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Associative between mHealth CBT-informed psychoeducational text messaging and substance use among university students: a quasi-experimental study in a low-resource setting

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Abstract

Substance use among university students is a growing public health concern, often contributing to adverse health outcomes and reduced academic performance. This study aimed to examine the association between mHealth CBT-informed psychoeducational text messaging interventions and substance use frequency among undergraduate students at Jimma University, Ethiopia. A quasi-experimental study design was employed, involving 140 students with substance use allocated equally into intervention (n = 70) and control (n = 70) groups by campus. Substances assessed included tobacco, alcohol, cannabis, and khat. Substance use frequency (low/moderate/high) was measured using the validated WHO Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). The intervention group received three months of mHealth CBT-informed psychoeducational text messages addressing knowledge and skill-building, while the control group received no study-related text messages, follow-up calls, or mobile credit incentives during the study period. Endline assessment was conducted immediately following the intervention. Ordinal logistic regression was used to assess associations, adjusting for baseline substance use frequency. After adjusting for baseline imbalance (intervention: 82.9% high use vs. control: 45.7%; $p < 0.001$), the intervention was associated with significantly lower odds of higher substance use frequency (OR = 0.10, 95% CI [0.03-0.31], $p < 0.001$). Higher self-esteem and low monthly income were also associated with reduced odds (OR = 0.10, $p = 0.010$), (OR = 0.06, $p = 0.013$) respectively. The findings suggest that mHealth CBT-informed psychoeducational text messaging intervention was associated with reduced substance use among university students. However, due to the non-randomized design and baseline imbalance, causal inference is limited.

Key words: mHealth, self-esteem, CBT, text message, substance use, Quasi-Experimental, Jimma University, Ethiopia.

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Introduction

Substance use remains a major global public health issue, contributing to considerable morbidity, mortality, and societal burden.[1] Early initiation is particularly concerning, as it strongly correlates with increased severity of use in later life and is associated with a range of adverse physiological, social, and behavioral outcomes including physical and mental health problems, cognitive impairment, violent conduct, lower educational achievement, and difficulties with family and occupational functioning.[2, 3] Among young adults, these risks are further compounded by the developmental and transitional challenges characteristic of this life stage, making university students a particularly vulnerable population.[4]

Higher education institutions have developed a reputation for fostering environments that encourage substance use.[5-7] Some students initiate use during their university years, while those with prior use often escalate the frequency and intensity of their consumption in the university context.[8,9] Indeed, university students consistently report higher rates of substance use particularly alcohol, marijuana, and non-prescription stimulants compared to their non-student peers.[6] These patterns underscore the urgent need for effective prevention and intervention strategies tailored to the unique challenges faced by students.

In Ethiopia, substance use among young adults represents a major public health and social concern, with high prevalence rates documented across higher education institutions.[10] Alcohol, tobacco, and khat are the most commonly used substances, and such behaviours have been associated with adverse academic outcomes, social withdrawal, violent tendencies, and risky sexual practices.[11-13] Despite this burden, engaging students in traditional face-to-face programs remains challenging due to considerable stigma surrounding substance use services.[14] Moreover, conventional healthcare systems often struggle to deliver high-quality, individualized programs that meet the diverse needs of large student populations.[15]

Mobile health (mHealth) interventions, particularly those utilizing Short Message Service (SMS), have emerged as promising tools for addressing risky behaviours in accessible and scalable ways. SMS-based systems offer several advantages over traditional approaches, including broader reach, lower cost, minimal disruption to participants' daily lives, and the ability to deliver interventions at any time and location.[16] These benefits have positioned

mobile phone interventions as evidence-based strategies for preventing substance use, including tobacco and alcohol consumption.[15,17] Among university students specifically, technology-based interventions whether web-based, mobile, SMS, or computerized CBT have demonstrated feasibility, acceptability, and potential to reduce substance use and related harms, particularly when incorporating personalization, normative feedback, or interactive content.[18] Text messaging interventions for alcohol, for instance, have shown greater reductions in consumption compared to providing no information or basic health information alone.[19]

Cognitive Behavioral Therapy (CBT) is one of the most well-researched psychosocial therapies for substance use disorders and has demonstrated effectiveness in both in-person and digital formats. CBT techniques focus on coping mechanisms, relapse prevention, and cognitive restructuring to reduce substance use and its associated negative effects.[20] Psychoeducation the provision of brief, targeted information and skills training is widely used in campus prevention programs and can increase knowledge and sometimes reduce risky use, though effects on long-term consumption are typically modest unless combined with motivational or skills-based components.[21] Integrating CBT principles into psychoeducational text messaging may therefore offer a promising approach to reach students who might otherwise avoid traditional services.

Self-esteem and self-efficacy are well-established psychosocial determinants of substance use behaviours, each playing a distinct yet complementary role in shaping health-related decisions among young adults.[22-24] Higher self-esteem has been consistently linked to greater resilience against peer pressure and a stronger inclination toward health-promoting behaviours, whereas low self-esteem is associated with increased vulnerability to substance use.[22-24] Self-efficacy is defined as an individual's belief in their capacity to successfully execute the behaviours required to achieve desired outcomes that similarly influences both the initiation and maintenance of substance use behaviours.[25] Together, these psychological constructs offer valuable targets for intervention; understanding how they interact with mHealth-delivered content can inform the development of more tailored and effective prevention strategies.[26,27]

Given the demonstrated potential of mobile phone-based interventions in health promotion and the widespread use of mobile technology among young adults, mHealth interventions offer a viable pathway to reach at-risk students. However, evidence from low-resource settings, particularly in sub-Saharan Africa, remains limited. This quasi-experimental study aimed to examine the associative between mHealth CBT-informed psychoeducational text messaging and substance use frequency among undergraduate students at Jimma University, Ethiopia.

Research questions

Is the mHealth CBT-informed psychoeducational text messaging intervention associative to reduce substance use among students at Jimma University, Ethiopia?

Materials and Methods

Study setting and period

This study was conducted at Jimma University, located in the southwestern part of Ethiopia. Established in 1952, Jimma University is one of the country's largest and most reputable higher education institutions. The university currently enrolls approximately 13,370 students and employs about 2,600 academic and administrative staff members. It comprises two institutes and six colleges distributed across various parts of Jimma town, including the Institute of Health Sciences, Jimma Institute of Technology, the College of Agriculture and Veterinary Medicine, the College of Social Sciences and Humanities, the College of Natural Sciences, the College of Business and Economics, the College of Law and Governance, and the College of Education and Behavioral Sciences. In addition, the university maintains a satellite campus located in Agaro, a nearby town.

Jimma University is situated in one of Ethiopia's traditional khat-growing regions, where the prevalence of khat use is notably higher than the national average.[28] This context provided a relevant setting for studying substance use behaviours among students. The present study was conducted among undergraduate students from two of the university's five campuses, selected purposively to minimize contamination between intervention and control conditions. The Institute of Technology campus, located in Jimma town, and the Agaro Campus, located in Agaro town, were non-randomly assigned as the intervention and control sites, respectively.

Study design

This study employed a quasi-experimental, non-randomized design. Allocation of the 140 participants into intervention (n = 70) and control (n = 70) groups was performed using a non-random method by campus residence to minimize contamination between conditions. The Institute of Technology campus, located in Jimma town, and the Agaro Campus, located in Agaro town, were purposively assigned as the intervention and control sites, respectively.

It had three phases to assessed the intervention's associations with one group (n = 70) getting the mobile health CBT-informed psychoeducational text messaging intervention and a control group (n = 70) experiencing merely assessments. Evaluations were carried out at the baseline and endline of the intervention. Participants were recruited, included, and assigned in early 2025, with the intervention program beginning in February 2025. The baseline assessment was conducted during the first week of February 2025, and the endline assessment was conducted during the first week of May 2025, immediately following the three-month intervention period.

Eligibility

Inclusion criteria

Undergraduate students aged 18 years or older, currently enrolled and attending classes at Jimma University during the study period, were eligible to participate. Eligibility was determined through a brief screening questionnaire that assessed substance use history, confirming current or lifetime use of alcohol, khat, cigarettes, or cannabis through the responding sampling method. Participants were required to have access to a functional mobile phone to receive text messages and complete study assessments. Written informed consent was obtained from all eligible participants prior to enrolment.

