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Adverse childhood experiences and risk patterns of alcohol and cannabis co-use: a longitudinal study of Puerto Rican youth

Priscila Dib Gonçalves, Ph.D[1,2,3], **Cristiane S. Duarte, Ph.D, MPH**[2,3], **Thomas Corbeil, MPH**[2,3], **María A. Ramos-Olazagasti, Ph.D**[4], **Tamara Sussman, Ph.D**[2,3], **Ardesheer Talati, Ph.D**[2,3], **Margarita Alegria, Ph.D.**[5], **Glorisa Canino, Ph.D.**[6], **Hector Bird, M.D.**[2], **Silvia S. Martins, Ph.D., M.D.**[1]

[1]Department of Epidemiology, Columbia University Mailman School of Public Health, New York, NY, USA

[2]Department of Psychiatry, Columbia University Irving Medical Center, New York, NY, USA

[3]New York State Psychiatric Institute, New York, NY, USA

[4]Child Trends, Bethesda MD, USA

[5]Massachusetts General Hospital, Boston, MA, United States

[6]Behavioral Sciences Research Institute, University of Puerto Rico, San Juan, Puerto Rico, USA.

Abstract

Purpose: Adverse childhood experiences (ACEs) are common in Puerto Rican youths. Few large longitudinal studies of Latine youth examined what predicts co-use of alcohol and cannabis in late adolescence and young adulthood. We investigated the prospective association between ACEs with alcohol/cannabis co-use in Puerto Rican youth.

Methods: Participants from a longitudinal study of Puerto Rican youth (n=2,004) were included. Using multinomial logistic regressions to test associations between prospectively reported ACEs (eleven types, reported by parents and/or children, categorized as 0-1, 2-3, and 4+ ACEs) with young adult alcohol/cannabis use patterns in the past month (i.e., no lifetime use, low-risk[no binge drinking and cannabis use <10], binge-drinking only, regular cannabis use only, alcohol/cannabis co-use). Models were adjusted for sociodemographic variables.

Results: In this sample, 27.8% reported 4+ ACEs, 28.6% endorsed binge drinking, 4.9% regular cannabis use, and 5.5% alcohol/cannabis co-use. Compared to individuals with no lifetime use, those reporting 4+ (vs 0-1) ACEs had greater odds of low-risk use (aOR 1.60, 95% CI=1.04-2.45), regular cannabis use (aOR 3.13 95% CI=1.44-6.77) and alcohol/cannabis co-use (aOR 3.57, 95% CI=1.89-6.75). In relation to low-risk use, reporting 4+ ACEs (vs. 0-1) was associated with 1.96 odds (95%CI= 1.01-3.78) of regular cannabis use and 2.24 odds (95%CI=1.29-3.89) of alcohol/cannabis co-use.

Corresponding author: Silvia S. Martins, Department of Epidemiology, Columbia University Mailman School of Public Health, 722 West 168th St Room 509, New York, NY, 10032, ssm2183@cumc.columbia.edu.

Conclusions: Exposure to 4+ ACEs was associated with the occurrence of adolescent/young adulthood regular cannabis use and alcohol/cannabis co-use. Importantly, ACEs exposure differentiated young adults who were co-using compared to those engaged in low-risk use. Preventing ACE or interventions for Puerto Rican youth experiencing 4+ ACEs may mitigate negative consequences associated with alcohol/cannabis co-use.

Implications and Contribution: Our findings highlight the need to prevent ACEs and to develop interventions focused on high ACEs considering that it could potentially prevent alcohol/cannabis co-use and the negative consequences related to this high-risk pattern of substance use in Puerto-Rican youth.

Keywords

Adverse childhood experiences (ACEs); binge drinking; cannabis; polysubstance use; co-use

Introduction

Alcohol and cannabis co-use involves using both substances in a given period (e.g., the same month) and this risk pattern is increasing in youth aged 18-22 in the US [1]. This increase raises concerns as alcohol/cannabis co-use is associated with individual adverse outcomes, such as poor cognitive functioning, enhanced impulsivity, risk behaviors, and poor response to alcohol use disorder (AUD) treatment [2-4]. Familial characteristics, such as having a parent with alcohol and/or substance use disorder, as well as environmental factors have been associated with substance use outcomes [5]. Therefore, investigating childhood predictors of alcohol and cannabis co-use is crucial as improved understanding could suggest novel approaches to the prevention of risky substance use patterns such as alcohol and cannabis co-use.

