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The #Tamojunto Drug Prevention Program in Brazilian Schools: a Randomized Controlled Trial

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Abstract A randomized controlled trial was conducted in 2014 with 7th and 8th grade students from 72 public schools in 6 Brazilian cities. This trial aimed to evaluate the effects of an adapted European school-based drug prevention program *Unplugged*, called *#Tamojunto* in Brazil, which was implemented by the Ministry of Health as part of public policy. The experimental group (n = 3340) attended 12 classes in the *#Tamojunto* program, and the control group (n = 3318) did not receive a school prevention program. Baseline data were collected prior to program implementation, and follow-up data were collected 9 months later, allowing a matching of 4213 adolescents in both waves. The substances examined were alcohol, tobacco, marijuana, inhalants, cocaine, and crack. Multilevel analyses were used to evaluate the changes in consumption of each drug between time points and between groups. The intervention and control groups had similar baseline characteristics. The mean age of the adolescents was 12.5 ± 0.7 years, and 51.3% were female. The program seemed to increase alcohol use initiation (first alcohol use); students in the experimental group had a 30% increased risk of initiating alcohol use during the 9-month follow-up (aRR = 1.30, 95% confidence interval (95%CI) 1.13–1.49, $p < 0.001$) compared to the control group. The opposite was found for the first inhalant use: the risk of using inhalants for the first time after baseline was lower in the experimental group (aRR = 0.78, 95%CI 0.63–0.96, p = 0.021) than the control group. The results of the *#Tamojunto p*rogram suggest that the content and lessons regarding alcohol may enhance curiosity about its use among adolescents. We suggest a re-evaluation of the expansion of the #Tamojunto program in schools while analyzing why the program's effects were inconsistent with those of previous European studies.

Keywords Prevention · School · Intervention · Drugs · Adolescents

Introduction

Drug consumption during adolescence is a risky behavior that can progress to drug abuse and dependence and potentially cause serious immediate- and long-term health and social problems (Bava and Tapert 2010; Behrendt et al. 2012; Sloboda 2014). Accordingly, school-based drug prevention programs with proven effectiveness are critical to reducing this consumption and delaying the onset of drug use (Foxcroft and Tsertsvadze 2012; Strøm et al. 2014).

According to Botvin and Griffin (2007), one of the main challenges experienced by drug use prevention researchers is program evaluation and identification of the intervention mechanisms responsible for reducing drug use among adolescents. Recent studies suggest that programs based on a social influence approach, which aims to strengthen the personal and interpersonal skills of participants through interactive techniques and normative education, are more likely to be

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effective than programs based on other models (Faggiano et al. 2008; Giannotta et al. 2014; Guo et al. 2015). The social influence model assumes that drug use initiation results from social influences, through which adolescents develop erroneous perceptions of the frequency and acceptability of drug consumption. Normative education and development of resistance skills are thought to reduce the effects of social influence through changes in attitude, beliefs and normative perceptions (Giannotta et al. 2014).

Unplugged is a drug use prevention program based on the social influence model; it is implemented through 12 weekly 1-h lessons and is supported by school teachers (Kreeft et al. 2009).

The theoretical nature of the intervention is based on a complex model that integrates theories such as social learning theory, problem behavior theory, the health belief model, the theory of reasoned action, and social norms theory (Sussman et al. 2004). The *Unplugged* prevention curricula support the development of general social skills that are thought to reduce the effects of social influence by modifying attitudes, beliefs, and normative perceptions (Giannotta et al. 2014). A detailed description of the curriculum has been published elsewhere (Kreeft et al. 2009).

The short-term goal of these 12 lessons is to reduce the number of adolescents who experiment with alcohol and other drugs (Faggiano et al. 2008). A broad multicenter study in seven European countries (Belgium, Germany, Spain, Greece, Italy, Austria, and Sweden) evaluated the effectiveness of *Unplugged* in terms of drug use among 7079 students between 10 and 14 years old (Faggiano et al. 2008). The authors found significant reductions in episodes of drunkenness and in reports of frequent cannabis use in the past 30 days (Faggiano et al. 2010). Positive effects of the program were also observed in an independent study conducted in the Czech Republic that showed a reduction in tobacco (any, daily and heavy smoking), cannabis (any and frequent use), and any drug use (Gabrhelik et al. 2012).

In Brazil, drug use has been identified as a main risk behavior in adolescents. Studies with Brazilian students have shown that the onset of licit and illicit drug use occurs in early adolescence, between 12 and 14 years of age (Carlini et al. 2010; Malta et al. 2011). However, Brazil has not historically implemented evidence-based drug use prevention programs in schools (Pereira et al. 2016). Programa Educacional de Resistência às Drogas e à Violência (PROERD—the Brazilian version of the North American program Drug Abuse Resistance Education (DARE)) remains the most widespread educational program (Shamblen et al. 2014) in Brazil, despite the fact that the effectiveness of PROERD has not been evaluated and that international evidence suggests that DARE has no long-term effects on drug use (Lynam et al. 1999).

