




## Adverse Childhood Experiences, Ethnicity, and Substance Use among College Students: Findings from a Two-State Sample

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### ABSTRACT

**Objectives:** Despite college students reporting high rates of substance use and adverse childhood experiences (ACE), few studies have examined ACE-related substance use patterns with diverse student samples. We estimated the prevalence of ACE and substance use and investigated ethnic differences in the relationship between ACE and substance use among college students from two states. **Design:** Data are responses ( $N=7,148$ ) on the National College Health Assessment (in California) and the College Student Health Survey (in Minnesota). Multivariable regression models assessed the associations between individual and accumulated ACE and alcohol, tobacco, marijuana, and illicit substance use and binge drinking (adjusting for age, gender, depression, and state) among non-Hispanic White, Hispanic, African American/Black, Asian Pacific Islanders, multiracial, and other students. Interaction terms were calculated to test for ethnic differences. **Results:** In the month preceding the survey, 22% of students used marijuana, 28% used tobacco, 75% drank alcohol; 6% used an illicit drug in the past year and 30% acknowledged past 2-week binge drinking. Although ACE were associated with all substance use behaviors (AORs ranged from 1.19 to 1.54,  $p < .001$ ), there was significant ethnic variation in ACE exposure (40–52%) and the dose-response relationship between ACE and marijuana and tobacco use and binge drinking. **Conclusions:** The variability in ACE-related substance use patterns across ethnic groups highlights the need for research that advances our understanding of sociocultural influences in trauma response and the role that campus communities could have in the development of culturally sensitive services that address this issue.

### KEYWORDS

Adverse childhood experiences; ethnicity; substance use; college students

## Introduction

College is a critical period of transition when students must meet the demands of their academic goals, adapt to their increasing autonomy from family, assume greater responsibilities, and begin planning for their future. Although the college years can be a period of exploration and transformation they are also marked by an increase in risky behaviors such as substance use that threaten students' ability to successfully obtain a degree, develop enduring social bonds, and participate in the work force (Arnett, 2000; Hingson & White, 2014; Hudson, Hiripi, Pope, & Kessler, 2007; Pascarella 2006; Schwartz, Côté, & Arnett, 2005). In comparison to non-college attending young adults, college students' alcohol, tobacco, marijuana and illicit drug use has

remained relatively high (Substance Abuse and Mental Health Services Administration (SAMHSA), 2018) despite increasing awareness of the health risks associated with substance use and ongoing campus prevention efforts (Hingson, Zha, & Weitzman, 2009; SAMHSA, 2013). In 2016, 38% of college students binge drank, 21% used tobacco products, 38% used marijuana, and 23% had used an illicit substances, trends that have led to concerns about the psychological and behavioral health of American college students (Gallagher, 2012; SAMHSA, 2018) and a call for improved services for this population (Castillo & Schwartz, 2013).

Recent research indicates there may be important ethnic differences in college student substance use patterns (Lawrence, Abel, & Hall, 2010; Paschall,

Bersamin, & Flewelling, 2005; Rogers, Forster & Unger, 2018). For example, Sutfin, McCoy, Morrell, Hoepfner, and Wolfson (2013) found that non-Hispanic White students had higher odds of tobacco use than African American or Hispanics, and Pacek et al. (2012), using a national sample, found that non-Hispanic White and Hispanic college students had the highest estimated rate of alcohol use disorders (compared to African Americans), although African-American students were more likely than non-Hispanic Whites and Hispanics to have marijuana use disorders. These studies provide useful information; however, given that research with diverse college samples is limited, much more work with samples comprised of sufficient numbers of students representing diverse ethnic backgrounds is needed to improve our understanding of substances use patterns and correlates among young adult populations.

A key factor in risk behavior etiology are adverse childhood experiences (ACE). ACE are a set of highly correlated traumatic and negative events (Anda et al., 1999; Anda et al., 2006) that include child maltreatment (e.g. physical, verbal, sexual abuse), parental divorce, parental mental illness, and parental substance use that compromise healthy attachment and self-regulation and increase young people's vulnerability to substance use, victimization, and medical illnesses (Felitti & Anda, 2010; Forster et al., 2017a, 2017b). Maladaptive coping strategies such as substance use, linked to the ACE-related deficits in emotional and cognitive processing (Gilbert, 2009; Pollak, Cicchetti, Hornung, & Reed, 2000), jeopardize academic performance and the degree to which students can leverage new academic and professional opportunities (Anda et al., 1999; Anda et al., 2006; Anda et al., 2008; Ford et al., 2011; Goodman, McEwen, Dolan, Schafer-Kalkhoff, & Adler 2005, McEwen, 2006; Shonkoff et al., 2012). Although studies have documented a relatively high prevalence of ACE among college students, with estimates indicating that as many as 70% report at least one (Read, Ouimette, White, Colder, & Farrow, 2011; Smyth, Hockemeyer, Heron, Wonderlich, & Pennebaker, 2008; Strand et al., 2017), little is known about the role of ACE in young adult health behaviors.