Adverse childhood experiences (ACEs) may significantly contribute to alcohol and cannabis co-use in adolescence and young adulthood. Prior research indicates that reporting 4+ ACEs is associated with heavy alcohol use, problematic alcohol, and drug use [6]. However, studies reporting the associations between ACEs and alcohol and substance use outcomes (i.e., initiation, severity, and the development of alcohol/substance use disorders) tend to assess ACEs retrospectively and to have cross-sectional designs [6-9]. Also, these investigations focused on ACEs as predictors of substance use, assessed alcohol and cannabis use separately, and performed on predominately non-Latine White populations [6-9], which are likely to be less exposed to ACEs [10,11]. Specifically in Puerto Rican youth, studies have reported associations between 4+ACEs and suicide ideation attempts [12], and 4+ ACES and sleep disturbances [13], suggesting that 4+ ACEs are associated with several adverse outcomes in Puerto Rican youth as well [6,12-14].

Among the investigations that explored ACEs in Latine samples (we use the word “Latine” as a non-binary gender-inclusive term to refer to individuals of Latin American and Caribbean background), data from Project RED showed that ACEs were predictors of alcohol, cannabis, and tobacco after controlling for cultural factors in a Latine sample. In Project RED (*Reteniendo y Entendiendo Diversidad para Salud*), ACEs were measured at age 21 (retrospective reports about experiences before age 18), and substance use was

evaluated at age 24 [15]. Specifically, in Puerto Rican youth, data from the Boricua Youth Study (BYS) showed that ACEs were associated with early alcohol initiation [16], which is related to future co-use of alcohol and cannabis according to Monitoring the Future (MTF) data [17]. However, little is known about the association between ACEs and co-use of alcohol/cannabis in Puerto Rican youth.

Focusing alcohol and cannabis use patterns on Puerto Rican youth is relevant considering their high alcohol and substance use rates in this population [18-22]. In 2020, it was estimated that about 5.7 million Puerto Ricans lived on the US mainland and 3.2 million on the island [23]. Among Latine sub-groups living in the US, Puerto Rican individuals have the highest prevalence of binge drinking and psychiatric disorders, including AUD and Substance Use Disorders (SUD) [18-22]. BYS data shows that among youth (ages15-29) living on the mainland, 17% met the criteria for AUD and 18% for SUD [24]. Another study (The Hispanic Americans Baseline Alcohol Survey) reported that 7.9% of Puerto Rican men (ages 18-29) endorsed binge drinking in the past month [20]. Furthermore, data from the MTF shows that Latine students in the 8th grade had the highest levels of binge drinking (5.3%) in the prior two weeks in 2019 compared to White and African American youth [25]. Another MFT study reported an increase in past-month cannabis use among Latine students in the 12th grade from 2006-2015 [26]. Shifting to alcohol and substance use among Puerto Ricans living on the island, 23% of those aged 18-29 years old reported binge drinking in the past month [22] and 11% of adults (ages 18-64) used cannabis in the past year in Puerto Rico [27]. BYS data showed that 14% of youth met the criteria for AUD and 8% for SUD [24].

Sociodemographic characteristics associated with binge drinking and cannabis use in the overall population [25], and Puerto Rican youth are gender (male) and age (18-39 years) [22,27]. Puerto Rican present the highest levels of psychopathology among Latine subgroups [28]. Additionally, Latine individuals are at higher risk for ACEs when compared to those identifying as white in the US[11] thus, considering their exposure to early acute stress, multiple substance use such as alcohol and cannabis co-use later in life could be a coping strategy that has been reported in self-medication models [6,29,30]. In another Latine sample, the self-medication hypothesis has been supported, findings showed a higher likelihood of AUD and SUD at ages:19-26 among those who experienced traumatic events in adolescence (ages:12-17) [31].

Understanding the association between ACEs and alcohol and cannabis co-use, can inform future targeted prevention strategies for Puerto Rican youth with alcohol/cannabis co-use. Our study investigates the relationship between exposure to ACEs and alcohol/cannabis use patterns in Puerto Rican youth. Data were gathered in an ongoing longitudinal study, the Boricua Youth Study (BYS). We used data from Waves 1 to 4 (age range from 5 to 29 years during the study). Analyses included five different patterns of substance use related to separate and concurrent alcohol and cannabis use. We hypothesize that participants reporting 4+ ACEs during childhood will have increased likelihood of alcohol/cannabis use outcomes.

