



## Transition from nonuse to use of alcohol or binge drinking among adolescents: Secondary analysis of a randomized controlled trial

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### HIGHLIGHTS

- Parents' alcohol consumption and the absence of the father at home seem to be predictors of early alcohol use and binge drinking initiation.
- Students' violent behavior at baseline seems to predict alcohol use initiation.
- School drug prevention programs should tackle violent behavior at an early age and also address parents' alcohol consumption practices.

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### ABSTRACT

**Objective:** The objective of this study was to evaluate the predictors of the transition from nonuse of alcohol to the first use of alcohol and the first episode of binge drinking.

**Methods:** Data were drawn from a randomized controlled trial conducted with seventh- and eighth-grade students from 72 public schools over a 21-month period in six cities in Brazil. A total of 3298 students who reported that they had never consumed alcoholic beverages and had never engaged in binge drinking at baseline were included in this study. The two binary outcomes were tested concomitantly via structural equation modeling. Maximum likelihood estimates for logistic regression models were performed to evaluate how baseline data regarding risk factors, such as sociodemographic characteristics (socioeconomic status, gender, and age), school experiences (violence and perception of academic performance), and social variables (family and friends), affected the initiation of alcohol use and binge drinking at 9- and 21-month follow-up assessments.

**Results:** Older age, the perpetration of violent behaviors at baseline and the absence of the father living with the adolescent were predictors of both alcohol use initiation and binge drinking initiation. The #Tamojuntó program showed iatrogenic effect for first alcohol use.

**Conclusions:** The results indicate the need to develop and implement effective alcohol prevention programs that consider the main characteristics in the prediction model for alcohol consumption and binge drinking, including early intervention for aggressive behaviors at school and parental alcohol use.

### 1. Introduction

The use of alcohol during adolescence has been a subject of increasing concern (Degenhardt, Stockings, Patton, Hall, & Lynskey, 2016). In Brazil, the average age of onset of alcohol consumption is 13 years, and 60.5% of students aged 10–18 years reported having consumed alcohol (Carlini et al., 2010). In addition, 20.3% of students aged 13–15 years reported having become drunk at least once in their lifetime (IBGE, 2016). Approximately 15.2% of individuals who start

drinking at or before age 14 develop alcohol dependence or abuse compared to 2.1% of those who start consuming alcohol at age 21 (Substance Abuse and Mental Health Services Administration, 2014). The early use of alcohol increases the risk of heavy alcohol use during early adulthood (Liang & Chikritzhs, 2015) as well as the consumption of illicit drugs (Peeters et al., 2014). Moreover, the earlier the onset of alcohol consumption, the higher the probability of binge drinking (BD) among adolescents aged 15–18 years (Sanchez et al., 2013).

BD is a pattern of consumption defined by at least one episode of

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alcohol consumption of five or more doses on the same occasion (Hibell, Guttormsson, Ahlström, Balakireva, Bjarnason, Kokkevi, & Kraus, 2009). This behavior exposes adolescents to personal and social risks, including risky sexual behavior (Kuntsche, Kuntsche, Thrul, & Gmel, 2017), violent behavior (Mendoza, Gomez-Baya, & Medero, 2017; Moreira et al., 2008), poor school performance (Davis et al., 2018; Soldera, Dalgalarondo, Corrêa Filho, & Silva, 2004a), cognitive deficits, especially regarding executive functions (Mota et al., 2013) and working memory (López-Caneda et al., 2014), alcohol dependence, and illegal drug use (Ellickson, Tucker, & Klein, 2003; Marshall, 2014).

To prevent this harm, prevention programs have been implemented worldwide (Foxcroft & Tsertsvadze, 2011; Strøm, Adolfsen, Fossum, Kaiser, & Martinussen, 2014). However, in Brazil, national prevention programs with established effectiveness for use on a large scale in schools are not yet available (Pereira, Paes, & Sanchez, 2016). To fill this gap and follow international guidelines on prevention (UNODC, 2014), the Brazilian Ministry of Health (BMH) in partnership with the United Nations Office on Drugs and Crime (UNODC) established a cross-cultural adaptation of the effective “Unplugged” European program for Brazilian public schools. In Brazil, this drug prevention program was renamed #Tamojuntto (Pedroso, Abreu, & Kinoshita, 2015). Unplugged is an interactive program based on the “Global Social Influence Model” (Vadrucci et al., 2016), whose approach involves building specific skills for adolescents to learn to manage social influences by modifying normative beliefs and providing knowledge about drugs and their health consequences. Despite the evidence of positive drug prevention results in a multicenter study in Europe (Faggiano et al., 2008), the results (at 9 and 21 months of follow-up) of the Brazilian version indicated that the program had contradictory effects: it increased alcohol experimentation and decreased inhalant experimentation (Sanchez et al., 2017, 2018).