At baseline, participants completed a structured, interviewer-administered questionnaire (in-person) assessing socio-demographic characteristics, substance use patterns, and psychological variables such as self-esteem, self-efficacy, attitudes and knowledge toward substance use. Substance use was measured using a modified version of the WHO Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), which includes standardized scoring to classify low, moderate, or high-risk use. Follow-up (endline) assessments, conducted after the intervention period,

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used the same toolset to measure changes in substance use behaviours and psychosocial outcomes.

Exclusion criteria

Students were excluded if they did not possess a mobile phone, were non-regular (e.g., evening or distance learning) students, or declined to provide informed consent. For Phase Two, the intervention phase, all 140 undergraduate students who met the inclusion criteria that reported substance use, and provided consent were eligible to participate in both the baseline and endline assessments.

Sample size determination

Sample size was calculated using G*Power software for an ordinal logistic regression model. Based on previous literature on psychoeducational interventions for substance use, we assumed a medium effect size (OR = 2.0, equivalent to Cohen's f = 0.25) [29, 30]. With a two-sided alpha of 0.05 and statistical power (1-beta) of 0.80, the minimum required sample size was 128 participants. To account for a potential 10% attrition rate, we aimed for a final sample of 140 participants (70 per group), which was enrolled to ensure adequate power for the planned ordinal regression analysis. This sample size was estimated based on the assumption of independent observations. Prior to the main data collection, a pretest was conducted on 5% of the total sample size (n = 7) among students at the College of Social Sciences, Jimma University, to assess the clarity and feasibility of the questionnaire.

Recruitment strategy

Participants were recruited using Respondent-Driven Sampling (RDS), a link-tracing method similar to snowball sampling that is particularly effective for reaching hidden or difficult-to-identify populations, such as university students who use substances. The recruitment process began with the purposive selection of five initial «seeds», three male and two female undergraduate students enrolled at Jimma University who were identified through preliminary campus health surveys and peer referrals, as having a history of substance use consistent with the study's inclusion criteria. Prior to enrolment, all seeds were confirmed eligible based on age (18 years or older), current enrolment status, and current or lifetime use of alcohol, khat, cigarettes, or cannabis. Recruitment then proceeded over three sequential waves: Wave 1 comprised 32 participants directly recruited by the seeds; Wave 2 included 58 participants recruited by Wave 1 participants; and Wave 3 consisted of 45 participants recruited by Wave 2 participants, with the remaining participants enrolled through additional chains extending to a fourth wave. While participant characteristics remained broadly similar across waves, later waves showed a slightly higher proportion of male participants (Wave 1: 65.6% male; Wave 2: 71.8% male; Wave 3: 73.3% male). Importantly, no significant differences in substance use frequency or psychosocial variables were observed across recruitment waves (all $p > 0.05$), suggesting that the sampling process yielded relatively homogeneous groups despite the increasing male representation. To ensure data confidentiality, all participant data were anonymized using unique study IDs, with identifiable information (e.g., names, contact details) stored separately from survey data in a password-encrypted, access-restricted drive. Data transmission and storage complied with applicable regulations and only named study investigators had access to the final dataset. Regarding participant incentives, individuals received a small gift worth approximately 25 bir mobile card every month during the intervention time. For RDS, each participant also received a 25 bir mobile card every month during the intervention time and as incentive for each eligible peer they successfully recruited, up to a maximum of three recruits. All incentives were chosen to be non-coercive and were reviewed by the ethics committee. Safeguards for RDS included uniquely coded and time-stamped coupons to prevent duplication or fraudulent claims, with duplicate registrations checked using a combination of coupon codes and a de-duplication algorithm on demographic data (age, sex, self-reported RDS seed). Participants were clearly instructed not to coerce others into participation and that refusal would not affect their own incentive. A dedicated study hotline was available for any participant who felt pressured, and recruitment was capped at three referrals per participant to reduce the risk of undue influence within dense social networks.

After providing written informed consent, each seed participated in the baseline survey and was then given a limited number of unique recruitment coupons to invite peers from their social network who also used substances and were enrolled as undergraduate students at Jimma University. Each new participant recruited through these coupons underwent the same eligibility screening and consent process before joining the study. Once enrolled, they were also provided with recruitment coupons to distribute to other eligible peers, allowing the recruitment chain to expand until the desired sample size was achieved.

Throughout the recruitment process, the principal investigator and trained research assistants closely monitored the procedure but did not directly influence peer selection. Their role was to ensure ethical standards were maintained, clarify the study's purpose, and assist participants with the consent and screening procedures when needed. Each participant was assigned a unique identification number to maintain confidentiality and facilitate data tracking. This recruitment process continued iteratively until the required sample size of 140 eligible participants was reached (Figure 1).

Study procedure

The study employed a respondent-driven sampling approach to recruit undergraduate students who reported substance use, following which eligible participants provided written informed consent and completed a baseline assessment that gathered data on sociodemographic characteristics, substance use patterns, and psychosocial factors including knowledge, attitudes, and self-efficacy toward substance use.

Participants were then non-randomly assigned by campus to either the intervention group (drawn from the Institute of Technology campus) or the control group (from the Agaro campus), with 70 participants allocated to each group, and all 140 participants completed both baseline and endline assessments over the three-month study period with no attrition, achieving a 100% retention rate that was likely facilitated by monthly mobile credit incentives of 25 Ethiopian Birr per participant for three months, active follow-up calls for non-response to text messages, and the timing of the study during the active academic year when students were regularly present on campus.

The intervention group received a mobile health cognitive-behavioral therapy-informed psychoeducational text messaging intervention, while the control group served as an assessment-only waitlist control, receiving no intervention during the active study period but provided with the full intervention content following the post-endline assessment to ensure equitable access, and all participants continued to receive standard campus health services.

The message content, developed based on core CBT principles, was organized into six thematic categories: awareness and

reflection, self-monitoring and goal setting, cognitive restructuring, coping skills and stress management, assertiveness and peer pressure resistance, and relapse prevention and behavioral activation with examples including prompts to identify triggers, track substance use patterns, replace negative thoughts with balanced alternatives, practice stress-management techniques, refuse substance use assertively, and maintain progress despite setbacks. Skill-building was incorporated through action-oriented messages requiring active cognitive engagement, such as identifying triggers, setting weekly goals, practicing coping strategies, and reflecting on use patterns, with standardized messages delivered consistently across participants without tailoring to individual substances or user profiles, although the CBT framework addressed common cognitive-behavioral mechanisms across substances, and messages were non-interactive beyond requiring a «YES» confirmation reply but designed to stimulate self-reflection and active cognitive processing.

Throughout the study, participants exhibiting signs of severe psychological distress were referred to the university's student clinic for professional support, and mental health distress was not used as an exclusion criterion to maintain sample representativeness given the frequent co-occurrence of substance use and mental health conditions, the supportive rather than therapeutic nature of the intervention with established referral pathways, and the goal of evaluating the intervention in a real-world university population where mental health comorbidities are common, while students with severe psychiatric conditions requiring immediate intensive treatment were referred to appropriate services rather than enrolled, ensuring appropriate care and ecological validity. After the three-month intervention period, an endline assessment identical to the baseline survey was administered to both groups to evaluate changes in substance use behaviours, attitudes, and psychosocial outcomes.

Data collection

Data were collected using a structured, interviewer-administered questionnaire designed to capture both sociodemographic and psychosocial characteristics of participants. Sociodemographic variables included gender, age, area of study, year of study, and family's primary source of income. Additional components assessed participants' knowledge, attitudes, self-esteem, self-efficacy, and patterns of substance use.

Substance use was measured using a culturally adapted version of the WHO Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), Version 3.0, a validated screening instrument originally developed to detect substance use and related problems across eight categories of psychoactive substances,[31] with modifications for the Ethiopian context that included cultural adaptation of language to ensure local comprehension, the addition of khat as a specific substance category given its high prevalence in Ethiopia, and minor wording adjustments to reflect local terminology for substances and use patterns, while the core items and scoring algorithms were retained to maintain validity.

