

Original Research Article

Structured health education and risk of alcohol-related harm among youth in Kiambu, Kenya: a quasi-experimental study

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ABSTRACT

Background: Alcohol remains a major contributor to mortality and increased disability adjusted life years (DALYs) among the youth. In Kenya, where youth alcohol consumption affects 13% of 15–24 year old and reaches 28.9% in Kiambu County, structured health education interventions remain underexplored as a prevention strategy, and this informs the current study title.

Methods: Fourteen trained community health promoters delivered 12 monthly one-hour structured sessions over 12 months, supported by educational materials and peer learning components. Using the World Health Organisation alcohol use disorders identification test (WHO AUDIT) tool, 356 participants were randomly allocated per arm, following power calculations to detect an 11% risk reduction with 80% power. AUDIT scores categorized participants as low-risk, risky-hazardous, harmful, or high-risk, while the questionnaire established sociodemographic characteristics. Qualitative data were analyzed thematically. Kenyatta University's ethics committee granted study approval.

Results: Comparing pre- and post-study results, the mean risk in the intervention group dropped from 14.4 (risky-hazardous) to 4.8 (low risk), while the control group increased from 11.4 (risky-hazardous) to 18 (harmful). Youths with higher odds of risk were male, aged 20–24 years, uneducated, unemployed, not living with parents, widowed, separated, divorced, and residing in suburban areas, particularly in Muguga ward. The study reported a DiD estimate of -16.197 and a Cohen's d of -1.882, indicating that participants in the intervention group scored 16 points lower on the AUDIT scale. FGDs and KIIs revealed limited awareness and access to screening services, and intervention youths reported decreased alcohol consumption.

Conclusion: The intervention raised awareness of alcohol-related harm and reduced the risk of harm.

Keywords: Alcohol-related harm, Health education, Quasi-experimental

INTRODUCTION

Despite global evidence that structured health education can reduce youth alcohol consumption, implementation research in sub-Saharan Africa remains limited, particularly regarding structured community-based interventions tailored to local contexts.¹ Compounding the problem of inadequate structured health education, the prevalence of alcohol consumption continues to increase, with research showing that alcohol is the most widely

consumed substance and the first to be tried globally. It causes nearly 2.6 million deaths each year, including 320,000 among youths.² This burden is exacerbated by the high prevalence of alcohol consumption, with 23.5% of youths aged 15–19 being current drinkers.

In the African context, alcohol consumption among youths aged 15 to 24 is one of the leading predictors of disability-adjusted life years (DALYs) and mortality. The impact on DALYs is particularly pronounced among young males.³

The alcohol consumption rate among youths aged 15 to 19 years is estimated to be over 25%.⁴

In Kenya, youths are exposed to alcohol at a young age due to a lack of understanding about the consequences, the widespread availability of alcohol, peer pressure, insufficient educational programs, and limited life skills to resist the allure of alcohol.⁵ These multifactorial influences require comprehensive, community-based interventions that address knowledge deficits, build resilience skills, and modify social norms—the approach tested in this study. Although the National Agency for the Campaign Against Drug Abuse (NACADA) recommends a structured, youth-friendly health education program, county governments continue to struggle with implementing this intervention. The Central region has one of the highest rates of lifetime alcohol consumption among people aged 15 to 24 years.⁶ Kiambu County stands out as one of the most affected regions in Central Kenya. Approximately 28.9% of the youths in Kiambu have already consumed alcohol.⁷ This is comparable to the rate of heavy episodic drinking among 15 to 19-year-olds in Kenya, estimated at 55.1%.²

The intervention in this study was grounded in the extended parallel process model (EPPM), which predicts that fear-inducing health messages combined with high self-efficacy messaging will motivate protective behaviors.⁸

Despite evidence supporting health education effectiveness, three critical gaps exist in the Kenyan context such as no rigorous quasi-experimental studies have tested community-based alcohol education interventions, the optimal intensity and duration of youth-focused alcohol education remains unknown, and culturally appropriate intervention components for Kenya's diverse communities have not been systematically evaluated.

A cost-effectiveness analysis using this study's data reveals favorable economic outcomes. Total intervention costs of KES 3,000 per participant (including CHP training, materials, and supervision) resulted in the prevention of harmful drinking in 81.2% (286) of at-risk participants. Compared to the treatment costs of 172,000 KES (approximately US\$700-2,000) for a 90-day residential program per alcohol dependency case reported by Jaguga et al, the intervention prevents 1 case for every 1.2 participants treated (356/286), generating a 48:1 (172,000/3000×1.2) cost savings.⁹ The objective of this study was to find out the effect of enhanced structured health education on the risk of alcohol-related harm among the youth aged 15-24 years in Kiambu County.

