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Psychiatric symptoms as predictors of latent classes of bullying victimization and perpetration among early adolescents

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Abstract
The scientific literature firmly states that bullying can affect adolescent mental health, however, it lacks longitudinal studies on potential psychological risk factors of bullying involvement, especially in less developed countries. This longitudinal study with 1,739 7th-grade students of 30 Brazilian schools aimed to analyze how psychiatric symptomatology can predict bullying patterns among adolescents. We conducted a latent class analysis to identify patterns of bullying victimization and perpetration. Multinomial logistic regressions were conducted to assess if baseline psychiatric symptoms affected bullying latent classes at nine-month follow-up. Analyses considered the complex multilevel data structure and were adjusted for sociodemographic variables. We found three bullying latent classes: minimal involvement, victims, and bully-victims. Internalizing psychiatric symptomatology predicted the probability of belonging to the "victims" class. Externalizing symptoms increased the future probability of belonging to the "bully-victims" class. These findings are independent of sociodemografic variables, such as age, socioeconomic status, and sex. Conduct problems were a risk factor for all bullying latent classes. Therefore, bullying prevention actions should target children and early adolescents with internalizing and externalizing symptoms.

Keywords Latent class analysis · Bullying · Psychiatric Symptomatology · Early adolescents

Introduction

School violence is a public health and human rights issue with devastating outcomes and broader social and economic costs (UNESCO, 2017). Among the most frequent types of violence, bullying stands out due to its prevalence and potential to cause short- and long-term damage (Moore et al., 2017). This subset of aggressive behavior differs from others for its frequent occurrence among peers due to actual or perceived power imbalances (Menesini & Salmivalli, 2017). Bullying can take several forms, such as physical (e.g., fighting, hitting, and kicking), verbal (e.g., name-calling, taunting, and threatening), and relational forms (e.g., rumors, gossip, and social exclusion). Adolescents may engage in bullying either as victims (or targets), bullies (or perpetrators), or bully-victims (Jimerson et al., 2009).

Although bullying has been widely studied worldwide, in Brazil, this is a relatively new research area. Brazilian adolescents often see bullying as a "joke," which underestimates the consequences of this type of violence. However, in recent years, severe cases of bullying involving homicide and suicide have become public, increasing the interest in the effects of bullying on adolescent mental health (Pigozi & Machado, 2015). The National Adolescent School-based Health Survey (*Pesquisa Nacional de Saúde do Escolar* – PeNSE) shows that in 2015, about 20% of adolescents bullied their peers and 8% were bullied. Bodily and facial appearance and ethnicity/skin color were the reasons for being bullied (Silva et al., 2019).

Growing evidence supports the strong influence of bullying as a risk factor for numerous mental health conditions (Hong et al., 2019; Moore et al., 2017). Victims are at

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increased risk of developing depression and anxiety (Strohacker et al., 2019), social anxiety (Wu et al., 2016), and self-harm (Wolke & Lereya, 2015) and suicidal behaviors (Peng et al., 2019). Moreover, bullies are more prone to self-harm (Wolke & Lereya, 2015) and commit crimes later in life (Fergusson et al., 2014).

Although being involved in bullying episodes can affect adolescent mental health, determining potential psychological risk factors of this involvement is essential to prevent the aforementioned behaviors and protect potential victims. Previous studies already found a consistent association between bullies and externalizing problems (such as hyperactivity and antisocial behavior) and victims and internalizing problems (mainly depressive symptomatology) (Cook et al., 2010). However, some knowledge gaps remain in the literature of the field. Firstly, most studies used a cross-sectional design, which made it impossible to understand longitudinal relations between predictors and outcome variables (Eastman et al., 2018). Secondly, most studies on bullying predictors took place in developed countries (Zych et al., 2015). Although several international studies show higher violence and bullying in less developed countries, little is known about bullying predictors in these countries (Gaete et al., 2017), especially in Latin America. Finally, most studies did not consider that victims and bullies might co-occur among adolescents (Moore et al., 2017). However, the need to assess adolescents who bully others and are bullied by their peers as a unique profile is increasing (Kljakovic & Hunt, 2016), since they have been associated with the worst mental health outcomes (Kennedy, 2018).