In 2011, to reduce the supposed crack epidemic and to address the lack of evidence-based prevention programs in Brazilian schools, the Brazilian government instituted the "Integrated Plan to Combat Crack and Other Drugs," which focused on reducing the already established consumption and the future drug use demands of the population, thereby prioritizing drug use in social and public health policy agendas (Decree 7.637, December 8, 2011). Accordingly, the *Ministério da Saúde* (Brazilian Health Ministry), together with the UNODC Brazil (United Nations Office on Drugs and Crime in Brazil), conducted a transcultural adaptation and implementation of three evidence-based prevention programs that had positive results in other countries: *Unplugged*, called *#Tamojunto* in Brazil, for adolescents 10 to 14 years old in middle schools; *Good Behavior Game* (Elos, in Brazil), for children between 6 and 10 years old at elementary schools (Schneider et al. 2016); and the *Strengthening Families Program* (Famílias Fortes in Brazil), which focused on families in the public welfare system (Miranda and Murta 2016).

Evaluations of the fidelity, acceptability, and viability of the *Unplugged* program in the Brazilian context were promising. The 12 lessons in the program were taught in 94% of the classrooms. However, the number of activities per lesson had to be reduced and the standard teaching schedule had to be re-structured to ensure that regular academic content could still be taught in each classroom in addition to *Unplugged*. Additionally, teachers reported having to exclude some activities to provide adequate lesson content in their 50-min classes. The majority of teachers and students had positive perceptions about the program and reported perceived changes in the classroom environment (Medeiros et al. 2016).

The same positive trend was found in a non-randomized controlled trial that was conducted to analyze the results of *Unplugged* among 2185 adolescents in 62 classes from eight public schools in three Brazilian cities. The program seemed to lead to a decrease in recent marijuana use among 13- to 15-year-old students. Students who received the *Unplugged* program had similar drug consumption levels before and after the intervention. However, students in the control group showed a significant increase in marijuana use and binge drinking (Sanchez et al. 2016).

After the initial evaluation of the *Unplugged* program, it was culturally adapted to the Brazilian context, and this new version was called *#Tamojunto*. It was thus necessary to evaluate whether this program had similar effects in Brazil as those observed in European countries, as public policies should ideally have an evidence base that justifies the investment and acceptance of those involved in order to be both implemented and sustainable. Therefore, the present study aimed to evaluate the effectiveness of the school program *#Tamojunto* in preventing alcohol, tobacco, inhalant, marijuana, cocaine, and crack use among 7th and 8th grade adolescents in public schools in six Brazilian cities.

Methods

Study Design

We conducted a two-arm school randomized controlled trial (sRCT) that compared the integration of the prevention program *#Tamojunto* into school curricula (intervention condition) with usual curricula in Brazil, i.e., no prevention program (control condition).

The sRCT was conducted in 72 public schools in 6 Brazilian cities, i.e., São Paulo, São Bernardo do Campo, Florianópolis, Tubarão, Fortaleza, and Distrito Federal, which were located in 4 Brazilian states (trial registration at the Brazilian Ministry of Health "Brazilian Register of Clinical Trials—REBEC," number RBR-4 mnv5 g). The intervention schools implemented *#Tamojunto* from March to June 2014 with 7th and 8th grade students, while the control schools did not receive any prevention program in 2014. We confirmed that no other prevention programs were simultaneously implemented in the schools participating in the study. The baseline assessment of substance use was conducted in the second week of February 2014, and the follow-up assessment was performed 9 months after baseline, on the third and last weeks of November 2014 for the control and intervention schools. This follow-up interval was based on the short-term results of *Unplugged* (Faggiano et al. 2008). The implementation and cultural adaptation were the responsibility of the Brazilian Ministry of Health (BMH), and the evaluation was performed by an independent team from two universities.

Population and Sample Size

Based on the sample size calculation by Lwanga and Lemeshow (1991), for a given power of 80%, a significance level of 5%, and a difference between groups of 1.5 percentage points (i.e., from 5 to 3.5%), the necessary sample size for each study arm was calculated to be 2835. To account for a loss of 50%, the sample had to include 4253 participants in each arm. The parameters used were based on a previously conducted pilot study (Sanchez et al. 2016).

As the target population was 13-year-old students (who, on average, are enrolled in the 8th grade) and as each school had approximately four 8th grade classes of 30 students each, at least 35 schools in the intervention arm and the same number in the control arm (total of 70 schools) were needed to access the number of students required to maintain the power of the test. Considering a 10% refusal of schools, 38 schools were enrolled in each arm. A total of 72 schools accepted our invitation to participate in the study, as described in Fig. 1.

In each of the participating municipalities, 4 to 30 schools were randomly selected (in proportion to the size of the city's population) from all of the public middle schools in these locations (using the national registration list of schools from the Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP)). Using the schools selected to participate in the study, a second simple, random selection process was performed to match the control and intervention schools at a ratio of 1:1 by municipality.