Scientific/policy contributions

With 28.9% of Kiambu youth consuming alcohol compared to the national average of 11.2%, this study addresses an urgent public health crisis. The intervention's large effect size (Cohen's $d=-1.882$) suggests the potential

prevention of approximately 429 future alcohol-dependent cases ($44,000 \times 0.812 \times 0.012$) among Kiambu's 44,000 at-risk youth (28.9% of the total population aged 15-24 years in Kiambu, estimated at 153,000). This study contributes to the limited body of rigorous intervention research in sub-Saharan Africa by providing the first quasi-experimental evidence of structured health education effectiveness for youth alcohol prevention in Kenya.

Economic implications are substantial. If scaled county-wide, preventing 429 cases of alcohol dependency could save an estimated KES 74 million in direct healthcare costs, based on estimates of KES 172,000 annual treatment costs per case. The implementation costs of KES 132 million ($44,000 \times 3,000$) for a county-wide scale-up would yield a 6:10 return on investment over 10 years.

Specific policy contributions include validated implementation protocols for community health promoter-led interventions, evidence-based session content adaptable across Kenyan counties, cost-effectiveness data supporting resource allocation decisions, and demographic risk factor profiles enabling targeted intervention deployment.

METHODS

Study design

The study employed a quasi-experimental design, utilizing a mixed-methods approach to collect both quantitative and qualitative data. It consisted of three phases: pre-intervention, intervention, and post-intervention. The pre-intervention and post-intervention surveys provided baseline and endline data on participants' risk of alcohol-related harm for both groups, respectively. The intervention phase involved administering structured health education sessions to the intervention group while the control group received the routine health education.

Setting

Kiambu County was selected due to its high alcohol consumption rate of 28.9% among youth aged 15-24, which is 2.6 times the national average of 11.2%, making it an appropriate high-risk setting for intervention testing.⁶ The two sub-counties selected for study (Gatundu South and Kabete) have similar sociodemographic characteristics and are far apart to minimize contamination.

Baseline demographic analysis confirmed similarity across key variables: mean age (21.3 versus 21.1 years), male proportion (79% versus 71%), secondary education completion (47% versus 66%), and unemployment rates (89% versus 67%), with no statistically significant differences (all $p>0.05$). In each sub-county, three wards were randomly selected: Gatundu South (Ngenda, Kiganjo, and Kiamwangi wards) and Kabete (Kabete, Nyathuna, and Muguga wards). Homes with alcohol-drinking youths were randomly identified, and a random

selection was made to select households to recruit alcohol-drinking youths.

Participant recruitment, baseline risk screening, questionnaire administration, and the initial health education session took place in May 2022. Pre- and post-study data collection on risk involved screening and categorizing youths who consume alcohol across four risk categories. At low risk (0-7), the youth's risk for alcohol-related problems remains low because they are learning to drink and should be helped early to prevent the situation from worsening. At the risky-hazardous level (8-15), the youth may have started experiencing alcohol-related harm.¹⁰ At a harmful level (16-19), the youth is dependent on alcohol, and drinking habits may eventually become damaging. Finally, the high-risk (≥ 20) category includes a drinker who is experiencing clear harm and is often dependent on alcohol. To collect sociodemographic data, participants completed a questionnaire.

During the intervention phase, 12 community health promoters (CHPs) in the control group recruited participants, conducted a baseline survey, provided routine health education and management as typically practiced in the community, and performed an endline survey in May 2023. However, for the intervention group, 14 CHPs recruited participants, conducted a baseline survey, provided enhanced structured health education sessions monthly, each lasting one hour, and continued for one year until May 2023. The CHPs also provided the corresponding supportive sub-interventions in the WHO AUDIT tool. During the implementation, the principal investigator and five community health assistants (CHAs) who are formally employed by the county as supervisors of the selected CHPs helped in monitoring attendance, content delivery, and participant engagement to ensure study fidelity. Furthermore, at the endline, the CHPs were supervised in carrying out an end-line survey. Five recovered alcoholics also supported the intervention group CHPs by giving motivational talks.

The structured health education was expected to enhance intervention group participants' knowledge of the adverse effects of alcohol, influence their behavior change, reduce their alcohol consumption, and lower their risk of alcohol-related harm. Twelve topics were addressed in the intervention group, including understanding alcohol: myths, facts, and realities; risk levels and patterns of alcohol use; alcohol and youth: Why it is riskier at this age; sociodemographic factors and alcohol use; health effects of alcohol use; non-health effects of alcohol use; legal and social consequences of underage drinking; alcohol, mental health, and emotional well-being; building life skills for resisting alcohol use; alternatives to alcohol: healthy lifestyles for youth; and the role of family, peers, and community in alcohol prevention and management, along with structured health education and behavior change.

Each 60-minute session followed a structured format of 15-minute interactive discussion of previous session content, 30-minute new topic presentation using EPPM-based messaging combining fear appeals with self-efficacy building, 10-minute peer discussion and goal setting, and 5-minute distribution of take-home materials. The average attendance was 85% across 12 sessions. Boarding students participated in the sessions during the midterm and end-of-term holidays.