The ASSIST's risk categories low, moderate, and high that reflect an ordinal gradient of substance involvement severity that has been validated across multiple populations and has demonstrated sensitivity to change in previous intervention studies, with specific frequency items assessing use in the past three months (never, once or twice, monthly, weekly, daily or almost daily), frequency of experiencing craving or urges to use, and frequency of substance use leading to health, social, legal, or financial problems, all of which feed into established standardized scoring procedures that categorize respondents into risk levels. Knowledge and attitude sections were also adapted from the ASSIST to reflect the context of substance use among Ethiopian university students, while self-esteem was measured using the Rosenberg Self-Esteem Scale,[32] a 10-item instrument widely validated across populations, and self-efficacy was assessed using the General Self-Efficacy Scale,[33] consisting of 10 items rated on a four-point Likert scale; reliability analyses were performed for each adapted tool to confirm internal consistency in the local context, with the ASSIST demonstrating acceptable internal consistency in our sample (Cronbach's $\alpha = 0.82$ for the overall scale), and although test-retest reliability was not assessed due to the study design, the ASSIST has established reliability in previous research ($\alpha = 0.80–0.94$ across substance categories). The same toolset was administered at both baseline and endline to measure changes in substance use behaviours and psychosocial outcomes following the intervention period.

Data were collected using a structured, paper-based questionnaire administered in-person by trained research assistants in private settings to minimize social desirability bias. Participants were assured of confidentiality prior to each interview. Following data collection, all paper questionnaires were reviewed for completeness on the same day by research assistants under the principal investigator's supervision. To minimize transcription errors, double data entry was performed by two independent data entry clerks using EpiData version 4.6, with discrepancies resolved by cross-referencing against the original paper questionnaires. A 10% random sample of entries was verified against the original questionnaires to ensure accuracy. Data were then coded, cleaned, and exported to SPSS version 26 for analysis. During cleaning, range checks and logical consistency checks were performed, and inconsistent or incomplete responses were reviewed against the original paper questionnaires for verification.

Regarding missing data, participants with incomplete responses on minor sociodemographic variables (e.g., family income or area of study) were retained in the analysis, and missing values were treated as "system-missing" in SPSS without imputation. However, if a participant had substantial missing data such as unanswered sections on key outcome measures (knowledge, attitude, or substance use frequency), their data were excluded from the final analysis for that specific domain. The proportion of missing data was minimal (<5%) and did not affect the overall analytical integrity.

Intervention

All undergraduate students on both study campuses were informed about the study objectives and procedures through campus announcements. Students who met the inclusion criteria were invited to participate, and written informed consent was obtained before enrolment. A total of 140 undergraduate students who reported substance use were recruited for the study, with 70 participants assigned to the intervention group and 70 to the control group. Participants in the intervention group received a mobile health (mHealth) Cognitive Behavioral Therapy (CBT)-informed psychoeducational text messaging intervention delivered directly to their mobile phones over the study period. In contrast, the control group received no study-related text messages, follow-up calls, or mobile credit incentives; they were contacted only for baseline and endline assessments. However, both groups continued to have access to standard campus health services routinely available to all students, meaning the control condition reflected usual care rather than a complete absence of support.

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The text messaging intervention was newly developed for this study, drawing conceptually from prior mobile-based CBT and psychoeducational messaging programs targeting substance use behavior change.[34,35] The message content was developed based on core CBT principles and WHO materials on substance use disorders. The message library was reviewed by two clinical psychologists and two public health experts for cultural relevance, accuracy, and clarity. The final set of messages achieved 100% agreement among reviewers after two rounds of revision. The intervention aimed to support substance users by fostering self-awareness, challenging unhelpful thought patterns, and developing essential coping skills.

The messages were organized thematically across the three-month intervention period to ensure a structured, step-by-step approach. The first set of messages focused on raising awareness and encouraging reflection on substance use, triggers, and motivations. Subsequent messages emphasized self-monitoring, goal setting, and cognitive restructuring to challenge negative beliefs and promote positive self-talk. Later messages concentrated on coping skills, stress management, and resilience building, while final themes addressed assertiveness, peer pressure resistance, behavioral activation, and relapse prevention. All participants in the intervention group received the same standardized sequence of messages in the same order, guided by a message delivery manual that detailed weekly themes and delivery times. Messages were not personalized to specific substances but were designed to be broadly relevant to users of alcohol, khat, cigarettes, or cannabis.

Each text message had two main components: an introductory greeting and the main body containing the CBT-informed content. The introductory message included a friendly greeting and the study's identification, such as: "Hello [Participant Name], this is from the Jimma University mHealth Study Team. Thank you for being part of this important research!" The main message body contained the psychoeducational or motivational content. For example, one message addressing cognitive restructuring read: "Think about one negative thought you have after using substances (e.g., 'I can't control it'). Try to replace it with a balanced thought, such as 'I'm learning to make better choices each day.' Every small step counts."

The intervention messages were delivered using the AUTO MESSAGE application—a free, secure Android-based automated text messaging tool available on the Google Play Store—at a consistent time of 3:00 p.m. each scheduled day. Delivery followed a tapered schedule designed to gradually shift responsibility from the intervention to the participant: three messages per week during the first month (Tuesday, Wednesday, and Thursday), two per week during the second month (Tuesday and Thursday), and one per week during the third month (Thursday). This progressive reduction aimed to provide intensive initial support while fostering independent self-management skills over time. To monitor engagement, participants were asked to reply «YES» to confirm message receipt; non-response within 30 minutes triggered a resend, and if still unanswered, a follow-up phone call was placed after one hour. As an incentive and compensation for their participation, each participant received a mobile card worth 25 Ethiopian Birr per month throughout the three-month intervention period.

The *AUTO MESSAGE* platform operated in compliance with its privacy policy, ensuring that personal information was not shared beyond the message delivery process. Data collected were limited to message delivery and response confirmations, which were used solely for engagement monitoring. At the end of the three-month intervention, an endline survey that was identical to the baseline questionnaire administered in person to both the intervention and control groups to evaluate the association with the intervention. The survey, which took approximately 10 minutes to complete, assessed changes in substance use behavior, attitudes, and psychosocial outcomes following the intervention.

We acknowledge that the observed association between the intervention and substance use reduction may partly reflect non-specific effects, including increased attention from the research team, regular contact through text messages, follow-up calls to confirm message receipt, and the mobile credit incentive provided to participants. The intervention group received more attention and contact than the control group, which could contribute to behavior change independent of the CBT-informed message content. This limits our ability to attribute the observed reduction specifically to the CBT-informed psychoeducational content versus general attention/support.

Outcomes

This mobile health intervention delivered CBT-informed psychoeducational text messages over three months, with the explicit goal of reducing substance use specifically alcohol, khat, cigarettes, or cannabis among young adult university students who were already using substances. The primary outcome was assessed at endline using the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), which measured substance use in the past three months. However, because this recall period directly coincided with the three-month intervention window, the endline assessment captured substance use during the intervention rather than strictly after its completion. As a result, we are unable to determine whether any observed reductions were sustained beyond the active intervention phase, as there was no post-intervention washout period to assess longer-term maintenance of behavior change. This overlapping measurement period represents a key limitation of the study design.

Data management and analysis

After collecting all required data, the data was thoroughly reviewed for completeness, and questionnaires containing incomplete data were excluded Data were coded, cleaned, and entered using EpiData version 4.6 before being exported to SPSS version 26 for analysis. Data were summarized using descriptive statistics such as frequencies, percentages, means, and standard deviations, as well as cross-tabulations. The Chi-Square Tests, Case Processing Summary, Model Fitting, Goodness-of-Fit, Pseudo R-Square, Parameter Estimates, Test of Parallel Lines, the reliability statistics, and the associations between the dependent variable and predictors were done.

Substance use frequency, assessed using the ASSIST tool, was categorized as low, moderate, or high, reflecting a natural ordinal gradient of severity. Ordinal regression (ordered logistic regression) was therefore selected to model the probability of being at or above each level while respecting the inherent ordering of the outcome.

Crosstabulation with chi-square testing compared baseline substance use frequency between groups, and no serious multicollinearity was detected among predictors. Missing data were minimal (<5%) and handled via complete-case analysis; no sensitivity analysis was conducted due to the low proportion of missingness, which is noted as a limitation. The study results are presented following the TREND (Transparent Reporting of Evaluations with Non-randomized Designs) statement guidelines for quasi-experimental studies.