The health impact of childhood trauma and the prevalence of ACE across segments of the population are receiving increasing attention. Arguably, the strong association between structural disadvantage and maladaptive coping behaviors and child maltreatment (Drake & Jonson-Reid, 2014) increases risk of ACE exposure for students from historically

vulnerable groups and likely contributes to life course disparities in health outcomes. However, these relationships have not been well researched among non-clinical, young adult samples. Findings from a recent study using surveillance data collected from non-Hispanic White, Hispanic, and African American adults living in 10 US states (Behavioral Risk Factor Surveillance System, CDC) revealed that accumulated ACE increased risk for heavy alcohol use among Non-Hispanic Whites and Hispanics but not African Americans and elevated risk for depression for all groups (Lee & Chen, 2017). These differential associations between ACE and health outcomes highlight the need for further replication across populations and developmental stages to inform prevention and intervention strategies that address and account for ethnic differences.

The effects of a specific form of maltreatment (e.g., sexual abuse or physical abuse) or household dysfunction (e.g., parental substance use, parental incarceration) on a single type of substance use behavior (Kendler et al., 2000; Lansford, Dodge, Pettit, & Bates, 2010; Simpson & Miller, 2002) have been well documented. Moreover, adult retrospective self-report data have identified ACE as potent predictors of substance use (Allem, Soto, Baezconde-Garbanati, & Unger, 2015; Dube et al., 2003) with evidence overwhelmingly demonstrating a dose-response relationship (i.e. the likelihood of poorer outcomes increases as the number of ACE increases) among adolescents (Chatterjee et al., 2018; Dube et al., 2006; Forster et al., 2017a), older adults (Anda et al., 2002), and more recently among young adult community and college samples (Allem et al., 2015; Forster, Grigsby, Rogers & Benjamin, 2018; Wiehn, Hornberg, & Fischer, 2018). However, investigations of the ACE-health relationship in college populations have often been constrained by samples drawn from relatively homogenous student bodies (Brenner, McMahon, Warren, & Douglas, 1999; Smyth et al., 2008) and have emphasized emotional or psychological outcomes (Shen, Wang, & Shen, 2009; Wolitzky-Taylor et al., 2017) rather than health behaviors.

The few studies that have examined the ACE-substance use relationship among college students have yielded inconsistent results. For example, Forster and colleagues (2018) found that ethnic minority students with elevated levels of ACE had higher odds of alcohol, marijuana, and illicit substance use than non-Hispanic White students with high ACE, whereas Turner and Lloyd (2003) found that compared to non-Hispanic Whites, the probability of drug dependence associated with increasing levels of

ACE was lower among African American and Hispanic young adults. Although trauma exposure and substance use patterns may vary across age cohorts and segments of the population, further exploration of these patterns with large samples can inform efforts to help the rising number of young people in postsecondary institutions successfully meet the challenges of adulthood (United States Department of Education, 2016).

To address these gaps in the literature, the present study assessed ACE exposure among college students from diverse ethnic backgrounds in two states. First, we examined the proportion of students self-reporting ACE within each ethnic group. Second, we assessed the association between each ACE (controlling for other ACE) and past 30-day (a) alcohol, (b) tobacco, and (c) marijuana use, (d) past 2-week binge drinking, and (e) past-year illicit drug use, the five most commonly reported substance use behaviors among college students (Lipari & Jean-Francois, 2016; National Institute on Drug Abuse, 2018). Third, drawing upon prior work demonstrating a dose-response relationship between ACE and substance use, we hypothesized that every additional ACE would be associated with an increase in the odds of all five substance use behaviors. Finally, we tested whether these relationships were similar or different across ethnicity; due to the limited literature in this area, we did not develop *a priori* hypotheses.

## Materials and methods

Data are student responses ( $N=7,148$ ) on standardized college health surveillance instruments: the American College Health Association-National College Health Assessment (ACHA-NCHA II), administered to college students in California ( $n=3,332$ ) and the College Student Health Survey (CSHS), administered to college students in Minnesota ( $n=3,816$ ) in 2015. The questionnaires were web-based and focused on health and health behavior-related issues of students. Because we were interested in ACE-related health behaviors during early adulthood, we restricted the analytic sample to students between 18 and 27 years old enrolled in a participating public university. Using list-wise deletion, approximately 6% of students were removed from the sample due to missing data on ACE or substance use items. The universities' health service offices sent emails to either all students or a random sample of students (depending on each University's protocol) asking them to participate in the survey, yielding response rates that ranged from 7 to 35% by college. The University Institutional Review Boards at all participating sites approved the study protocols.