Methods

Data were obtained from the BYS data, Waves 1 to 4. BYS is a longitudinal study of Puerto Rican children living in the South Bronx (SBx), New York, and in the Standard Metropolitan Area of San Juan and Caguas, Puerto Rico (PR) [24,32]. The BYS design is a multistage probability sample of the target populations in both sites. Eligibility criteria at Wave 1 were: (1) presence of a child aged 5-13 years, (2) the child and at least one parent identifying as Puerto Rican, (3) absence of severe developmental delays in the child, (4) living in the household in the past nine months. Most of the caretakers were biological mothers (89%). Participants were assessed every year for three years, each wave spaced by about 12 months from the previous wave (from summer of 2000 to fall of 2004, mean age, wave 1 = 9.2 [range 5-15 years old]), with retention rates at Wave 3 being 86% in SBx and 90% in PR [31,32]. Assessments of Wave 4 were performed during the years 2013-2017, a period in which participants were 15-29 years old (mean age 22.23 years old). with a retention rate of 83.1 in SBx and 82.5% in PR [24]. All interviews were computerized and conducted in Spanish or English (with the option of switching languages). More details on study design and procedures are described elsewhere [24,32,33]. The Institutional Review Boards of the New York State Psychiatric Institute and the University of Puerto Rico Medical School approved all procedures. All participants provided informed consent.

Exposure

Our exposure variable was the number of ACEs during childhood/early adolescence (Waves 1-3). This measure was first collected as a lifetime retrospective measure at Wave 1. Afterwards, at waves 2 and 3, ACEs were collected a short period of time after their occurrence. ACEs were reported by either a parent, child, or both, during Waves 1-3 [12,13,16]. All the questions regarding ACEs were from existing scales and consistent with the original ACEs study [35,36]. We added exposure to violence as an adversity due to its socio-cultural importance in urban populations [13,16]. Briefly, lifetime ACEs were assessed in four constructs (1) parental loss (parental death and divorce/separation), (2) child maltreatment (physical, sexual, and/or emotional abuse; neglect), (3) parental maladjustment (intimate-partner violence, incarceration, substance use problems, and emotional problems), and (4) sociocultural stressors (exposure to violence). For more details on ACEs measures, see elsewhere [12,13,16]. In this study, we used a cumulative variable from Wave1 to 3. First, we created a count of types of ACEs during the lifetime of the child. If the participant had missing information during waves 2 and/or 3, data from the prior wave was used to complete the corresponding ACEs. We allowed up to 3 missing individual ACEs and excluded 20 observations due to missing data for our main analyses. For our analyses, ACEs were categorized into three levels: (i) 0-1 ACEs, (ii) 2-3 ACEs, and (iii) 4+ ACEs, consistent with prior literature, including literature with data from the BYS sample suggesting that 4+ ACEs are associated with several adverse outcomes in youth [6,12-14].

Outcomes

We determined alcohol and cannabis co-use during late adolescence and young adulthood as well as four additional patterns of use. Alcohol and cannabis use questions used in Wave 4 were adapted from the Youth Risk Behavior Survey and measured lifetime and past month

frequency of substance use [32]. For this study, we selected the following questions: (1) *During your life, on how many days have you had at least one drink of alcohol?* (2) *During your life, how many times have you used marijuana?* (3) *During the past 30 days, on how many days did you have 5 or more (males) or 4 or more (females) drinks of alcohol in a row, that is, within a couple of hours?* (4) *During the past 30 days, how many times did you use marijuana?* The primary outcome for this investigation was a 5-level categorical variable considering participants' alcohol and cannabis use patterns in the past month at Wave 4. The categories used were: (1) Never use: no lifetime alcohol and cannabis use (2) Low risk of alcohol/cannabis use: lifetime use of alcohol and/or cannabis but no past month binge drinking (5+ standard drinks for boys, and 4+standard drinks for girls) and cannabis use < 10 times in the past month.). (3) Binge drinking: 1+ episodes of binge drinking in the past month (cannabis use < 10 times). (4) Regular cannabis use: past-month cannabis use (10+ times)[37] and no binge drinking episodes in the past month. (5) Co-use of alcohol and cannabis: 1+ episodes of binge drinking in the past month and regular cannabis use (10+ times) in the past month. Four observations were excluded from the outcome data due to missing data on the variables.