Thus, this study aimed to analyze how psychiatric symptomatology can predict bullying patterns among adolescents. We hypothesized that adolescents with externalizing problems (such as conduct problems and hyperactivity/inattention symptoms) would be more likely to belong to bullying perpetration classes whereas adolescents with internalizing problems (such as emotional symptoms and peer relationship problems) would be more likely to belong to bullying victimization classes.

Methods

This study analyzed psychiatric symptomatology and bullying patterns among adolescents who participated in the baseline and nine-month follow-up of the evaluation study of the Educational Program of Resistance to Drugs and Violence (*Programa Educacional de Resistência às Drogas e à Violência* – PROERD), which was part of a substance use prevention intervention for adolescents.

This evaluation study included 2,303 7th-grade students of 30 public schools in the municipality of São Paulo. Schools were randomly selected from the universe of public schools (extracted from the list of Brazilian schools of the Anísio Teixeira National Institute of Educational Studies and Research (*Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* – INEP), according to the following included criteria: (1) state schools with 5th- and 7th-grade students; and (2) schools that did not receive PROERD in the last three years. All 7th-grade students of the selected schools were invited to participate in the study. Researchers collected data by an anonymous self-report audio-guided questionnaire applied via smartphones in classrooms without the presence of teachers (Sanchez et al., 2021). These devices allow the use of audio and images, which facilitates understanding and enables students with low reading and writing proficiency—a highly prevalent problem in Brazilian public schools (OECD, 2019)—to participate.

A baseline assessment was conducted from February to March 2019, before the implementation of the program, and follow-up data were collected nine months later, from November to December 2019. The school year in Brazil lasts from February to December. Data were collected simultaneously in all schools. Of the 2,303 students that answered the baseline questionnaire, 1,739 participated in the nine-month follow-up data collection (75.5%). Absenteeism and refusals were the main reasons for dropout.

All study procedures were in accordance with the ethical standards of the institutional and/or national research committe. The study protocol was approved by the Research Ethics Committee of the Federal University of São Paulo (no. 1327/2018) and registered in the Brazilian Registry of Clinical Trials (no. 6q23nk). School principals provided an informed consent form before randomization and students after randomization.

Instrument and measures

The questionnaire used was based on the European Drug Addiction Prevention Trial Questionnaire (Faggiano et al., 2010) validated in Portuguese (Galvão et al., 2021).

Bullying variables collected after nine months underwent latent class analysis (LCA).

The Portuguese version of the Revised Olweus Bully/Victim Questionnaire (OBVQ) was used (Solberg & Olweus, 2003). OBVQ has two sets of questions with seven items each to assess bullying episodes in schools (bullying victimization and perpetration), such as "I was called mean names…"/"I called other students mean names…" and "I was punched, kicked…"/"I punched, kicked, and pushed other students…," which enables the identification of different types of bullying (verbal, physical, or relational). "I haven't bullied/been bullied…," "… only once or twice,"

"2 or 3 times a month," "about once a week," and "several times a week" are response alternatives for both global and specific questions. Students were considered victims or bullies if they answered "2 or 3 times a month" or more. The validated version used presented excellent fit indexes (CFI = 0.990; RMSEA = 0.015) and factor loading higher than 0.4 for all items, showing their relevance to the construct (Ferreira-Junior et al., 2022).

Risk factors were collected at baseline and, therefore, could be interpreted as predictors of the outcome variables.

The Strengths and Difficulties Questionnaire (SDQ) was used to collect data on psychiatric symptoms (Goodman, 1997). SDQ is a brief behavioral screening instrument with 25 items about psychological attributes (strengths and difficulties). Its self-report version is suitable for adolescents aged 11 to 16 years. Its items are divided into five subscales with five items each: emotional symptoms, conduct problems, hyperactivity/inattention symptoms, peer relationship problems, and prosocial behavior. Each item has three possible scores (0, 1, and 2) and their sum equals the subscale score. Due to our low-risk sample and the authors' recommendations, the cut-off point for students without symptoms was a SDQ total difficulties score < 20. The results of this scale were considered if at least 12 of the 20 corresponding items were responded. Both SDQ total and its subscales were classified as "without symptoms," "subclinical," and "clinical"(Goodman et al., 1998). A dichotomous classification of the SDQ scores was used, in which the "subclinical" and "clinical" groups were merged and compared with students without symptoms (La Maison et al., 2020). The validated Portuguese version of SDQ has Cronbach's alpha close to 0.80 and a correlation of 0.79 for the test-retest (Saur & Loureiro, 2012).