In the intervention schools, all 8th grade classes were invited to receive the *#Tamojunto* program, and the schools selected a teacher from each class to receive a 16-h training on the implementation of the program. In Fortaleza, Santa Catarina, and Tubarão, 7th grade classes from the selected schools were also included because these cities were in the process of changing the age of students assigned to each grade and because the State Education Secretariat requested the inclusion of the 7th grade classes in the study.

The Program

The intervention schools received the *#Tamojunto p*rogram, which was delivered by teachers in the classroom. The intervention was originally designed by the European Drug Addiction Prevention trial (EU-DAP) group (Kreeft et al. 2009) and includes four 1-h classes on attitudes toward and knowledge of drugs, four classes on social and interpersonal skills, and four classes on personal skills. In each class, three to five activities were conducted. The 12 classes were guided by the student and teacher manuals and lasted an average of 50 min. Both manuals are open access and available in several languages on the EU-DAP website (www.eudap.net).

The teachers who delivered the program attended a 2-day training facilitated by coaches who had been trained by the European developers, the master trainers of the EU-DAP Intervention Planning Group. The Education Secretariat of each city adapted the Brazilian training for acceptability, and the training workload was reduced by 30% as a result.

During program implementation, teachers had to complete a fidelity questionnaire at the end of each class to monitor the dose of the program delivered. A total of 89% of the classes completed the 12 program lessons. The other 11% terminated the program between lessons 4 and 11 for two main reasons: the teachers went on medical leave or were not comfortable implementing the program.

Cultural Adaptation

The transcultural adaptation of the program was performed by the BMH team, and the program was supervised in the first year (2013) by the European developers. The English version of *Unplugged* material was translated into Portuguese, retaining the original format and subject (educational strategies provided in 12 classes and 3 parent workshops) but with adapted activities. In the student handbook, the classes maintained the central theme; however, adaptations for time were made in every class. Revisions were made to eliminate