ACE. Six items drawn from the original ACE study (Felitti et al., 1998) were added to the ACHA-NCHA II (California) and the CSHS (Minnesota) surveys. All items were preceded by "Prior to the age of 18..." *Household substance use* was comprised of two questions: "...did you live with anyone who drank too much alcohol?" and "... did you live with anyone who used illegal drugs or abused prescription drugs?" If a student acknowledged living with someone who used alcohol, illicit drugs, or prescription drugs they were coded as experiencing household substance use. *Verbal abuse* was measured with one item: "... did a parent or other adult in your home regularly swear at you, insult you or put you down?" *Physical abuse* was assessed with a single question: "... did a parent or other adult in your household ever hit, beat, kick or physically hurt you in any way?" *Exposure to parental intimate partner violence* was measured with an item asking: "... did your parents or other adults in your home ever slap, hit, kick, or punch or beat each other up?" *Familial sexual abuse* was measured with the one question: "... did any older or stronger parent or member of your family ever touch you or have you touch them sexually?" Response options for each were coded no = 0 or yes = 1. A cumulative ACE composite score was calculated by summing affirmative responses.

*Past 30-days alcohol, marijuana, and tobacco use, past year illicit drug use, and past 2-week binge drinking.* Separate items asked respondents on how many days they had used alcohol, marijuana, or cigarettes in the past month. Response options ranged from "never", "1-2 days," "3-5 days," "6-9 days," "10-19 days," "20-29 days," and "daily." Survey items referring to illicit drugs (cocaine, methamphetamine, heroin, hallucinogens, or club drugs) asked respondents whether they had used any of these substances within the last year. Due to small cell size, illicit substances were combined. *Polysubstance use* was a binary measure coded 1= multiple substances (i.e. using more than one substance) vs. the use of one or none coded =0. Binge drinking was assessed with one question that asked students on how many days during the past 2 weeks they had consumed more than five drinks in one sitting. All past 2 week, 30-day or past year responses were dichotomized to did not use = 0 and used = 1.

## Ethnicity

On the ACHA-NCHA II, one item asked "How do you usually describe yourself?" with students selecting all that apply from the following categories: Non-

Hispanic White, African American/Black, Asian or Asian Pacific Islander or Hispanic, American Indian or Alaska Native, or Other. On the CSHS, one item asked “What is your racial identity? (Check all that apply)” with the following possible response options: American Indian or Alaskan Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White (includes Middle Eastern), Prefer not to answer, Something else. A separate item asked “Do you identify with any of the following ethnicities? (Check all that apply)” with response options of Hispanic or Latino, Hmong, Somali, none of the above, prefer not to answer. Due to inconsistent data regarding ethnicity across the NCHA and the CHSH, we created a categorical ethnicity variable comprised of non-Hispanic White, Hispanic, Asian or Pacific Islander (API, includes Hmong), Black/African American (includes Somali), Multiracial, and Other. The largest group, Non-Hispanic Whites, were classified as the reference group in analyses.

### Covariates

Sex was coded as female = 0 and male = 1. Age was a continuous variable ranging from 18 to 27. State was coded California = 0, Minnesota = 1. In view of the strong correlation between depressive symptoms and ACE (Schilling, Aseltine, & Gore, 2007) and depressive symptoms and substance use (Anda et al., 2002), we controlled for this potential confounder. Depression was assessed with one item asking students whether they had been diagnosed with depression in the last 12 months; a response of yes was coded = 1 and no = 0.

### Analyses

First, we calculated the proportion of students who reported past 30-day alcohol, tobacco, marijuana, and illicit drug use, polysubstance use and past 2-week binge drinking in each state and across the six ethnic categories. Second, proportional analyses compared the percentage of students self-reporting ACE across ethnic groups. Third, a set of six logistic regression models tested the associations between individual ACE (controlling for other ACE) and past 2-week binge drinking, past 30-day alcohol, tobacco, and marijuana use, past-year illicit drug use, and polysubstance use, adjusting for covariates (age, gender, ethnicity, depression, and state). To test the hypothesized dose-response relationships, substance use behaviors were regressed on the total number of ACE in logistic regression models, adjusting for all covariates. Locally

weighted scatter plot smoothing (lowess), a desirable smoothing method because it tends to follow the data (Cleveland, 1979), was used to determine whether the relationship between accumulated ACE and each substance use behavior was linear or curvilinear. Lastly, an interaction term (ACE\*ethnicity) was entered into a second set of six models to determine whether the ACE-substance use association varied across ethnic groups. Due to significant moderation by ethnicity ( $p < .05$ ), results were converted from conditional log odds to probabilities with figures graphically depicting group differences.