Furthermore, every youth in the intervention group received a flyer to read regularly at home and collectively during the sessions to promote peer-to-peer learning. Flyers incorporated EPPM principles by presenting graphic anatomical diagrams that illustrated the health effects of alcohol (fear appeal) alongside practical reduction strategies and success stories (self-efficacy enhancement). The content was validated through focus groups with 15 youth representatives from the target population. The flyer provided information on the signs of alcoholism, methods for reducing alcohol consumption, the effects of alcohol, and the benefits of quitting. Flyers for the youths and CHPs were designed as shown in Figures 1a and b.

The study also included 12 focus group discussions (FGDs), each with six participants, totaling 72 individuals, as well as 20 key informant interviews (KIIs), all conducted by three CHAs in each sub-county. In every subcounty, one FGD was held per ward at baseline and another at endline. Random sampling was used to select specific CHPs, and the subsequent six participants associated with these CHPs for the FGD. For the KIIs, purposive sampling helped identify 20 key community leaders, including the County CHP coordinator, subcounty coordinators, CHAs, chiefs, public health officers, and youth leaders.

Participants

Alcohol-drinking youths aged 15 to 24 who consented to participate were selected. Parents or guardians consented for the minors. The study involved 26 registered CHPs in the area and five recovered alcoholics who agreed to participate as motivational speakers. The lead subcounty coordinator in each subcounty recruited the CHPs. CHP selection criteria included active registration with the county health department, minimum 2 years of community health experience, demonstrated youth engagement through previous programs, and availability for monthly training sessions. Selection was conducted blind to intervention allocation to minimize bias.

The primary reasons for dropout included relocation (45%), work commitments (36%), and loss of interest (19%). Before youths' recruitment, all selected CHPs received training.



Figure 1: Flyers for the youths and CHPs.

Variables

The independent variables in this study encompassed sociodemographic factors, while the dependent variable was the risk of alcohol-related harm. Some potential confounding variables included previous exposure to alcohol education programs, religious and cultural beliefs, and family history of alcohol use.

Study size

In Gatundu, CHPs recruited 156 youths in Kiganjo, 132 in Ngenda, and 68 in Kiamwangi. In Kabete Subcounty, screening yielded 145 in Kabete ward, 109 in Nyathuna, and 102 in Muguga. The three Gatundu wards (Kiganjo, Ngenda, and Kiamwangi) encompass 29,146 households, with approximately 8,744 households containing alcohol-drinking youth (30% of 29,146). Kabete's three wards

(Kabete, Nyathuna, and Muguga) comprise 23,099 households, with approximately 6,930 households containing youth who consume alcohol.

The sample was calculated using the formula for comparing two proportions employed by Charan et al.¹¹ Sample size calculation assumed 55% baseline prevalence of risky alcohol use, targeting 11% absolute reduction (44% post-intervention), with 80% power and $\alpha=0.05$.

$$n = 2[Z\alpha/2\sqrt{(2P(1-P))} + Z\beta\sqrt{(P_1(1-P_1) + P_2(1-P_2))}]^2 / (P_1 - P_2)^2$$

Where, n =desired sample size, α =type I error (0.05), and β =type II error (0.10),

At 95% confidence, $Z\alpha/2=1.96$, at 80% power, $Z\beta=0.842$

$\bar{P}1=55\%$ baseline prevalence of risky alcohol use, and $\bar{P}2=44\%$ post-intervention prevalence of risky alcohol use.

$$P = (P1 + P2)/2 = 0.495$$

This yielded $n=324$ per arm. Accounting for a 10% attrition rate and a design effect of 1.0 (individual randomization), the final sample size was set at 356 per arm.

Statistical methods

R software was used for descriptive and inferential statistical analysis. Tables, charts, and figures illustrate quantitative data, while qualitative data were presented in thematic order. Chi-square was employed to determine the association between variables. The use of ordinal logistic regression helped establish the predictors of risk, while DiD, Cohen's d , and mean risk scores measured the intervention's impact.

RESULTS

Quantitative results

The study recruited a total of 712 participants, with 356 assigned to each of the intervention and control arms, as shown in Table 1. Demographic risk profiling revealed concerning patterns. Females showed 61% lower odds of the outcome compared to males ($OR=0.39$, 95% CI (0.20, 0.75)), while youths aged between 20-24 had higher odds or risk of 83% as compared to those between 15-19 years ($OR=1.83$, 95% CI (1.00–3.38)). Most critically, youth who did not go to school showed 73% higher odds of risk of alcohol related harm as compared to those at university level with ($OR=0.27$, 95% CI (0.04, 2.03)), suggesting the importance of education.