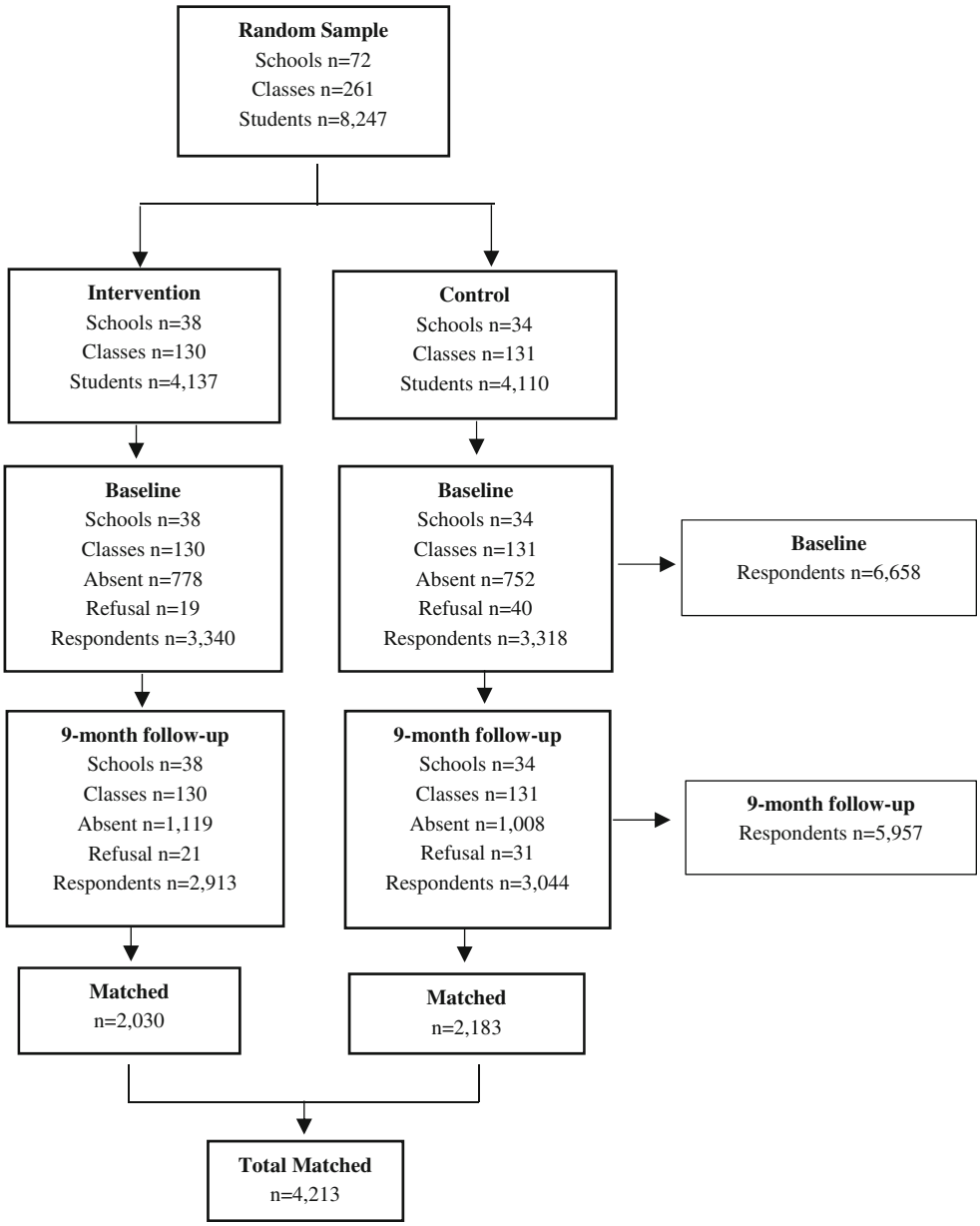

Fig. 1 Flowchart of participation in the two groups at baseline and 9-month follow-up, Brazil 2014

information that was interpreted by the BMH team as potentially part of a "War on Drugs" model, since this did not correspond to the Alcohol and Other Drugs Policy paradigm advocated by the Brazilian Government (Brazil 2015). For example, in lesson 3, "Choices—Alcohol, Risk and Protection," sentences such as "Do not drink alcohol because it is not healthy (....) particularly at your age" were excluded, and reflexive questions including "Why do some people drink alcohol but not get drunk?" and "What can be done so that you do not become dependent on alcohol?" were added.

Additionally, given the epidemiological profile of illegal drug use among students in Brazil, all information on heroin was excluded and replaced with information on crack-cocaine (Carlini et al. 2010). The details about the changes are described at Abreu et al. (2017).

The theoretical bases of the cultural adaptation were defined by a process evaluation that allowed for concurrent revisions (Linnan and Steckler 2002; Steckler et al. 2002; Posavac and Carey 2003). In the first year of implementation (2013), the BMH team offered weekly teacher supervision to monitor the program implementation process. After a complete program cycle had been implemented, the information collected was used to make decisions about the program's cultural adaptations and to restructure the manuals for the following year (2014).

Instrument and Variables

In Brazil, we used a translated and adapted version of the EU-DAP questionnaire (Faggiano et al. 2008) in Portuguese

(Prado et al. 2016) that had replaced some questions with those from two questionnaires widely used in studies with Brazilian students: a World Health Organization questionnaire used by the Brazilian Center for Psychotropic Drug Information (Carlini et al. 2010) to survey drug use at schools and a questionnaire by PENSE (the National Survey of School Health) applied by the BMH (IBGE 2012). The instrument used for data collection was developed and tested by the EU-DAP and had been applied in previous studies on the effectiveness of *Unplugged* (Faggiano et al. 2008).

In the present study, we used three sets of variables, namely sociodemographic data and lifetime and past-month use of the following drugs: alcohol, tobacco, marijuana, inhalants, cocaine, and crack. We also evaluated binge drinking, i.e., consuming five or more doses of alcohol (identified through measurements and drawings) during a 2-h period. The following variables were generated for the analysis: "any licit drug use" (use of alcohol and/or tobacco), "any illicit drug use" (use of marijuana, inhalants, cocaine, and/or crack), and "any drug use" (use of any licit and/or illicit drug).

To pair the questionnaires answered at both times in the study (baseline and follow-up), students created an anonymous code that was based on the following information: first name, last name, date of birth, mother's name, father's name, and maternal grandmother's name. Each code consisted of seven letters and one number and could be decoded only by the students themselves; this process provided them anonymity and confidentiality, which are essential in studies on illicit behaviors (Galanti et al. 2007). School and class codes were included in the matching process. The students' codes were matched using the Levenshtein algorithm, which identifies similarities between a set of characters (Levenshtein 1965).

Questionnaires that were positive for lifetime use of a fictional drug (Holoten and Carpinol) were excluded from the analysis ($n = 48$).

Analysis

For the intention-to-treat analysis (ITT), we included all adolescents with matched codes, those who did not show a positive response to using the fictitious drug, and those aged between 11 and 15 years at baseline. For the per protocol (PP) analysis, adolescents in the intervention group who did not receive the 12 planned classes of the #*Tamojunto* program were excluded (271 students, 6%). The results of the PP analysis are presented in the Supplementary files only (Tables S1 and S2).

The parameters of interest were the relative differences between groups of changes over time in odds of past-month drug use (i.e., alcohol/binge drinking, tobacco, marijuana, inhalants, cocaine, crack, any licit, any illicit, and any drug use) and relative differences in incidence of drug use (i.e., first use alcohol/binge drinking, tobacco, marijuana, inhalants, cocaine, crack) between groups.

Descriptive statistics were performed for the variables "past-month use (prevalence)" and "first use (incidence)" of alcohol/binge drinking, tobacco, inhalants, marijuana, cocaine, crack, any licit drug, any illicit drug, and any drug.

