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JOURNAL OF
ADOLESCENT
HEALTH

www.jahonline.org

Original article

The Indirect Effect of #Tamojunto2.0 Program on Bullying Through Reduction of Alcohol Use Initiation

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Article history: Received November 26, 2021; Accepted February 15, 2023

Keywords: Prevention programs; Bullying; Alcohol use; Adolescence; Substance use; Mediation analysis; Randomized controlled trial

ABSTRACT

Purpose: The Brazilian version of the prevention program Unplugged, #Tamojunto, has had a positive effect on bullying prevention. However, the curriculum has recently been revised, owing to its negative effects on alcohol outcomes. This study evaluated the effect of the new version, #Tamojunto2.0, on bullying. For adolescents exposed to the school-based program #Tamojunto2.0, we investigated (1) whether the prevalence of bullying victimization and perpetration was reduced, (2) whether this reduction was moderated by gender, and (3) whether the program's effect on bullying was mediated by adolescents' alcohol use.

Methods: A cluster randomized controlled trial was conducted using 5,208 eighth-grade students from 73 Brazilian public schools. Baseline data were collected before program implementation, and follow-up data were collected nine months later. We used a multilevel mixed-effects model to examine the effect of #Tamojunto2.0 on bullying, and a moderation model to test the moderating effect of gender on program outcomes. A mediation analysis was performed to determine lifetime alcohol use as a mediator of the intervention effect on bullying.

Results: We found that the positive effect of #Tamojunto2.0 on bullying victimization ($\beta = -0.019$, 95% confidence interval = $-0.035; -0.002$) and perpetration ($\beta = -0.027$, 95% confidence interval = $-0.051; -0.004$) was mediated by a decrease in alcohol use, but not moderated by gender.

Discussion: #Tamojunto2.0 program can be indirectly effective in the prevention of bullying by decreasing adolescents' alcohol use. Moreover, alcohol and drug use prevention programs might also affect bullying outcomes through mediation, and we suggest that future studies consider this.

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IMPLICATIONS AND CONTRIBUTION

Given that substance use and bullying tend to co-occur among adolescents, programs based on social-emotional learning models can effectively prevent both risky behaviors. The results of this study emphasize that school-based prevention programs for alcohol and drug use may also affect bullying outcomes through mediation.

Conflicts of interest: The authors have no conflicts of interest to disclose.

Disclaimer: The trial and the preregistered hypothesis were registered at the Ministry of Health Brazilian Register of Clinical Trials-REBEC (Registro Brasileiro de Ensaios Clínicos – REBEC) under protocol number RBR-8cnkwq (<http://www.ensaioclinicos.gov.br/rg/RBR-8cnkwq/>).

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Bullying is a major public health priority [1]. Bullying involvement in any form can adversely affect young people's social adjustment and cause long-lasting mental health consequences [2]. Three core elements define bullying as: intention to harm, physical or social imbalance of power between perpetrators and victims, and repetition [3].

Bullying is a prevalent behavior among young people worldwide [4]. Two meta-analyses that reviewed studies from

different countries identified prevalence levels of 33% and 36% for bullying perpetration and victimization, respectively [5,6]. In Brazil, 7.4% of ninth-grade students reported often feeling humiliated by provocations by peers at school [7].

Given the high prevalence, adverse outcomes associated with bullying, and substantial societal impact, there is growing interest in implementing intervention programs to prevent bullying and mitigate harmful outcomes [1]. Moreover, a recent meta-analysis of 100 studies reporting bullying interventions showed a substantial reduction in bullying perpetration by 19%–20% and bullying victimization by 15%–16% [8]. Although school bullying prevention programs seem to be effective, there are significant differences in the results among countries, regions, and cultures, with a lack of information on prevention efforts in Latin America [9]. Another systematic review that evaluated antibullying interventions for adolescents in low- and middle-income countries showed mixed results and did not find evidence of the effectiveness of interventions [10].

Furthermore, as interventions produce different results depending on the cultural context in which they are implemented, it is necessary to evaluate the effectiveness of all implemented interventions to prevent harm [11]. In Brazil, the Brazilian Ministry of Health (BMH), in partnership with the United Nations Office on Drugs and Crime (UNODC), implemented an adapted version of the European prevention program Unplugged, named #Tamojuntto. Unplugged was designed to prevent drug use based on a comprehensive social influence approach that focuses on building life skills (social and personal), and correcting normative beliefs related to drug use to control social influences. In addition, the program aimed to strengthen relationship skills, communication skills, and decision-making skills, engage adolescents in critical thinking, and teach them how to cope with emotions [12].