By the end of the year, four participants dropped out of the intervention arm and seven from the control arm, due to relocation (45%), work commitments (36%), and loss of interest (19%), resulting in 352 participants in the intervention group and 349 in the control group. The population, predominantly male and aged 20-24, presented a demographic picture of alcohol-consuming youths in Kiambu County, with the demographic pattern in the pre-study resembling the post-study findings (Table 1). The baseline demographic profile guided the adaptation of the intervention, with session timing adjusted to accommodate employment patterns and school attendance, and content modified to address male-specific risk factors such as social drinking pressures during community events. Overall, the demographics most affected across all risk categories were males, individuals aged between 20-24 years, those who have completed secondary education, single persons, the unemployed, those not residing with their parents, and those living in rural areas. In the pre-study, the intervention group consisted of 79% males, while the control group comprised 71% males. The majority, 64% (intervention group) and 71% (controls),

were aged 20-24 years. Most participants had completed at least secondary education, with 47% (intervention) and 66% (control) having done so. Most participants were single, with 89% (intervention) and 88% (control). Additionally, the majority lived in rural areas, with 94% (intervention) and 90% (control). Unemployment rates were high, with 89% in the intervention group and 67% in the control group. Regarding living arrangements, most participants resided with their parents or guardians, comprising 82% (intervention) and 69% (control).

Regarding the association between sociodemographic characteristics and the risk of alcohol-related harm in the intervention group, as shown in Table 1, gender, education level, and marital status demonstrated statistically significant relationships with risk levels ($p<0.05$) during pre-study or post-study periods. For the control group, gender, age, education level, settlement, and employment status was statistically significant ($p<0.05$) during both the pre-study and post-study periods (Table 1). Dose-response analysis revealed significant relationships between session attendance and outcomes. Participants attending ≥ 9 sessions (75th percentile) showed greater risk reduction compared to those attending ≤ 6 sessions (25th percentile), $p<0.001$, suggesting minimum effective dose requirements.

In a graphical representation of the change in risk scores among youths, as shown in the stacked bar chart in Figure 2, the structured health education reduced the percentage of intervention youths ranked at high risk from 31.5% to 7.1% and increased the percentage of those at low risk from 30.1% to 81.2%. For the controls, the percentage of participants ranked at high risk increased from 21.9% to 41%, while the percentage of low-risk participants decreased from 43% to 7.7%. As shown on the bar graph on the right in Figure 2, the positive changes in the intervention group can be attributed to the fact that 31% of participants quit drinking and 36% lowered their scores. In contrast, none in the control group quit, and only 5% lowered their scores. Figure 2's bidirectional pattern—intervention group improving while controls deteriorated—suggests alcohol risk naturally progresses without intervention. The 31% quit rate in the intervention group versus 0% in the controls indicates substantial behavioral change beyond mere risk reduction, with implications for long-term prevention strategies. Furthermore, the results of the mean risk scores in Table 2 indicate that, prior to the study, participants' mean risk scores in both groups were at a risky-hazardous level. Post study, the mean risk in the intervention group had dropped from 14.4 (risky-hazardous) to 4.8 (low risk), while the control groups had increased from 11.4 (risky-hazardous) to 18 (harmful). The 9.6-point mean improvement in the intervention group represents movement across two full AUDIT categories (from risky-hazardous to low-risk), while the 6.6-point deterioration in controls moved them from risky-hazardous to harmful drinking levels. This bidirectional pattern suggests both intervention benefits and natural progression of untreated alcohol risk.

Table 1: Distribution of the participants' demographic characteristics across different risk categories at pre-study and post-study in both arms.

