



# Racial-Based Bullying and Substance Use: a Brazilian National Cross-Sectional Survey Among Students

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## Abstract

Racial discrimination has been associated with worse health status and risky health behavior. Understanding the relationship between racial-based bullying (RBB) — an overlap of bullying and interpersonal racial discrimination — and substance use can guide school-based actions to prevent bullying and substance use, but investigations rarely involve Brazilian students. We used data from the National Survey of School Health (PeNSE) 2015, which included 102,072 ninth-grade students from the capital and inland cities in the five regions of Brazil. Students self-reported their race/skin color according to the Brazilian official census. We explored racial and recent RBB differences in recent use of alcohol, tobacco, and other substances [marijuana, cocaine, crack, sniffed glue, *loló/lança-perfume* (ether and chloroform blend)] by comparing prevalence ratios (estimated with *quasi*-Poisson, crude, and adjusted models by demographic and socioeconomic characteristics) obtained from analyses of imputed data and complete case. We found that RBB prevalence increased according to racial categories associated with darker skin tones; racial differences in the prevalence of RBB were greater among girls than boys. Girls from all racial groups consistently had a higher prevalence of alcohol use than boys. RBB partially explained the recent use of alcohol and tobacco for the minority racial groups and was not associated with the use of other substances. School-based actions should explicitly incorporate anti-racist goals as strategies for substance use prevention, giving particular attention to gender issues in racial discrimination and alcohol use.

**Keywords** Racism · Gender · Substance use · Adolescent · School · Bullying

## Introduction

As a set of discourses and practices used by dominant groups to justify unequal access to material, symbolic, and legal resources, racism fosters prejudice (disposition) and promotes (harmful) racial discrimination. The latter necessarily involves biased action with at least one perpetrator and one target in a way that disadvantages the target racial group or favors the perpetrator's group [1].

Discrimination can be quite characteristic of the environment in which it occurs. Among students, for example, it can

happen in different ways, including bullying [2]. Though bullying and discrimination can differ (discrimination is not always intentional; bullying generally occurs between peers), they also have similarities, including forms of aggression (e.g., verbal, physical, social) and objectives (disqualification or humiliation of their targets) [2]. Not all bullying is based on prejudice, i.e., it does not always attack socially devalued identities, but when it is caused by discriminatory bias, the target adolescent could be greatly affected [2, 3]. The more devalued characteristics the students have, the more complex their condition as a target of bullying. As an example, several studies have shown that, within the school, racial minority girls receive worse treatment due to gender and race prejudices, whether from peers, teachers, or other school staff [4–6].

Among adolescents, the perception of being racially discriminated, including experiencing racial/ethnic-based bullying [7], has already been linked to worse health conditions, including engagement in health-risk behaviors, such as alcohol and tobacco use [7–10]. At early ages, the use

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of psychoactive substances can lead to clinically significant psychopathology [11], alterations in neurodevelopment [12], and drug use disorder in adulthood [13, 14]. The harmful effects of discrimination on substance use are aggravated in adolescents who use substances as a coping mechanism [15]. According to the literature, the stress of racism plays an essential role in the pathway linking discriminated racial groups to substance use and, therefore, to disorders resulting from this behavior [8, 16–19].

Other studies have analyzed the relationship of bullying and discrimination with health-related outcomes (such as substance use) among adolescents' racial groups in developed countries [8, 10, 16–22]. For example, Xu et al. [21] reviewed 135 studies on this theme, the majority ones from the USA, and found evidence that universal programs have reduced students' involvement in bullying, both as bullies and targets. However, this decrease was inconsistent within racial groups. Therefore, to support effective programs and public policies that address bullying, it is essential to investigate how it affects students from discriminated racial groups.

Nevertheless, our search found few epidemiological studies addressing the relationship between racial-based bullying (RBB) (or racial discrimination) and substance use among adolescents from low- and middle-income countries. In Brazil, for example, several studies have addressed general bullying and (or) substance use [23–29] without incorporating a measure of race [25, 27, 29]; or, when they did it, the racial groups were not the primary interest. Only two studies have addressed adolescents' interpersonal racial discrimination but were limited to specific Brazilian regions [30, 31]. Furthermore, they did not explore the relationship between racial discrimination and substance use.

To address this gap, our study aimed to explore substance use among racial groups in a representative sample of Brazilian students, investigating whether RBB explained these racial patterns and whether sex modified any of them. We hypothesized that the prevalence of RBB differs by sex; RBB is associated with greater prevalences of substance use, partially explaining those higher prevalences in racially discriminated groups.

## Materials and Methods

### Study Design and Population

The National Survey of School Health (*Pesquisa Nacional de Saúde do Escolar – PeNSE*), conducted by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística – IBGE*) in partnership with the Brazilian Ministries of Health and Education, periodically investigates Brazilian students' health. In 2015, PeNSE included 102,072 ninth-grade students from the urban, rural,

public, and private schools in the 26 Federative Units (FU) and the Federal District (FD), divided into 53 strata (26 FU capital cities, 26 FU inland cities, and the FD). The survey had a complex sampling, and other information about planning, data collecting, weighting process, and available database are accessible elsewhere [32].

The National Research Ethics Committee (*Comissão Nacional de Ética em Pesquisa – CONEP*) approved the 2015 PeNSE under protocol 1.006.467 of March 30, 2015 [32]. All students signed the Informed Consent Form (ICF) in the research.

### Racial Groups

Our racial groups are derived from the self-reported race/skin color by the students, which are categorized into five groups according to the Brazilian census administered by the IBGE: *branca*, *preta*, *parda*, *amarela*, and *indígena*. This official Brazilian racial classification is primarily based in the phenotype, with skin color being the dominant characteristic pointed out by the citizens for self-identification or racial attribution [33, 34]. *Amarela* is for Asian descent people, and *indígena* (indigenous) encompasses over 300 ethnic groups spread across the national territory [35]. Generally, the *branca* (white), *preta* (black), and *parda* (mixed-race) categories are such that *parda* occupies an intermediate position between the white and black skin tones [34], encompassing various popular denominations for mestizos [36]. This classification is complex, involved in many debates about its limits [37–42], but it has been consistent in the survey of racial inequalities [43]. Besides being used in the Brazilian census, several studies use this classification to allow comparisons.