### Results

Overall, the sample was approximately 60% female with slightly over 50% of students identifying as non-Hispanic White, followed by Hispanic, Asian Pacific Islander, and Multiracial with African American/Black and Other the smallest groups. As seen in Table 1, 45% of students reported at least one ACE, with parental substance use and verbal abuse the most common. There was considerable co-occurrence of ACE, with almost half of the respondents who reported any ACE experiencing more than one and 8% acknowledging three or more. Tests of ACE exposure across groups indicated that non-Hispanic White and Asian/Pacific Islander students reported significantly lower ACE than their peers from other ethnic backgrounds, as shown in Table 2 (42 and 40%, respectively:  $\chi = 94.81$ ,  $p < .001$ ). Overall, 22% of students reported using marijuana, 28% had smoked tobacco, 72% had used alcohol in the past 30 days, 33% acknowledged binge drinking in the past 2 weeks, and approximately 6% had used an illicit substance in the past year (Table 1).

There were some significant state differences, with more alcohol and tobacco use among students in Minnesota (MN) compared to California (CA) whereas students in CA reported more marijuana use than students in MN. Non-Hispanic Whites had the highest estimated prevalence of substance use, with over 70% acknowledging past 30-day alcohol use, 40% binge drank in previous 2 weeks, 64% had used tobacco, 27% used marijuana, and 7% had used an illicit substance. This was followed by all other groups of whom 50 to 60% used alcohol, 22 to 27% binge drank, 15 to 30% smoked tobacco, 11 to 20% had used marijuana, and between 3 and 8% had used an illicit substance.

Models assessing the association between individual ACE (adjusting for all other ACE, demographic characteristics, and depression) and the six substance use

**Table 1.** Descriptive statistics for the total student sample and stratified by state.

	Total N = 7,148 Mean (SD) Frequency (%)	Minnesota n = 3,816 Mean (SD) Frequency (%)	California n = 3,332 Mean (SD) Frequency (%)	p-value State diffs
Age <sup>a</sup>	22.27 (4.06)	22.19 (4.16)	22.39 (4.00)	NS
Female <sup>b</sup>	4,603 (64%)	2404 (63%)	2199 (66%)	NS
<i>Race/ethnicity<sup>b</sup></i>				
Hispanic	1,361 (19%)	115 (3%)	1,246 (37%)	<.001
White (non-Hisp)	3,851 (54%)	3,052 (80%)	799 (24%)	<.001
Black (non-Hisp)	248 (3%)	115 (3%)	133 (4%)	NS
Asian/Pacific Islander (non-Hisp)	870 (12%)	382 (10%)	488 (15%)	<.05
Multiple races (non-Hisp)	613 (9%)	114 (3%)	499 (15%)	<.05
Other (non-Hisp)	205 (3%)	38 (1%)	167 (5%)	<.05
<i>Depression<sup>b</sup></i>				
Yes	567 (8%)	267 (7%)	300 (9%)	NS
<i>ACE</i>				
Any ACE	3,248 (45%)	1,699 (45%)	1,549 (46%)	NS
Parent substance use	1,646 (23%)	932 (24%)	714 (21%)	NS
Parent intimate partner violence	506 (7%)	219 (6%)	287 (9%)	NS
Childhood verbal abuse	1,539 (21%)	1,106 (29%)	433 (13%)	<.001
Childhood sexual abuse	646 (9%)	114 (3%)	532 (16%)	<.001
Childhood physical abuse	1006 (14%)	219 (6%)	787 (24%)	<.001
Accumulated ACE	.77 (1.01)	.67 (.93)	.81 (1.08)	NS
<i>Recent substance use</i>				
Any alcohol	5155 (72%)	3374 (88%)	1781 (53%)	<.001
Binge drinking	2,363 (33%)	1,582 (41%)	781 (23%)	<.001
Tobacco	1,978 (28%)	1,412 (37%)	566 (17%)	<.001
Marijuana	1,542 (22%)	628 (16%)	914 (27%)	<.001
Illicit substance	431 (6%)	230 (6%)	201 (6%)	NS
Multiple substances	3,256 (45%)	2,290 (60%)	966 (29%)	<.001

<sup>a</sup>Numbers in cells are means and corresponding standard deviations.