Unplugged was initially designed to prevent drug use, and it was found that programs that develop positive behavior and social-emotional skills in students are effective in improving student well-being [13] and preventing bullying and other forms of school violence [14]. One meta-analysis showed that psychosocial interventions sharing three core components—interpersonal skills, emotional regulation, and alcohol and drug education—tend to significantly affect multiple mental health outcomes, including bullying and drug use [15]. Moreover, previous studies have reported consistent correlations between substance use and bullying among adolescents. A recent meta-analysis showed that those who bully their peers have a higher risk of later substance use [16]. Another meta-analysis found evidence of a causal relationship between bullying victimization and substance use [2,17]. Evidence suggests that these two risk behaviors may share the same risk and protective factors [18,19]. Therefore, programs based on social–emotional learning models, such as Unplugged (#Tamojuntto), can effectively prevent both risk behaviors. Overall, school bullying prevention programs have been proven effective; however, there are significant differences between cultures, and existing intervention programs and long-lasting effects that are unusual [9]. In addition, Unplugged, when adapted to its first Brazilian version (#Tamojuntto) in 2014 showed promising results in reducing the likelihood of bullying, particularly among girls 13–15 years old at the nine-month follow-up [20]. However, the curriculum was revised in 2018 because of its negative effects on alcohol consumption [21]. The new curriculum resulted in a 22% reduction in the initiation of alcohol consumption. Moreover, it is important to understand

the effect of #Tamojuntto2.0 on bullying, and the mediating effect of alcohol initiation reduction, considering that it was effective in preventing alcohol use initiation. The co-occurrence of alcohol use and bullying in adolescence [17] also suggest that this is a plausible hypothesis to investigate.

Tamojuntto's findings on bullying noted the importance of conducting gender moderation analysis when evaluating anti-bullying interventions [20]. Furthermore, the differences in the prevalence of bullying between the genders suggest that bullying prevention programs might impact boys and girls differently [4].

Therefore, we aimed to investigate whether adolescents exposed to the school-based program #Tamojuntto2.0: (1) reduced their prevalence of bullying victimization and perpetration, (2) whether this reduction was moderated by gender, and (3) whether the program's effect on bullying was mediated by alcohol use.

Method

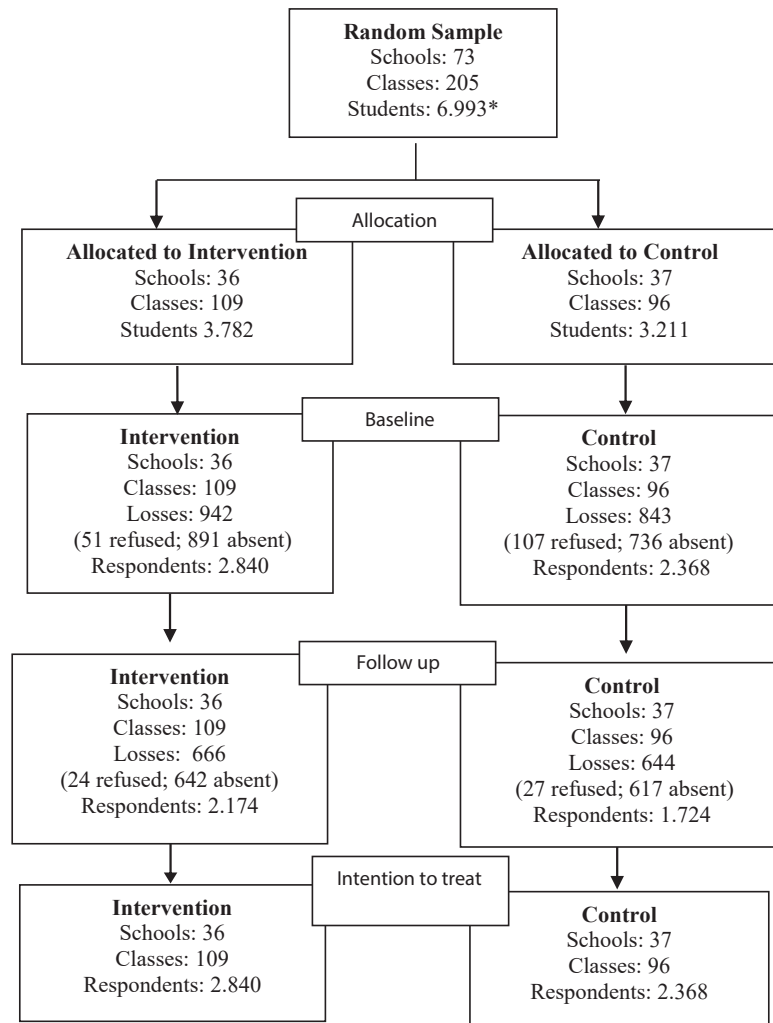
The effectiveness of the #Tamojuntto2.0 school-based prevention program was evaluated through a two-armed, parallel, cluster randomized controlled trial (RCT) conducted with 5,208 eighth graders from 73 public schools in three Brazilian cities (São Paulo, Fortaleza, and Eusébio). The study compared the results of the intervention condition (#Tamojuntto2.0 curricula) to those of the control condition (no prevention program). Implementation and cultural adaptation were responsibilities of the Brazilian Ministry of Health, while the evaluation was performed by an independent team from a federal university. Data were collected simultaneously from the control and intervention groups. The baseline assessment was conducted between February and March, 2019 (before the implementation of the program) and follow-up data were collected nine months after the baseline assessment between November and December, 2019.