Racial inequalities deeply mark the country. Indigenous, blacks, and mixed-race (*pardos*) are racial groups that had the worst socioeconomic conditions [44–46]. They are the principal victims of violence: blacks and mixed-race (*pardos*) in urban areas; indigenous in rural zone — a substantial part of these deaths is related to disputes over the drug market and in the entry route of drugs into the country [47]. Evidence also suggests that blacks are over-represented in substance dependence treatment centers [48].

### Racial-Based Bullying (RBB)

Our primary exposure, recent RBB, was obtained from two questions in PeNSE. The first was “In the last 30 days, how often have any of your schoolmates mocked, harassed, intimidated, or made fun of you so much that you felt hurt, annoyed, offended, or humiliated?” (never, rarely, sometimes, most of the time, and always). The second was “In the last 30 days, what was the reason/cause for your colleagues to have mocked, teased, intimidated, or humiliated

you?” (race/skin color, religion, facial appearance, body appearance, sexual orientation, region of origin).

Our RBB variable was dummy-coded from the second question, grouping all respondents who reported race/skin color-motivated bullying in the “yes” category. The “no” category included those who did not suffer any harassment and those harassed for different reasons. We do not think RBB is ever more important than other causes of bullying in general. However, (a) as bullying based on discriminatory bias is associated with greater odds of negative health-related outcomes to the target student than other types of bullying [3], (b) the race/skin color is an important marker of the country inequalities, and (c) our analysis focuses on racial differences in risky health behavior, then we hypothesize RBB is associated with greater prevalences of substances use for students belonging to historically discriminated racial groups.

### Substance Use

Our three outcomes of interest were (a) *alcohol use*, if the student consumed any alcoholic beverages on at least one occasion in the last 30 days before the survey (no or yes); (b) *tobacco use*, if the student smoked cigarettes or used other tobacco products in at least one occasion in the last 30 days before the research (no or yes); and (c) *other substance use*, if the student used marijuana, cocaine, crack, sniffed glue, *loló/lança-perfume* (ether and chloroform blend), ecstasy, or oxi on at least one occasion in the last 30 days before the study (no or yes).

### Covariates

We considered other demographic-socioeconomic characteristics that could have affected the relationship studied, including (a) *sex* (male or female); (b) *age* (< 13 years old, 14 years old, or  $\geq 15$  years old); (c) *region* (Southeast, Northeast, South, North, or Midwest); (d) *mother’s schooling level* (did not study/elementary school, complete high school, or university education); and (e) *access to goods and services* (AGS). For AGS, based on the complete cases, we assigned a value for each good or service owned by the student (cell phone, landline, computer, Internet, car, motorcycle, number of bathrooms with shower, and domestic service) equivalent to its prevalence complement in the sample, incorporating the difficulty of access to the good or service. Thus, if 80% of the students had a particular good or service, each student who owned that good or service received a value equal to 0.20. Each AGS level was equivalent to one quintile of the sum of values attributed to the goods or services.

### Data Analysis

All analyses were conducted in the R Program version 4.1.3 in four steps.

Firstly, we estimated the unweighted and weighted of absolute frequencies and prevalences of the participants’ characteristics by the total sample, race/skin color, and RBB. Rao-Scott chi-square tests were used to assess differences in the prevalences between the racial categories and between those who reported RBB and those who did not.

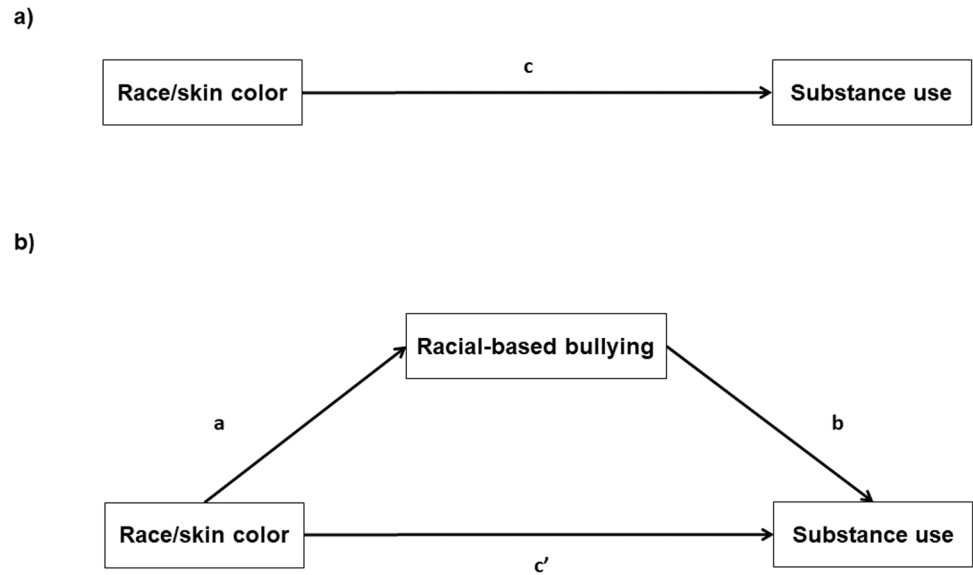
Secondly, the relationships between race/skin color and RBB were evaluated as prevalence ratios (PR) and adjusted prevalence ratios (APR) using univariable and multivariable *quasi-Poisson* regressions with log-link, respectively. The multivariable models were adjusted by age, sex, region, AGS, and mother’s schooling level (covariates). Race/skin color considered white people as the reference category, whereas RBB considered non-RBB as the reference group. The cross-product term of race/skin color with sex was added in the full multivariable model. The statistical significance of this term on RBB was assessed with a Wald test, and we observed a significance. In addition, we calculated the covariate-adjusted predicted marginal prevalences of RBB and their 95% confidence intervals (95% CI) for the groups formed by race/skin color crossed with sex.