Results

Socio-demographic characteristics of respondents

A total of 140 students from Jimma University were assessed for eligibility and enrolled via respondent-driven sampling, with 70 participants assigned to the intervention group and 70 to the control group. All enrolled participants completed both baseline and endline assessments, yielding a 100% retention rate and complete data on all key outcome variables. For minor sociodemographic variables, incomplete responses were minimal (<5%) and were treated as system-missing in SPSS without imputation; no cases had substantial missing data on primary outcome measures requiring exclusion. Consequently, a complete-case analysis was conducted on the final sample of 140 participants. Males constituted the majority, accounting for 70.0% of the intervention group and 71.4% of the control group. Most participants (78.6% of the intervention and 90.0% of the control) were between 20 and 24 years old, with representation across various academic disciplines. Participants were distributed across all academic years, with third-year students representing the largest group (27.1% of the intervention and 48.6% of the control). The majority resided in university dormitories (67.1% of the intervention and 91.4% of the control) and were unmarried (84.3% and 88.6%, respectively).

In terms of religion, 45.7% of control participants were Muslim, and 41.4% of intervention participants were Orthodox Christian. The most common frequency of attending religious services was «less than weekly» among the intervention group (27.1%) and «daily» among the control group (41.4%). Most participants originated from urban settings (90.7% intervention, 81.4% control), with the majority having previously lived with their families (87.1% intervention, 94.3% control).

Employment was the primary source of family income for 34.3% of intervention and 55.7% of control participants. A higher

Table 1. Socio-demographic characteristics of participants by study group.

Variable	Category	Control (n=70) n (%)	Intervention (n=70) n (%)
Age	Below 20	3 (4.3)	4 (5.7)
	20–24	63 (90.0)	55 (78.6)
	25 and above	4 (5.7)	11 (15.7)
Gender	Male	50 (71.4)	49 (70.0)
	Female	20 (28.6)	21 (30.0)
Year of Enrolment	First year	–	16 (22.9)
	Second year	20 (28.6)	10 (14.3)
	Third year	34 (48.6)	19 (27.1)
	Fourth year	16 (22.9)	15 (21.4)
	Fifth year	–	10 (14.3)
Residence	On campus	64 (91.4)	47 (67.1)
	Private rental room	5 (7.1)	21 (30.0)
	At home	1 (1.4)	2 (2.9)
Marital Status	Divorced	1 (1.4)	–
	Cohabiting	6 (8.6)	7 (10.0)
	Separated	1 (1.4)	4 (5.7)
	Single	62 (88.6)	59 (84.3)
Religion	Orthodox	22 (31.4)	29 (41.4)
	Muslim	32 (45.7)	18 (25.7)
	Protestant	13 (18.6)	17 (24.3)
	Catholic	3 (4.3)	6 (8.6)
Frequency of Religious Attendance	Daily	29 (41.4)	11 (15.7)
	2–3 times/week	21 (30.0)	14 (20.0)
	Weekly	7 (10.0)	15 (21.4)
	Less than weekly	10 (14.3)	19 (27.1)
	Never	3 (4.3)	11 (15.7)
Setting Before University	Urban	57 (81.4)	63 (90.0)
	Rural	13 (18.6)	7 (10.0)
Living Situation Before University	Living alone	4 (5.7)	9 (12.9)
	Living with family	66 (94.3)	61 (87.1)
Family Livelihood	Agriculture	16 (22.9)	5 (7.1)
	Employment	39 (55.7)	24 (34.3)
	Trade	15 (21.4)	41 (58.6)
Avg. Monthly Income (ETB)	Below 1000	54 (77.1)	11 (15.7)
	1000–1999	7 (10.0)	10 (14.3)
	2000–2999	3 (4.3)	20 (28.6)
	3000 and above	6 (8.6)	29 (41.4)
Cumulative GPA	Less than distinction	45 (64.3)	49 (70.0)
	Distinction level	25 (35.7)	21 (30.0)
Knows Mobile Health Services	Yes	55 (78.6)	47 (67.1)
	No	15 (21.4)	23 (32.9)

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proportion of intervention participants (41.4%) reported monthly students' incomes above 3000 ETB, whereas most control participants (77.0%) reported less than 1000 ETB. The cumulative GPA of most participants (70.0% intervention, 64.3% control) was below the «distinction» level. Awareness of mobile health services was relatively high in both groups (67.1% intervention, 78.6% control; *Table s1 and 2)*.

Attitude and knowledge toward substance use

At baseline, most participants demonstrated a high level of knowledge about substance use and its association, with 80.0% of the intervention group and 85.7% of the control group classified as having "good knowledge." Attitudes toward substance use showed more variation: 51.4% of the intervention group and 80.0% of the control group demonstrated a favorable or "good attitude."

Internal consistency was assessed using Cronbach's alpha across all study measures, and all scales demonstrated good to excellent reliability, with values exceeding the acceptable threshold of 0.70. The Rosenberg Self-Esteem Scale showed acceptable reliability ($\alpha = 0.84$ in the overall sample), while the General Self-Efficacy Scale demonstrated strong internal consistency ($\alpha = 0.88$). For the knowledge scale, Cronbach's alpha was 0.85 for the treatment group and 0.91 for the control group, whereas the attitude scale yielded values of 0.84 for the treatment group and 0.86 for the control group. Overall, these results indicate that all instruments used in this study possessed satisfactory psychometric properties.

The self-esteem and self-efficacy

Self-esteem, measured by the Rosenberg Self-Esteem Scale ($\alpha = 0.84$), showed that the majority of participants in both the control (78.6%) and intervention (68.6%) groups had moderate levels of self-esteem. Self-efficacy, measured by the General Self-Efficacy Scale ($\alpha = 0.88$), revealed that 72.9% of intervention participants demonstrated high self-efficacy, while the same proportion (72.9%) of control participants showed moderate self-efficacy (Table 3).

Baseline substance use frequency

At baseline, a significant imbalance was observed between the intervention and control groups with respect to substance use frequency. High-frequency use was reported by 82.9% of intervention participants compared to 45.7% of control participants, and a Chi-square test confirmed this difference was statistically significant ($\chi^2 = 21.22$, $p < 0.001$). To address this baseline disparity in our analysis, we included baseline substance use frequency as a covariate in the ordinal logistic regression model, a statistical approach that adjusts for differences in initial severity and allows for estimation of the intervention's association while holding baseline use constant. However, we acknowledge that this adjustment cannot fully account for unmeasured confounders or potential regression to the mean, and therefore the findings should be interpreted with appropriate caution (Table 4, Figure 2). The most commonly used substances were khat, tobacco, alcohol, and cannabis. Lifetime use rates for the treatment group were highest for khat (94.3%), followed by tobacco (85.7%), cannabis (80.0%) and alcohol (58.6%): for the control group were highest for khat (90%), followed by alcohol (45.7%) and tobacco (44.3%). Current use (within the past 3 months) followed a similar trend: for the treatment group were highest for khat (90%), followed by tobacco (84.3%), alcohol (77%) and cannabis (74.3%): for the control group were highest for khat (88.6%), followed by alcohol (35.7%) and tobacco

Table 2. The baseline data for both control and intervention groups across the attitude and knowledge.

Category	Subcategory	Control (%)	Intervention (%)
Attitude	Good Attitude	56 (80.0)	36 (51.4)
	Poor Attitude	14 (20.0)	34 (48.6)
Knowledge	Good Knowledge	60 (85.7)	56 (80.0)
	Poor Knowledge	10 (14.3)	14 (20.0)

Table 3. The baseline data for both control and intervention groups across the self-esteem and self-efficacy.

Category	Subcategory	Control (%)	Intervention (%)
Self-Esteem	High self-esteem	9 (12.9)	6 (8.6)
	Moderate self-esteem	55(78.6)	48 (68.6)
	Low self-esteem	6 (8.6)	16 (22.9)
Self-Efficacy	High self-efficacy	18 (25.7)	51 (72.9)
	Moderate self-efficacy	51 (72.9)	18 (25.7)
	Low self-efficacy	1 (1.4)	1 (1.4)
Total N		70 (100)	70 (100)

Table 4. Baseline substance use frequency by study group.