Randomization

A list of all eligible schools from each municipality was retrieved from the National Institute for Educational Studies and Research Anísio Teixeira (INEP). Furthermore, using an algorithm based on atmospheric noise (available at www.random.org), 70 schools were selected as the main target schools of the study, while an additional 70 schools were placed on a waitlist. The random assignment of participants to the intervention arms and control group was performed using Efron's biased coin design, allowing the maintenance of a balanced sample ratio (1:1 allocation ratio per municipality), and was implemented in PASS version 22. Three schools put on hold were invited to participate when three schools on the main target list were still deciding whether to participate. All six schools agreed to participate, and for ethical reasons, we decided to retain all of them in the study, reaching a total of 73 schools (Figure 1). Details of the sample have been published by Sanchez [22]. Informed consent was obtained from the school directors before randomization, and from the students and parents after randomization.

Study sample

For a given power of 82%, significance level of 5%, and difference between groups of 2.5% for binge drinking, with an initial prevalence of 10% (intra-class correlation of 0.005), the necessary



* Students enrolled in schools drawn in 2019 - not necessarily attending school.

Figure 1. Flowchart of the randomized controlled trial to assess the effect of the drug use prevention program #Tamojunt0.0. * Students enrolled in schools drawn in 2019—not necessarily attending school.

sample size was calculated as 3,150 adolescents in the control group and 3,150 adolescents in the intervention group from 35 schools (clusters). We calculated the sample size by considering binge drinking as the main outcome of the program. The PASS 15.0 program was used for testing two proportions, based on the Donner and Klar equation [23]. However, based on previous literature [20], we expected the current sample size to determine the effect of the #Tamojunt0.0 program on bullying.

Among 6,993 students enrolled in 205 classes from 73 schools, who were randomized in the study, 5,208 answered the baseline questionnaire, and 3,898 answered the follow-up questionnaire nine months after baseline (resulting in a follow-up rate of 74.8%), as presented in Figure 1.

Study intervention

The #Tamojunt0.0 program is a Brazilian version of a European school-based program for substance use prevention called Unplugged, designed by the European Drug Addiction Prevention

group [24]. #Tamojunt0.0 is a 12-lesson program that lasts for 50 minutes on average. The program uses interactive methods and includes lessons that provide information about drugs, social and interpersonal skills, and personal skills [12]. Trained teachers conducted the program, guided by student and teacher manuals. The teacher's handbook provided information and tips on each lesson's procedures, objectives, required materials, and activities. Both manuals are open access and are available at <https://bvsm.s.saude.gov.br>.

Study instrument and measures

The instrument used for data collection was designed based on the European Drug Addiction Prevention Trial [25] and was used in a previous RCT of #Tamojunt0 in Brazil [26]. The students were provided with a code on the first page of the questionnaire, which involved generating letters and numbers from their personal information. This code provided anonymity and confidentiality to the participants while allowing the researchers to

match individual questionnaires during different evaluation time points. The datasets of the two assessments were integrated by matching student codes using the Levenshtein algorithm, which can identify similarities between a set of characteristics [27]. A full description of the instrument is provided by Galvão [28].

The analyzed outcomes—bullying victimization and perpetration in the past month—were evaluated using the Olweus Bully/Victim Questionnaire [29], which was validated for Brazilian Portuguese [30]. Students were asked about bullying experiences in the past 30 days, addressing specific types of bullying, such as verbal, physical, and relational types. The questionnaire contained seven dichotomous questions (yes or no) about bullying victimization, and eight dichotomous questions (yes or no) about bullying perpetration. For the mixed-effects model, we created two scores for each bullying domain, in which a higher score implied a higher rate of bullying (ranging from 0 to 8). For mediation analysis, we created a latent trait score for each bullying dimension, in which a higher score implied a higher bullying trait. The details of the measurement model and the description of all the items are shown in Figure 2. An item-level analysis was conducted using confirmatory factor analysis (CFA).

The mediator variable was the incidence of the first drug use (lifetime use = yes vs. no) of alcohol consumption. To assess the mediator variable, participants were asked, “Have you ever tried any alcoholic beverage?” Confounding variables such as sex, age, and socioeconomic class (SES) were assessed using Associação Brasileira de Empresas de Pesquisas (ABEP) scale [31]. The ABEP scale includes the education level of the head of household, and the goods and services used, with scores ranging from 1 to 100 and categories ranked from A to E. Higher scores indicate a better economic status. The socioeconomic classes were ranked from A (highest) to E (lowest).

Statistical analysis

Descriptive analysis. The data were initially submitted to descriptive analysis; categorical variables were summarized by number and percentage, and continuous variables by means and standard deviations (SDs). All descriptive analyses were performed using STATA version 16 (StataCorp LLC, College Station, TX).