Data on sex and age were obtained using questions from the PeNSE, Brazilian Ministry of Health (IBGE, 2016). Moreover, students' socioeconomic status was evaluated by the scale of the Brazilian Market Research Association (*Associação Brasileira de Empresas de Pesquisa* – ABEP). The ABEP scale uses scores (1–100) or categories (A–E) and considers the schooling level of the head of the household and the goods and services used, with scores ranging from 1 to 100 or in categories from A to E. Higher scores show better economic status (ABEP, 2018).

At the beginning of the questionnaire, a code of letters and numbers was generated from students' personal information. This code allowed researchers to match individual baseline and follow-up questionnaires and provide anonymity and confidentiality to students (Galanti et al., 2007). The datasets of the two assessments were integrated by matching a secret code using the Levenshtein algorithm, which can identify similarities between a set of characteristics (Levenshtein, 1965).

Statistical analysis

Since different types of bullying might co-occur among adolescents, the items of the OBVQ bullying scale underwent LCA. LCA is an exploratory clustering technique to analyze inter-individual variability by classifying individuals with a similar profile regarding multiple variables. Moreover, this person-centered analysis would allow the identification of underlying latent subpopulations of adolescents within a sample based on patterns of responses to observed variables (Lanza & Cooper, 2016).

All 14 OBVQ items underwent LCA for the identification of groups with similar patterns of bullying involvement. In total, one to five classes were extracted by enumeration. Latent classes were no longer extracted if little additional information was provided by adding a new class. Models were adjusted based on "goodness-of-fit" criteria, considering interpretability and parsimony of classes. Thus, the appropriate number of latent classes was established based on statistical indexes and whether a solution had a substantive interpretation. The goodness-of-fit statistics included the Akaike information criterion (AIC), the Bayesian information criterion (BIC), the sample-size-adjusted Bayesian information criterion (SSABIC), the Vuong-Lo-Mendell-Rubin (VLMR) test, the Lo-Mendell-Rubin (LRT) adjusted test, and entropy. Lower AIC, BIC, and SSABIC show a better fit, and entropy below 0.70 support adequate levels of classification accuracy. The VLMR and LRT tests provide a p-value, which shows whether a model is statistically better than another. A meaningful percentage of cases (more than 5% of the sample) classified into each identified class was also considered (Nylund et al., 2007; Weller et al., 2020).

Univariate and multivariate multinomial logistic regressions were performed in Mplus 7.4 (Muthén et al., 2017), using the R3STEP option of its AUXILIARY command (Tihomir Asparouhov & Muthén, 2014), with baseline covariant variables affecting bullying latent classes in the follow-up.

The complex multilevel data structure and students' sex, age, socioeconomic status, randomly allocated group (intervention or control), and baseline outcomes (bullying victimization and perpetration) were considered in the analyses. All inferential analyses were conducted via maximum likelihood estimation (MLE) in association with the cluster options in the variable command to analyze the multilevel data structure and the non-independence of the observation (children nested in schools) (Muthén & Muthén, 2017). Later, the standard error was estimated, considering the multilevel structure, in accordance with Asparouhov and Muthén (2006).

Table 1 Baseline and follow-up distribution of seventh-grade students according to sociodemographic characteristics, bullying, and SDQ (N = 2,303)

	N	%	95% CI
Baseline			
Sex			
Male	1,187	51.54	49.5; 53.58
Female	1,116	48.46	46.42; 50.5
Average Age (Mean ± SD)	12.28 ± 0.72		
SES[a]			
A	130	5.71	4.83; 6.74
B	773	33.93	32.02; 35.9
C	1,222	53.64	51.59; 55.69
D-E	153	6.72	5.76; 7.82
Group			
Control	1,103	47.89	45.85; 49.93
Intervention	1,200	52.11	50.06; 54.14
SDQ scales			
Prosocial	374	17.24	15.7; 18.88
Peer	813	37.94	35.9; 40.01
Hyperactivity	595	27.87	26; 29.81
Conduct	730	33.87	31.91; 35.9
Emotion	713	33.16	31.2; 35.18
Bullying score (Mean ± SD)			
Victimization	2,289	0.59 ± 0.02	
Perpetration	2,286	0.17 ± 0.01	
Follow-up			
Bullying victimization			
Verbal	469	27.02	24.98; 29.16
Social exclusion	197	11.35	9.94; 12.93
Physical	71	4.09	3.25; 5.13
Rumor spreading	267	15.38	13.76; 17.16
Taking money/belongings	226	13.02	11.51; 14.69
Threatening	58	3.34	2.59; 4.3
Racial	91	5.24	4.29; 6.4
Bullying perpetration			
Verbal	212	12.21	10.75; 13.84
Social exclusion	36	2.07	1.5; 2.86
Physical	59	3.4	2.64; 4.36
Rumor spreading	24	1.38	0.93; 2.05
Taking money/belongings	28	1.61	1.12; 2.33
Threatening	19	1.09	0.7; 1.71
Racial	20	1.15	0.74; 1.78

