure sufficient time. In terms of language, the program used familiar terms drawn from students' own language and words usually used in South Africa. To address the lack of physical and financial resources, the program provided two youth development specialists and support for educators. As illustrated in the selected studies, considering the lack of resources and cultural limitations is essential when adapting existing programs for African countries.

The original Our times, Our Choices program reported positive effects in several outcomes: 1) reducing alcohol use, 2) reducing the tendency to use alcohol, 3) reducing the combination of cigarette and alcohol use, 4) changing the functional meanings of alcohol use, 5) reducing peer norms and peer influence to use, 6) introducing skills to resist peer influences, and 7) increasing parent-child communication about the consequences of drinking [32]. However, one study that involved the Our times, Our Choices program reported no significant direct intervention effects on any of the alcohol-related outcomes and mediating alcohol-related variables[25]. The other study reported there were no intervention effects with regard to attitudes and intention to use alcohol, although the intervention groups showed a greater increase in the ability to refuse alcohol and alcohol refusal self-efficacy than the control groups [26]. Moreover, it was reported that alcohol-related behavioral outcomes also showed no significant intervention effects for ever using alcohol [26]. In the original program, some activities involved parents as well as students and teachers [32]. This difference may explain why the modified program in South Africa was less effectiveness compared with the original program.

Previous systematic reviews reported that multi-component interventions were effective, although there was little evidence that interventions with multiple components were more effective than interactive interventions with single components [15,16,19]. Moreover, a systematic

review by Mark et al. [33] reported that the most effective prevention programs to reduce marijuana and alcohol use among adolescents aged 10–15 years in the long-term were comprehensive programs that included anti-drug information combined with refusal skills, self-management skills, and social-skills training. An earlier study reported that important components of effective drug abuse prevention curricula were social resistance skills training, normative education, broader-based skills training, and comprehensive health education [34]. Our review found similar results to that study. A systematic review by Fisher et al. [35] reported there was a strong relationship between risk for alcohol use and HIV infection in Africa. This suggested that providing preventive education targeting reducing alcohol use and HIV infection, and decreaing risky sexual behavior may be effective in the African context.

In terms of targeting, methodology, and education content, Sussman [36] argued that to pursue prosocial goals, children aged 12–15 years have to learn about consequences of drug use, refusal assertion, decision making, counteracting social influences to use drugs, and life skills through means such as classroom discussion and peer group interaction. The effectiveness of participatory methods such as peer and interactive education has been proven in previous meta-analyses [15,37]. A systematic review by Cuijpers [38] also reported peer education methods were effective. Cuijpers [38] concluded that adding life skills training to such programs may strengthen the effects. Furthermore, Dusenbury et al.[34] reported that interactive teaching techniques are an important component of effective drug abuse prevention curricula. Our review found similar results to these studies. These findings suggested that alcohol use prevention education should involve participatory methods and focus on developing students' social-emotional skills as well as education about risk behaviors. Moreover, these prevention activities should be incorporated into existing curricula as part of official health education. The importance of integrating this information into school curricula has been highlighted in previous reviews [34,39].

In a recent systematic review, Strøm et al. [40] reported that school-based programs had potential to reduce alcohol use among adolescents. However, that review indicated that most drug prevention programs have no effect [40]. Similarly, we could not find robust evidence that school-based interventions in Africa improved students' attitudes, and reduced the frequency/quantity of drinking and intentions to use alcohol. Nevertheless, Strøm et al. [40] and other reviews argued that school-based interventions were most effective for preventing and reducing alcohol use among adolescents when delivered as primary prevention programs to youth who had not yet started drinking [39,41]. One intervention in our study also showed positive effects on non-drinkers at baseline. This finding suggested that prevention programs may need to be implemented before seventh grade, and should address the risks associated with early drinking [32,42]. Gottfredson et al. [43] argued that programs targeting junior high school students were marginally more effective than those targeting adolescents in elementary or high schools. The above evidence emphasized the importance of appropriate timing of interventions. Furthermore, tobacco and other drug abuse prevention programs may need to be tailored to specific human developmental stages [36]. For children, interventions to prevent alcohol use should be provided before initiation of drinking.

Heterogeneity among the reviewed studies was attributed study participants, languages used in questionnaires, and evaluation of the effects of peer leader training. First, participants in all interventions were students in grades 8 or 9. However, some papers lacked sufficient information about participants, such as race and the sex ratio. Therefore, it is uncertain whether possible differences in participnts influenced the intervention results. Second, some studies noted that a local language was used for the questionnaire, whereas others did not clearly state the language used. This might have created some differences in intervention results. Nevertheless, it was difficult to evaluate these differences because of the non-uniformity of outcome indicators among the studies. Third, all studies applied modified programs originally developed in the US. However, some studies included peer leader training, whereas others did not; this difference might also have affected the results. The lack of evaluation of the effects of training in the reviewed studies meant that we could not examine the influence of training. This suggests that papers reporting on interventions should include basic information necessary to enable the evaluation of heterogeneity among the studies.

Limitations

Few of the retrieved papers were selected for systematic review, and we could not conduct a meta-analysis because of the heterogeneity among studies. In addi-

tion, selected papers only reported interventions in an upper middle-income country. Africa has diverse religions, races, and school systems. Therefore, this review may not be representative of school-based alcohol use prevention activities in the whole of Africa.

Conclusion

The intervention effects were inconsistent among the selected studies. However, it is noteworthy that the interventions had positive effects on students who were non-drinkers at baseline, especially girls. This review suggests that school-based preventive interventions for alcohol use that incorporate multi-component activities and are based on participatory methods may be effective for secondary school students in Africa who have not yet started drinking. Such interventions should be incorporated into existing school-based health promotion activities. Using programs modified from those developed in other countries is recommended to minimize costs and efforts in developing intervention programs.

Contribution

S.T., K.M., T. Akiyama, Y.M., A.N. J.K. and M.J contributed to design the study. S.T. wrote the initial draft of the manuscript. S.T. and K.M. performed the analysis and interpreted the analyzed data. K.M. and T. Asakura assisted in the preparation of the manuscript. N.S., A.I. and other authors contributed to critical interpretation to the manuscript. All authors approved the final version of the manuscript, and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Conflict of interest disclosure

The authors declare no conflicts of interest associated with this manuscript.

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