Previous studies have indicated that the initiation of alcohol use may be associated with individual and environmental factors. With regard to the school environment, the perpetration of violence is a risk factor for early alcohol use (Brady, Tschann, Pasch, Flores, & Ozer, 2008; Tharp-Taylor, Haviland, & D’Amico, 2009) and for BD in adolescents (Brewer, 2005). Previous studies have also found an association between poor school performance and alcohol consumption among students (Bergen, Martin, Roeger, & Allison, 2005; Cox, Zhang, Johnson, & Bender, 2007; Davis et al., 2018; Miller, Naimi, Brewer, & Jones, 2007). Additionally, alcohol consumption by family members is one of the strongest predictors of alcohol consumption at an early age (Challier, Chau, Prédine, Choquet, & Legras, 2000; Ryan, Jorm, & Lubman, 2010; Yap, Cheong, Zaravinos-Tsakos, Lubman, & Jorm, 2017) and BD among adolescents (Sanchez et al., 2013).

Considering that Brazil has a very particular culture related to alcohol consumption, with a high permissiveness of consumption and weak regulatory control of the promotion and sale of alcoholic beverages (Laranjeira, 2007), it is necessary to invest in Brazilian studies that understand this reality. Identifying the main predictors of the initiation of alcohol use and BD by Brazilian adolescents may aid in understanding the results from the #Tamojuntto prevention program because the first use of alcohol can be related to some environmental factors that are outside the scope of the program, such as parental and peer factors. Therefore, by analyzing the predictors of alcohol use initiation, we can contribute to the development of preventive programs and appropriate interventions for this population (Soldera, Dalgalarondo, Corrêa Filho, & Silva, 2004b).

The objectives of this study were to evaluate the predictors of the transition from nonuse of alcohol to the first instance of alcohol experimentation and the first episode of BD in the context of a randomized controlled trial to evaluate the #Tamojuntto program. The domains of the investigated risk factors were sociodemographic variables (socioeconomic status [SES], gender, and age), school experiences (violence and perception of academic performance), and social variables (family and friends).

## 2. Materials and methods

### 2.1. Study design and sampling

This study presents the results of a secondary analysis of data from a cluster randomized controlled trial, with data prospectively measured at 3 time points to assess the effectiveness of the #Tamojuntto drug prevention program with seventh- and eighth-grade students from 72 public elementary schools in six Brazilian cities. The BMH decided to test a culturally adapted version of the European drug prevention program Unplugged, renamed #Tamojuntto, in Brazilian public schools (Pedroso et al., 2015), and the evaluation was performed by an independent team from two universities (Sanchez et al., 2017). The schools were randomized into two groups: intervention and control. Students from the intervention group attended 12 classes of the #Tamojuntto program, whereas students from the control group attended no classes.

This article examined the data from the baseline assessment conducted in February 2014 and the data from two follow-ups (at 9 months and 21 months after the baseline assessment). Only the students who reported never consuming alcoholic beverages and never engaging in BD at baseline were included in the present study ( $n = 2649$ ).

Details of the study design and of the sampling process have been presented in a prior publication (Sanchez et al., 2017). Of the 72 schools, 261 classes participated in the program, corresponding to a total of 6391 students at baseline, of whom 3298 had never consumed alcohol, and thus, were included in the analyses. Of these students, 2649 were evaluated until the end of the 21-month follow-up period (Fig. 1).

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and were in accordance with the 1964 Declaration of Helsinki. This study was registered in the Registro Brasileiro de Ensaios Clínicos (REBEC) of the BMH under Protocol No. RBR-4mnv5g. The study protocol was approved by the Research Ethics Committee of the Federal University of São Paulo under Protocol No. 473,498.

### 2.2. Instruments and variables

Both groups responded to structured, anonymous, and self-completed questionnaires. The questionnaire was developed and tested by the European Drug Prediction Prevention Trial (EU-Dap) and was used in previous Unplugged studies (Faggiano et al., 2008). The questionnaire was adapted and translated to Brazilian Portuguese, and some questions were adapted from the following two questionnaires: 1) the World Health Organization questionnaire for the use of drugs among students (adapted by the Brazilian Center for Information on Psychotropic Drugs) (Carlini et al., 2010) and 2) the National Survey on Student Health from the BMH (IBGE, 2013).

To correlate the students’ responses to the questionnaires throughout the three phases of the study, the students generated a “secret code” containing letters and numbers from personal information. These codes allowed researchers to compare individual questionnaires at different follow-up periods while simultaneously ensuring the participants’ anonymity and confidentiality (Galanti et al., 2007). The databases were integrated by combining the secret codes using the Levenshtein distance (Levenshtein, 1965).

One question about the use of fictitious drugs (Holoten and Carpinol) was included to ensure a minimum information bias (false-positive responses) in the questionnaires. This question led to the exclusion of 49 students at baseline, 70 students at 9 months of follow-up, and 25 students at 21 months of follow-up.