Covariates

We included the following variables from wave 1: gender (male, female), public assistance (yes, no), years of mother's education (continuous variables), and recruitment site (SBx, PR). We opted to include sociodemographic variables, such as gender and family income (public assistance and mother's education), as these measures have been associated with substance use in prior research [38]. Also, we decided to include recruitment site (SBx and PR) in our analyses as different sites have been associated with different rates of alcohol and substance use and AUD/SUD [24], and there are different cultural, policy and other environmental factors in each site . In addition, we added age at wave 4 could be an important confounder as older individuals could have more time to experiment alcohol and cannabis, we included this variable in our analyses.

Statistical Analysis

We ran descriptive analyses of the sample characteristics (socio-demographic at Wave 1 and 4, past month alcohol and cannabis use at Wave 4) and ACEs at Waves 1-3. After, we ran logistic regression models to test the association between the number of ACEs (0-1, 2-3, 4+) at Waves 1-3 and alcohol and cannabis outcomes at Wave 4, adjusting for socio-demographics (Wave 1: gender, public assistance, mother's education and site, Wave 4: age). First, we ran multinomial logistic regression models using the 5-level categorical outcome variable. We report results using the 'never use' category (Table 2) as the referent, and with the 'low-risk' category as the referent (Table 3). We compared alcohol and cannabis use patterns using two different reference categories (never and low risk), as some individuals could have not been exposed to alcohol/cannabis use and co-use due to their age and examine differences among those with low levels of use among those with higher alcohol and cannabis use and co-use. To further investigate the role of each substance individually, we compared co-use of alcohol and cannabis with binge drinking only, and co-use of alcohol and cannabis with regular cannabis only (Appendix Table A1). Finally, as sensitivity analysis, we ran the same models excluding parental substance use from our

ACEs count, considering that parental substance use could influence the results due to potential genetic exposure instead of environmental exposure (Appendix tables 2A and 3A). All statistical analyses were conducted using R software, with type I error set at 5%. We reported conditional odds ratios (OR) and 95% confidence intervals for all weighted logistic regression models.

Results

Table 1 displays the descriptive results of the overall sample. The most prevalent ACE during childhood/early adolescence was divorce/separation, with 56.5% of participants endorsing this exposure, followed by parental emotional problems (35.1%) and emotional abuse (32.9%). Regarding the number of ACEs reported, 34.3% of participants endorsed experiencing 0-1ACEs, 37.9% 2-3ACEs, and 27.8% 4+ ACEs in this sample. Also, Table 1 shows alcohol and cannabis use patterns indicating that most participants reported a low-risk use of alcohol and cannabis (48.3%), followed by binge drinking (28.6%), no lifetime alcohol or cannabis (12.6%), regular cannabis use alone (4.9%), and alcohol/cannabis co-use (5.5%) (Table 1).

We used a 5-level categorical variable on participants' alcohol and cannabis use patterns in the past month during late adolescence/young adulthood to examine associations between ACEs and different patterns of substance use in the same weighted multinomial logistic regressions models (Tables 2 and 3). When using the *no lifetime use* as the reference category, the results of our models showed that reporting 4+ACEs during childhood/early adolescence (vs. 0-1 ACEs) was associated with greater odds of engaging in low-risk alcohol/cannabis use (aOR 1.60, 95% CI=1.04-2.45), regular cannabis use alone (aOR 3.13 95% CI=1.44-6.77) and alcohol/cannabis co-use (aOR 3.57, 95% CI=1.89-6.75) during late adolescence/young adulthood. However, no significant associations between ACEs and binge-drinking only category were seen.

Furthermore, the adjusted odds of alcohol and cannabis co-use among those with 4+ ACEs compared to those with 0-1 ACEs was 2.24 odds (95%CI=1.29-3.89), and the adjusted odds of regular cannabis use only was 1.96 odds (95%CI= 1.01-3.78). However, we observed no associations between ACEs and binge-drinking only (*low-risk use* as a reference category). Other characteristics associated with alcohol/cannabis use outcomes were gender (male) for all the risk outcomes (i.e., binge drinking, regular cannabis use alone, and with binge drinking) and site (SBx) for the cannabis use outcomes (regular cannabis use alone and binge drinking and regular cannabis co-use). In addition, when examining alcohol/cannabis co-use using binge drinking only as a reference, we observed an increased likelihood of alcohol/cannabis co-use among those reporting 4+ACEs during childhood/early adolescence (vs. 0-1 ACEs) (Table A1). Nonetheless, we did not observe significant results in the model compared to alcohol/cannabis co-use and regular cannabis only (reference category) (Table A1).