Charac- teristics	Low risk (%)	Risky or hazard- ous (%)	Harm- ful risk (%)	High risk (%)	P ²	Low risk (%)	Risky or hazard- ous (%)	Harm- ful risk (%)	High risk (%)	P ²	
Intervention, pre						Intervention, post					
	n=107 ^I	n=89 ^I	n=48 ^I	n=112 ^I		n=286 ^I	n=29 ^I	n=12 ^I	n=25 ^I		
Gender											
Male	70 (65)	76 (85)	37 (77)	97 (87)	<0.001	223 (78)	23 (79)	6 (50)	24 (96)	0.016	
Female	37 (35)	13 (15)	11 (23)	15 (13)		63 (22)	6 (21)	6 (50)	1 (4)		
Age (years)											
15-19	46 (43)	30 (34)	15 (31)	37 (33)	0.3	109 (38)	6 (21)	2 (17)	10 (40)	0.13	
20-24	61 (57)	59 (66)	33 (69)	75 (67)		177 (62)	23 (79)	10 (83)	15 (60)		
Level of education											
Un- educated	1 (0.9)	2 (2.2)	3 (6.3)	5 (4.5)	<0.001	8 (2.8)	2 (6.9)	0 (0)	1 (4.0)	0.5	
Primary	10 (9.3)	16 (18)	11 (23)	28 (25)		48 (17)	9 (31)	2 (17)	5 (20)		
Secondary	56 (52)	47 (53)	22 (46)	41 (37)		133 (47)	14 (48)	5 (42)	14 (56)		
Poly- technic	3 (2.8)	8 (9.0)	0 (0)	4 (3.6)		13 (4.5)	1 (3.4)	0 (0)	1 (4.0)		
College	22 (21)	10 (11)	10 (21)	33 (29)		65 (23)	1 (3.4)	3 (25)	4 (16)		
University	15 (14)	6 (6.7)	2 (4.2)	1 (0.9)		19 (6.6)	2 (6.9)	2 (17)	0 (0)		
Settlement											
Rural	99 (93)	82 (92)	47 (98)	107 (96)	0.4	266 (93)	28 (97)	12 (100)	25 (100)	0.4	
Suburban	8 (7.5)	7 (7.9)	1 (2.1)	5 (4.5)		20 (7.0)	1 (3.4)	0 (0)	0 (0)		
Marital status											
Married	7 (6.5)	7 (7.9)	5 (10)	5 (4.5)	0.022	17 (5.9)	2 (6.9)	3 (25)	2 (8.0)	0.6	
Single	100 (93)	81 (91)	39 (81)	97 (87)		257 (90)	25 (86)	9 (75)	22 (88)		
Divorced	0 (0)	0 (0)	0 (0)	3 (2.7)		2 (0.7)	1 (3.4)	0 (0)	0 (0)		
Separated	0 (0)	1 (1.1)	4 (8.3)	5 (4.5)		8 (2.8)	1 (3.4)	0 (0)	1 (4.0)		
Widowed	0 (0)	0 (0)	0 (0)	2 (1.8)		2 (0.7)	0 (0)	0 (0)	0 (0)		
Employment status											
Un- employed	97 (91)	78 (88)	39 (81)	104 (93)	0.2	246 (86)	24 (83)	10 (83)	22 (88)	0.9	
Employed	10 (9.3)	11 (12)	9 (19)	8 (7.1)		40 (14)	5 (17)	2 (17)	3 (12)		
Control, pre						Control, post					
	n=153 ^I	n=80 ^I	n=45 ^I	n=78 ^I		n=27 ^I	n=120 ^I	n=59 ^I	n=143 ^I		
Gender											
Male	99 (65)	63 (79)	34 (76)	55 (71)	0.13	15 (56)	78 (65)	49 (83)	106 (74)	0.018	
Female	54 (35)	17 (21)	11 (24)	23 (29)		12 (44)	42 (35)	10 (17)	37 (26)		
Age (years)											
15-19	54 (35)	14 (18)	10 (22)	27 (35)	0.017	13 (48)	41 (34)	9 (15)	40 (28)	0.009	
20-24	99 (65)	66 (83)	35 (78)	51 (65)		14 (52)	79 (66)	50 (85)	103 (72)		
Level of education											
Un- educated	1 (0.7)	1 (1.3)	1 (2.2)	2 (2.6)	0.022	1 (3.7)	0 (0)	1 (1.7)	3 (2.1)	<0.001	
Primary	0 (0)	0 (0)	0 (0)	0 (0)		1 (3.7)	9 (7.5)	13 (22)	35 (24)		
Secondary	89 (58)	60 (75)	35 (78)	50 (64)		14 (52)	56 (47)	31 (53)	70 (49)		

Continued.

Charac- teristics	Low risk (%)	Risky or hazard- ous (%)	Harm- ful risk (%)	High risk (%)	P ²	Low risk (%)	Risky or hazard- ous (%)	Harm- ful risk (%)	High risk (%)	P ²
Poly- technic	13 (8.5)	2 (2.5)	0 (0)	8 (10)		2 (7.4)	10 (8.3)	3 (5.1)	8 (5.6)	
College	39 (25)	16 (20)	8 (18)	10 (13)		4 (15)	36 (30)	10 (17)	20 (14)	
University	11 (7.2)	1 (1.3)	1 (2.2)	8 (10)		5 (19)	9 (7.5)	1 (1.7)	7 (4.9)	
Settlement										
Rural	146 (95)	73 (91)	41 (91)	62 (79)	0.002	23 (85)	114 (95)	54 (92)	124 (87)	0.11
Suburban	7 (4.6)	7 (8.8)	4 (8.9)	16 (21)		4 (15)	6 (5.0)	5 (8.5)	19 (13)	
Marital status										
Married	10 (6.5)	3 (3.8)	3 (6.7)	8 (10)	0.15	3 (11)	8 (6.7)	3 (5.1)	10 (7.0)	0.11
Single	140 (92)	74 (93)	37 (82)	63 (81)		23 (85)	108 (90)	53 (90)	124 (87)	
Divorced	1 (0.7)	1 (1.3)	1 (2.2)	3 (3.8)		0 (0)	1 (0.8)	0 (0)	4 (2.8)	
Separated	2 (1.3)	2 (2.5)	4 (8.9)	3 (3.8)		0 (0)	3 (2.5)	3 (5.1)	5 (3.5)	
Widowed	0 (0)	0 (0)	0 (0)	1 (1.3)		1 (3.7)	0 (0)	0 (0)	0 (0)	
Employment status										
Un- employed	108 (71)	43 (54)	35 (78)	52 (67)	0.022	20 (74)	80 (67)	32 (54)	100 (70)	0.14
Employed	45 (29)	37 (46)	10 (22)	26 (33)		7 (26)	40 (33)	27 (46)	43 (30)	