The response variables (outcomes) considered in this study were generated only among nondrinkers at baseline and were evaluated at 9 and 21 months of follow-up:

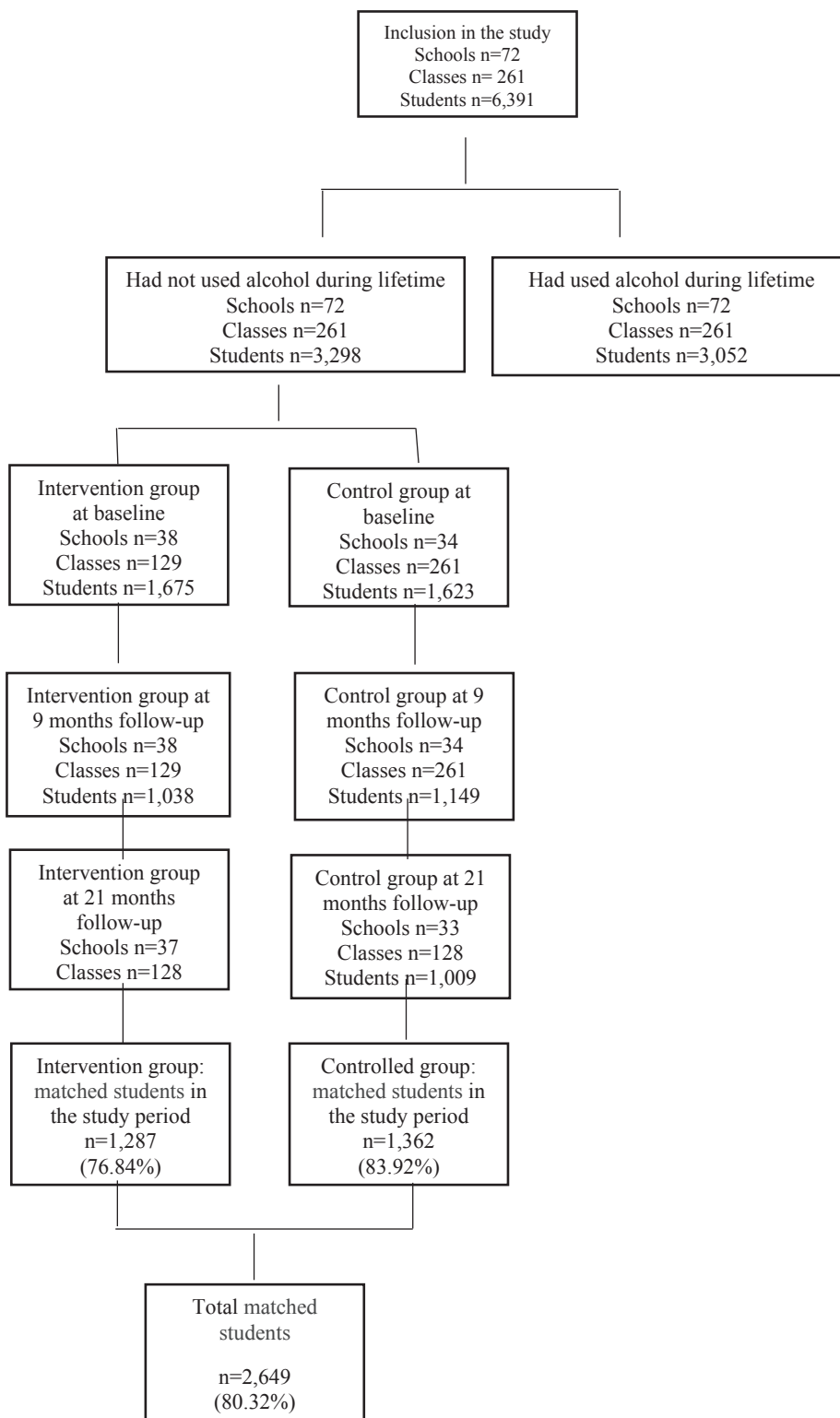


Fig. 1. Flowchart of the controlled and randomized study of the #Tamojuntto drug prevention program in 2014–2015 in Brazil.

- 1) Initiation of alcohol consumption: alcohol consumption at baseline (t = 0) corresponded to a negative answer to the question “Have you ever consumed alcoholic beverages?” (Yes/No), and consumption at follow-up (9 or 21 months) corresponded to an affirmative answer to the same question, characterizing the initiation of alcohol use; and
- 2) Initiation of binge drinking (BD) practices: BD at baseline (t = 0) corresponded to a negative answer to the question “Have you ever

consumed five or more servings of alcohol in a single occasion?” (Yes/No), and BD at follow-up (9 or 21 months) corresponded to an affirmative answer to the same question, characterizing the beginning of BD.

The following explanatory variables were evaluated at baseline and therefore could be interpreted as predictors of future initiation of alcohol consumption:

**Table 1**  
Sociodemographic variables, school experiences, social variables, first alcohol use, and first episode of BD among students from the control and intervention groups (#Tamojuntto drug prevention program) (n = 2649).