In the third step, similarly to the second step, the relationships of race/skin color with each one of alcohol, tobacco, and other substances were assessed separately, with crude models. The multivariable models were adjusted by adding the covariates (Model A). Covariate-adjusted predicted marginal prevalence of the use of alcohol, tobacco, and other substances and its respective 95% CI were estimated for race/skin color categories crossed with sex. Next, RBB was added to covariate-adjusted multivariable models (Model B). We tested the cross-product terms of race/skin color with sex, race/skin color with RBB, and the three-way interaction term given by race/skin color, sex, and RBB. No significance was observed.

Finally, for all substances associated with RBB, a mediation analysis was conducted [49] to verify if RBB could partially explain the substance use for the racial groups. RBB models were then fitted given race/skin color and covariates; outcomes were also fitted given race/skin color, RBB, and covariates. These relations were analyzed with total effect (Fig. 1a), direct and indirect effects (Fig. 1b), and mediation proportion (percentage of the total effect explained by the RBB). We also tested whether sex modified the relationship of RBB on the use of that substances across racial groups, and no significance was observed.

In steps 1–3, functions from the *survey* R-package [50] were used to incorporate the sample complexity [32]. All analyses were performed with replicate-weights created with Canty and Davison’s bootstrap to deal with the low

**Fig. 1** Conceptual model showing the general use of substances across racial groups (a), and the relationship between racial-based bullying and the use of substances across racial groups (b) (nine-grade, Brazil, 2015 PeNSE). c, total effect;  $a*b$ , indirect effect;  $c'$ , direct effect



prevalences of students of Asian descent and indigenous students in the population not considered by PeNSE; 95% CI for the generalized linear models' estimates derived from robust standard errors determined with a generalization of the *sandwich* estimators. Also, all categorical variables with more than two levels were tested with a Wald test. The covariate-adjusted predicted marginal prevalences were estimated using the Korn and Graubard's method for generalized linear models available in the *survey* R-package [50].

The fourth step used two-level (students within schools) generalized linear mixed-effects models (link set to *probit*) available in the *mediation* package. One thousand quasi-Bayesian Monte Carlo simulations provided the 95% CI for stable estimates, i.e., without significant variation from one simulation to another.

To deal with missing data (~25% for mother's schooling level), all analyzes of steps 2 and 3 used two distinct and complementary strategies: imputed data, obtained by multiple imputations (MI) with *missing at random* (MAR) hypothesis [51], and complete case (CC). Sample-design effects and social conditions associated with racial and substance use issues were integrated as predictors in data imputation. Fifty-three dummies referring to strata (geographic locations) and school size were thus included as a proxy for clusters. Other predictors were race/skin color, the substances used, causes for bullying, age, sex, AGS, and mother's schooling level. We also considered as predictor a proxy for neighborhood characteristics (around the school/home) based on whether the student *skipped school* (no or yes) in the last 30 days before the survey for feeling unsafe on the way to school. The places where students live and study are related to drug use [52] and race/skin color [44], and this variable proved to be a crucial predictor in the data imputation.

The imputation model was adjusted to solve collinearity issues. Altogether, 100 datasets were imputed in 15 interactions with satisfactory convergence. We calculated all imputed estimates and rate of missing information according to specific rules for this type of analysis [53], using functions implemented in the *mice*, *miceadds*, *survey*, and *mitools* R-packages. As a sensitivity analysis for the MAR hypothesis in data imputing, MI estimates were compared with those from CC. The MI and CC results were consistent, and we based our interpretation on the MI results due to better precision. Both results are presented, MI in the main text and CC in the Supplementary Information.

A significance level of 0.05 was adopted, and  $seed = 12,345$  was used for the quasi-Bayesian Monte Carlo simulations and imputation procedures to ensure reproducibility.

## Results

### Participants' Characteristics

Table 1 shows weighted prevalences and chi-square test results. Participants were mainly girls (51.3%), 14 years old (51.0%), mixed-race (*pardos*: 43.1%), and white (36.1%) students, followed by black (13.4%), of Asian descent (4.1%), and indigenous (3.3%) students. The overall RBB prevalence was 2.6% (~68,000 students), but compared to white students, black and indigenous students were overrepresented in these bullying complaints (8.5% and 4.6%, respectively, vs. white students = 1.1%,  $p < 0.001$ ).

Concerning the use of substances, the overall prevalences of alcohol, tobacco, and other substances were 23.8%, 9.0%, and 4.7%, respectively; black students had higher prevalence of use of substances than other racial groups. Most students older than expected for their grade were black, indigenous,

**Table 1** Participants' characteristics by total sample, race/skin color, and racial-based bullying (ninth grade, Brazil, 2015 PeNSE, *n* = 102,072)