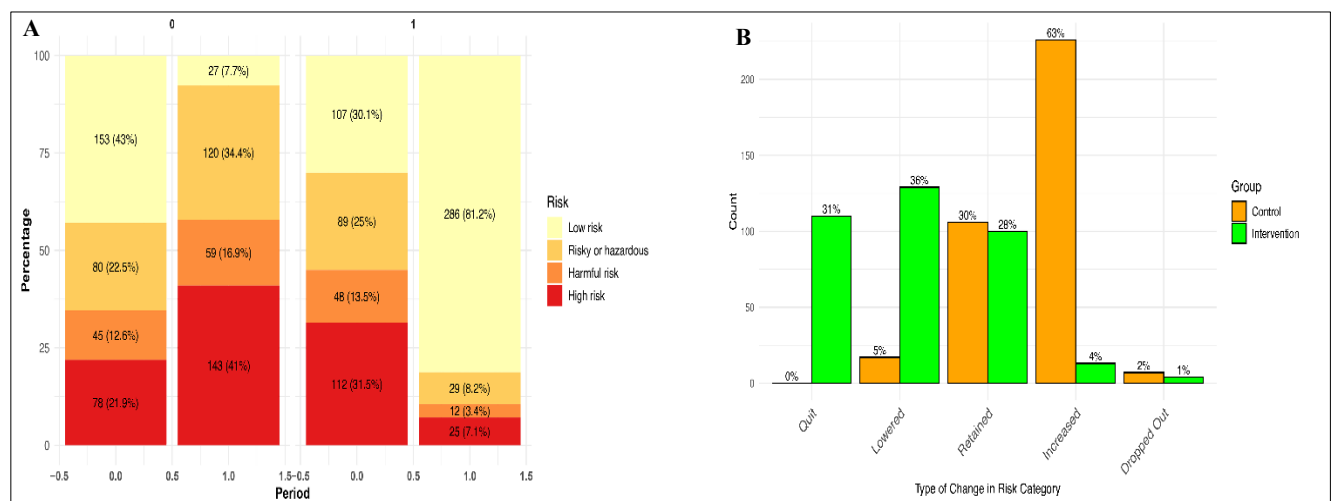


Figure 2: (A) Distribution of risk levels by study group and time point; (B) Graphical representation of the changes in risk categorization.

Additionally, as outlined in Table 2, the study reported a DiD estimate of -16.197, indicating a significant intervention effect of 16.197 units (the negative value indicates the direction of the impact, in this case, risk reduction).

Table 2: Risk mean scores.

Period	Arm	Mean risk score	Standard error
Pre	Control	11.444	0.4729
Pre	Intervention	14.407	0.5327
Post	Control	18.011	0.3927
Post	Intervention	4.7784	0.3577

DiD estimate: -16.197

Furthermore, Figure 3 presents a Cohen's *d* of -1.882, indicating a very large effect size, with the intervention group outperforming the control group by nearly two standard deviations. The graph compares two distributions: the blue line (labeled "0") represents the control study group, with higher risk scores centered around 18. In comparison, the green line (labeled "1") shows the intervention study group with substantially lower risk scores concentrated between 0 and 5. The minimal overlap between these distributions, along with the dramatic shift toward lower scores indicated by the dashed vertical lines representing the group risk means, demonstrates that the intervention was remarkably effective in reducing alcohol-related risk behaviors.

Table 3: Univariate and multivariate ordinal logistic regression model for pre- and post-study period in both arms.