	Group				Total	
	Control		#Tamojuntto program			
	N	%	N	%	N	%
<i>Gender</i>						
Male	661	48.5	663	51.5	1324	50.0
Female	701	51.5	624	48.5	1325	50.0
Age (years) – mean (standard deviation)	1362	12.4 (0.69)	1287	12.4 (0.75)	2649	12.4 (0.72)
SES – mean (standard deviation)	1359	27.2 (7.67)	1287	27.3 (7.29)	2646	27.3 (7.49)
<i>Father lives in the same house</i>						
No	474	34.9	477	37.2	951	36.0
Yes	885	65.1	805	62.7	1690	64.0
Missing	3		5		8	
<i>Mother lives in the same house</i>						
No (valid)	132	9.7	115	9.0	247	9.4
Yes (valid)	1227	90.3	1167	91.0	2394	90.6
Missing	3		5		8	
<i>Perception of school grades in the past year</i>						
High (valid)	455	34.1	449	35.9	904	35.0
Intermediate/low (valid)	880	65.9	802	64.1	1682	65.0
Missing	27		36		63	
<i>Perpetration of physical aggression at school in the past 30 days</i>						
No (valid)	1280	96.4	1207	96.3	2487	96.4
Yes (valid)	48	3.6	46	3.7	94	3.6
Missing	34		34		68	
<i>Perpetration of verbal aggression at school in the past 30 days</i>						
No (valid)	1277	95.2	1187	94.5	2464	94.9
Yes (valid)	64	4.8	69	5.5	133	5.1
Missing	21		31		52	
<i>Perpetration of bullying at school in the past 30 days</i>						
No (valid)	1191	88.7	1112	88.5	2303	88.7
Yes (valid)	151	11.3	144	11.5	295	11.3
Missing	20		31		51	
<i>Consumption of alcohol by the father</i>						
No (valid)	773	59.1	804	64.8	1577	61.9
Yes (valid)	535	40.9	437	35.2	972	38.1
Missing	54		46		100	
<i>Consumption of alcohol by the mother</i>						
No (valid)	1045	79.9	1020	82.2	2065	81.0
Yes (valid)	263	20.1	221	17.8	484	19.0
Missing	54		46		100	
<i>Consumption of alcohol by a sibling</i>						
No (valid)	1210	92.5	1144	92.2	2354	92.4
Yes (valid)	98	7.5	97	7.8	195	7.6
Missing	54		46		100	
<i>Consumption of alcohol by a best friend</i>						
No (valid)	1263	96.6	1211	97.6	2474	97.1
Yes (valid)	45	3.4	30	2.4	75	2.9
Missing	54		46		100	
<i>Exposure to a drunk father</i>						
No (valid)	1191	91.0	1158	93.5	2349	92.2
Yes (valid)	118	9.0	81	6.5	199	7.8
Missing	53		48		101	
<i>Exposure to a drunk mother</i>						
No (valid)	1281	97.9	1218	98.3	2499	98.1
Yes (valid)	28	2.1	21	1.7	49	1.9
Missing	53		48		101	
<i>Exposure to a drunk sibling</i>						
No (valid)	1275	97.4	1217	98.2	2492	97.8
Yes (valid)	34	2.6	22	1.8	56	2.2
Missing	53		48		101	
<i>Exposure to a drunk best friend</i>						
No (valid)	1283	98.0	1231	99.3	2514	98.7
Yes (valid)	26	2.0	8	0.7	34	1.3
Missing	53		48		101	
<i>Transition to alcohol consumption during study follow up</i>						
No (valid)	416	39.2	315	32.0	731	35.7

- 1) Sociodemographic variables: These variables included gender, age, and SES. SES was evaluated using the scale from the Associação Brasileira de Empresas de Pesquisa (ABEP, 2012). The score varies from 0 to 46, with higher scores indicating a higher SES of the student.
- 2) Social variables: Data included alcohol use and episodes of drunkenness by parents, siblings, and best friend were collected using eight dichotomous (Yes/No) questions, asking the participant whether his/her father, mother, sibling, or best friend drink occasionally and if they had episodes of drunkenness. Data on family composition were collected using two dichotomous (Yes/No) questions that assessed whether the student lived with the father or mother.
- 3) School experiences variables: Episodes of violence perpetrated by adolescents at school were measured using three dichotomous (Yes/No) questions, which allowed reported cases of bullying and physical and verbal aggression at school in the past 30 days. Data on the students' perception of academic performance in the past year were measured using a categorical question with three possible answers: low, intermediate, or high.
- 4) Intervention group: The students either participated or not in the #Tamojuntto drug use prevention program (schools were randomized to the control or intervention group).