Variable	Overall											
	<i>n</i>	%	<i>N</i>	% <sub>wt</sub>	Black	Indigenous	Mixed-race	Of Asian descent	White	RBB <sup>a</sup> No	Yes	
				% <sub>wt</sub>	% <sub>wt</sub>	% <sub>wt</sub>	% <sub>wt</sub>	% <sub>wt</sub>	% <sub>wt</sub>	% <sub>wt</sub>	% <sub>wt</sub>	
Total	102,072	100.0	2,630,835	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
<b>Race/skin color</b>												
White	33,775	33.1	949,723	36.1	-	-	-	-	100.0	37.9 ***	15.2 ***	
Of Asian descent	4,580	4.5	108,092	4.1	-	-	-	100.0	-	4.2 ***	3.2 ***	
Mixed-race	46,935	46.0	1,131,256	43.1	-	-	100.0	-	-	43.2 ***	32.1 ***	
Indigenous	3,825	3.8	86,615	3.3	-	100.0	-	-	-	3.4 ***	5.8 ***	
Black	12,849	12.6	351,793	13.4	100.0	-	-	-	-	11.3 ***	43.7 ***	
RBB <sup>a</sup>	2,333	2.3	67,755	2.6	8.5 ***	4.6 ***	1.9 ***	2.0 ***	1.1 ***	-	-	
<b>Outcomes</b>												
Alcohol	22,597	22.2	624,726	23.8	25.6 *	23.7 *	23.2 *	23.7 *	23.9 *	25.3 ***	32.4 ***	
Tobacco <sup>b</sup>	8,111	8.0	236,372	9.0	10.5 *	9.7 *	8.7 *	8.2 *	8.9 *	9.7 ***	13.2 ***	
Other substances <sup>c</sup>	4,447	4.4	124,479	4.7	6.1 ***	4.8 ***	4.3 ***	4.4 ***	4.7 ***	4.6 *	6.3 *	
<b>Covariates</b>												
<b>Sex</b>												
Male	49,290	48.3	1,281,656	48.7	56.5 ***	53.3 ***	45.2 ***	42.2 ***	50.4 ***	48.6 ***	61.6 ***	
Female	52,782	51.7	1,349,178	51.3	43.5 ***	46.7 ***	54.8 ***	57.8 ***	49.6 ***	51.4 ***	38.4 ***	
<b>Age</b>												
≤ 13 years old	17,260	16.9	480,022	18.2	14.9 ***	16.1 ***	17.8 ***	19.1 ***	20.2 ***	19.9 ***	12.8 ***	
14 years old	51,611	50.6	1,342,096	51.0	45.1 ***	50.8 ***	51.0 ***	49.9 ***	53.3 ***	53.0 ***	49.3 ***	
≥ 15 years old	33,201	32.5	808,717	30.7	40.1 ***	33.0 ***	31.2 ***	31.0 ***	26.5 ***	27.2 ***	37.9 ***	
<b>Region</b>												
Southeast	17,772	17.4	1,141,441	43.4	46.3 ***	37.6 ***	39.6 ***	43.0 ***	47.3 ***	46.4 **	47.5 **	
Northeast	36,334	36.6	729,138	27.7	32.8 ***	35.3 ***	32.7 ***	31.5 ***	18.8 ***	25.5 **	26.3 **	
South	9,850	9.7	312,090	11.9	7.4 ***	8.1 ***	6.2 ***	8.2 ***	21.0 ***	12.0 **	9.4 **	
North	23,937	23.5	251,415	9.6	7.3 ***	10.1 ***	13.3 ***	8.7 ***	6.0 ***	8.7 **	8.8 **	
Midwest	14,179	13.9	196,750	7.5	6.2 ***	8.8 ***	8.2 ***	8.6 ***	6.8 ***	7.4 **	8.1 **	
<b>AGS<sup>d</sup></b>												
Q1 (Poorest)	17,433	17.2	424,510	16.2	21.7 ***	19.1 ***	19.8 ***	15.0 ***	9.8 ***	15.4 ***	20.3 ***	
Q2	22,999	22.6	596,381	22.8	26.2 ***	26.5 ***	24.8 ***	21.4 ***	18.9 ***	22.3 ***	23.0 ***	
Q3	19,930	19.6	511,362	19.5	20.5 ***	18.6 ***	20.6 ***	19.1 ***	18.1 ***	19.6 ***	22.7 ***	
Q4	20,894	20.6	617,313	23.6	19.7 ***	21.4 ***	21.0 ***	24.6 ***	28.2 ***	24.2 ***	19.0 ***	
Q5 (Wealthiest)	20,342	20.0	468,244	17.9	12.0 ***	14.4 ***	13.8 ***	19.8 ***	25.0 ***	18.5 ***	15.0 ***	
<b>Mother's schooling level</b>												
Did not study/elementary school	36,047	47.0	978,432	51.0	57.4 ***	56.9 ***	55.7 ***	48.5 ***	43.3 ***	50.4 ***	61.8 ***	

Table 1 (continued)

Variable	Overall		N	% <sub>wt</sub>	Black % <sub>wt</sub>	Indigenous % <sub>wt</sub>	Mixed-race % <sub>wt</sub>	Of Asian descent % <sub>wt</sub>	White % <sub>wt</sub>	RBB <sup>a</sup>	
	n	%								No	% <sub>wt</sub>
Complete high school	23,359	30.5	592,154	30.9	30.3 ***	27.4 ***	30.1 ***	31.6 ***	32.2 ***	31.1 ***	24.6 ***
University education	17,232	22.5	347,929	18.1	12.3 ***	15.7 ***	14.3 ***	19.9 ***	24.6 ***	18.5 ***	13.6 ***
Crucial predictor for the multiple imputation											
Skipped school for not feeling safe on the way <sup>e</sup>	11,269	11.1	299,158	11.5	13.9 ***	15.0 ***	11.5 ***	14.2 ***	9.9 ***	14.1 ***	23.4 ***

n: total in the sample

%: unweighted prevalence

N: population estimated

%<sub>wt</sub>: weighted prevalence

\*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$

<sup>a</sup>RBB (racial-based bullying): students reported being ridiculed, intimidated, or teased by their peers in the last 30 days before the survey because of their skin color or race

<sup>b</sup>“Tobacco” included using cigarettes and other tobacco products

<sup>c</sup>“Other substances” included marijuana, cocaine, crack, glue, *lolólançá-perfume* (ether and chloroform blend), ecstasy, and oxycodone

<sup>d</sup>AGS (access to goods and services): determined according to quintiles of the sum of the scores assigned to each good or service owned by the student (Q1 = poorest, Q5 = wealthiest)

<sup>e</sup>Proxy for the safety around home/school

or mixed-race (*pardos*). These groups also had worse access to goods and services and felt more insecure on the home-school path, and their mothers had lower schooling levels. On the other hand, most students with an advanced age for their grade, high levels of AGS, and mothers with higher education degrees were white or of Asian descent.

## Racial Groups and RBB

RBB prevalences were higher for the students of color than white students, even considering the sociodemographic and socioeconomic characteristics [students of Asian descent (APR = 1.84, 95% CI = 1.13–2.99), mixed-race students (*pardos*: APR = 1.62, 95% CI = 1.14–2.31), indigenous students (APR = 3.72, 95% CI = 2.28–6.06), and black students (APR = 5.64, 95% CI = 4.19–7.61)], i.e., increasing monotonically according to racial categories associated with darker skin tones (MI: Table 2; CC: Supplementary Information Table S1).