To account for the hierarchical structure of the data and the school cluster effect, multilevel modeling approaches were used in the analysis (Murray et al. 2004). Three-level random effect models (level 1: repeated time observations nested within students; level 2: students clustered within school; level 3: school) were used to evaluate the change in odds of past-month substance use over time. The explanatory variables used were group, time of assessment, and their interaction, controlling for sex, age, and municipality. The interaction term, called #*Tamojunto effect*, tested the equality of the changes in odds from baseline to follow-up between the intervention groups, and these results were presented as the odds ratio (OR) and 95% confidence interval (95%CI). Due to the low number of detected cases of the past 30-day crack use, the corresponding multilevel model was unstable and did not converge.

In addition, to evaluate the incidence of drug use according to the first time use of each drug, we analyzed the number of students who reported that they had never used the drug at baseline (denominator) and the number of these students who reported lifetime use at follow-up (numerator). For incidence of first use, the risk ratio (RR) was calculated; initially, the models were adjusted with group as an explanatory variable and schools as a random effect (crude analysis), and they were then adjusted by sex, age, and municipality (adjusted analysis). In both cases, two-level random effect models (level 1: students; level 2: students clustered within school) were used to evaluate incidence. Multilevel models were fitted with Stata program Generalized Linear Latent Mixed Models (GLLAMM) (Rabe-Hesketh and Pickles 2004).

For the attrition analysis, we compared students whose data from the two time points had been matched with students who answered only the baseline questionnaire.

All data analyses were performed with STATA/SE 13.1 for Windows, and p values under 0.05 were considered statistically significant.

Results

Of the 8247 students enrolled in the 261 classes from the 72 schools investigated, 6658 answered the baseline questionnaire, and 5957 answered the follow-up questionnaire 9 months after baseline. Pre- and post-test questionnaires were matched using the self-generated anonymous code (Galanti et al. 2007). Considering the participants at each time point, 4213 students had paired questionnaires (63%) from both time

points and constituted the analytical sample, excluding students who were not present in schools at baseline or follow-up. The differences in participation at the baseline and follow-up time points were mainly due to students being absent on the day that the questionnaires were administered (Fig. 1).

Table 1 shows the distribution of students' sociodemographic data. The data show that both groups (i.e., intervention and control groups) were homogenous in sex and age.

At baseline, the intervention and control groups had a similar prevalence of drug consumption, with no statistically significant difference between groups (p values for the between-group comparisons are not presented in the tables). Alcohol was the most commonly used drug in both study groups at both time points (i.e., baseline and follow-up).

According to Table 2, the prevalence of alcohol, binge drinking, tobacco, marijuana, and inhalant use in the past month was higher in both groups at follow-up compared to the initial assessment ($p < 0.05$). Given its low prevalence, crack use could not be statistically analyzed.

Despite the increase in past-month drug use when comparing baseline to follow-up data within each group, the #*Tamojunto* effect (the between-group difference in prevalence increase) did not significantly differ between the two groups for any of the variables studied ($p > 0.05$). It is worth noting that the estimated ORs favored the intervention group for all variables, except cocaine and crack, but these differences were not significant.

The Supplementary Tables S1 and S2 show the results of the PP analysis, in which the same trend in results was observed. Both analyses, which involved all of the students with paired data or only those enrolled in the classes that received the complete course, suggested that the program did not affect students' use of drugs in the past month for any of the drugs evaluated.

After evaluating the onset of drug use (first use), i.e., the incidence of use among those who reported that they had never consumed the respective drug at baseline and then reported lifetime use after 9 months, we found an increase of approximately 30% (adjusted risk ratio aRR = 1.30, 95%CI 1.13–1.49, $p < 0.001$) in the chance of using alcohol for the first time among those who had received the program.

The opposite finding was observed for inhalant initiation; 10% of the intervention group with no lifetime use of inhalants at baseline reported their first use during the 9-month follow-up, compared to 13% of the control group, suggesting that #*Tamojunto* led to a 22% decrease (aRR = 0.78, 95%CI 0.63–0.96, $p = 0.021$) in the risk of first inhalant use, as presented in Table 3. As previously noted, the two analyses (PP

Table 1 Distribution of the adolescents at baseline according to sociodemographic variables by study group ($N = 4213$)