Characteristic	Pre-study							Post-study						
	Univariate				Multivariable			Univariate				Multivariable		
	N	OR ¹	95% CI ¹	P	OR ¹	95% CI ¹	P	N	OR ¹	95% CI ¹	P	OR ¹	95% CI ¹	P
Gender	712			<0.001			<0.001	701			0.89			0.004
Male		—	—		—	—			—	—		—	—	
Female		0.55	0.40, 0.75		0.38	0.22, 0.64			0.98	0.72, 1.33		0.39	0.20, 0.75	
Age (years)	712						0.022	701						0.051
15-19		—	—		—	—			—	—		—	—	
20-24		1.23	0.92, 1.64		1.81	1.09, 3.02			1.57	1.17, 2.12		1.83	1.00, 3.38	
Ward	712			<0.001			0.079	701			<0.001			<0.001
Kiganjo		—	—		—	—			—	—		—	—	
Kiamwangi		0.78	0.47, 1.29		2.96	1.19, 7.48			0.63	0.28, 1.32		0.67	0.15, 2.66	
Ngenda		0.74	0.49, 1.14		1.11	0.50, 2.48			0.76	0.42, 1.37		0.61	0.19, 1.92	
Kabete		0.39	0.26, 0.60		1.62	0.76, 3.53			21.4	12.9, 36.3		80.9	28.5, 256	
Muguga		1.28	0.81, 2.03		1.51	0.62, 3.67			42	23.6, 76.5		117	34.7, 435	
Nyathuna		0.28	0.17, 0.45		0.65	0.18, 2.05			15.7	9.28, 27.1		33.2	10.6, 114	
Settlement	712			0.069			0.004	701			0.28			0.11
Rural		—	—		—	—			—	—		—	—	
Suburban		1.59	0.96, 2.64		4.95	1.66, 15.3			1.33	0.79, 2.25		3.06	0.79, 13.7	
Level of education	712			<0.001			0.001	701			0.093			0.009
Uneducated		—	—		—	—			—	—		—	—	
Primary		0.87	0.32, 2.27		0.42	0.06, 2.38			1.9	0.70, 5.55		2.18	0.33, 16.3	
Secondary		0.34	0.14, 0.82		0.25	0.04, 1.29			1.44	0.54, 4.05		1.11	0.19, 7.09	
Polytechnic		0.31	0.11, 0.90		0.17	0.03, 1.04			1.48	0.49, 4.72		0.65	0.09, 5.08	
College		0.35	0.14, 0.88		0.09	0.02, 0.50			1.07	0.39, 3.09		0.4	0.06, 2.62	
University		0.17	0.06, 0.49		0.08	0.01, 0.48			0.9	0.30, 2.83		0.27	0.04, 2.03	
Employment status	712			0.41			0.13	701			<0.001			0.94
Unemployed		—	—		—	—			—	—		—	—	
Employed		0.87	0.64, 1.20		0.43	0.13, 1.28			1.91	1.40, 2.61		1.05	0.29, 4.06	
Live with parents/relatives	712			<0.001			0.015	701			0.004			0.74
Yes		—	—		—	—			—	—		—	—	
No		1.67	1.23, 2.27		2.7	1.21, 6.10			1.57	1.15, 2.14		1.16	0.48, 2.90	
Money received from parents	284			0.0954			0.22	270			<0.001			0.062
1-5000		—	—		—	—			—	—		—	—	
50001-10000		0.45	0.20, 0.93		0.54	0.22, 1.28			0.17	0.06, 0.40		0.64	0.17, 2.08	
Above 10001		1.01	0.54, 1.85		1.3	0.56, 3.00			0.5	0.24, 1.00		2.87	1.04, 7.99	
Marital	712			<0.001			0.17	701			0.66			0.24
Married		—	—		—	—			—	—		—	—	
Single		0.86	0.50, 1.47		0.18	0.03, 1.12			0.87	0.51, 1.50		2	0.13, 33.4	
Others		3.4	1.53, 7.7						1.15	0.50, 2.61		0.37	0.01, 9.87	

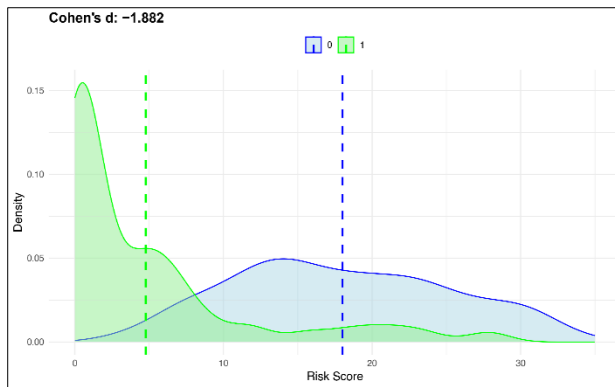


Figure 3: Impact assessment using Cohen's d; density plot showing the distribution of mean risk scores.

Regarding the predictors of risk at pre-study, gender, age, ward type, settlement, education level, living arrangements, and marital status were identified as significant factors (Table 3). Categories with higher odds of risk included the males (in both the univariate and multivariate analyses), individuals aged 20-24 years (in the multivariate analysis), Muguga youths (in the univariate analysis), suburban dwellers (in the multivariate analysis), those with primary level education (in both the univariate and multivariate analyses), those not living with parents (in both the univariate and multivariate analyses), and the divorced/separated/widowed (in the univariate analysis). In the post-study phase, the main predictors of risk were gender, age, ward type, level of education, employment status, and living arrangement (Table 3). Those with higher odds of risk included males (in the multivariate analysis), 20–24-year-olds (in the univariate analysis), Muguga youths (in both the univariate and multivariate analyses), individuals with primary education level (in the multivariate analysis), the employed (in the univariate analysis), and those not living with parents (in the univariate analysis).