Covariate-adjusted predicted marginal prevalences in Fig. 2 (numerical details in Supplementary Information Table S2) show that boys reported more RBB than girls (APR = 0.41, 95% CI = 0.27–0.60). Nonetheless, black girls and white girls had a greater RBB prevalence difference (interaction: APR = 2.15, 95% CI = 1.42–3.26) than black and white boys (MI, Table 2; CC, Supplementary Information Table S1).

## Racial Groups and RBB on the Use of Substances

Prevalences of the use of substances differed significantly across race/skin color groups. Covariate-adjusted models (Model A, MI, Table 3; and CC, Supplementary Information Table S3) showed that mixed-race (*pardos*) students had a higher use of alcohol (APR = 1.07, 95% CI = 1.02–1.13) and tobacco (APR = 1.13, 95% CI = 1.02–1.26) than white students. Analogously, it was the tobacco use for indigenous students (APR = 1.23, 95% CI = 1.01–1.50). Black students had a higher prevalence of the use of alcohol (APR = 1.11, 95% CI = 1.04–1.19), tobacco (APR = 1.25, 95% CI = 1.09–1.43), and other substances (APR = 1.33, 95% CI = 1.11–1.59) than white students.

Figure 3 (numerical details in Supplementary Information Table S4) shows the covariate-adjusted predicted marginal prevalences of the use of substances and their respective 95% CI according to race/skin color and sex. Girls from all racial groups consistently had a higher prevalence of alcohol use than boys.

The entry of RBB in the covariate-adjusted models (Model B, MI, Table 3; and CC, Supplementary Information Table S3) only slightly attenuated the associations' magnitude for black students, with RBB remaining associated with a higher prevalence of the use of alcohol (APR = 1.30, 95% CI = 1.16–1.46) and tobacco (APR = 1.34, 95% CI = 1.10–1.65), but not with the use of other substances (APR = 1.18, 95% CI = 0.92–1.51) (MI, Table 3; CC, Supplementary Information Table S3).

**Table 2** Associations between race/skin color and racial-based bullying (ninth grade, Brazil, 2015 PeNSE)

Variable	Crude model PR (95% CI)	Adjusted model <sup>a</sup> APR (95% CI)
Race/skin color	*** <sup>b</sup>	*** <sup>b</sup>
White	Ref	Ref
Of Asian descent	1.83 (1.28–2.61) **	1.84 (1.13–2.99) *
Mixed-race	1.78 (1.37–2.30) ***	1.62 (1.14–2.31) **
Indigenous	4.23 (2.90–6.17) ***	3.72 (2.28–6.06) ***
Black	7.82 (6.22–9.83) ***	5.64 (4.19–7.61) ***
Sex		
Male	-	Ref
Female	-	0.41 (0.27–0.60) ***
Race/skin color: sex		* <sup>b</sup>
White: female	-	Ref
Of Asian descent: female	-	1.19 (0.58–2.47)
Mixed-race: female	-	1.42 (0.81–2.47)
Indigenous: female	-	1.40 (0.71–2.76)
Black: female	-	2.15 (1.42–3.26) ***

Data imputation according to the MAR hypothesis

All rates of missing information were 4% or less except for mother’s schooling level, which was 29%

PR: crude prevalence ratio

APR: adjusted prevalence ratio

CI: confidence interval

\*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$

<sup>a</sup>Race/skin color regressed on racial-based bullying adjusted by sex, age, region, access to goods and services, and mother’s schooling level

<sup>b</sup>Wald test

### RBB on the Use of Alcohol and Tobacco by Racial Groups

Regarding alcohol use, even if the mixed-race (*pardos*) (+ direct effect,  $p < 0.01$ ), indigenous (+ direct effect,  $p < 0.05$ ), and black (+ direct effect,  $p < 0.001$ ) students had the same RBB level as white students, alcohol use by these groups would still be higher than that observed for white students. However, the higher levels of RBB of the mixed-race (*pardos*) (+ indirect effect,  $p < 0.001$ ), indigenous (+ indirect effect,  $p < 0.001$ ), and black (+ indirect effect,  $p < 0.001$ ) students increased their alcohol use compared to white students, so that RBB could partially explain the alcohol use for these racial groups [4% for mixed-race (*pardos*); 10% for indigenous; 12% for black] (MI, Table 4; CC, Supplementary Information Table S5).

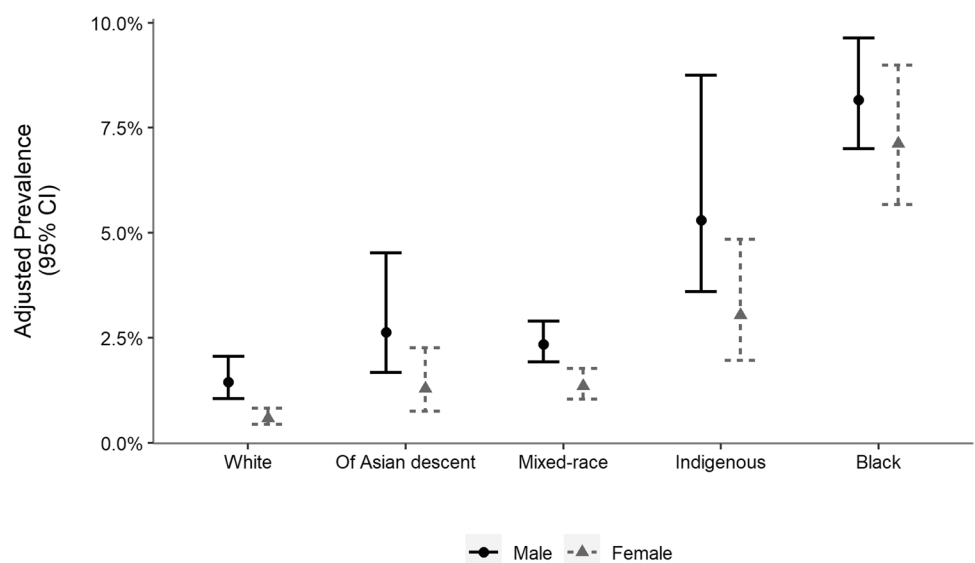
Concerning to tobacco use, the results were analogous for the Asian descent (+ direct effect,  $p < 0.05$ ; + indirect effect,  $p < 0.001$ ), mixed-race (*pardos*) (+ direct effect,  $p < 0.05$ ; + indirect effect,  $p < 0.001$ ), indigenous (+ direct effect,  $p < 0.001$ ; + indirect effect,  $p < 0.001$ ), and black (+ direct effect,  $p < 0.001$ ; + indirect effect,  $p < 0.001$ ) students. RBB could explain 3%, 4%, 4%, and 12% of the tobacco use for the Asian descent, mixed-race (*pardos*), indigenous, and black students, respectively (MI, Table 4; CC, Supplementary Information Table S5).