We ran sensitivity analyses to investigate whether our results have been driven by potential familial confounders such as parental substance use which could be associated with increased risk for offspring future substance use [5]. We ran weighted multinomial

regression models excluding parental substance use. Results from the sensitivity analysis models were similar to those obtained in our initial models, revealing the consistent association between high exposure to ACEs and regular cannabis use, and 4+ ACEs and alcohol/cannabis co-use (Tables A2 and A3).

Discussion

Our study investigated associations between ACEs and past month alcohol and cannabis use patterns in Puerto Rican youth. One of our main findings was the association between high ACEs exposure with alcohol/cannabis co-use. More specifically, experiencing 4+ACEs (vs. 0-1 ACEs) was associated with higher odds of alcohol/cannabis co-use (i.e., past month binge drinking and regular cannabis co-use) in youth than individuals reporting low-risk use, which is in line with the current literature for each of these substance used separately [6-9,39]. Our study further expands the knowledge in the literature by reporting the associations of high ACEs with alcohol/cannabis co-use. We found associations between 4+ ACEs and regular cannabis use (vs. low-risk); however, no associations between ACEs and “binge drinking only” were noted. Comparisons using low risk patterns as a reference category provide valuable information on potential risk factors related to the transition to more risky patterns among those who had initiated substance use to risk patterns of substance use such as alcohol/cannabis co-use.

Reporting 4+ACEs was associated with a higher likelihood of low-risk patterns of alcohol and/or cannabis use, regular cannabis use only and alcohol/cannabis co-use compared to never use (i.e., no lifetime alcohol and cannabis use). The association between high exposure to ACEs and low-risk alcohol/cannabis use (compared to no lifetime use) may reflect the initial vulnerability prompted by ACEs exposures [6]. This initial vulnerability, exposure to high ACEs, may contribute with other types of processes (e.g., how to cope with stress [29,30], how to establish social relationships)[40,41] creating more severe patterns of substance use such as alcohol/cannabis co-use. Furthermore, our current findings align with prior self-medication models (i.e., drinking to cope with stress). These models describe relationships between a history of early acute stress in youth and later alcohol and other substances used in order to relieve stress and anxiety [29,30].

High exposure to ACEs may influence how youth establish social relationships, prioritizing affiliation with deviant peer groups, with more oppositional behaviors [40]. Association with deviant peers may contribute to normalization of some negative and adverse experiences including ACEs, and contribute to alcohol and substance use including further development of SUD [41]. Furthermore, alcohol/cannabis co-use, especially high risk patterns as binge drinking and regular cannabis use, during youth raises concerns due to its association with higher levels of impulsivity, poor cognition, risky behaviors, limited academic achievement and the future potential development of AUD [2-4]. Further investigations may focus on examining how other environmental factors (e.g., peer group affiliation) may interact with ACEs and whether those can be protective factors and shed light on mechanisms related to risk and resilience in Puerto Rican Youth.

Although our findings examining the association of experiencing 4+ACEs (vs. 0-1 ACEs) and binge drinking only (compared to never use) were not significant, associations are in the expected direction. One possible explanation for the lack of significant associations between ACEs and binge drinking could be that past month binge drinking is common in Puerto Rican youth (ranging from 8-23% in prior studies[20,22], and 28.6% in our sample), therefore, binge drinking seems to be a prevalent pattern of alcohol consumption in this sample occurring independently of prior ACEs exposure. In addition, these findings are in line with prior research on ACEs and binge drinking, and cannabis use in another Latine sample in the US [39], adding to the literature as we combined different subgroups when examining patterns of substance use. Further studies should investigate factors that may impact the transition from low-risk alcohol and cannabis use patterns to risky alcohol/cannabis use among individuals who experience 4+ ACEs.