Confirmatory factor analysis. CFA provided evidence for the construct validity of the bullying scale. CFA was used to test how well the measured variables represented the number of constructs and provided evidence of validity [32]. The comparative fit index (CFI), Tucker–Lewis index (TLI), and root-mean-square error approximation (RMSEA) were used to evaluate goodness-of-fit. RMSEA was estimated to be less than or equal to 0.08, and CFI and TLI were greater than 0.90. Factor loading shows the variance as explained by the variables for each factor of the model. We considered factor loadings greater than 0.7 to providing evidence that the factor extracts sufficient variance from that variable. The analyses were performed using Mplus version 7.4 (Muthén & Muthén, Los Angeles, CA).

Mixed-effects linear model. To examine the #Tamojunto2.0 program’s effect on bullying, we carried out a multilevel mixed-effects linear model with random intercepts to account for the clustering of pupils within schools. In this model, the variability within measures of the same individual and between individuals

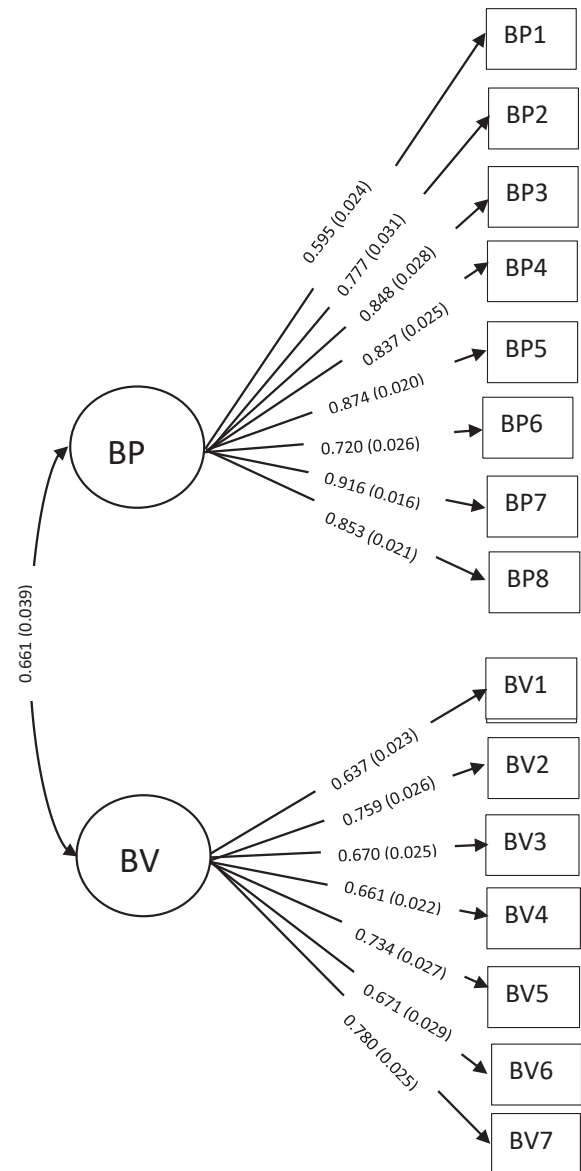


Figure 2. Diagram of the latent model, representing one factor solution for Bullying Scale with standardized factor loadings and their standard errors in parentheses. BP = Bullying perpetration: BP1 = I called another student(s) mean names, made fun of, or teased him/her in a hurtful way; BP2 = I hit, kicked, pushed, and shoved him/her around or locked him or her indoors; BP3 = I spread false rumors about him/her and tried to make others dislike him/her; BP4 = I took money or things from him/her or damaged his/her belongings; BP5 = I threatened or forced him/her to do things he/she did not want to do; BP6 = I kept him/her out of things on purpose, excluded him or her from my group of friends, or completely ignored him or her; BP7 = I bullied him/her with mean names or comments about his/her race or color; BP8 = I have sent aggressive or humiliating messages on social networking sites and/or WhatsApp. BV = Bullying victimization; BV1 = Other students left me out of things on purpose, excluded me from their group of friends, or completely ignored me; BV2 = I was hit, kicked, pushed, shoved around, or locked indoors; BV3 = Other students told lies or spread rumors about me and tried to make others dislike me; BV4 = I had money or things taken away from me or damaged; BV5 = I was threatened or forced to do things I did not want to do; BV6 = I was bullied with mean names or comments about my race or color; BV7: I received aggressive or humiliating messages from some student(s) in social networking sites and/or WhatsApp.

was considered, thus highlighting the relationship between observed responses and explanatory covariates [33]. We also evaluated an interaction version of the above-described model (also called the moderation model), in which the effect of the proposed intervention would be conditioned by sex. We created an interaction term for the interaction model: time \times group \times sex. All multivariate analyses were adjusted for sex, age, and SES, and all multilevel analyses were performed using STATA 16.

Mediation analysis. An analysis was performed to determine the effect of the intervention assignment group (random) on two different outcomes (bullying victimization and perpetration), mediated by lifetime alcohol use. In other words, we tested whether random assignment to the intervention (#Tamojuntto2.0) influenced the outcome variables (bullying) indirectly through students' alcohol use. The covariates were age, sex, SES, and outcomes at the baseline assessment. Figure 3 shows the mediation model: path A (effects of exposure on the mediator), path B (effects of the mediator on the outcome), path C (direct effects of exposure on the outcome), and indirect effect (product between paths A and B). Moreover, the covariates were regressed simultaneously on the two mediators and outcomes.