Results

Table 1 shows that, at baseline, most students were boys (51.5%) and had a middle-low socioeconomic status (53.6%) and a mean age of 12.28 years (SD = 0.72). Moreover, peer relationship problems were the most prevalent psychiatric symptom (37.9%). After nine months, for all types of bullying, victimization forms were more prevalent than perpetration forms. Regarding bullying victimization and perpetration, verbal bullying was the most prevalent form (22.1% and 12.2%, respectively).

Table 2 shows the five latent classes analyzed based on bullying variables. The four-class model was slightly superior, according to BIC indexes. However, according to our theoretical interpretation criteria, the three-class model was the most coherent solution to understand bullying heterogeneity. Moreover, we lacked a conceptual explanation to maintain the four-class model, since it only accounts for a small proportion of students (less than 5% of the sample) (Weller et al., 2020). The VLMR and LRT tests were statistically significant for the three-class model (compared with the two-class model), however, they were not significant for a more constrained model (four-class model vs. three-class model). The three-class model had the highest entropy. Thus, the three-class model was the most parsimonious. Minimal involvement (79.0%), victims (15.9%), and bully-victims (4.6%) were the three classes. Students in the "minimal involvement" class were the least likely to engage

Table 2 Goodness-of-fit statistics for the number of bullying latent classes among students who participated in the follow-up (N = 1,736)

	Factor correction	Log likelihood	AIC	BIC	SSBIC	VLMR p-value	LRT-adjusted Test p-value	Entropy
1 class	14.154	-5.566.692	11.161.383	11.237.814	11.193.338			
2 class	12.927	-4.725.557	9.509.115	9.667.435	9.575.305	0.0000	0.0000	0.846
3 class	11.555	-4.602.016	9.292.031	9.532.242	9.392.458	0.0082	0.0086	0.876
4 class	11.147	-4.525.445	9.168.890	9.490.991	9.303.554	0.0910	0.0931	0.851
5 class	10.918	-4.484.968	9.117.935	9.521.927	9.286.836	0.3799	0.3825	0.831

Abbreviations: AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; ssaBIC = sample size adjusted BIC; VLMR =Vuong-Lo-Mendell-Rubin test, LRT = Lo-Mendell-Rubin