Group	Low use	Moderate use	High use	Total
Control	19 (27.1) [79.2]	19 (27.1) [73.1]	32 (45.7) [35.6]	70 (100) [50.0]
Intervention	5 (7.1) [20.8]	7 (10.0) [26.9]	58 (82.9) [64.4]	70 (100) [50.0]
Total	24 (17.1) [100]	26 (18.6) [100]	90 (64.3) [100]	140 (100) [100]

Chi-square test: χ^2 (2) = 21.22, p<0.001. Note: Values are presented as n (row %) [column %]. The intervention group had a significantly higher proportion of high-frequency substance users at baseline compared to the control group (82.9% vs. 45.7%).

(24.3%) reported. Participants from the treatment group of 81.4% were multi-substance users while 75.7% of the control group participants were single substance users (Table 5).

Endline substance uses and ordinal regression analysis

At endline, substance use frequency was distributed as follows: low (11.4%), moderate (42.1%), and high (46.4%). The ordinal regression model including both baseline substance uses and treatment group significantly improved prediction over the null model (χ^2 (2) = 54.22, p < 0.001), indicating that these predictors jointly explained a substantial proportion of variance in endline outcomes.

Model diagnostics supported overall adequacy. The model explained approximately 32–38% of the variance in endline substance use (Nagelkerke R^2 = 0.38), with the Test of Parallel Lines confirming the proportional odds assumption (χ^2 (2) = 0.15, p = 0.93). Baseline substance use was the strongest predictor (B = 2.07, p < 0.001, OR = 7.93, 95% CI [4.20–14.98]), indicating that for each one-unit increase in baseline substance use frequency, the odds of being in a higher endline substance use category increased nearly 8-fold. After adjusting for baseline substance use frequency, the intervention-associated reduction was significant (B = −2.285, p < 0.001, OR = 0.10, 95% CI [0.03–0.31]) [The intervention group served as the reference category; therefore, a positive estimate for the control group indicates higher odds of substance use compared to the intervention group], indicating that participants in the intervention group had approximately 90% lower odds of being

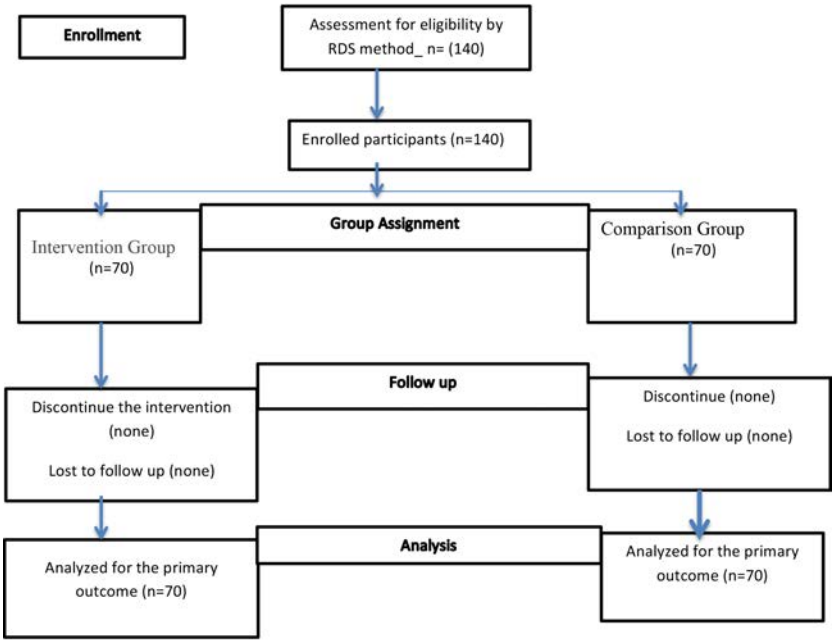

Figure 1. The study results are presented following the TREND (Transparent Reporting of Evaluations with Non-randomized Designs) statement guidelines for quasi-experimental studies.

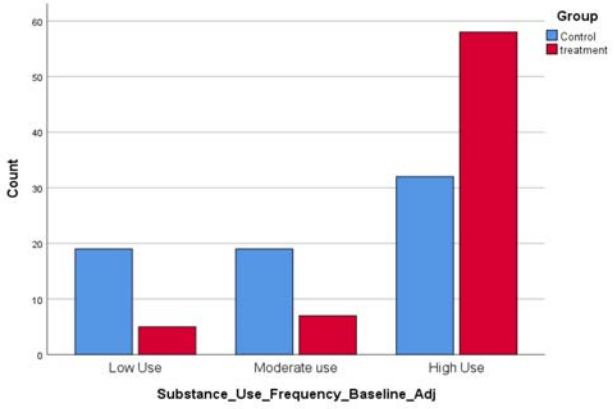

Figure 2. Comparing baseline substance use frequency between control and intervention groups.

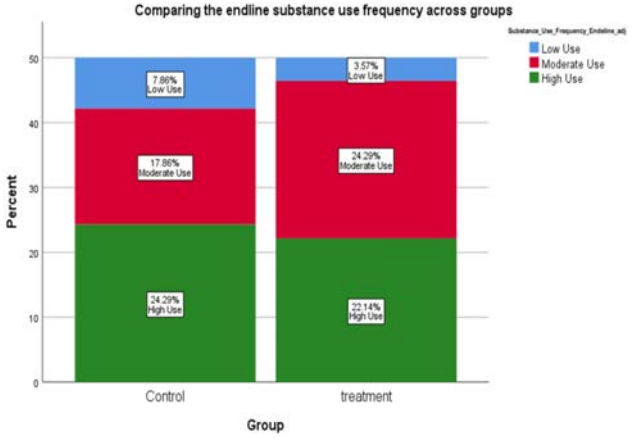

Figure 3. Comparing the endline substance use frequency between control and intervention groups

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classified into a higher substance use category compared to the control group. At endline, substance use frequency across both groups was distributed as follows: low use (11.4%), moderate use (42.1%), and high use (46.4%; Figure 3).

Associations between substance use and psychosocial predictors

Multivariable ordinal regression (Table 6) revealed significant predictors of endline substance use. Baseline substance use frequency remained a strong positive predictor (Est. = 2.07, $p < 0.001$). Higher self-esteem was associated with reduced odds of substance use (B = -2.30, p = 0.010). Income level also influenced outcomes: participants with monthly incomes below 1000 ETB had significantly lower odds of high-frequency substance use (B = -2.81, p = 0.007) compared to those earning above 3000 ETB (Table 6).

Discussion

This study evaluated the associative of a mobile health (mHealth)–based, CBT-informed psychoeducational text messaging intervention at reducing substance use among university students. The intervention leveraged mobile technology to reach students in their daily academic environments, providing continuous, and accessible, to promote behavioral change. Given the widespread adoption of mobile phones among young adults, this approach represents an innovative, low-cost, and scalable strategy to address substance use on university campuses. The results provide compelling evidence that such technology-driven, CBT-based interventions can significantly reduce the frequency and severity of substance use among students.

The study involved 140 undergraduate students from Jimma University, equally divided between an intervention and a control group. Participants represented a range of demographic and academic backgrounds, with the majority aged 20–24 years and enrolled in various fields of study. Both groups demonstrated generally good knowledge of substance use and moderate levels of self-esteem factors often associated with better behavioral outcomes. Although the intervention group had higher baseline self-efficacy (72.9% *vs*. 25.7% in controls), self-efficacy was not a significant predictor in the adjusted regression model (p = 0.983), suggesting it did not explain the intervention-associated reduction. The ordinal logistic regression analysis revealed that baseline substance use was the strongest predictor of endline outcomes, indicating that individuals who reported higher levels of substance use at the start of the study were more likely to continue higher use patterns later. After entering baseline substance use frequency (which differed significantly between groups) as a covariate in the ordinal regression model, the intervention group showed a significantly lower likelihood of being in a higher substance use category compared to the control group, suggesting potential effectiveness, though causality cannot be established due to baseline differences.

Table 5. The lifetime and past 3 months (current) use of substances (Tobacco, Alcohol, Cannabis, and Khat) and Single-Multi Substance Users for the Control and Treatment groups of the baseline.