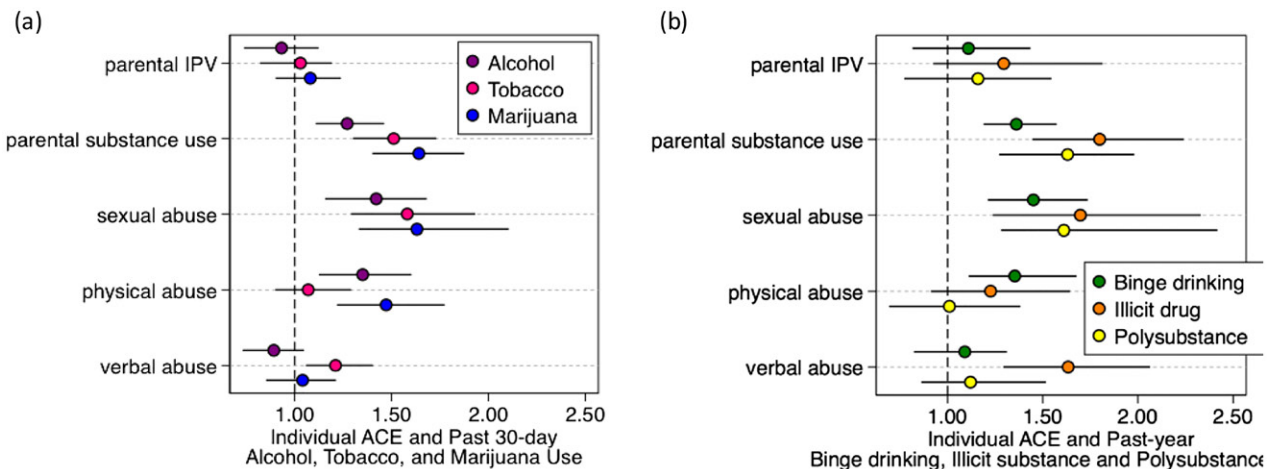
<sup>b</sup>Numbers in cells are frequencies for each characteristic for total sample and by state. Frequencies were compared using chi square tests. NS, non-significant.

**Table 2.** ACE exposure by ethnicity.

ACE	Non-Hispanic White (%)	Non-Hispanic Black (%)	Hispanic (%)	Asian Pacific Islander (%)	Multiracial (%)	Other (%)
0 ACE	<b>58.8</b>	51.7	48.1	<b>60.1</b>	50.52	50.6
1–3 ACE	<b>40.1</b>	45.4	48.9	<b>37.8</b>	46.03	46.1
≥4 ACE	<b>1.4</b>	2.9	3.0	<b>2.1</b>	3.5	3.5

Note: Percent listed may not add to 100% due to rounding.

Bolded % are groups that reported statistically significantly lower ACE exposure than other ethnic groups.



**Figure 1.** (a and b) All models were adjusted for covariates (e.g. age, gender, depression, state, and ethnicity) and other ACE. With a 95% confidence interval, depict aORs for individual ACE and substance use. IPV, intimate partner violence.

behaviors revealed a consistent pattern of statistical association between parental substance use, childhood sexual abuse and student substance use, with physical

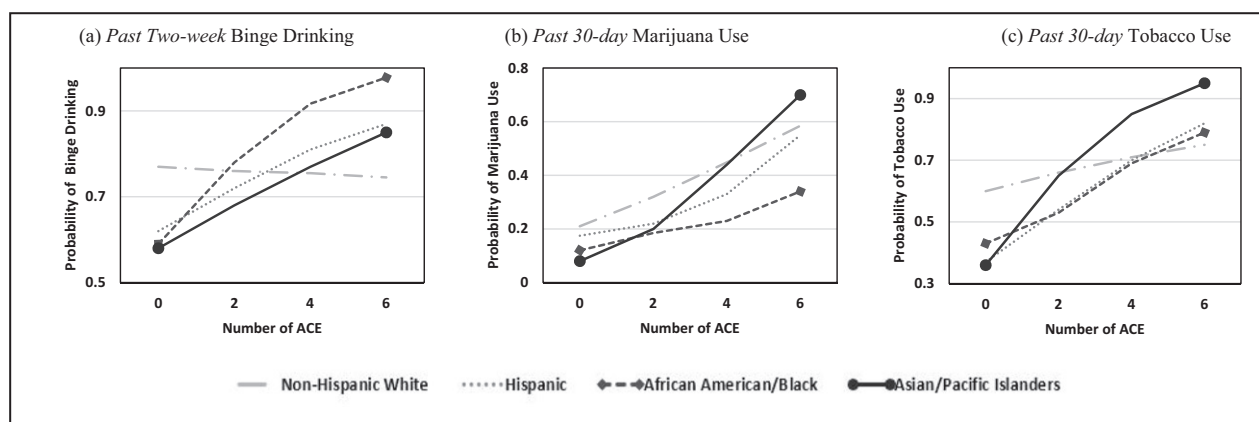
and verbal abuse associated with some, but not all (Figure 1). In multivariable, direct effects models, African American/Black (AOR range 0.32–0.63, 95%