### 2.3. Statistical analysis

Only the students who reported never consuming alcoholic beverages or engaging in BD at baseline were considered in this analysis (n = 2649). Due to the exploratory nature of this study, all 18 independent variables were simultaneously inserted into the model, where two binary measures were tested concomitantly as outcomes (i.e., initiation of alcohol consumption and initiation of the practice of BD) via structural equation modeling (SEM). Because two logistic regressions were analyzed simultaneously under SEM, we adjusted the adopted significance level to 0.05/2 = 0.025. Therefore, we claimed statistical significance for p-values below 0.025. We used Mplus version 8.2 (Muthén & Muthén, 2017) to run all the analyses under robust maximum likelihood, which uses the Huber-White Sandwich estimator to estimate robust standard errors due to the multilevel structure of the data (i.e., adolescents nested on schools); consequently, all the standard errors were adjusted for the nonindependence of the observations (i.e., adolescents nested on schools) (Asparouhov & Muthén, 2006; Asparouhov, 2005). To address the missing covariates and outcomes, assuming the missing-at-random (MAR) mechanism (Enders, 2010), we used two approaches: complete case analysis and full-information maximum likelihood (FIML). The first one considered only subjects with all the covariates and outcomes concomitantly complete. The second approach to deal with missing data was an FIML estimation of a likelihood function for each individual based on the variables that are present so that all the available data are used. Moreover, in the complete case analysis, the model was estimated conditioned on the independent variables, where their means, variances, and covariances were not model parameters. As a consequence, the sample size is reduced in the complete case analysis. Because we want to adhere to the intention-to-treat paradigm and to not lose cases, we included the variances of all of the independent variables in the FIML model. Then, distributional assumptions were made about these variables, and their means, variances, and covariances were model parameters. Therefore, as a consequence, the population parameters most likely produced estimates from the sample data that were analyzed, allowing the data to be analyzed under the intention-to-treat paradigm.

Also, to understand if model fit is the same when paths are constrained to be equal between groups (Log-likelihood = -18022.432, scaling correction factor = 2.3735, free parameters = 226) vs are not (Log-likelihood = -17867.380, scaling correction factor = 2.6821, free parameters = 277) we ran a multiple group analysis within the Mplus SEM. The difference testing using the Loglikelihood under robust



Table 1 (continued)

	Group				Total	
	Control		#Tamojuntó program			
	N	%	N	%	N	%
Yes (valid)	646	60.8	668	68.0	1314	64.3
Missing	300		304		604	
<i>Transition to binge drinking during study follow up</i>						
No (valid)	695	77.0	591	73.2	1286	75.2
Yes (valid)	208	23.0	216	26.8	424	24.8
Missing	459		480		939	

SES = Socioeconomic status.

maximum likelihood estimator returned  $\chi^2_{(51)} = 76.57$ ,  $p$ -value = 0.011. Although, the  $p$ -value is significant, in favor of a less restrictive model (i.e., model where the parameters are freely estimated across control and intervention), it is important to notice that loglikelihood test, as in any statistical model, the power of a test is influenced by sample size, effect size, and type I error. Our sample size is 2,649. Therefore, we believe that even small deviations between both models are being captured. In this scenario, it is important to notice that the intervention effect is controlled in the model and predictors are independent of the intervention effect. This analysis is presented at the [Supplementary Material \(Table S1\)](#).

### 3. Results

The distributions of the sociodemographic data of students who had never consumed alcohol at baseline ( $n = 2649$ ) are shown in [Table 1](#). The mean age of the interviewees was 12.4 years ( $SD = 0.72$ ), and females represented 50% of the total respondents. Among baseline alcohol abstainers, 64.3% reported initiating alcohol consumption during the study period (21 months), and 24.8% reported having practiced BD for the first time in the same period. There were no significant differences between the intervention and control groups for the investigated variables.

The results related to the first alcohol consumption through the multivariate adjusted model indicated that older age, absence of the father living with the adolescent, the practice of physical aggression, and any alcohol consumption by family members (father and mother) at baseline were predictors of initiation of first alcohol consumption after 9 or 21 months of follow-up. The strongest predictor in this model was the practice of physical aggression ( $OR = 2.19$ ; 95%  $CI: 1.18-4.07$ ). The assigned group was also a predictor of first alcohol consumption. Belonging to the #Tamojuntó group at baseline increased the risk of first alcohol use after 9 or 21 months of follow-up ( $OR = 1.38$ ; 95%  $CI: 1.10-1.75$ ) compared to the adolescents in the control group when controlled by all other variables in the FIML model; this result converges even under the complete case analysis ([Table 2](#)).

With respect to the onset of BD ([Table 3](#)), the multivariate adjusted model indicated that older age (increase of 35% per year), the absence of the father from living with the student and the perpetration of verbal aggression and bullying at baseline were predictors of initiation of BD after 9 or 21 months of follow-up. The strongest predictor in this model was both verbal aggression and bullying, which almost doubled the likelihood of BD initiation ( $OR = 1.99$ , 95%  $CI: 1.29-3.08$ ; and  $OR = 1.94$ , 95%  $CI: 1.34-2.81$ , respectively).

We adjusted the adopted significance level to  $0.05/2 = 0.025$ . Therefore, we claimed statistical significance for  $p$ -values below 0.025.

### 4. Discussion

The main predictors of first alcohol consumption and BD initiation

among early adolescents were as follows: 1) older age; 2) aggression perpetrated by the students; 3) the absence of the father living with the adolescent; and 4) any alcohol consumption by the parents.