	Total ($N = 4213$)		Intervention ($N = 2030$)		Control ($N = 2183$)		
	N	%	*N*	%	*N*	%	*p*
Municipality							<0.001
Distrito Federal	380	9.0	195	9.6	185	8.5	
Fortaleza	294	7.0	127	6.3	167	7.6	
São Bernardo do Campo	606	14.4	298	14.7	308	14.1	
São Paulo	2195	52.1	1111	54.7	1084	49.7	
Florianópolis	593	14.1	245	12.1	348	15.9	
Tubarão	145	3.4	54	2.6	91	4.2	
Sex[a]							0.099
Boy	2049	48.7	1014	50	1035	47.5	
Girl	2160	51.3	1014	50	1146	52.5	
Age group							0.058
11–12 years old	2458	58.3	1154	56.8	1304	59.7	
13–15 years old	1755	41.7	876	43.2	879	40.3	
Grade							<0.001
7th	576	13.7	234	11.5	342	15.7	
8th	3637	86.3	1796	88.5	1841	84.3	
Mother's education level[b]							0.386
Elementary school	882	29.0	412	28.2	470	29.8	
Middle school	889	29.2	441	30.2	448	28.4	
High school	903	29.7	423	28.9	480	30.4	
College/university	365	12.0	185	12.7	180	11.4	

[a] Four missing values

[b] One thousand two hundred and twenty-two missing values

Table 2 Distribution of past-month drug use according to group and time point

Past-month use	Intervention							Control							#Tamojunto at effect	
		Baseline		9-m follow-up					Baseline		9-m follow-up				OR (95%CI)	p^a
	N	*N*	%	*N*	%	OR (95%CI)	p^a	*N*	*N*	%	*n*	%	OR (95%CI)	p^a		
Tobacco	1992	24	1.2	50	2.5	2.8 (1.6–5.1)	0.001	2154	22	1.0	56	2.6	3.6 (2.0–6.6)	<0.001	0.7 (0.3–1.6)	0.441
Alcohol	2013	298	14.8	374	18.6	1.5 (1.2–1.8)	<0.001	2169	272	12.5	382	17.6	1.8 (1.5–2.2)	<0.001	0.8 (0.6–1.1)	0.192
Binge drinking	1983	229	11.5	272	13.7	1.3 (1.0–1.6)	0.016	2137	196	9.2	261	12.2	1.6 (1.2–2.0)	<0.001	0.8 (0.6–1.2)	0.314
Marijuana	1998	18	0.9	55	2.7	5.4 (2.6–10.9)	<0.001	2152	12	0.6	50	2.3	7.3 (3.3–16.3)	<0.001	0.7 (0.3–2.0)	0.545
Inhalant	1991	47	2.4	68	3.4	1.6 (1.0–2.5)	0.028	2156	49	2.3	85	3.9	2.1 (1.4–3.2)	<0.001	0.8 (0.4–1.4)	0.420
Cocaine	1994	1	0.05	2	0.1	2.0 (0.2–22.1)	0.572	2155	3	0.1	3	0.1	1.0 (0.2–4.9)	0.997	2.0 (0.1–36.0)	0.639
Crack|	1998	0	0.0	1	0.05	Non-estimable	2157	1	0.05	0	0.0	Non-estimable	Non-estimable			
Any licit drug	2001	310	15.5	394	19.7	1.5 (1.2–1.9)	<0.001	2160	288	13.3	398	18.4	1.8 (1.4–2.2)	<0.001	0.8 (0.6–1.1)	0.280
Any ilicit drug	1969	60	3.0	109	5.5	2.4 (1.6–3.6)	<0.001	2127	57	2.7	123	5.8	3.1 (2.1–4.6)	<0.001	0.8 (0.5–1.4)	0.429
Any drug	1963	331	16.9	420	21.4	1.5 (1.3–1.9)	<0.001	2118	318	15.0	433	20.4	1.8 (1.5–2.2)	<0.001	0.9 (0.6–1.1)	0.311

Intention-to-treat analysis for the total sample (N = 4213)

[a] Multilevel analysis (STATA GLLAMM) adjusted for group, time, interaction of group × time, sex, age, municipality and random effects of school, reference response category is no past-month use, and the reference for #Tamojunto effect is the control group

N total participants who answered the question, *n* number of positive answers for each variable

Table 3 Incidence of first alcohol and drug use among students participating in the randomized controlled trial of the *#Tamojunto* school prevention program

	Intervention		Control					
First use	*n*/*N*	%	*n*/*N*	%	Crude RR[a] (95%CI)	*p*[a]	Adjusted RR[b] (95%CI)	*p*[b]
Alcohol	376/1055	35.6	325/1167	27.8	1.29 (1.12–1.49)	<0.001	1.30 (1.13–1.49)	<0.001
Binge drinking	216/1657	13.0	236/1844	12.8	1.04 (0.83–1.30)	0.720	1.05 (0.85–1.29)	0.661
Inhalant	163/1623	10.0	230/1766	13.0	0.77 (0.62–0.95)	0.017	0.78 (0.63–0.96)	0.021
Tobacco	127/1847	6.9	154/2011	7.7	0.91 (0.69–1.22)	0.543	0.92 (0.70–1.22)	0.583
Marijuana	92/1929	4.8	107/2084	5.1	0.96 (0.69–1.32)	0.793	0.96 (0.70–1.31)	0.802
Cocaine	9/1992	0.4	11/2143	0.5	0.88 (0.35–2.21)	0.789	0.84 (0.34–2.08)	0.715
Crack	5/1974	0.2	6/2147	0.3	0.88 (0.24–3.17)	0.843	Non-estimable	

Intention-to-treat analysis

N total participants who answered "no" to the question at baseline (non-cases), *n* number of "yes" answers at the 9-month follow up for each variable (cases)

[a] Multilevel analysis (STATA GLLAMM) adjusted for group, time, interaction of group × time, and random effects of school; reference is the control group

[b] Multilevel analysis (STATA GLLAMM) adjusted for group, time, interaction of group × time, sex, age, municipality, and random effects of school; reference is the control group

and ITT) showed similar results for all variables (see Supplementary files for the PP analysis).