Substances	Use Type	Category	Control, n=70 (%)	Treatment, n=70 (%)
Tobacco	Lifetime	Yes	31 (44.3)	60 (85.7)
		No	39 (55.7)	10 (14.3)
	Current	Never	53 (75.7)	11 (15.7)
		Once or twice	1 (1.4)	5 (7.1)
		Monthly	0	3 (4.3)
		Weekly	5 (7.1)	10 (14.3)
		Daily or almost daily	11 (15.7)	41 (58.6)
Alcohol	Lifetime	Yes	32 (45.7)	58 (82.9)
		No	38 (54.3)	12 (17.1)
	Current	Never	45 (64.3)	16 (22.9)
		Once or twice	9 (12.9)	18 (25.7)
		Monthly	1 (1.4)	13 (18.6)
		Weekly	13 (18.6)	18 (25.7)
		Daily or almost daily	2 (2.9)	5 (7.1)
Cannabis	Lifetime	Yes	0 (0.0)	56 (80.0)
		No	70 (100.0)	14 (20.0)
	Current	Never	70 (100.0)	18 (25.7)
		Once or twice	0	6 (8.6)
		Monthly	0	4 (5.7)
		Weekly	0	15 (21.4)
		Daily or almost daily	0	27 (38.6)
Khat	Lifetime	Yes	63 (90.0)	66 (94.3)
		No	7 (10.0)	4 (5.7)
	Current	Never	8 (11.4)	7 (10.0)
		Once or twice	16 (22.9)	10 (14.3)
		Monthly	0	6 (8.6)
		Weekly	16 (22.9)	11 (15.7)
		Daily or almost daily	30 (42.9)	36 (51.4)
Substance Use Category	Single Substance User		53 (75.7)	13 (18.6)
	Multi-Substance User		17 (24.3)	57 (81.4)
Total			70 (100.0)	70 (100.0)

The finding that higher self-esteem served as a protective factor against frequent substance use (OR = 0.10, p = 0.010) aligns with previous studies demonstrating that individuals with greater self-esteem are less likely to engage in substance use. This suggests that interventions targeting self-esteem may hold particular value, as students with lower self-esteem appear to be at elevated risk and could benefit from programs that incorporate self-esteem building components alongside substance use education. Such integrated approaches may be more effective than education alone in addressing the psychosocial vulnerabilities that contribute to substance use among university students.

This aligns with literature showing that college students with higher self-esteem are less likely to engage in substance use across multiple substances and developmental periods.[36] In a study of 943 high school students in Iran, those engaging in illegal drug use (including heroin, pills, alcohol, and hookah) had significantly lower self-esteem scores than non-users. This supports that higher self-esteem is significantly associated with lower substance use.[37] A comprehensive systematic review of adolescent risk behaviours found a consistent negative relationship between self-esteem and many risk behaviours (e.g., smoking, alcohol use, and non-suicidal self-harm). While cannabis results were ambiguous, the predominant finding across behaviours is that high self-esteem serves as a protective factor and low self-esteem as a risk factor.[38] The current study's findings strengthen this evidence, suggesting that interventions combining CBT principles with digital delivery can associate both cognitive and behavioral risk factors.

Economic status also emerged as a significant predictor of substance use frequency, with students reporting monthly expenses below 1,000 Ethiopian birr showing significantly lower odds of frequent substance use compared to those spending 3,000 birr or more. This association between higher personal expenses and increased substance use risk suggests that students with greater financial resources may require targeted interventions that specifically address the availability of disposable income for purchasing substances, as well as the social environments and peer networks commonly associated with higher economic status. Collectively, these findings underscore the importance of moving beyond one-size-fits-all approaches toward stratified, multi-component interventions that simultaneously address multiple risk and protective factors such as self-esteem, economic resources, and substance use education—to more effectively reduce substance use among university students.

This relationship between higher disposable income and increased likelihood of substance use has been reported in similar studies among Ethiopian students from Wellega University[25] and

Table 6. Multivariable ordinal regression analysis of factors associated with endline substance use frequency.

Variable (Predictors)	Estimate (B)	Std. Error	Wald	Df	p	95% CI (Lower)	95% CI (Upper)
Thresholds							
Endline Use = Low Use	1.275	1.060	1.446	1	0.229	-0.803	3.353
Endline Use = Moderate Use	4.578	1.188	14.841	1	<0.001	2.249	6.907
Fixed Effects							
Baseline Substance Use Frequency	2.071	0.324	40.771	1	<0.001	1.435	2.706
Group (Ref: Intervention)							
Control	2.285	0.575	15.781	1	<0.001	1.158	3.412
Age (Ref: 25 and above)							
Below 20	-1.951	1.055	3.421	1	0.064	-4.019	0.117
20–24	-0.991	0.697	2.022	1	0.155	-2.356	0.375
Gender (Ref: Female)							
Male	-0.692	0.410	2.852	1	0.091	-1.495	0.111
Academic Year (Ref: Other years)							
Third Year	-1.622	0.861	3.555	1	0.059	-3.309	0.064
Cumulative GPA (Ref: Distinction)							
Less than Distinction	0.315	0.377	0.698	1	0.404	-0.425	1.055
Attitude (Ref: Poor)							
Good Attitude	-0.495	0.444	1.242	1	0.265	-1.366	0.375
Knowledge (Ref: Good)							
Poor Knowledge	-0.197	0.461	0.183	1	0.669	-1.102	0.707
Self-Efficacy (Ref: Low)							
High Self-Efficacy	0.035	1.664	0.000	1	0.983	-3.227	3.297
Self-Esteem (Ref: Low)							
High Self-Esteem	-2.299	0.889	6.683	1	0.010	-4.042	-0.556
Moderate Self-Esteem	-1.490	0.797	3.494	1	0.062	-3.052	0.072
Monthly Income (Ref: ≥3000 ETB)							
Below 1000 ETB	-2.811	1.134	6.141	1	0.013	-5.035	-0.588
1000–1999 ETB	-0.966	0.669	2.082	1	0.149	-2.278	0.346
2000–2999 ETB	-0.723	0.586	1.522	1	0.217	-1.871	0.425
Religious Attendance (Ref: Less than daily)							
Daily	0.673	0.755	0.793	1	0.373	-0.808	2.153

Model Fit: Nagelkerke $R^2 = 0.375$; Test of Parallel Lines: χ^2 (2) = 0.15, p = 0.93. Note: Dependent variable = endline substance uses frequency (low/moderate/high). Positive estimates indicate higher odds of being in a higher use category. Bolded p-values indicate statistical significance ($p < 0.05$). The positive estimate for "Group = Control" indicates that control participants had higher odds of higher substance use compared to the intervention group. Reference categories are indicated in parentheses (Ref).

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Kenyan.[26] Samples: lower pocket money or SES was associated with reduced substance use likelihood, while higher economic resources correlated with increased substance use (AOR ≈ 2.27 for >1,000 ETB/month holders; median per-month drug spend USD 25.85 in low-SES vs USD 18.84 in high-SES). Qualitative evidence from Mekelle University further supports this, indicating that students with greater financial freedom are more likely to engage in polysubstance use and social substance-related activities.[36] These findings underscore the complex interplay of socioeconomic and psychological factors influencing student behavior and highlight the importance of addressing contextual risk factors alongside individual-level interventions.

At baseline, a substantial imbalance in substance use frequency was observed between the two groups, with the intervention group exhibiting significantly higher initial use (82.9% classified as high-frequency use) compared to the control group (45.7% high-frequency use; $p < 0.001$). This marked imbalance likely reflects the non-random assignment process, as the Institute of Technology campus (intervention) serves primarily technology and engineering students, while the Agaro campus (control) serves business, agriculture, and management students. These academic populations may have systematically different substance use patterns—engineering and technology students may experience higher stress levels, operate within different peer norms, or have greater access to substances. Furthermore, the Jimma campus's location in a traditional khat-growing region may have contributed to higher substance availability and use among students studying there. This suggests that the two campus populations were fundamentally different at baseline, which is precisely the type of confounding that randomization is designed to prevent, and underscores the importance of interpreting our findings as associative rather than causal.