The most consistent finding for both first alcohol use and first binge indicates that adolescents' perpetration of violence at school at baseline might be a predictor of alcohol use 21 months later. The initiation of alcohol consumption was positively associated with the previous perpetration of physical aggression at school, and this result corroborates the results of other studies ([Maldonado-Molina, Jennings, & Komro, 2010](#); [Tharp-Taylor et al., 2009](#)). The initiation of BD was associated with the previous perpetration of verbal aggression and bullying, an association that has been reported in previous studies ([Oliveira, Silva, da Silva, & de Mello, 2016](#)). A possible explanation for these findings is that school violence and alcohol use share the same protective and risk factors associated with the individual, such as externalizing problem behaviors ([Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998](#)) and other psychiatric symptoms ([Choe, Teplin, & Abram, 2008](#); [Volavka, 2010](#)), or with the environment, such as parental abuse and neglect ([Widom & White, 1997](#)), family structure ([Griffin, Botvin, Scheier, Diaz, & Miller, 2000](#)) and low SES ([Atkinson et al., 2009](#)). Thus, engaging in any risk behavior increases the likelihood of engaging in other problem behaviors ([Jessor & Jessor, 1977](#)). Identifying the students involved in the perpetration of violence may help recognize children who are at risk of becoming involved with alcohol use. In this sense, the school plays a fundamental role in implementing primary preventive interventions by reducing exposure to these frequent risk factors ([Soulander et al., 2007](#)), which can take place with the early identification of at-risk students and the promotion of school-based interventions targeting this population ([Newton et al., 2016](#)) or even referring such students to appropriate clinical services ([Arango et al., 2018](#)).

The results indicate that the consumption of alcohol by parents plays a predictive role in the initiation of alcohol consumption and BD practices by adolescents. Cross-sectional studies have found associations between family factors and alcohol consumption among adolescents ([De Micheli & Formigoni, 2004](#); [Galduróz & van der Sanchez, 2010](#)). However, few studies to date have investigated whether this relationship is predictive of alcohol consumption using a longitudinal design, as is adopted in the present study ([Alati et al., 2005](#); [Janssen et al., 2014](#); [Valente, Cogo-Moreira, & Sanchez, 2018](#)), and a systematic review that investigated modifiable parenting factors associated with adolescent alcohol misuse support our findings that parental drinking is a longitudinal predictor of alcohol use initiation ([Yap et al., 2017](#)). One possible explanation for our findings is that children are highly perceptive of their parents' drinking habits, modeling their drinking behavior ([Vermeulen-Smit et al., 2012](#)) through the transmission of positive expectations on alcohol use ([Handley & Chassin, 2013](#); [Jones, Corbin, & Fromme, 2001](#)) and a permissive environment surrounding alcohol use ([van der Zwaluw et al., 2008](#)), which suggests that school program interventions should also include parents as a target audience. Additionally, parents who drink appear to provide greater accessibility of alcohol to adolescents ([Komro, Maldonado-Molina, Tobler, Bonds, & Muller, 2007](#)). Parental screening and brief intervention for drinking behaviors would be a possible element to improve school programs.

The absence of the father living with the adolescent also appeared to be a predictor of the first use of alcohol and the practice of BD by adolescents. Despite the lack of studies in this field, this result is in line with some previous studies carried out in other countries, which also found the importance of adolescents' living arrangements ([Ali & Dean, 2015](#); [Ledoux, Miller, Choquet, & Plant, 2002](#)). One possible explanation for these results is that a single parent's family may have less ability to provide the same level of affective support and monitoring that could be given in the presence of an additional parent in the household. It is important to highlight that these skills are well-proven protective factors for adolescent substance use ([Valente et al., 2018](#); [Yap et al., 2017](#)). This result suggests that parenting skill interventions targeting families

**Table 2**  
Distribution and regression analysis of the predictors of first alcohol consumption within 21 months of baseline.