**Table 3.** Adjusted odd ratios for accumulated ACE and substance use behaviors ( $N = 7,184$ ).

	Alcohol AOR (95% CI)	Binge drinking AOR (95% CI)	Marijuana AOR (95% CI)	Tobacco AOR (95%CI)	Illicit substance use AOR (95% CI)	Polysubstance use AOR (95% CI)
Accumulated ACE	1.19 (1.09–1.22)***	1.13 (1.08–1.19)***	1.38 (1.30–1.45)***	1.28 (1.21–1.34)***	1.54 (1.42–1.67)***	1.26 (1.20–1.32)***
African American/Black	0.56 (0.40–0.77)***	0.63 (0.44–0.91)*	0.48 (0.33–0.69)***	0.41 (0.29–0.58)***	0.32 (0.14–0.74)**	0.29 (0.25–0.33)***
Hispanic	0.53 (0.45–0.63)***	0.84 (0.71–1.00)	0.62 (0.51–0.77)***	0.48 (0.39–0.58)***	0.66 (0.47–0.92)*	0.84 (0.64–1.09)
Asian/Pacific Islander	0.43 (0.36–0.52)***	0.61 (0.50–0.74)***	0.39 (0.31–0.48)***	0.48 (0.40–0.58)***	0.46 (0.31–0.69)***	0.51 (0.44–0.59)***
Multiracial	0.81 (0.66–0.99)*	0.87 (0.70–1.07)	1.11 (0.89–1.38)	0.81 (0.65–1.01)	1.10 (0.77–1.57)	0.50 (0.41–0.59)***
Other	0.51 (0.36–0.71)***	0.75 (0.51–1.10)	0.51 (0.32–0.80)**	1.33 (0.95–1.87)	0.93 (0.50–1.75)	0.62 (0.45–0.84)**

Note: ORs were calculated for each ethnic group as compared to Non-Hispanic Whites. All models adjust for age, gender, depression, and state.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ . AOR, adjusted odds ratio; 95% CI, 95% confidence interval.



**Figure 2.** Accumulated ACE and substance use by ethnicity. (a–c) Depicts significant ethnic group differences in the probability of substance use associated with each additional ACE. All models adjust for age, gender, depression, and state.

CI range: 0.40–0.91) Hispanic (AOR range: 0.48–0.66, 95% CI range: 0.39–0.92), and Asian Pacific Islander (AOR range: 0.39–0.61, 95% CI range: 0.31–0.74) students had lower odds of all substance use behaviors than their non-Hispanic White peers, with the exception of binge drinking and polysubstance use among Hispanics. Similarly, students in the “Other” race category had lower odds of alcohol (AOR: 0.51, 95% CI: 0.36–0.71) and marijuana use (AOR: 0.51, 95% CI: 0.32–0.80) while Multiracial students had lower odds of alcohol use (AOR: 0.81, 95% CI: 0.66–0.99) than non-Hispanic Whites (Table 3).

For the combined sample, there was a significant linear trend between accumulated ACE and the odds of substance use. Every additional ACE was associated with a corresponding increase in the estimated odds of any alcohol use (AOR: 1.19, 95% CI: 1.09–1.22), binge drinking (AOR: 1.13, 95% CI: 1.08–1.19), marijuana (AOR: 1.38, 95% CI: 1.30–1.45), tobacco (AOR: 1.28, 95% CI: 1.21–1.34), illicit drug use (AOR: 1.54, 95% CI: 1.42–1.67), and polysubstance use (AOR: 1.26, 95% CI: 1.20–1.32) after adjusting for demographic variables, depression, and state (Table 3).

There were ethnic differences in the dose response relationships between ACE and binge drinking, marijuana use, and tobacco use (Figure 2a–c). Although

non-ACE-exposed African American/Black students had relatively low probability of binge drinking, as ACE increased, they had the highest probability of binge drinking relative to their peers. Among Hispanics, who had similar alcohol use patterns as non-Hispanic Whites, as ACE increased the odds of binge drinking also exceeded that of their non-Hispanic White peers. Similarly, Asian Pacific Islander students, who had the lowest overall prevalence of marijuana use and one of the lowest for tobacco use, as ACE increased however, the probability of using marijuana and tobacco exceeded that of any other group. The relationship between accumulated ACE and substance use behaviors for students of “Other” and Multiracial groups did not vary from that of non-Hispanic Whites. Associations between accumulated ACE and alcohol use, illicit drug use, and polysubstance use did not vary across ethnicity categories.