To deal with the multilevel structure of the data (children nested in schools), we applied a postestimation adjustment to

the standard errors (SEs) to account for nesting. Maximum likelihood estimation with robust SEs was used to account for the nonindependence of the observations, as proposed by Asparouhov [34]. The SE was computed using a sandwich estimator with a complex option in the analysis command, in conjunction with the cluster option of the variable command. A mediation analysis was performed using Mplus version 7.4.

Missing data. In addition to the traditional completed cases (CC) analysis (considering only observation with completed data from baseline and follow-up), we performed intention-to-treat (ITT) analysis. Owing to the study design, an in-cluster RCT for both analyses (mixed-effects linear and mediation analyses) was carried out. Missing data across the follow-up time point were imputed to fulfill the ITT paradigm following CONSORT (Consolidated Standards of Reporting Trials) statements [35]. This paradigm estimated the program effect among all participants, without considering their participation in the follow-up assessment. For ITT, multiple imputation was used to deal with missing data, and concomitantly, the effect was estimated among all participants without considering the extent to which they complied with the treatment requirements and participation in the follow-up evaluation. Each missing value was replaced with a set of plausible values that preserved the statistical distribution of the

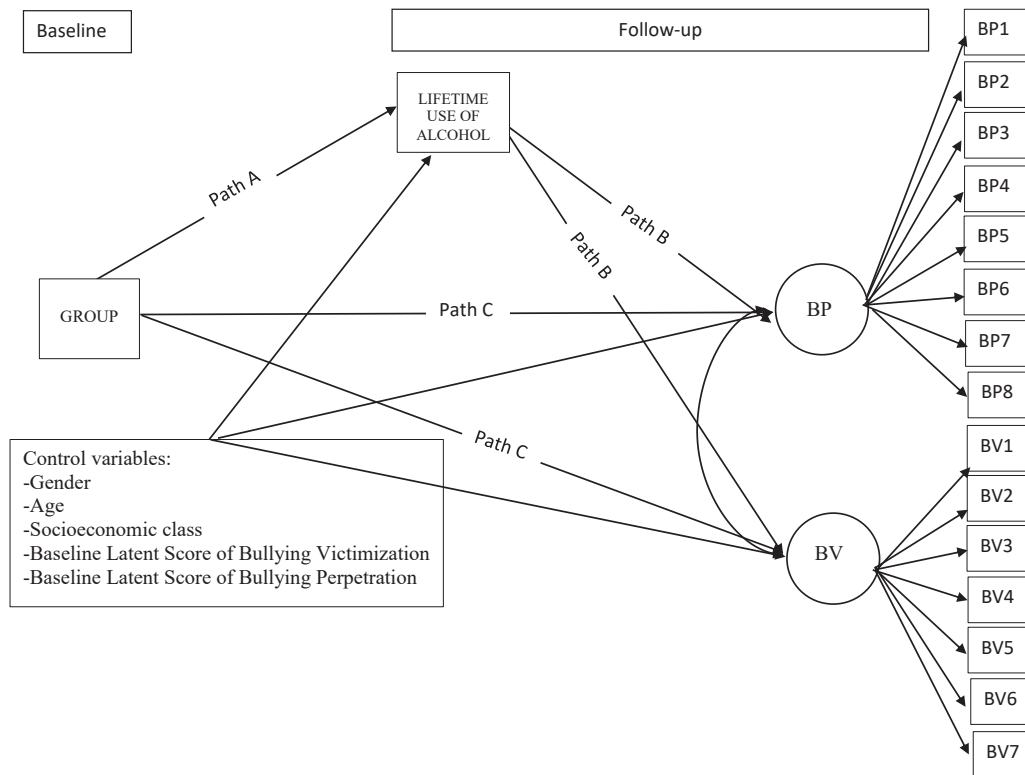


Figure 3. Conceptual model of the mediation analysis. BP = Bullying perpetration; BP1 = I called another student(s) mean names, made fun of, or teased him/her in a hurtful way; BP2 = I hit, kicked, pushed, and shoved him/her around or locked him or her indoors; BP3 = I spread false rumors about him/her and tried to make others dislike him/her; BP4 = I took money or things from him/her or damaged his/her belongings; BP5 = I threatened or forced him/her to do things he/she did not want to do; BP6 = I kept him/her out of things on purpose, excluded him or her from my group of friends, or completely ignored him or her; BP7 = I bullied him/her with mean names or comments about his/her race or color; BP8 = I have sent aggressive or humiliating messages on social networking sites and/or WhatsApp. BV = Bullying victimization; BV1 = Other students left me out of things on purpose, excluded me from their group of friends, or completely ignored me; BV2 = I was hit, kicked, pushed, shoved around, or locked indoors; BV3 = Other students told lies or spread rumors about me and tried to make others dislike me; BV4 = I had money or things taken away from me or damaged; BV5 = I was threatened or forced to do things I did not want to do; BV6 = I was bullied with mean names or comments about my race or color; BV7 = I received aggressive or humiliating messages from some student(s) in social networking sites and/or WhatsApp.