Group	First alcohol consumption				Complete cases with covariates (n = 1565)			FIML with covariates (n = 2649)		
	No		Yes		OR	95% CI	p-value	OR	95% CI	p-value*
	n	%	n	%						
Control	416	39.2	646	60.8	1			1		
#Tamojuntó group	315	32.0	668	68.0	1.40	1.09;1.79	0.023	1.38	1.10;1.75	0.018
Gender										
Male	380	38	621	62	1			1		
Female	351	33.6	693	66.4	1.32	1.05;1.66	0.035	1.27	1.03;1.56	0.044
Age	731	12.3 (0.65)	1314	12.5 (0.71)	1.20	1.01;1.43	0.056	1.27	1.09;1.50	0.008
SES	731	27.7 (7.27)	1313	27.7 (7.27)	1.00	0.99;1.02	0.299	1.00	0.99;1.01	0.654
Father lives in the same house										
No	226	31.0	501	69.0	1.24	1.01;1.52	0.020	1.35	1.11;1.64	< 0.001
Yes	504	38.4	807	61.6	1			1		
Mother lives in the same house										
No	65	35.3	119	64.7	1			1		
Yes	665	35.9	1189	64.1	0.95	0.68;1.33	0.757	1.06	0.77;1.47	0.723
Perception of school grades in the past year										
High	268	38.8	422	61.2	1			1		
Intermediate/low	444	33.9	864	66.1	1.20	0.99;1.46	0.086	1.22	1.02;1.45	0.048
Perpetration of physical aggression at school in the past 30 days										
No	699	36.4	1220	63.3	1			1		
Yes	16	20.5	62	79.5	1.97	1.06;3.64	0.002	2.19	1.18;4.07	< 0.001
Perpetration of verbal aggression at school in the past 30 days										
No	695	36.5	1209	63.5	1			1		
Yes	26	24.3	81	75.7	1.39	0.79;2.45	0.175	1.32	0.78;2.25	0.236
Perpetration of bullying at school in the past 30 days										
No 650		36.6	1126	63.4	1			1		
Yes 70		30.2	162	69.8	1.13	0.74;1.70	0.530	1.15	0.80;1.65	0.409
Consumption of alcohol by the father										
No	484	40.5	711	59.5	1			1		
Yes	217	28.1	554	71.9	1.66	1.29;2.15	0.002	1.70	1.36;2.15	< 0.001
Consumption of alcohol by the mother										
No	614	38.7	973	61.3	1			1		
Yes	87	23.0	292	77.0	1.76	1.31;2.35	0.004	1.65	1.25; 2.17	0.005
Consumption of alcohol by a sibling										
No	661	36.4	1155	63.6	1			1		
Yes	40	26.7	110	73.3	1.08	0.68;1.72	0.746	1.20	0.79;1.81	0.437
Consumption of alcohol by a best friend										
No	688	36.1	1217	63.9	1			1		
Yes	13	21.3	48	78.7	3.37	1.17;9.68	0.191	2.57	1.11;5.94	0.153
Exposure to a drunk father										
No	650	36.0	1155	64.0	1			1		
Yes	50	31.6	108	68.4	0.85	0.60;1.20	0.318	0.86	0.61;1.19	0.316
Exposure to a drunk mother										
No	691	35.9	1234	64.1	1			1		
Yes	9	23.7	29	76.3	1.12	0.45;2.75	0.823	1.05	0.43;2.62	0.910
Exposure to a drunk sibling										
No	690	36	1229	64	1			1		
Yes	10	22.7	34	77.3	1.44	0.65;3.23	0.455	1.60	0.76;3.22	0.322
Exposure to a drunk best friend										
No	690	35.6	1247	64.4	1			1		
Yes	10	38.5	16	61.5	4.76	1.18;19.1	< 0.001	2.80	0.90;8.69	0.200

SES = Socioeconomic status.

FIML = Full-information maximum likelihood.

\*Because two logistic regressions were analyzed simultaneously, we adjusted the adopted significance level to 0.05/2 = 0.025. Therefore, we claimed statistical significance for p-values below 0.025.

with nonresident fathers would likely be of significant help to the field of substance abuse prevention.

The results related to the iatrogenic effect of the #Tamojuntó program for first alcohol use are already known (Sanchez et al., 2017, 2018); however, the environmental predictors related to the initiation of alcohol use have not yet been tested. Considering the findings from this study, which showed that parental alcohol use, violent behavior of the student, and a perception of poor academic performance appear to predict the initiation of alcohol use (regardless of the effect of the program), we must reflect that the initiation of alcohol use is a complex phenomenon that involves a combination of multiple factors. Therefore, preventative interventions must consider this complexity in their

component structures. Health approaches should target parents to prevent adolescent alcohol use. These findings are in line with other studies that have found that the effect of school-based universal programs may be increased by adding parent-based components (Koning, Van Den Eijnden, Verdurmen, Engels, & Vollebergh, 2013; Koutakis, Stattin, & Kerr, 2008; Newton et al., 2017; Stormshak et al., 2011). Despite this established knowledge of promoting rule-setting, monitoring and parent-child communication, there is a lack of evidence about interventions targeting parental alcohol use (Kuntsche & Kuntsche, 2016). It is important to highlight that in the Brazilian population, the implementation of such parent-based interventions would represent a challenge because there is great difficulty in integrating

**Table 3**  
Distribution and regression analysis of the predictors of the first episode of binge drinking within 21 months of baseline.