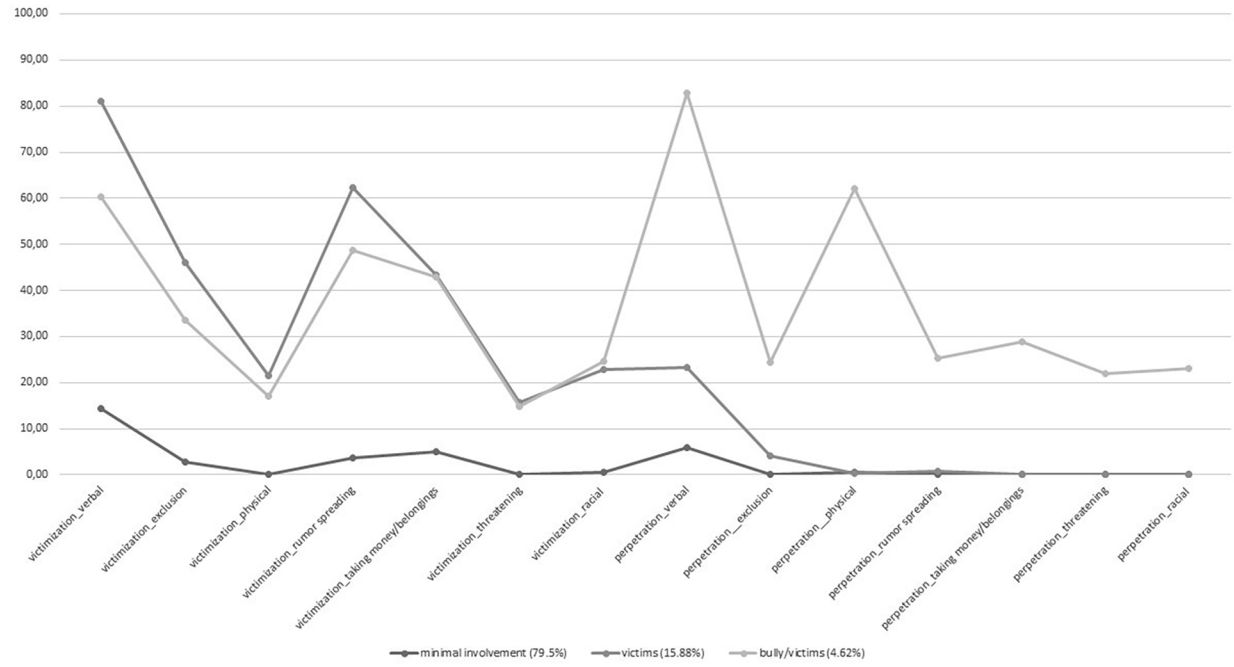

Fig. 1 Weighted probabilities for the occurrence of bullying victimization and perpetration among students who participated in the follow-up according to the four-class model (N = 1736)

in any type of bullying victimization and perpetration. Students in the "victims" class had a high probability of having been bullied but a low probability of having perpetrated it. Students in the "bully-victims" class were the most likely to engage in all types of bullying victimization and perpetration (Fig. 1).

Table 3 shows the descriptive statistics and univariate and multivariate multinominal logistic regressions with three bullying latent classes as outcomes. We used the "minimal involvement" class as reference. The "victims" class had the strongest association with peer relationship problems (aOR = 3.88, 95% CI 2.52–5.97). Moreover, students with baseline emotional symptoms and conduct problems were also more likely to fit in the "victims" class at nine-month follow-up (aOR = 2.66; 95% CI 1.55–4.58 and aOR = 1.84; 95% CI 1.16–2.91, respectively). The "bully-victims" class had the strongest association among students with baseline conduct problems (aOR = 8.16; 95% CI 3.15–21.15). Students with baseline hyperactivity/inattention symptoms were also more likely to fit in the "bully-victims" class (aOR = 2.01; 95% CI 1.02–3.98).

Discussion

Our findings enrich the literature by assessing psychiatric bullying predictors (perpetration and victimization) among adolescents via a longitudinal design and a person-centered approach. We found three latent classes of bullying involvement: minimal involvement, victims, and bully-victims.

Table 3 Distribution of bullying perpetration and victimization found via a latent class analysis at follow-up according to baseline sociodemographic characteristics, bullying, and SDQ scales in a sample of seventh-grade students (N = 1,736)