Due to the low proportions of indigenous and Asian descent students in the sample, the results for these groups should be viewed with caution.

### Discussion

We explored substance use patterns across racial groups in a representative sample of ninth-grade Brazilian students, investigating if racial-based bullying (RBB) — an overlap

**Fig. 2** Adjusted marginal predicted prevalences of racial-based bullying according to race/skin color and sex (ninth grade, Brazil, 2015 PeNSE). Data imputation according to the MAR hypothesis. CI: confidence interval. The models were adjusted by sex, age, region, access to goods and services, and mother’s schooling level. Numerical details in supplementary information (Table S2)



**Table 3** Associations of race/skin color and racial-based bullying with the use of substances (ninth grade, Brazil, 2015 PeNSE)

Substance/variable	Crude models PR (95% CI)	Model A <sup>a</sup> APR (95% CI)	Model B <sup>b</sup> APR (95% CI)
<b>Alcohol</b>			
Race/skin color	ns <sup>c</sup>	ns <sup>c</sup>	ns <sup>c</sup>
White	Ref	Ref	Ref
Of Asian descent	0.99 (0.88–1.11)	1.05 (0.94–1.18)	1.05 (0.94–1.18)
Mixed-race	0.97 (0.92–1.02)	1.07 (1.02–1.13) **	1.07 (1.02–1.12) *
Indigenous	0.99 (0.88–1.10)	1.07 (0.96–1.19)	1.06 (0.95–1.18)
Black	1.07 (1.00–1.15)	1.11 (1.04–1.19) **	1.09 (1.01–1.17) *
<b>RBB<sup>d</sup></b>			
No	Ref	-	Ref
Yes	1.37 (1.23–1.53) ***	-	1.30 (1.16–1.46) ***
<b>Tobacco<sup>e</sup></b>			
Race/skin color	ns <sup>c</sup>	* <sup>c</sup>	ns <sup>c</sup>
White	Ref	Ref	Ref
Of Asian descent	0.92 (0.78–1.08)	1.02 (0.87–1.19)	1.02 (0.87–1.19)
Mixed-race	0.97 (0.87–1.09)	1.13 (1.02–1.26) *	1.13 (1.01–1.26) *
Indigenous	1.08 (0.89–1.31)	1.23 (1.01–1.50) *	1.21 (0.99–1.49)
Black	1.17 (1.03–1.34) *	1.25 (1.09–1.43) **	1.22 (1.06–1.40) **
<b>RBB<sup>d</sup></b>			
No	Ref	-	Ref
Yes	1.50 (1.24–1.80) ***	-	1.34 (1.10–1.65) **
<b>Other substances<sup>f</sup></b>			
Race/skin color	** <sup>c</sup>	* <sup>c</sup>	ns <sup>c</sup>
White	Ref	Ref	Ref
Of Asian descent	0.93 (0.71–1.22)	1.03 (0.80–1.33)	1.03 (0.79–1.33)
Mixed-race	0.91 (0.80–1.04)	1.07 (0.94–1.21)	1.07 (0.94–1.21)
Indigenous	1.03 (0.81–1.30)	1.18 (0.93–1.49)	1.17 (0.92–1.48)
Black	1.29 (1.07–1.54) **	1.33 (1.11–1.59) **	1.31 (1.09–1.57) **
<b>RBB<sup>d</sup></b>			
No	Ref	-	Ref
Yes	1.38 (1.08–1.75) *	-	1.18 (0.92–1.51)

Data imputation according to the MAR hypothesis

All rates of missing information were 7% or less except for mother's schooling level, which was 23%

PR: crude prevalence ratio

APR: adjusted prevalence ratio

CI: confidence interval

\*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$

<sup>a</sup>Model A: race/skin color regressed on the substance used, adjusted by sex, age, region, access to goods and services, and mother's schooling level

<sup>b</sup>Model B: RBB added to Model A

<sup>c</sup>Wald test (*ns*: not significant)

<sup>d</sup>RBB (racial-based bullying): students reported being ridiculed, intimidated, or teased by their peers 30 days before the survey because of their skin color or race

<sup>e</sup>"Tobacco" included using cigarettes and other tobacco products

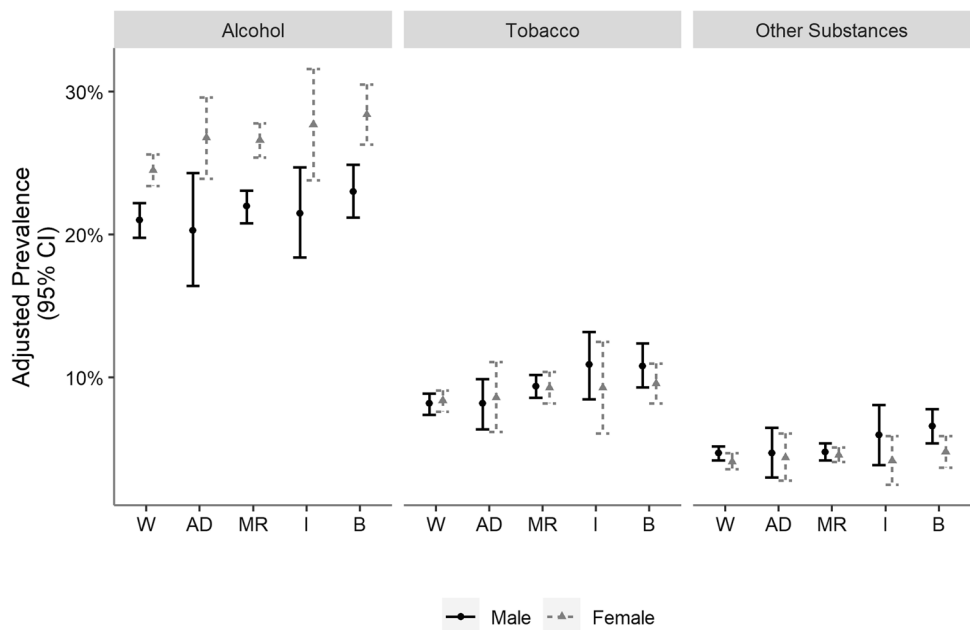
<sup>f</sup>"Other substances" included marijuana, cocaine, crack, glue, *loló/lança-perfume* (ether and chloroform blend), ecstasy, and oxi