While it is crucial to protect future generations from ACEs, it is essential to focus on intervention efforts for those who have experienced 4+ ACEs and are currently at high risk for alcohol and cannabis co-use. Therefore, targeting the occurrence of ACEs by increasing awareness, preventing, and offering preventive interventions against ACEs could potentially impact and reduce rates of alcohol and cannabis co-use. Currently, limited interventions focus on preventing and reducing alcohol/cannabis co-use in youth[4]; despite the associations between alcohol/cannabis co-use and heavy patterns of consumption of both substances, contributing to the occurrence of risky behaviors in the short term and possible development of AUD and cannabis use disorder in the long term [2-4]. In addition, meeting the criteria for AUD and CUD is related to more psychosocial (interpersonal, financial, legal) and health-related problems than meeting criteria for only one disorder [42]. Finally, developing interventions focused on high ACEs could potentially prevent more severe outcomes such as alcohol/cannabis co-use and the negative consequences related to this high-risk pattern of substance use in Puerto-Rican youth.

Our study design allowed us to examine the association of ACEs and alcohol/cannabis use without relying on long recall periods, which is a significant strength. However, we did not evaluate the severity, persistence, and timing of ACEs and whether ACEs occurred separately or at the same period for those reporting 1+ACEs. Also, ACEs and alcohol/cannabis use data were obtained using self-report measures. However, we used a computerized interview format to collect this sensitive information, but no objective measures of alcohol and cannabis recent use were used. Our study did not assess whether cannabis use was for medical or recreational purposes, as both sites had medical cannabis laws enacted during wave 4 of the study. Additionally, we did not examine cultural and resilience factors. Finally, our sample was collected in two different sites (one in the US mainland and another in Puerto Rico), thus, only individuals at the South Bronx site (US mainland) should be considered an ethnically minoritized group. While participants from the Puerto Rico site are not members of an ethnically minoritized group in the context where they were raised, some participants in this site may have experienced discrimination and lack of access to care based on other cultural and socioeconomical factors.

Our findings further extend the existing literature and highlight the potential long-term effects of ACEs on alcohol/cannabis use patterns, especially binge drinking and regular

cannabis co-use in Puerto Rican youth. To the best of our knowledge, this is the first investigation evaluating co-use of alcohol/cannabis use in Puerto Rican youth considering multi comparison groups (vs. no lifetime alcohol/cannabis use, low use, alcohol use only, cannabis use only), as most studies examining co-use have only one comparison group (i.e., individuals with alcohol use only). Preventing ACEs or screening for ACEs in primary care, including pediatric settings, could help identify Puerto Rican youth at high-risk for substance use [43] and doing so is paramount considering the wide range of adverse health consequences [6], including polysubstance use, associated with ACEs. Finally, future studies should test whether family skills training programs[44] and alcohol/substance use interventions (e.g., brief interventions and digital interventions)[37] could be adapted for the needs of Puerto Rican Youth, aiming to reduce alcohol/cannabis use and their potential negative consequences in Puerto Rican Youth experiencing 4+ ACEs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Sociodemographic characteristics, childhood adverse experiences during childhood/early adolescence, alcohol/cannabis use patterns during adolescence / young adulthood in Puerto Rican Youth (n = 1980).

		Col. Weighted % (n)
Wave 1 (Years 2000-2001, ages 5-15 years old)		
Gender, male		50.74 (968)
Public assistance, yes		39.86 (766)
Mothers' education (in years)		
(min = 1, max = 25, median = 6)	Mean	9.05
Childhood/early adolescence		
Waves 1-3 (Years 2000-2004, ages 5-15 years)		
Type of adverse childhood experiences (ACEs) Waves 1-3		
Parental Loss		
Parental Death		5.27 (111)
Parental Divorce/separation		56.48 (1057)
Child maltreatment		
Neglect		21.59 (392)
Physical abuse		30.94 (590)
Sexual abuse		8.44 (154)
Emotional abuse		32.88 (642)
Parental maladjustment		
Intimate-partner violence		4.09 (86)
Substance use problems		19.27 (385)
Emotional problems		35.13 (715)
Incarceration		12.17 (241)
Sociocultural stressors		
Exposure to violence		29.12 (541)
Number of types of ACES Waves 1-3 (categorized)		
0-1		34.31 (687)
2-3		37.92 (762)
4		27.76 (531)
Adolescence / young adulthood		
Wave 4 (Years 2013-2017, ages 15-29 years)		
Age at the young adulthood assessment (years)		
(min = 15, max = 29, median = 22)	Mean	22.23
Alcohol and cannabis use, past month		
Alcohol/cannabis co-use (binge drinking + regular cannabis use)		5.50 (110)
Binge drinking only (cannabis use < 10 times)		28.61 (564)
Regular cannabis use (10+ times) only		4.92 (99)
Low-risk use (no binge drinking, cannabis use < 10 times)		48.34 (963)
No lifetime alcohol or cannabis use		12.63 (244)

Table 2.