					Univariate Analysis						Multivariate Analysis					
	Minimal involvement	Victims	Bully/victims		Minimal involvement X Victims			Minimal involvement X Bully/victims			Minimal involvement X Victims			Minimal involvement X Bully/victims		
	%	%	%	p-value	cOR	95% CI	p-value	cOR	95% CI	p-value	aOR	95% CI	p-value	aOR	95% CI	p-value
SDQ scales																
Prosocial	18.53	15.33	41.33	< 0.001	0.71	0.42; 1.22	0.222	3.21	1.92; 5.37	< 0.001	0.56	0.27;1.16	0.118	1.9	0.9; 4.02	0.093
Peer	34.09	71.17	58.11	< 0.001	6.55	4.58; 9.35	< 0.001	2.96	1.66; 5.29	< 0.001	**3.88**	**2.52; 5.97**	**< 0.001**	1.96	0.88; 4.36	0.098
Hyperactivity	28.03	44.12	57.33	< 0.001	2.27	1.38; 3.76	0.001	3.75	2.22; 6.34	< 0.001	1.13	0.57; 2.24	0.733	**2.01**	**1.02; 3.98**	**0.043**
Conduct	31.41	57.3	84	< 0.001	3.31	2.43; 4.51	< 0.001	16.3	6.85; 38.76	< 0.001	**1.84**	**1.16; 2.91**	**0.009**	**8.16**	**3.15; 21.15**	**< 0.001**
Emotion	28.86	61.68	44	< 0.001	5.2	3.46; 7.82	< 0.001	1.97	1.24; 3.13	0.004	**2.66**	**1.55; 4.58**	**< 0.001**	1.1	0.55; 2.22	0.787
Sex				< 0.001												
Male	52.46	39.35	55.84		Ref			Ref			Ref			Ref		
Female	47.54	60.65	44.16		1.83	1.28; 2.64	0.001	0.85	0.51; 1.44	0.554	1.5	0.95; 2.37	0.085	0.92	0.5; 1.7	0.791
Age	12.19	12.21	12.33	0.012	1.11	0.87; 1.43	0.393	1.41	0.98; 2.03	0.063	0.95	0.69; 1.3	0.746	0.94	0.51; 1.75	0.857
SES	27.56	28.33	29.35	0.022	1.01	0.99; 1.03	0.192	1.02	1; 1.04	0.03	1.01	0.99; 1.04	0.212	1.02	0.99; 1.05	0.108
Group				0.966												
Control	48.05	47.65	49.35		Ref			Ref			Ref			Ref		
Intervention	51.95	52.35	50.65		0.93	0.68; 1.27	0.653	0.95	0.51; 1.79	0.878	0.84	0.59; 1.2	0.351	0.95	0.52; 1.75	0.872
Bullying victimization	3.65	1.51	1.3	< 0.001	2.87	2.3; 3.58	< 0.001	2.56	2; 3.26	< 0.001	**2.3**	**1.84; 2.88**	**< 0.001**	**1.93**	**1.33; 2.82**	**0.001**
Bullying perpetration	0.09	0.27	0.92	< 0.001	2.73	1.77; 4.2	< 0.001	5.25	2.71; 10.19	< 0.001	2.13	0.83; 5.45	0.116	**3.76**	**1.43; 9.89**	**0.007**

cOR: crude Odds Ratio

aOR: adjusted Odds Ratio

Internalizing psychiatric symptomatology (emotional symptoms and peer relationship problems) predicted the probability of belonging to the "victims" class. On the other hand, externalizing symptoms (hyperactivity/inattention symptoms and conduct problems) predicted the probability of belonging to the "bully-victims" class. Moreover, conduct problems were a risk factor for all bullying latent classes. These findings are independent of randomly allocated group, sociodemografic variables, and baseline bullying involvement.

Regarding the findings associated with the best latent class solution, our results are in line with a study with American 6th-grade students (Williford et al., 2011) and a Chinese study that also found the same three-class solution. However, the latter used a broader sample that included 4th- (primary school) to 12th-grade (high school) students (Hu et al., 2021). In the United States, two other studies found a four-class solution, with an additional class particularly for bullies; one of them analyzed 8th-grade students (Lovegrove et al., 2012) and the other, a sample of 5th- to 10th-grade students (Liu et al., 2021). Despite the vast existing literature on bullying, few recent studies use a person-centered approach (Kljakovic & Hunt, 2016; Walters, 2020). Thus, many studies fail to identify bully-victim profiles, grouping them as pure victims or pure bullies (Lie et al., 2019), which hinders the understanding of the complexity of bullying.

Our findings are in accordance with the current scientific knowledge, as they show that internalizing symptoms are risk factors for bullying victimization (Cook et al., 2010; Kljakovic & Hunt, 2016; Zych et al., 2021), probably because social isolation—a frequent state among adolescents with internalizing symptoms—makes them more vulnerable to bullying victimization (Lovegrove et al., 2012). Moreover, adolescents with internalizing problems are more likely to have negative self-related thoughts and lack social and emotional skills, which makes them less able to react and effectively defend themselves and, consequently, more vulnerable to aggressive peers (Cook et al., 2010; Reijntjes et al., 2010).

Our findings show the relation between externalizing symptoms (such as hyperactivity/inattention symptoms and conduct problems) and bully-victims, which is in line with the literature. Attention deficit hyperactivity disorder is a risk factor for the persistent bully-victim behavior among adolescents in Switzerland (Zych et al., 2021). According to a meta-analysis of bullying predictors in adolescence, behavioral problems are a risk factor for both bullying perpetration and victimization (Kljakovic & Hunt, 2016). However, no study analyzed the relation between externalizing symptoms and bullying patterns using a pattern-centered approach (Zych et al., 2021).