As this study was a school trial, students recruited from within the same school could have shown similarities; this similarity was expressed using the intraclass correlation coefficient (ICC). For the past-month drug use, lower ICCs were obtained for the prevalence of any drug consumption (ICC = 0.7%, 95%CI 0.2–2.6%), and higher ICCs were observed for inhalants (ICC = 3.2%, 95%CI 1.2–8.2%). This finding suggests that 0.7 to 3.2% of the variance in the prevalence occurred across schools. Regarding the first use of substances, the ICCs varied from 1.6% (95%CI 0.5–4.6%) for alcohol initiation to 5.3% (95%CI 2.7–10.2%) for tobacco.

Attrition Analysis

As expected, students who missed the 9-month follow-up showed a significantly higher prevalence of the use of certain substances at baseline. Drug use was more common among students with only baseline data than among students with paired data for all substances evaluated. For example, while the prevalence of the past-month alcohol use was 13.6% among paired students, it was 23.1% among non-paired students ($p < 0.001$). For inhalants, past-month use rose from 2.3% to 3.6% ($p = 0.013$). However, when attrition was compared between groups (i.e., intervention and control), no significant difference was found. Age also differed between the paired and non-paired groups; the mean age of students without paired data was 12.9 years (SD = 0.9), and the mean age of paired students was 12.5 years (SD = 0.7). No difference in gender was found.

Discussion

This study evaluated the results of a European program that was implemented in Brazilian schools as part of public policy on the prevention of adolescent drug use. We identified a possible protective effect of the program on first inhalant use, no effects on the prevalence of past-month drug use, and a potential iatrogenic effect on first alcohol use. Of all the results, the most concerning for the implementation of this program in schools as part of Brazilian public policy was the increase in RR of first alcohol use, suggesting an anticipation effect of alcohol use in these adolescents.

The program seemed to have a protective effect on first inhalant use, indicating that the program delayed the first use of these substances among 22% of the students. It is important to highlight that the recreational consumption of inhalants is a global problem, with significant social and neuropsychiatric consequences for users (Balster et al. 2009). Furthermore, inhalants seem to be an intermediate option between legal and illegal drugs, as prior inhalant initiation has been associated with first marijuana use after adjusting for previous alcohol and tobacco initiation (Sanchez et al. 2013). However, when discussing prevention programs, alcohol remains the primary target, as its misuse is one of the main public health problems in Brazil (Rehm et al. 2009).

It is worth noting that when implemented in Europe, the *Unplugged* program showed a relative reduction of 38% in episodes of frequent drunkenness among adolescents (Faggiano et al. 2010). In the case of *#Tamojunto*, no effects were observed for a similar variable, binge drinking. However, there seemed to be non-significant trends in recent *binge drinking* in the past 30 days that favored the intervention.

Moreover, the possible negative effects regarding the initiation of alcohol use in this study conflict with the positive results reported for the *Unplugged* program in European countries (Faggiano et al. 2008). Producing a meaningful effect on drinking behavior through school programs is known to be difficult (Strøm et al. 2014). According to a systematic review, increases in alcohol consumption are the most common type of negative outcome resulting from prevention programs (Werch and Owen 2002). Similar findings have been reported in other school-based prevention studies (Sloboda et al. 2009; Teasdale et al. 2009; Valente et al. 2007). In fact, there are limited findings supporting the "universality" of intervention effects on alcohol outcomes (Stockings et al. 2016). One explanation of these findings could be the unintended boomerang effect, when the attempt to correct exaggerated perceptions of the general prevalence of alcohol use increases rather than protects against alcohol use (Hopfer et al. 2010).

The cultural adaptation of the *Unplugged* program should also be considered, as these modifications may also be responsible for the negative results of the program in Brazil regarding alcohol use. It is important to consider the effects of the changes made in the "Alcohol, Risk, and Protection" lesson, as phrases that emphasized the importance of abstaining from alcohol use among adolescents were excluded and reflexive questions about how to avoid alcohol abuse and dependence were added. In light of the negative results, these changes could be considered to have influenced adolescents' experimentation with alcohol.