Group	Binge Drinking				Complete Cases (n = 1565)			FIML with covariates (n = 2649)		
	No		Yes		OR	95% CI	p-value	OR	95% CI	p-value*
	N	%	N	%						
Control	695	77.0	208	23.0	1			1		
#Tamojunto	591	73.2	216	26.8	1.20	0.89; 1.62	0.275	1.20	0.90;1.60	0.245
Gender										
Male	633	75.9	201	24.1	1			1		
Female	653	74.5	223	25.5	1.30	1.03; 1.65	0.56	1.22	0.96;1.55	0.136
Age	1286	12.4 (0.66)	424	12.5 (0.72)	1.31	1.11; 1.55	0.005	1.35	1.15;1.58	0.001
SES	1286	28.0 (7.17)	424	27.8 (7.25)	0.99	0.98; 1.02	0.851	1.00	0.99;1.02	0.882
Father lives in the same house										
No	408	70.2	173	29.8	1.35	1.03;1.76	0.020	1.37	1.08;1.76	0.003
Yes	875	77.9	248	22.1	1			1		
Mother lives in the same house										
No	112	72.7	42	27.3	1			1		
Yes	1171	75.5	379	24.5	0.88	0.61;1.27	0.480	0.96	0.68;1.35	0.802
Perception of school grades in the past year										
High	469	79.6	120	20.4	1			1		
Intermediate/low	790	72.7	297	27.3	1.41	1.09;1.83	0.028	1.36	1.06;1.76	0.037
Perpetration of physical aggression at school in the past 30 days										
No	1225	76.0	387	24.0	1			1		
Yes	33	55.0	27	45.0	1.61	0.90;2.88	0.038	1.59	0.88;2.88	0.050
Perpetration of verbal aggression at school in the past 30 days										
No	1219	76.5	374	23.5	1			1		
Yes	48	52.7	43	47.3	2.16	1.40;3.32	< 0.001	1.99	1.28;3.08	< 0.001
Perpetration of bullying at school in the past 30 days										
No	1153	77.4	336	22.6	1			1		
Yes	114	59.1	79	40.9	2.02	1.36;3.00	< 0.001	1.94	1.34;2.81	< 0.001
Consumption of alcohol by the father										
No	780	77	233	23	1			1		
Yes	458	72.4	175	27.6	1.31	1.02;1.68	0.064	1.36	1.05;1.76	0.046
Consumption of alcohol by the mother										
No	1017	76.2	317	23.8	1			1		
Yes	221	70.8	91	29.2	1.10	0.80; 1.51	0.578	1.03	0.75;1.43	0.844
Consumption of alcohol by a sibling										
No	1151	75.3	377	24.7	1			1		
Yes	87	73.7	31	26.3	0.81	0.48;1.34	0.359	0.85	0.52;1.40	0.489
Consumption of alcohol by a best friend										
No	1207	75.8	386	24.2	1			1		
Yes	31	58.5	22	41.5	1.68	0.90;3.12	0.201	2.02	1.11;3.70	0.100
Exposure to a drunk father										
No	1144	75.7	368	24.3	1			1		
Yes	92	70.2	39	29.8	1.01	0.65;1.58	0.958	0.97	0.63;1.48	0.877
Exposure to a drunk mother										
No	1221	75.8	390	24.2	1			1		
Yes	15	46.9	17	53.1	2.54	1.09;5.95	0.162	2.67	1.13;6.31	0.155
Exposure to a drunk sibling										
No	1215	75.4	396	24.6	1			1		
Yes	21	65.6	11	34.4	1.53	0.68;3.44	0.403	1.59	0.70;3.64	0.380
Exposure to a drunk best friend										
No	1223	75.4	400	24.6	1			1		
Yes	13	65.0	7	35.0	1.49	0.40;5.50	0.467	1.70	0.48;6.07	0.281

SES = Socioeconomic status.

FIML = Full-information maximum likelihood.

\*Because two logistic regressions were analyzed simultaneously, we adjusted the adopted significance level to  $0.05/2 = 0.025$ . Therefore, we claimed statistical significance for p-values below 0.025.

parents into school activities (Pedroso et al., 2015). In addition, the results reinforce the importance of alcohol use prevention programs to simultaneously address school violence and alcohol use (Botvin, Griffin, & Nichols, 2006; Cox et al., 2016). Furthermore, we found that students with a perception of poor academic performance are at higher risk for using alcohol earlier than are other students. Targeted preventative interventions should, therefore, be implemented to address this population (O'Donnell, Hawkins, Catalano, Abbott, & Day, 1995).

The main limitation of this study is the attrition rate due to follow-up losses, which compromised the data collection and may indicate a possible selection bias; however, this is an expected limitation in longitudinal studies, especially those with long follow-up periods (Ariza

et al., 2013; Newton, Teesson, Vogl, & Andrews, 2010; Shope, Dielman, Butchart, Campanelli, & Kloska, 1992). The estimator we used, robust maximum likelihood, invokes full-information maximum likelihood (FIML), which is efficient compared to the other methods (i.e., multiple imputation) of dealing with missing data under the missing-at-random (MAR) assumption (Enders & Bandalos, 2001). Another limitation was the use of a self-report questionnaire as the instrument, in which the answers may have been subject to information bias due to incorrect interpretation, intention to report the truth, or testing bias through repetition across the two follow-up time points. However, it is common practice to collect alcohol use information through self-report questionnaires (Strøm et al., 2014). To address potential bias, we used an

anonymous questioner, had the teacher be absent from the classroom during data collection, and performed the study a short time after the average first occurrence of alcohol consumption among Brazilian adolescents.

The results indicate that the initiation of alcohol use involves a combination of multiple factors (demographic, behavioral and family characteristics), pointing to the need for the development and implementation of more complex interventions that also consider the role played by social factors in the prevention of adolescent alcohol use, including early intervention for aggressive behaviors at school and advice on parental alcohol use.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.addbeh.2019.106159>.

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