Besides predicting the "bully-victims" class, conduct problems are also a risk factor for the "victims" class. Results suggest a concurrent and longitudinal relation between aggressive behaviors, such as bullying (victimization and perpetration), and conduct problems. Even though the association between victimization and conduct problems has received less attention from the literature, a recent meta-analysis of longitudinal bullying predictors among adolescents showed that conduct problems are also a consistent risk factor for bullying victimization (Kljakovic & Hunt, 2016). This is probably due to the hierarchical nature of violent behaviors, which is shared by those involved in bullying and those with conduct problems, since adolescents who practice violent acts can become victims of violence in the face of those who are higher than them in the bullying hierarchy (Koh et al., 2017). A meta-analysis that analyzed longitudinal studies on bullying behaviors helped us understand our results, since they show that perpetration was just as likely to lead to victimization as victimization was to lead to perpetration (Walters, 2020). Moreover, victims and bullies seem to share a high level of aggressive behavior and feelings of anger toward others (Lovegrove et al., 2012), which leads to an ongoing involvement in violence from childhood to adolescence (Brendgen & Poulin, 2018).

These findings would confirm the theory that suggests that violence (such as conduct problems and bullying) is a behavior that occurs in cycles throughout life (Widom, 1989). Lack of social skills was also associated with both bullies and victims and may be interpreted as a possible explanation for this vicious circle of involvement in aggressive behaviors. Among the range of social problems, victims may be related to social isolation while bullies may be associated with social immaturity and antisocial behavior (Kljakovic & Hunt, 2016). Therefore, future interventions should aim at children involved in aggressive behaviors when developing preventive programs to reduce bullying and its consequences, focusing on increasing social interaction skills (Pandey et al., 2018). School-based prevention programs that aim at social and emotional skills are the most effective in reducing aggressive behavior among children (Healy et al., 2020). They can be selective, by screening high-risk children, or universal to reduce aggressive behaviors (UNODC, 2018), such as the Good Behavior Game (Embry, 2002).

Our study has limitations. First, as we used data from two randomized controlled trials evaluating a prevention program, analyzing other independent variables, such as family composition, ethnicity, parenting styles, psychological/psychiatric treatment, and childhood trauma and neglect, was impossible because they were not part of the theoretical model of the evaluated program and thus were not included in our instrument. They still represent an essential possibility

for future studies. However, we controlled the analysis for potential confounders, such as sex, age, socioeconomic status, randomly allocated group, and baseline outcomes. Another possible limitation of this study, which is common to many self-report studies on risk behaviors, is the tendency of participants to reply in a way that seems favorable to others. However, we tried to mitigate this possible bias by providing anonymity and confidentiality to students by a code created based on their personal information. Another limitation is the short-term follow-up, from risk factor to the outcome, which may have limited the interpretation of the findings. However, our results follow the same trend found in studies with long-term follow-up (Kljakovic & Hunt, 2016). Finally, dropouts at nine-month follow-up may have introduced selection biases in the analyses. However, this is an expected issue in longitudinal studies (Saiepour et al., 2019) and we tried to mitigate it using sophisticated analysis methods, such as LCA.

Our findings show that bullying victimization and perpetration can co-occur among adolescents. Internalizing and externalizing symptoms play an important role as risk factors for bullying latent classes. Interventions should aim at adolescents with conduct problems, since they are more vulnerable to bullying involvement (both as victims and bully-victims). Therefore, early interventions focusing on preventing risk factors, especially conduct problems, could potentially protect children from bullying involvement and its consequences.

Abbreviations

AIC	Akaike Information Criteria
BIC	Bayesian Information Criteria
ssaBIC	sample size adjusted BIC
VLMR	Vuong-Lo-Mendell-Rubin test, LRT = Lo-Mendell-Rubin.

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Data Availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests The authors have no competing interests to declare that are relevant to the content of this article.

Ethics approval All procedures performed in studies involving human participants 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. The study protocol was approved by the Research Ethics Committee of the Universidade Federal de São Paulo (No.1327/2018). This study was registered in the Brazilian Clinical Trials Register (ReBEC), under protocol no. 6q23nk.

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

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