## Discussion

The present study used a two-state sample to expand the limited literature focused on ethnic differences in ACE-related patterns of alcohol, tobacco, marijuana and illicit drug use among college students. The distribution of students’ self-identified ethnic background

was similar to that of each respective state's population with a few exceptions. There was a higher percentage of Asian/Pacific Islander students in MN and a lower percentage of non-Hispanic Black students in CA and MN than in the states' general population. Our finding that between 40 and 50% of the NCHA or CSHS respondents self-reported exposure to ACE is somewhat lower than US surveillance data that estimates approximately 60% of the US adult population has experienced at least one (Centers for Disease Control and Prevention, 2018; Merrick, Ford, Ports, & Guinn, 2018). Despite this discrepancy, our data confirm that a significant proportion of the young adult college population is affected by this class of stressors (Allem et al., 2015; Dube et al., 2003; Forster et al., 2017c) and, with the exception of Asian/Pacific Islanders, when ACE were operationalized as they are in surveillance data, ethnic minority college students had elevated levels of 1–3 ACE and  $\geq 4$  ACE compared to their non-Hispanic White peers. These findings, in conjunction with the numerous studies demonstrating the enduring effects of ACE on adult functioning, point towards the potential benefits of campus-based initiatives that address childhood adversity and facilitate the adoption of effective coping strategies for the increasingly diverse college educated workforce.

Over half of the sample reported past 30-day alcohol use yet, compared to published estimates of college substance use patterns, this sample had slightly lower binge drinking (33 vs. 38%) and marijuana use (22 vs. 38%), substantially lower levels of illicit substance use (6 vs. 23%), and somewhat higher tobacco use (28 vs. 22%) (SAMHSA, 2016). Our finding that a higher percentage of non-Hispanic White students reported using substances than students from other ethnic backgrounds is consistent with prior work examining these trends among young adults (Chartier & Caetano, 2010; Mohler-Kuo, Lee & Wechsler, 2003). Not surprisingly, we also found that respondents with a history of childhood adversity disproportionately accounted for recent substance users, nearly 60% of whom were ACE exposed.

Our primary objective was to explore whether the graded relationship between accumulated ACE and substance use was similar or different among the ethnic groups assessed in the study. Although increases in ACE were associated with higher odds of using almost all substances, a central finding of this study, and one that has important implications for research and practice, was the ethnic variation in these associations. First, although non-Hispanic Whites reported

more binge drinking, as ACE increased, African American/Black students had the highest probability of binge drinking, the riskiest type of alcohol use. Similarly, Asian/Pacific Islanders who report lower family-based trauma and behavioral health issues than other groups (Stoops, 2004; DeNavas-Walt, Proctor & Smith, 2008), and are at comparatively low risk for trauma-related negative outcomes (Husey, Chang, & Kotch, 2006; Roberts, Gilman, Breslau, Breslau, & Koenen, 2011), at higher levels of ACE, they had the highest probability of marijuana and tobacco use. And lastly, among Hispanic students, who had similar alcohol use patterns as non-Hispanic Whites, higher levels of ACE were associated with higher odds of high-risk drinking than similarly exposed non-Hispanic Whites. According to recent epidemiological data, Hispanics and African Americans/Blacks tend to drink less alcohol than non-Hispanic Whites, but when they do drink, they consume more and have higher rates of binge drinking (Delker, Brown & Hasin, 2016), findings that may in part be linked to unaddressed adversities in childhood. While sociocultural factors have rarely been studied in the context of ACE and substance use, they likely play an important role in trauma-related outcomes and influence a young person's willingness to seek help for family-based stressors. For instance, family norms in Asian cultures tend to emphasize traditional hierarchical family structures (Weil & Lee, 2004), discretion, and parental authority – values that may deter young people from seeking treatment for fear that disclosing private matters may stigmatize their family (Roberts et al., 2011; Yoshioka, Dang, Shewmangal, Vhan, & Tan, 2000). Furthermore, factors such as the diminished trust in institutions and medical treatment stemming from a history of discrimination, poor quality of care, and rising health care costs, especially African Americans and Hispanics, can also discourage young people from seeking help from providers (Armstrong et al., 2007; McGuire & Miranda, 2008). Although speculative, it is likely that the joint effects of the health behaviors themselves, stigma related to treatment and intervention for ACE, low confidence in institutions and providers (Yamashiro & Matsuoka, 1997; Alim, Charney, & Mellman, 2006; Johnson, Chen, & Cohen, 2004) and structural barriers contribute to, and exacerbate, health disparities.