Despite this baseline difference, the intervention remained significantly associated with reduced substance use after controlling for baseline use in the ordinal regression model. The model explained approximately 37.5% of the variance in endline substance use (Nagelkerke $R^2 = 0.375$), representing a moderate-to-strong relationship. However, a critical alternative explanation for the observed improvement in the intervention group is regression to the mean. The intervention group's extreme baseline severity meant it had considerably more statistical room to show improvement than the control group. Even in the absence of any real intervention effect, extreme values tend to regress toward the mean on repeated measurement. Therefore, while we adjusted for baseline substance use in our ordinal regression model, regression to the mean remains a plausible alternative explanation for the observed between-group differences. We therefore interpret our findings cautiously, as the association may partly reflect statistical artifact rather than a true intervention effect. Participants in the control group had approximately 9.8 times higher odds of being classified into a higher substance use category compared to the intervention group (OR = 9.82, 95% CI [3.22-30.12]), corresponding to the intervention group having approximately 90% lower odds (OR = 0.10, 95% CI [0.03-0.31]) of higher substance use.

These findings are consistent with previous studies demonstrating the efficacy of mobile-based psychoeducational interventions. For instance, findings from a cluster-randomized trial among vocational school students showed a significant reduction in risky drinking behavior after a 3-month psychoeducational text messaging intervention (OR = 0.62, 95% CI 0.44–0.87).[37] While a broader meta-analysis of 14 studies confirmed that SMS interventions reduce substance use behaviours among adolescents and young adults (mean effect size ~0.25).[38] Among university students, an RCT of a 6-week automated SMS program demonstrated feasibility and secondary outcome reductions in heavy episodic drinking.[35] Thus, the present findings contribute new evidence from a low-resource, university setting, confirming that CBT-informed mHealth interventions was associated with significantly lower odds in reducing substance use behaviours among students.

Strengths and limitations

This study provides one of the first empirical evaluations of an mHealth, CBT-informed psychoeducational text messaging intervention for substance use reduction among Ethiopian university students. Its strengths include the use of validated instruments (ASSIST, Rosenberg Self-Esteem Scale, and General Self-Efficacy Scale), structured follow-up, and a contextually relevant intervention design tailored to local needs. The inclusion of psychosocial variables also allowed for a multidimensional understanding of substance use behaviours.

This study has several limitations inherent to its quasi-experimental, non-randomized design. First, a critical limitation of this study is that the intervention and control conditions were confounded with campus, as the Institute of Technology campus (intervention) and Agaro campus (control) differ across multiple unmeasured dimensions—including faculty composition, access to substances (particularly khat, given Jimma's location in a khat-growing region), peer norms regarding substance use, and broader campus culture. While we statistically adjusted for baseline substance use frequency in the ordinal regression model to reduce confounding, we cannot rule out the possibility that other campus-level factors, rather than the intervention itself, contributed to the observed differences. Consequently, causal interpretation remains limited, and we therefore interpret our findings as showing an association between the intervention and reduced substance use, rather than a causal effect. Furthermore, the campus-level allocation introduces potential cluster effects, as participants within each campus may be more similar to one another than to those in the other campus due to shared peer norms, campus culture, substance accessibility, and other environmental factors—a phenomenon known as intra-cluster correlation. In our analysis, we did not account for this clustering, which may lead to underestimation of standard errors and inflated Type I error rates. The small number of clusters (only two campuses) precluded multilevel modelling, which typically requires at least 15–30 clusters. Future studies with multiple campuses should therefore employ multilevel or cluster-robust methods to properly account for clustering effects and strengthen the validity of their findings.

Second, despite purposive selection of geographically separated campuses to minimize contamination, environmental differences between Jimma town and Agaro town could have influenced outcomes independently of the intervention. Third, the study was not prospectively registered, which reduces transparency, although this is partially justified by the design itself. Fourth, Substance use was assessed via in-person, interviewer-administered self-report questionnaires, a method inherently subject to both recall bias and social desirability bias. This concern may be particularly pronounced in the intervention group, given that these participants received regular text messages from the research team and may have felt greater pressure to underreport their substance use, potentially inflating the apparent effectiveness of the intervention. To mitigate this risk, participants were assured of confidentiality, interviewed in private settings, and consistently reminded that all responses were neutral and carried no consequences. Nevertheless, we cannot definitively rule out systematic underreporting. Future

studies should therefore consider incorporating biological validation measures—such as urine toxicology, breathalyzer, or salivary cotinine—for at least a subset of participants to enhance the accuracy of substance use assessment and reduce reliance on self-reported data.

Fifth, a key limitation of this study is the absence of a post-intervention washout period, as the three-month endline assessment overlapped directly with the intervention timeline and therefore measured substance use during, rather than after, the active treatment phase. Consequently, we cannot determine whether observed reductions reflect sustained behavior change or merely transient effects that may fade once the intervention ceases. Furthermore, the three-month follow-up window precludes any assessment of longer-term intervention-associated reductions, leaving open the question of durability beyond the immediate post-intervention period. To address this, future studies should incorporate a follow-up assessment conducted at least three months after the intervention ends, enabling evaluation of whether initial gains are maintained over time and providing a clearer picture of the intervention's lasting impact.

Sixth, the lack of an active control condition means the observed association may partly reflect attention received rather than specific CBT-informed content. Seventh, the use of Respondent-Driven Sampling (RDS), which began with five purposively selected «seeds,» may have introduced selection bias that limits both the diversity and generalizability of the sample. Because seeds tend to recruit peers with similar characteristics—a phenomenon known as homophily—the resulting sample may overrepresent certain social networks or substance use patterns while underrepresenting others, thereby reducing the likelihood that findings are fully representative of all students who use substances at Jimma University. Consequently, although RDS is a practical approach for reaching hidden populations, the potential for non-random network effects means that the results should be interpreted with caution and may not be broadly generalizable to the wider student body.

Additionally, students without mobile phones were excluded, potentially limiting generalizability to lower-income groups. Although the study maintained a high participation rate, attrition and non-response could not be entirely ruled out. Finally, findings from two campuses of a single Ethiopian university may not be generalizable to other populations or settings. Readers should interpret the results with these limitations in mind.

Despite these limitations, the findings have significant implications for both practice and policy. They demonstrate the feasibility and potential impact of integrating digital health interventions within university settings, especially where conventional behavioral health services are limited.

Implications for practice and policy

The findings of this study provide important evidence to inform campus-based interventions and public health strategies aimed at reducing substance use among university students. The demonstrated association of the mobile health (mHealth) CBT-informed psychoeducational text messaging intervention highlights its potential as a scalable, cost-effective tool to promote healthier behaviours in higher education settings. Universities could incorporate such digital interventions into student health services, particularly targeting high-risk groups identified in this study, such as students with high baseline substance use or lower self-esteem. Additionally, the association between psychosocial factors like self-esteem and self-efficacy and substance use suggests that campus policies should integrate holistic support programs that combine substance use education with mental health promotion and skills development. At a broader level, these findings can inform regional and national substance use prevention strategies, guiding resource allocation toward evidence-based mHealth interventions that are both accessible and engaging for young adult populations.

Suggestions for future research

Several important priorities should guide future research in this area. First, although self-esteem emerged as a significant independent predictor, interaction terms between self-esteem and group assignment were not tested in this study due to limited sample size; subsequent investigations should therefore examine whether intervention effectiveness varies by baseline self-esteem levels. Second, longer-term follow-up with a post-intervention washout period, for example, assessing outcomes at least three months after the intervention ends is essential to evaluate whether behavior changes are sustained over time. Third, interventions should be tailored to individual substance use patterns or psychosocial profiles to enhance personalization and impact. Fourth, larger multi-campus randomized controlled trials incorporating objective substance use measures, such as biological markers, would strengthen causal inference and reduce reliance on self-report. Additionally, qualitative studies exploring student experiences could help optimize cultural relevance and engagement. In non-randomized designs, more sophisticated analytic approaches such as propensity score matching (PSM) or Inverse Probability of Treatment Weighting (IPTW) could be employed to create more comparable groups; however, these methods require large samples and detailed information on potential confounders, which were not feasible in the current context. We acknowledge this as a limitation and recommend that future multi-site studies consider either randomization or more advanced quasi-experimental designs to strengthen causal inference and build a more robust evidence base.