Table 1

Distribution of adolescents who participated in the cluster randomized controlled trial of the #Tamojunto2.0 program at the baseline according to sociodemographic variables, alcohol use, and bullying according to the allocation group, 2019 (N = 5,208)

	Total (N = 5,208)		Control group (N = 2,368)		Intervention group (N = 2,840)	
	N	%	N	%	N	%
City						
São Paulo	2,373	45.57	926	39.10	1,447	50.95
Fortaleza	2,051	39.38	1,022	43.16	1,029	36.23
Eusébio	784	15.05	420	17.74	364	12.82
Gender						
Boys	2,576	50.06	1,140	48.63	1,436	50.06
Girls	2,570	49.94	1,024	51.37	1,366	49.94
Age (years)						
12–14	4,645	91.44	2,081	90.16	2,564	208
15–17	535	8.56	227	9.84	92.50	7.5
Mean age (SD)		13.23 ± 0.85		13.28 ± 0.89		13.19 ± 0.81
ABEP score ^a						
A (45–100)	179	3.48	71	3.08	108	3.86
B (29–44)	1,279	24.84	522	22.21	757	27.05
C (17–28)	2,809	54.55	1,304	55.49	1,505	53.77
D/E (1–16)	882	17.13	453	19.28	429	15.33
Mean score (SD)		24.75 ± 9.19		24.16 ± 9.15		25.25 ± 9.19
Lifetime drug use						
Alcohol	2,516	48.80	1,149	48.89	1,367	48.72
Bullying score (Mean ± SD)						
Victimization		0.90 ± 0.02		0.89 ± 1.37		0.92 ± 1.36
Perpetration		0.47 ± 0.02		0.45 ± 1.03		0.50 ± 1.08

ABEP = Associação brasileira de empresas de pesquisas; SD = Standard deviation.

^a Socioeconomic classification according to ABEP from A (highest) to E (lowest).

imputed variable and its relationship with the other variables in the imputation model. This process resulted in valid statistical inferences that reflected the uncertainty of the missing values. Multiple imputation assumes that the data loss mechanism is random (missing at random, or MAR) when the probability of missing data on a variable is related to some other measured variable in the model but not to the value of the variable with missing values itself [36]. The following variables were used in the nonrestricted model: group, school, gender, age, and ABEP score. Fifteen imputed datasets are generated using these variables.

Attrition analysis. We compared the students' data from the two time points that matched data from students who were lost at

follow-up—that is, those who answered only the baseline questionnaire.

Results

Characteristics of the participants

According to Table 1, the students in the intervention and control groups were homogenous during the baseline assessment of the RCT of the #Tamojunto2.0 program, concerning sex, age, and socioeconomic classification based on the ABEP scale. The sample had an even gender ratio, with a mean age of 13.2 (±0.8) years, and the subjects were mainly of middle SES.

Table 2

Distribution, intragroup comparison of the #Tamojunto2.0 on bullying victimization and perpetration in the past month among adolescents

	Intervention			Control		
	Baseline	9 month follow-up	Intragroup comparison	Baseline	9 month follow-up	Intragroup comparison
	Mean (±SE)	Mean (±SE)	Coef p value	Mean (±SE)	Coef	Mean (±SE) p value
Bullying						
Victimization	0.94 ± 0.04	1.00 ± 0.05	0.06 ± 0.04 .145	0.89 ± 0.04	1.05 ± 0.04	0.16 ± 0.04 <.001
Perpetration	0.51 ± 0.03	0.61 ± 0.04	0.10 ± 0.03 .002	0.45 ± 0.03	0.57 ± 0.03	0.11 ± 0.03 <.001
Victimization*gender ^a						
Male	0.84 ± 0.05	0.87 ± 0.05	1	0.75 ± 0.04	0.92 ± 0.05	1
Female	1.05 ± 0.05	1.16 ± 0.05	0.16 ± 0.05 .001	1.01 ± 0.05	1.18 ± 0.05	0.09 ± 0.05 .016
Perpetration*gender ^a						
Male	0.55 ± 0.04	0.63 ± 0.05	1	0.46 ± 0.03	0.59 ± 0.04	1
Female	0.47 ± 0.04	0.58 ± 0.04	0.09 ± 0.04 .022	0.44 ± 0.04	0.54 ± 0.03	0.11 ± 0.02 <.001

coef = Coefficient; Diff = Difference; SE = Standard error.

^a Effect of interaction between group and time and gender.