of bullying and interpersonal racial discrimination — could explain these behaviors and whether sex modified them. As expected, students from discriminated racial groups showed

a high prevalence of recent RBB and substance use, with some differences between the sexes. Relative to whites, RBB differences were greater among girls than boys, and



**Fig. 3** Adjusted marginal predicted prevalences of the use of substances according to race/skin color and sex (ninth grade, Brazil, 2015 PeNSE). W, White; AD, of Asian descent; MR, mixed-race; I, indigenous; B, black. Data imputation according to the MAR hypothesis. CI: confidence interval. The models were adjusted by sex, age, region, access to goods and services, and mother’s schooling level. Numerical details in supplementary information (Table S4)



**Table 4** Racial-based bullying (RBB) on the use of alcohol and tobacco for racial groups (ninth grade, Brazil, 2015 PeNSE)

Substance/ race/skin color	Total effect <sup>a</sup> (95% CI)	Indirect effect <sup>b</sup> (95% CI)	Direct effect <sup>c</sup> (95% CI)	% Mediated <sup>d</sup> (95% CI)
<b>Alcohol</b>				
Race/skin color				
White	Ref	Ref	Ref	
Of Asian descent	0.0123 (-0.0018–0.0276)	0.0005 *** (0.0003–0.0010)	0.0118 (-0.0023–0.0272)	4.3 (-46.3–57.4)
Mixed-race	0.0117 ** (0.0044–0.0185)	0.0004 *** (0.0002–0.0006)	0.0113 ** (0.0040–0.0181)	3.5 ** (1.6–10.0)
Indigenous	0.0188 * (0.0027–0.0349)	0.0018 *** (0.0010–0.0028)	0.0170 * (0.0007–0.0331)	9.7 * (4.0–50.5)
Black	0.0315 *** (0.0217–0.0419)	0.0039 *** (0.0024–0.0054)	0.0278 *** (0.0180–0.0382)	12.4 *** (6.8–20.9)
<b>Tobacco<sup>e</sup></b>				
Race/skin color				
White	Ref	Ref	Ref	
Of Asian descent	0.0125 * (0.0029–0.0234)	0.0003 *** (0.0001–0.0007)	0.0123 * (0.0027–0.0233)	2.5 * (0.8–9.8)
Mixed-race	0.0063 ** (0.0016–0.0109)	0.0002 *** (0.0001–0.0004)	0.0061 * (0.0013–0.0107)	3.5 ** (1.4–15.7)
Indigenous	0.0261 *** (0.0150–0.0383)	0.0011 *** (0.0005–0.0018)	0.0252 *** (0.0138–0.0374)	4.3 *** (1.9–8.8)
Black	0.0178 *** (0.0111–0.0253)	0.0022 *** (0.0011–0.0034)	0.0159 *** (0.0093–0.0235)	12.2 *** (5.6–22.0)

Data imputation according to the MAR hypothesis

CI: confidence interval

\*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$

The models were adjusted by sex, age, region, access to goods and services, and mother’s schooling level

<sup>a</sup>Point estimate for the total effect

<sup>b</sup>Point estimate for the mediation effect of RBB on the use of alcohol and tobacco for racial groups

<sup>c</sup>Point estimate for the direct effect of RBB on the use of alcohol and tobacco for racial groups

<sup>d</sup>Size of the racial-specific mediation effects relative to the total effect

<sup>e</sup>“Tobacco” included the use of cigarettes and other tobacco products

girls from all racial groups consistently had a higher prevalence of alcohol use than boys. RBB was linked to higher prevalences of alcohol and tobacco use, partially explaining the use of these substances for non-white students. Our results suggest that anti-racist interventions that address gender issues in racial discrimination may play a role in substance use prevention strategies.

We found that students of color had a higher prevalence of RBB than white students, corroborating other studies on racial discrimination among Brazilian adolescents [30, 31]. In our study, students of Asian descent also had a higher prevalence of RBB than white students despite being closer to them regarding socioeconomic conditions. This result is particularly significant because Brazil took a long time to recognize the existence of racism [40]. The country's historical belief that discrimination is not racial but socioeconomic instead allows a non-racial discourse to justify racial inequalities [55]. However, our results counter this belief, aligning with the history of Asians in Brazil. Unlike Africans, Asians came as immigrants and not as enslaved people; however, they also suffered prejudice and discrimination [56, 57].

One caveat is that we found a much lower RBB prevalence than other studies examining racial discrimination among Brazilian adolescents [30, 31]. However, comparisons should consider the studies' different measures of race, methods, instruments, racial distribution in the population, time, and location considered. Specifically, the nature of our measurement may also have contributed to these differences. Bullying is defined as a conscious and intentional act of aggression or manipulation by one or more persons against a target person or persons, whether physical, verbal, or social (e.g., peer rejection) [2]. We, therefore, collected recent occurrences of interpersonal and intentional racial discrimination aimed at teasing, hurting, annoying, offending, or humiliating the target student. Already, the other studies [30, 31] focused on the overall perception of racial discrimination in the daily lives of the participants, based on a discrimination ever experienced by the adolescents.