Conclusions

In this quasi-experimental study conducted at Jimma University, the mobile-based, CBT-informed psychoeducational text messaging intervention was significantly associated with reduced higher-frequency substance use at the endline assessment, after adjusting for baseline imbalances in substance use frequency. Psychosocial factors, particularly self-esteem emerged as key protective influences, with students reporting higher self-esteem showing lower odds of frequent substance use. Conversely, students with higher monthly expenses were at greater risk of continued or increased use, while those with lower income levels demonstrated reductions over time. These findings underscore the importance of tailoring intervention efforts to specific high-risk subgroups, particularly students with lower self-esteem or greater financial resources, who may benefit most from targeted strategies.

Overall, the study provides robust preliminary evidence that a low-cost, scalable mHealth intervention grounded in cognitive-behavioral principles can effectively reduce substance use among university students, making it a promising tool for integration into university health services and potentially for broader application in regional and national substance use prevention strategies targeting young adult populations. However, given the non-randomized design and baseline imbalances, these findings should be interpreted as evidence of association rather than demonstrated causality.

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While the results suggest that digital health interventions are feasible in low-resource university settings, larger, randomized, multisite studies with longer follow-up periods and post-intervention washout assessments are needed to confirm these findings, establish causality, and determine generalizability across diverse student populations.

References

1. World Health Organization. Global status report on alcohol and health 2018. Geneva: World Health Organization; 2018.
2. Hingson RW, Heeren T, Winter MR. Age at drinking onset and alcohol dependence: age at onset, duration, and severity. Arch Pediatr Adolesc Med 2006;160:739-46.
3. Odgers CL, Caspi A, Nagin DS, et al. Is it important to prevent early exposure to drugs and alcohol among adolescents? Psychol Sci 2008;19:1037-44.
4. Eisenberg D, Golberstein E, Gollust SE. Help-seeking and access to mental health care in a university student population. Med Care 2007; 45:594-601.
5. Du Preez R, Pentz C, Lategan B. Why students drink: a study of South African university students' drinking behaviour. S Afr J High Educ 2016;30:73-93.
6. Schulenberg JE, Johnston LD, O'Malley PM, et al. Monitoring the future national survey results on drug use, 1975-2016: volume II, college students and adults ages 19-55. Ann Arbor, MI: Institute for Social Research, University of Michigan; 2017. Available from: https://creativecommons.org/licenses/by/4.0/
7. Yi S, Peltzer K, Pengpid S, Susilowati IH. Prevalence and associated factors of illicit drug use among university students in the Association of Southeast Asian Nations (ASEAN). Subst Abuse Treat Prev Policy 2017;12:9.
8. Arria AM, Caldeira KM, Bugbee BA, et al. The academic opportunity costs of substance use during college. College Park, MD: Center on Young Adult Health and Development; 2013.
9. Jafari F, Zamani AH, Alizadeh K. Reviewing the prevalence of (cigarette) smoking and its related factors in students of Tehran University, Iran. Addict Health 2011;3:105.
10. Fekadu A, Alem A, Hanlon C. Alcohol and drug abuse in Ethiopia: past, present and future. Afr J Drug Alcohol Stud 2007;6:40-53.
11. Derese A, Seme A, Misganaw C. Assessment of substance use and risky sexual behaviour among Haramaya University students, Ethiopia. Sci J Public Health 2014; 2:102-10
12. Mekonen T, Fekadu W, Chane T, Bitew S. Problematic alcohol use among university students. Front Psychiatry 2017;8:86.
13. Teferra S. Substance use among university students in Ethiopia: a systematic review and meta-analysis. Ethiop J Health Dev 2018;32.
14. Cunningham JA, Kypri K, McCambridge J. The use of emerging technologies in alcohol treatment. Alcohol Res Health 2011;33:320.
15. Patrick K, Griswold WG, Raab F, Intille SS. Health and the mobile phone. Am J Prev Med 2008;35:177-81.
16. Newman MG, Szkodny LE, Llera SJ, Przeworski A. A review of technology-assisted self-help and minimal contact therapies for anxiety and depression: is human contact necessary for therapeutic efficacy? Clin Psychol Rev 2011;31:89-103.
17. Hai AH, Curran L, Simons JN, et al. Technology-based substance use interventions for emerging adults and college students: a systematic review and meta-analysis. Int J Ment Health Addict 2024;24:603-22.
18. Bendtsen M, McCambridge J, Åsberg K, Bendtsen P. Text messaging interventions for reducing alcohol consumption among risky drinkers: systematic review and meta-analysis. Addiction 2021;116:1021-33.
19. McHugh RK, Hearon BA, Otto MW. Cognitive-behavioral therapy for substance uses disorders. Psychiatr Clin North Am 2010;33:511-25.
20. Magill M, Martino S, Wampold B. The principles and practices of psychoeducation with alcohol or other drug use disorders: a review and brief guide. J Subst Abuse Treat 2021;126:108442.
21. Hale WJ, Perrotte JK, Baumann MR, Garza RT. Low self-esteem and positive beliefs about smoking: a destructive combination for male college students. Addict Behav 2015;46:94-9.
22. Khajehdaluee M, Zavar A, Alidoust M, Pourandi R. The relation of self-esteem and illegal drug usage in high school students. Iran Red Crescent Med J 2013;15:e7682.
23. Martínez-Casanova E, Molero-Jurado MdM, Pérez-Fuentes MdC. Self-esteem and risk behaviours in adolescents: a systematic review. Behav Sci (Basel) 2024;14:432.
24. Thomas K, Linderoth C, Karlsson N, et al. Effectiveness of a text messaging-based intervention targeting alcohol consumption among university students: randomized controlled trial. JMIR Mhealth Uhealth 2018;6:e146.
25. Belay FK, Gudina EK, Desisa AE, et al. Magnitude of substance use and associated factors among Wallaga University undergraduate students, Western Ethiopia, 2024. Front Public Health 2025;13:1519425.
26. Were VO, Okoyo CO, Araka SB, et al. Socioeconomic disparities in the uptake of substances of abuse: results from a household cross-sectional survey in Murang'a County, Kenya. Discov Soc Sci Health 2022;2:5.
27. Haile D, Lakew Y. Khat chewing practice and associated factors among adults in Ethiopia: further analysis using the 2011 demographic and health survey. PLoS One 2015;10:e0130460.
28. Conrod PJ, Stewart SH, Comeau N, Maclean AM. Efficacy of cognitive-behavioral interventions targeting personality risk factors for youth alcohol misuse. J Clin Child Adolesc Psychol 2006;35:550-63.
29. Cohen J. A coefficient of agreement for nominal scales. Educ Psychol Meas 1960;20:37-46.
30. WHO ASSIST Working Group. The alcohol, smoking and substance involvement screening test (ASSIST): development, reliability and feasibility. Addiction 2002;97:1183-94.
31. Schmitt DP, Allik J. Simultaneous administration of the Rosenberg Self-Esteem Scale in 53 nations: exploring the universal and culture-specific features of global self-esteem. J Pers Soc Psychol 2005;89:623-42.
32. Scholz U, Doña BG, Sud S, Schwarzer R. Is general self-efficacy a universal construct? Psychometric findings from 25 countries. Eur J Psychol Assess 2002;18:242-51.
33. Heron KE, Smyth JM. Ecological momentary interventions: incorporating mobile technology into psychosocial and health behaviour treatments. Br J Health Psychol 2010;15:1-39.
34. Kazemi DM, Borsari B, Levine MJ, et al. A systematic review of the mHealth interventions to prevent alcohol and substance abuse. J Health Commun 2017;22:413-32.
35. Suffoletto B, Kristan J, Chung T, et al. An interactive text message intervention to reduce binge drinking in young adults: a randomized controlled trial with 9-month outcomes. PLoS One

2015;10:e0142877.
36. Kahsay ZH, Adhena T, Bazzano AN. A qualitative study of drivers of psychoactive substance uses among Mekelle University students, Northern Ethiopia. Subst Abuse Treat Prev Policy 2019;14:11.
37. Haug S, Paz Castro R, Kowatsch T, et al. Efficacy of a web- and text messaging-based intervention to reduce problem drinking in adolescents: results of a cluster-randomized controlled trial. J Consult Clin Psychol 2017;85:147-59.
38. Mason M, Ola B, Zaharakis N, Zhang J. Text messaging interventions for adolescent and young adult substance use: a meta-analysis. Prev Sci 2015;16:181-8.

Online supplementary materials
Supplementary Materials: CBT-Informed mHealth Text Messaging Intervention Protocol and Message Content

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