Table 3

Multilevel mixed effect model of the #Tamojuntoto2.0 on bullying victimization and perpetration in the past month among adolescents. Completed case analysis and intention to treat via multiple imputation

	#Tamojuntoto effect			#Tamojuntoto effect		
	Completed case analysis ^a (n = 4,817)			Intention to treat ^b (n = 5,208)		
	Coef	95% CI	p value	Coef	95% CI	p value
Bullying						
Victimization	-0.08	-0.20; 0.04	.177	-0.10	-0.21; 0.02	.094
Perpetration	0.00	-0.09; 0.09	.964	-0.02	-0.01; 0.07	.670
Victimization*gender ^b						
Male	1			1		
Female	0.07	-0.13; 0.27	.500	0.07	-0.10; 0.25	.416
Perpetration*gender ^b						
Male	1			1		
Female	0.07	-0.09; 0.24	.390	0.05	-0.01; 0.21	.519

coef = Coefficient; CI = Confidence interval.

^a Effect of interaction between group and time named #Tamojuntoto effect obtained via XTMIXED model, adjusted for sex, age, and socioeconomic status.

^b Effect of interaction between group and time named #Tamojuntoto effect obtained via XTMIXED model, adjusted for sex, age, and socioeconomic status and imputed through multiple imputation.

Confirmatory factor analysis

Fit indices for the bullying scale demonstrated a good fit of the two-dimensional model (bullying victimization and bullying perpetration), with $\chi^2 = 226.396$ and p value = .0000, RMSEA estimate = 0.020, RMSEA probability = 1.000, CFI = 0.971, and TLI = 0.966. All factor loadings were greater values than 0.6 (Figure 3).

Outcomes

Table 2 shows the descriptive statistics for bullying victimization and perpetration, with inferential statistics for both inter- and intragroup changes over time. The mean scores for bullying perpetration and victimization increased significantly over time in both groups. Table 3 presents the effect of the #Tamojuntoto program according to the CC and ITT paradigms. No statistical

difference was found between groups, indicating a lack of evidence for the effect of the intervention on bullying victimization (ITTcoefficient = -0.10, 95% confidence interval [CI]: -0.21; 0.02) and perpetration (ITTcoefficient = -0.02, 95% CI: -0.01; 0.07). We also did not find statistical significance of the intervention moderated by in either paradigm (that is for bullying victimization: ITTcoefficient = 0.07, 95% CI: -0.10; 0.25).

Table 4 shows the effects of the mediation paths through direct effects, representing the simple association between the variables and the indirect effect. The data from the ITT and CC paradigms were similar, and we opted to describe the results of the ITT. The results from the independent variable on the mediator showed that the program seemed to decrease the chances of lifetime alcohol use at follow-up, which means that #Tamojuntoto delayed the initiation of alcohol use compared to the control group, considering the baseline status of alcohol use. This was an expected finding, as we had previously found that

Table 4

Mediation paths and indirect effect from #Tamojuntoto2.0 on bullying (victimization and perpetration) via lifetime use of alcohol. Completed cases and intention to treat via multiple imputation (N = 5,208)

	Coef	95% CI	p value
Completed cases n = 4,875			
IV on mediator	-0.146	-0.268; -0.025	.019
Mediator on DV			
Bullying victimization	0.260	0.205; 0.315	<.001
Bullying perpetration	0.370	0.305; 0.434	<.001
IV on DV			
Bullying victimization	-0.018	-0.137; 0.101	.763
Bullying perpetration	0.136	-0.002; 0.275	.053
Indirect Effect			
IV on DV via mediator			
Bullying victimization	-0.029	-0.054; -0.004	.022
Bullying perpetration	-0.042	-0.078; -0.005	.027
Intention to treat (multiple imputation) N = 5,208			
IV on mediator	-0.140	-0.253; -0.026	.016
Path B: mediator on DV			
Bullying victimization	0.255	0.173; 0.272	<.001
Bullying perpetration	0.376	0.250; 0.393	<.001
IV on DV			
Bullying victimization	-0.022	-0.131; 0.087	.690
Bullying perpetration	0.110	-0.048; 0.230	.072
Indirect effect			
IV on DV via mediator			
Bullying victimization	-0.019	-0.035; -0.002	.023
Bullying perpetration	-0.027	-0.051; -0.004	.022

*Mediator = life-time alcohol use; IV = Independent variable (group); DV = Dependent variable (Bullying victimization and bullying perpetration).

the #Tamojuntto program was effective in delaying the onset age of alcohol use [22]. The effect of the mediator was statistically significant for both outcomes: bullying victimization (ITT β = 0.255, 95% CI = 0.173–0.272) and perpetration (ITT β = 0.376, 95% CI = 0.250–0.393) at follow-up. We found a significant indirect effect of the program on bullying through lifetime alcohol use; that is, the effect of #Tamojuntto2.0 on bullying victimization (ITT β = –0.019, 95% CI = –0.035; –0.002) and perpetration (ITT β = –0.027, 95% CI = –0.051; –0.004) was mediated by lifetime alcohol use. We found a lack of evidence for a direct effect of the program on both types of bullying.

Attrition

Lifetime alcohol use and bullying were more prevalent during the baseline assessment among students who were lost to follow-up. The mean score of bullying victimization was 0.86 (SD = 1.32) during baseline among the followed up students, and 1.04 (SD = 1.47) among the students who were not followed up ($p < .001$). No gender differences were found between the followed up students and those who were not followed. However, relatively older students and students from the control group were lost to follow-up (Table S1).