Multinomial logistic regression model of ACEs and alcohol/cannabis use patterns in Puerto Rican Youth using the never use category as reference

	Low risk vs Never use	**Binge drinking vs Never use**	**Regular cannabis use vs Never use**	**Alcohol/cannabis co-use vs Never use**
ACEs, Waves 1-3				
0-1 ACEs	ref	ref	ref	ref
2-3 ACEs	1.11 (0.78-1.57)	1.28 (0.85-1.94)	1.41 (0.70-2.83)	1.68 (0.84-3.36)
4+ ACEs	**1.60 (1.04-2.45)** *c*	1.57 (0.97-2.54)	**3.13 (1.44-6.77)** *b*	**3.57 (1.89-6.75)** *a*
Gender, *Wave 1*				
Male	ref	ref	ref	ref
Female	0.97 (0.67-1.42)	0.73 (0.49-1.09)	**0.24 (0.14-0.41)** *a*	**0.32 (0.22-0.70)** *a*
Public assistance, *Wave 1*	1.16 (0.76-1.75)	1.09 (0.72-1.65)	0.83 (0.49-1.41)	0.83 (0.48-1.42)
Mother's years of education, *Wave 1*	1.01 (0.98-1.04)	1.01 (0.98-1.04)	1.00 (0.97-1.04)	1.01 (0.97-1.05)
Site, *Wave 1*				
Puerto Rico	ref	Ref	Ref	ref
South Bronx	**2.01 (1.42-2.84)** *a*	**2.28 (1.58-3.28)** *a*	**14.50 (8.38-25.09)** *a*	**12.13 (6.25-23.56)** *a*
Age, *Wave 4*	**1.14 (1.06-1.22)** *a*	**1.21 (1.13-1.30)** *a*	**1.27 (1.15-1.41)** *a*	**1.16 (1.04-1.29)** *b*

Notes: ACEs: Childhood adverse experiences. Regression models were adjusted by sociodemographic characteristics (gender, public assistance, mother's year of education and site at Wave 1 and age at Wave 4). P values lower than 0.05 were considered statistically significant, a) p value < 0.001, b) p value < 0.01, c) p value < 0.05

Table 3.

Multinomial logistic regression model of ACEs and alcohol/cannabis use patterns in Puerto Rican Youth using the low-risk use category as a reference category.

	Binge drinking vs low risk	**Regular cannabis use vs low risk**	**Alcohol/cannabis co-use vs low risk**
ACEs Waves 1-3			
0-1 ACEs	ref	ref	ref
2-3 ACEs	1.16 (0.87-1.54)	1.28 (0.68-2.38)	1.52 (0.80 - 2.89)
4+ ACEs	0.98 (0.71-1.35)	**1.96 (1.01-3.78)** *c*	**2.24 (1.29- 3.89)** *b*
Gender, *Wave 1*			
Male	ref	ref	ref
Female	**0.75 (0.59-0.95)***c*	**0.25 (0.16-0.38)** *a*	**0.39 (0.25 - 0.60)** *a*
Public assistance, *Wave 1*	0.95 (0.77-1.18)	0.73 (0.49-1.07)	0.72 (0.44 -1.17)
Mother's years of education, *Wave 1*	1.00 (0.98-1.01)	0.99 (0.96-1.02)	1.00 (0.97-1.03)
Site, *Wave 1*			
Puerto Rico	ref	ref	ref
South Bronx	1.13 (0.87-1.48)	**7.22 (4.26-12.23)** *a*	**6.04 (3.26 - 11.20)** *a*
Age, *Wave 4*	**1.07 (1.02-1.11)** *b*	**1.17 (1.08 - 1.27)** *a*	1.02 (0.95 - 1.10)

Notes: ACEs: Childhood adverse experiences. Regression models were adjusted by sociodemographic characteristics (gender, public assistance, mother's year of education and site at Wave 1 and age at Wave 4). P values lower than 0.05 were considered statistically significant, a) p value < 0.001, b) p value < 0.01, c) p value < 0.05