The complexity of ethnicity's role in trauma associated health outcomes is evident in the varying results from the limited studies examining these relationships. A study by Roberts et al.'s (2011) found that African Americans/Blacks may be more likely than non-

Hispanic Whites to develop a trauma-related psychiatric disorder as a result of trauma exposure (Roberts et al., 2011) whereas Turner and Lloyd (2003) found higher ACE exposure among minority groups than among non-Hispanic Whites but a lower likelihood of developing substance use disorders. Taken together, these results suggest the possibility that the impact of ACE in behavioral and psychological health outcomes varies across subsets of the population and a clear need for research to identify the mechanisms involved in trauma-related behavior patterns across ethnic groups. An important future step will be the use of longitudinal methods to explore how previously established promotive and protective effects (Masten & Cicchetti, 2010; Masten, 2013) and cultural assets (Filbert & Flynn, 2010; Forster et al., 2017c; Ma and Schapira, 2017; Nagasawa, Qian, & Wong, 2001; Unger, Schwartz, Huh, Soto, & Baezconde-Garbanati, 2014) can be harnessed and emphasized in programs designed to foster resilience among diverse college populations. Given the extraordinary net benefits of a college education and that a college education may actually mitigate the effects of early life adversity (Hayward & Gorman, 2004), campus communities could play a pivotal role in identifying factors that can offset the negative effects of early adversity during the transition from adolescence to adulthood. In doing so, they would become significant partners in efforts to reduce health disparities and opportunities gaps and provide a context in which to develop and test culturally informed trauma-related interventions.

### Strengths and limitations

The present study had several limitations. First, based upon response rates the findings from the study have limited generalizability although respondent demographics are similar to published data describing college student profiles in California and Minnesota. As compared to aggregated national demographic profiles of US college students, this two-state sample had a slightly lower percentage of non-Hispanic Blacks and a higher percentage of Asian/Pacific Islander students (Minnesota State Demographic Center, 2017; National Center for Education Statistics, 2015; U.S. Census Bureau, 2017). Second, although demographic profiles resembled published data it is very likely that due to reporting bias and cultural norms the highest risk students did not participate in the survey and thus we underestimated the frequency of substance use, prevalence of ACE, and the association between ACE and substance use. Third, these data are cross-sectional

and do not support causal conclusions. Fourth, we assessed childhood adversity retrospectively and could not anchor ACE to any specific time in childhood. However, since survey items explicitly referred to events that occurred during childhood whereas substance use items assessed recent behaviors reverse temporality is unlikely. Fifth, we did not measure the duration or frequency of specific adverse experiences in childhood or account for the potential contribution of other types of stressors such as community or neighborhood violence or sociocultural stressors that may contribute to ethnic differences in ACE-related health outcomes. Sixth, because survey items assessing depression are limited to measuring past year treatment for depression rather than symptoms, the role of depressive symptoms may be underestimated. However, given the strong correlation between ACE and depression and depression and substance use, we included this construct to reduce potential confounding. Seventh, due to data limitations we cannot differentiate across subgroups of Hispanic, African American, and Asian Pacific/Islander. We therefore restricted our discussion to a broad conceptualization of Hispanic, A/PI, and African American that may mask important differences that should be considered in research examining the influence of sociocultural risk and protective factors across regions and populations. Eighth, although binge drinking is defined as four drinks for females and five for males, due to how the question was worded in surveys, we were limited to a five-drink definition for all students. Lastly, due to issues of confidentiality, we could not use school identifiers to control for potential clustering, but do control for state.

Despite these limitations, a unique advantage of the present study was data representing a large, diverse cross section of students drawn from two states in different regions of the U.S. Although response rates were relatively low at some schools, the study yielded samples whose demographic profiles align with published student data of the states and included large enough samples of traditionally under-represented groups to allow for statistically valid analysis.

### Conclusion

The variability in ACE-related substance use patterns among this sample of college students underscores the need for further research to advance our understanding of how ethnicity and culture influence trauma response, what sociocultural factors promote resilience at this life stage, and the role of postsecondary



institutions in the development of effective prevention services. Evidence that the behaviors adopted during this life stage are carried forward into middle and late adulthood (Bonnie, Stroud, & Breiner, 2014; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008) and the benefits of trauma-informed care for other segments of the population (Chafouleas, Riley-Tillman, Jaffery, Miller, & Harrison, 2015; Ko et al., 2008; Listenbee & Torre, 2012; Taylor & Siegfried, 2005) make a compelling case for campus communities to consider taking advantage of this critical window of opportunity and provide resources and supports for ACE-exposed students. An important next step is for research to investigate how socioeconomic and socio-cultural factors affect trauma response, how these experiences manifest as substance use, and identify which culture-specific protective practices, beliefs, and values should be integrated in trauma-informed prevention programs.

### Declaration of interest

The authors declare that they have no conflict of interest. The authors alone are responsible for the content and writing of the article.

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