Discussion

Our findings showed that the #Tamojuntto2.0 program indirectly decreased bullying by decreasing alcohol use. Moreover, the program was not directly effective in reducing the prevalence of bullying (victimization and perpetration) and its effect was not moderated by gender.

The #Tamojuntto2.0 program seems to decrease bullying victimization and perpetration by decreasing the prevalence of alcohol use. There is a lack of studies attempting to understand the underlying effect of interventions through mediation analysis [37]. The #Tamojuntto2.0 program showed positive results in the prevention of alcohol use [22] in line with the European findings of the program [25]. Our results suggest that #Tamojuntto is an effective program for delaying the initiation of alcohol use, and that the program's effect on alcohol prevention can also impact adolescents' bullying behaviors. One possible explanation for this finding is the well-documented positive association between different types of bullying and alcohol use. Many studies have highlighted the complex relationship between adolescent involvement in bullying and alcohol use, indicating that adolescents involved in bullying have a higher risk of alcohol use later in life [16,17]. A mechanism that might explain this indirect effect is a common factor predisposing individuals to these two risky behaviors (alcohol and bullying). Personality profiles and family conditions can be predictors that make young people more vulnerable to both alcohol initiation and bullying. Various individual-level mechanisms might drive this association, including shared personality characteristics such as externalizing symptoms, impulsivity, difficulties in emotion regulation, and sensation-seeking, which can be involved in bullying and alcohol consumption [38–42]. Moreover, adverse family conditions are positively linked to children's bullying behavior and alcohol use [17]. Thus, since these risky behaviors (alcohol use and bullying) tend to co-occur in adolescents (and one can enhance the other), interventions that reduce alcohol consumption can indirectly reduce bullying [15]. For future research, it is important to investigate the possible underlying mechanisms that might

explain the pathways through which interventions that reduce alcohol consumption can indirectly reduce bullying.

Our results regarding the null direct effect of #Tamojuntto2.0 on bullying contradict previous findings showing the positive effect of #Tamojuntto on school violence [20]. The first hypothesis was raised to understand the contradictory effect between the two versions of the program, owing to the different measures of bullying. In the evaluation of #Tamojuntto, bullying was assessed using two questions: one dichotomous question measuring the experience of being bullied in the past 30 days, and another dichotomous question measuring the practice of bullying others in the past 30 days. However, a small number of items cannot appropriately evaluate the complexity of bullying [43]. Thus, while evaluating #Tamojuntto2.0, we assessed bullying using a robust measure: a validated questionnaire containing seven dichotomous questions on bullying victimization, and eight dichotomous questions on bullying perpetration [30]. The second hypothesis to explain this null direct finding suggests that the most effective antibullying programs focus on specific bullying content in a broader social context, such as school and peers [44]. However, this was not present in the #Tamojuntto2.0 program, as it was not designed for this purpose. The direct effect of #Tamojuntto2.0 on bullying was null, whereas an indirect effect of #Tamojuntto2.0 on bullying was observed. It is essential to highlight that the prevention of bullying is not an expressed objective of #Tamojuntto, which means that the program had not been designed for this purpose and has no components that explicitly target bullying.

This study had some limitations that must be addressed. The students' absence from class compromised the data collection at two time points, which might have affected their exposure to the program. However, these limitations were expected because 20% of the registered students from public schools were regular absentees [22]. In addition, data loss due to follow-up is common in longitudinal studies, and missing data techniques have been used to converge the point estimate and its significance. Moreover, this study used a self-reporting questionnaire. Hence, the responses might be subject to information bias owing to incorrect interpretation, intention to report the truth, and learning questions through repetition at the two time points. There is a lack of information on the long-term effects of the Tamojuntto program on bullying. Therefore, we suggest that future studies focus on evaluating the sustainability impact of interventions. Another point limiting the findings' generalization is that most of the students were from middle SES, suggesting that the data may not represent the SES distribution of students in Brazil. We also must report that school selection was not weighted by size, which means that students do not have the same probability of being included in the study because of potentially unequal school sizes. The study was designed to be a cluster RCT, accounting for the heterogeneity among schools.

In conclusion, our findings indicate that the drug use prevention program #Tamojuntto2.0 can be effective in preventing bullying by reducing alcohol consumption. Furthermore, alcohol and drug use prevention programs may have affected bullying outcomes through mediation. Hence, future studies should consider this effect of bullying and explore the causal relationship between these two variables.

Acknowledgments

This study was part of Research and Innovation grant for Prevention of Mental Disorders and Use of Alcohol and other Drugs (Pesquisas e Inovações em Prevenção de Transtornos

Mentais e Uso de Álcool e Outras Drogas), funded by the Brazilian Ministry of Health (TED #176/2017). Mari is a senior researcher at the National Brazilian Council (CNPQ).

Supplementary Data

Supplementary data related to this article can be found at [10.1016/j.jadohealth.2023.02.023](https://doi.org/10.1016/j.jadohealth.2023.02.023).

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