Qualitative results

Qualitative findings triangulated quantitative results, with intervention participants reporting: 'Before the sessions, I didn't know alcohol could damage my liver so young' and 'The group discussions helped me realize I wasn't alone in wanting to quit.' Control group participants expressed: 'I wish we had learned these things earlier' and 'No one ever explained the AUDIT scores to us.' These quotes illustrate the knowledge-to-behavior pathway confirmed quantitatively.

Moreover, the qualitative findings from FGDs and KIIs indicated that youths lacked access to and awareness of screening services. Males and those with a secondary school education were at the highest risk of harm, with most introduced to drinking during circumcision or dowry ceremonies.

Unlike in the past, young people are now allowed to drink during the two ceremonies and are sometimes introduced to it by their parents. Once they taste alcohol, the behaviour continues, and the drinking pattern worsens with increasing age. Interviewees in the FGD and KII expressed a desire for structured health education to improve knowledge regarding the adverse effects.

Additionally, youths in Gatundu indicated that structured health education enhanced their awareness, helped them reduce alcohol intake, and mitigated the adverse effects they faced.

DISCUSSION

Overall, the intervention group demonstrated significant improvements in risk categorization over the study period. This was evidenced by the fact that the mean risk in the intervention group had dropped from 14.4 (risky-hazardous) to 4.8 (low risk), while the control group's mean risk had increased from 11.4 (risky-hazardous) to 18 (harmful). Furthermore, the study had a DiD estimate of -16.197, indicating a significant intervention effect of 16.197 units, and a Cohen's d of -1.882, suggesting a very large effect size, with the intervention group outperforming the control group. These improvements exceed most published educational interventions. Meta-analyses of youth alcohol education programs by Sinchi-Sinchi et al report average effect sizes of Cohen's d=0.3-0.39, making the study's observed effect (d=-1.882) exceptional and warranting replication studies.

These results align with recent studies highlighting the efficacy of educational interventions in reducing alcohol-related harm. Specifically, the findings exceed those reported, who conducted a meta-analysis of 83 RCTs and reported a pooled effect size of Cohen's d=0.36 for alcohol prevention programs targeting youth.¹² When broken down by theoretical model, the effect sizes were d=0.39 for motivational interviewing, d=0.30 for theory of planned behavior, and d=0.34 for social learning theory. These findings confirm that educational and psychosocial interventions consistently yield small to moderate effects, aligning with and contextualizing the strong community-based outcomes observed in this study. Moreover, Tanner-Smith et al found that alcohol-targeted behavioral interventions tend to yield few beneficial effects on the use of alcohol (g=0.12; 95% CI 0.08, 0.16).¹³

Implementation fidelity analysis revealed 94% adherence to session protocols, with CHPs delivering all 12 topics in 96% of sessions. However, session duration varied (45-75 minutes), and group sizes ranged from 10 to 15 participants, suggesting the need for standardization in scale-up efforts. Fidelity monitoring through monthly supervisor visits proved crucial for maintaining the quality of the intervention. Cultural adaptation proved essential for intervention success. Initial sessions addressing alcohol use during traditional ceremonies (circumcision, dowry payments) generated resistance until content was modified

to respect cultural practices while emphasizing health protection. Community elder endorsement, secured through preliminary engagement meetings, appeared crucial for youth participation and family support.

CONCLUSION

In conclusion, the 12-month structured health education intervention significantly reduced alcohol-related harm risk among Kiambu County youth, with participants moving from risky-hazardous to low-risk categories while controls deteriorated to harmful drinking levels. This highlights the need for Kiambu to adopt an evidence-based, structured approach to health education. Screening with the WHO AUDIT tool should precede health education, allowing the program to be tailored to each individual's risk level. It is also crucial to ensure that education is enhanced through regular monthly sessions, especially targeting the most affected populations, including young males aged 20-24 years who are educated up to the secondary level, the divorced, separated, widowed, unemployed, not living with their parents, and residing in suburban areas. Successful implementation can be achieved with the involvement of CHPs and recovered alcoholics. Key implementation insights include minimum 9-session attendance for optimal effects, community elder endorsement essential for cultural acceptance, peer learning components crucial for engagement, and CHP training requiring monthly supervision for fidelity. These findings provide actionable guidance for policymakers and program implementers across similar sub-Saharan African contexts.

Recommendations

Immediate actions (0-6 months)

Kiambu County should integrate the 12-session curriculum into existing community health programs, training additional CHPs using the validated protocols developed in this study. NACADA should adopt the AUDIT screening tool for systematic risk assessment, requiring 4-hour training modules for all community health workers.

Short-term implementation (6-18 months)

Short-term implementation should include scale intervention to all 12 Kiambu sub-counties and establish monthly supervision systems with dedicated coordinators.

Long-term sustainability (18+ months)

Long-term sustainability should include integrating alcohol education into Kenya's community health strategy, requiring Ministry of Health policy revision and national budget allocation and development of monitoring and evaluation systems using AUDIT scores as key performance indicators, with quarterly assessments and annual outcome evaluation.

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