We also found heterogeneity by sex in the relationship between race/skin color and RBB. As aforementioned, if the student's characteristics do not align with the esthetic and behavioral standards expected for their sex/gender or race (stereotypes), they could suffer distinct types of discrimination [6, 58]. Then, racism plus sexism can explain why black girls suffered RBB more than their white peers. The interconnection between race and sex puts these girls in a more hostile school environment [4, 5], causing these girls (blacks) not to enjoy the apparent protection for RBB of other girls have in relation to boys.

The racial patterns of the use of substances did not differ by sex, but the type of substance was. Although boys and girls had a similar prevalence of tobacco, marijuana, cocaine, crack, sniffed glue, and *loló/lança-perfume* (ether and chloroform blend), girls from all racial groups self-reported higher alcohol consumption than boys. Studies with Brazilian adolescents have found mixed results, with

some showing lower alcohol use for girls [27] and others for boys [29]. International studies show that alcohol use is rapidly increasing among women [59], especially during the COVID-19 pandemic [60]. Future studies should thus focus on addressing alcohol use by girls more thoroughly.

Racial-based bullying was associated with the use of alcohol and tobacco for non-white students, partially explaining their high prevalence of consumption. Although we did not find national studies for comparison, our results corroborate the literature, showing that perception of racial discrimination is positively associated with substance use among adolescents [10, 16–18]. For example, Gilbert et al. [10] analyzed more than two dozen articles involving teenagers and found racial discrimination connected with alcohol use.

Factors at all levels (societal, community, interpersonal, and individual) perpetuate bullying practices [2]. Then, even unintentionally, the school can reproduce and reinforce racism, sexism, homophobia, and other harmful discriminations. Racial tensions are even more aggravated in the school context because they can lead students to drop out [61]. Over time, this may reflect in other domains (e.g., labor and employment markets and criminal justice [4]), contributing to socioeconomic and health inequalities.

On the other hand, schools are an ideal educational environment for promoting prosocial relationships and bias-bullying prevention. Successful anti-racist school-based actions include promoting positive intergroup relationships among students by developing and changing prejudiced attitudes [62, 63]. As schools, directly and indirectly, convey a range of positive and negative racial messages, another example of anti-racist action comes from the intentional use of racial messages recognizing the reality of racism [64]. Among the actions and programs that the school can apply, it cannot miss the teachers and staff training to recognize and appropriately act in cases of RBB. Sometimes, these events are naturalized, and neither teachers nor school staff interferes in episodes of racial discrimination among the students [6].

Our results suggest that a hypothetical intervention in RBB can prevent until 12% of the use of alcohol and tobacco across racial groups of students, but this is not verifiable by us. However, since schools are part of different communities nested in the society, it is plausible that such interventions can positively affect public health; racial discrimination carries costs to the community and not only in substance use [65]. Furthermore, the escalation of anti-egalitarian ideals in Brazil has deepened gender, racial and socioeconomic inequalities among the population [32], considerably requiring anti-racist actions.

## Limitations

Epidemiological studies evaluating the relationship between RBB and substance use in a representative sample of Brazilian students are still rare. We addressed this gap; however, we did not do it without limitations. The cross-sectional

nature of the study design does not allow establishing precedence for RBB or drug use. However, both RBB and substance use are associated with several poor health and education outcomes in adolescents. Then, regardless of which cause the other, both should be subject to school-based intervention.

Regarding measure limitations, we also might have found lower RBB than other studies on racial discrimination among Brazilian adolescents because the 2015 PeNSE allowed participants to select only one reason for being bullied. In another study, the participant could choose several reasons for the discrimination perceived [31]. However, this lower prevalence could also mean that our RBB captured a measure of racial discrimination that has a greater impact on student well-being and therefore a more specific measure of racial discrimination than other Brazilian studies that measure this with several options for the reasons to the worst treatment perceived by the adolescent. Moreover, our results could have some bias since adolescents self-reported on issues that may be sensitive for them [67]. Also, it may have measurement errors or unmeasured confounders. However, it is worth noting that, due to how the racial inequalities in health are produced, these unmeasured confounders are also very likely to be grounded in the racism that structures society.

Finally, our findings cannot be generalized to out-of-school adolescents. Our substance use prevalences may be lower than among out-of-school adolescents. Also, the PeNSE was not designed to represent racial groups. However, we used strategies that allowed including students of Asian descent and indigenous students in the analyses without putting them in the other race/skin color categories, a practice commonly criticized in Brazilian studies [68]. Even so, we may have overlooked crucial aspects related to RBB and substance use for students of Asian descent and indigenous students. PeNSE should provide sufficient data to analyze health disparities within and across all racial groups.

## Conclusion

The apparent protection that girls had in the reports of RBB concerning boys did not apply to the black girl students. Girls within all racial groups used more alcohol than boys, and we observed no gender differences in using tobacco or other substances. RBB was positively associated with the use of alcohol and tobacco products, partially explaining the higher prevalence of these substances for discriminated racial groups. School-based actions should explicitly incorporate anti-racist objectives as substances use prevention strategies with particular attention to gender issues in racial discrimination and alcohol use.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s40615-022-01330-6>.

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**Author Contribution** Alessandra A. S. Menezes contributed to the study conception, data analysis, and the first version of the manuscript. Dandara O. Ramos, Zila M. Sanchez, and Richard Miskolci critically reviewed the text. All authors commented on previous versions of the manuscript and approved its final version.

**Data Availability** The data that support the findings of this study are available in <https://www.ibge.gov.br/estatisticas/sociais/educacao/9134-pesquisa-%20nacional-de-saude-do-escolar.html?=&t=downloads>.

## Declarations

**Ethics Approval** The National Research Ethics Committee (*Comissão Nacional de Ética em Pesquisa* – CONEP) approved the 2015 PeNSE under protocol 1.006.467 of March 30, 2015. This study was particularly exempt from ethical approval for working with public access data.

**Consent to Participate** Informed consent was obtained from all participants included in the study.

**Competing Interests** The authors declare no competing interests.

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