The Brazilian social context may be a risk in and of itself because of its weak environmental prevention policies, including the control, taxation, and promotion of alcoholic beverage sales (Laranjeira 2007). Although the sale or offer of alcoholic drinks to adolescents (<18 years old) is prohibited by law, there is a lack of effective law enforcement, and alcohol consumption by adolescents is also culturally accepted because alcohol is not commonly considered a drug (Pechanskya 2004). Given this context, and combined with the modifications that replaced the discourse of alcohol abstinence in the original *Unplugged* lesson with a discourse focused only on the prevention of drunkenness and dependence in the *#Tamojunto* version, we could presume that the results obtained in Brazil could greatly differ from those obtained in Europe.

Another important aspect that could explain the divergent results is the low quality of Brazilian public schools, which may have jeopardized the understanding of the activities both in students with poor literacy (Organization for Economic Co-operation and Development—OECD 2016) and in inadequately qualified teachers (INEP 2009), who considered the workload and content of the training insufficient (Medeiros et al. 2016). The program used interactive techniques that were unfamiliar to Brazilians teachers. Furthermore, only 57% of the classes were completed as described in the program manual, and teachers reported excluding activities due to difficulties finding the time needed to implement them (Medeiros et al. 2016). Moreover, as the teachers were initially supposed to be trained in 3 days, as proposed by the EU-DAP developers, and the Brazilian training was conducted in 2 days, it is important to consider that a 2-day training may be insufficient to guarantee fidelity of the implementation.

These findings also raise questions about the obstacles faced during the implementation of the program, as cultural sensitivity has frequently led to modifications of evidence-based interventions (Lundgren et al. 2011) and could have mediated program success (Castro et al. 2010; Gewin and Hoffman 2016). Therefore, we must highlight that the implementation of *#Tamojunto* differed from that of *Unplugged*. In Brazil, the BMH coordinated the program implementation in schools, and the research teams were responsible exclusively for assessing the effectiveness of the program. Moreover, in Brazil, the prevention program was delivered in schools as part of public policy; consequently, school and teacher participation was not voluntary, which may have compromised their engagement in the application of the lessons. According to Ringwalt et al. (2003), teachers' beliefs about the effectiveness of a program and organizational support are important predictors of program fidelity and unexpected adaptations.

These results emphasize the importance of evaluating prevention programs when determining the sustainability of public policy and the potential long-term effects of a program on society. The effectiveness of programs should be proven and their cost-benefit relationship should be rigorously evaluated, as these analyses would allow managers to not only understand the impact of these interventions on the public health field (UNODC 2013) but also consider these evaluations in policymaking decisions. Nevertheless, a significant number of these programs do not evaluate their effects (Jackson et al. 2012) or, even worse, do not demonstrate efficacy and effectiveness in reducing or delaying consumption in evaluations (Faggiano et al. 2014). Evidence-based and culturally adapted prevention programs that target students (Faggiano et al. 2014; Jackson et al. 2012; Pentz 2003) are needed worldwide.

A limitation of this study was the excessive number of students who could not be found at school and were absent at baseline and/or follow-up. Attrition also posed a potential problem in terms of the internal and external validity. The initial number of students potentially enrolled in the study ($n = 8247$) was provided by the Ministry of Education; however, we found that not all students who were enrolled were actually attending school. This discrepancy is a problem in the Brazilian social context, where complete school attendance by all enrolled children has been a challenge. Moreover, considering only the students present at baseline, some were absent in the post-test or left school between the two surveys (dropouts), resulting in an attrition rate of 37%; a national survey previously found that approximately 20% of students in public schools were absent (IBGE 2012). It is worth noting that other controlled trials have

found similar attrition rates (Ariza et al. 2013; Newton et al. 2010; Shope et al. 1992). According to a meta-analysis of school-based preventive interventions, attrition rates varied from 5 to 52% (Strøm et al. 2014). Despite the differences found in the prevalence of drug use between students responding at both time points and those who answered only at baseline, no difference in attrition was observed between the control and intervention groups. Therefore, these results could not be extrapolated to all students who were involved in the study. Moreover, it is important to highlight that this study presents only the short-term effects of the program, and a larger follow-up study could show different results.

The findings of this study suggest that the BMH should re-evaluate the expansion of the *#Tamojunto* program in schools and analyze why the program's effects were inconsistent with those of previous European studies; these efforts should focus, in particular, on the changes made to the handbooks and teacher training, as these modifications could have affected the theoretical model and fidelity. Additionally, we suggest adapting and evaluating other evidence-based drug prevention programs for schools that have shown beneficial results in Latin American countries or in sociocultural environments more similar to those of Brazil than to those of European countries.

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Compliance with Ethical Standards

Funding This study was funded by the Brazilian Ministry of Health through the TED 89-2014 (PI: Dr. Sanchez).

Conflict of Interest The authors declare that they have no conflicts of interest.

Human Participants and/or Animals All procedures in the present study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was approved by the Ethics in Research Committees at the University of São Paulo (#473.498) and the Federal University of Santa Catarina (#711.377).

Informed Consent Informed consent to participate in the study was obtained from all of the participants.

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