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MAJOR ARTICLE



## Investigating differences in sex, race/ethnicity, and impulsivity across substance user profiles: a person-centered approach

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### ABSTRACT

Although substance use is considered normative in college, continued examination of factors associated with problematic use is merited. This study identified latent substance user classes and examined their relations with sex, race/ethnicity, impulsivity-like facets, and substance use outcomes among 702 undergraduate students. Non-Alcohol Abstaining Users (NAA), Minimal Users (MU), and Polysubstance Users (PSU) emerged from latent class analysis. Variable-centered analyses indicated that substance user classes did not differ by sex. Students in the Asian and Other groups were at greater odds of being in the MU class than either NAA or PSU class, compared to White students. Differential patterns of impulsigenic trait levels emerged across latent classes. The present study highlights the utility of integrating person- and variable-centered approaches in studying heterogeneous substance use behaviors among college students. College PSU are particularly at risk for problematic outcomes, thus warranting preventive intervention that may target impulsigenic traits or polysubstance use.

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Impulsivity; mixture analysis; racial/ethnic differences; sex differences; substance use

### Introduction

Despite particular types of substance use during emerging adulthood (i.e. roughly ages 18–25)<sup>1,2</sup> is considered statistically normative among college students, there are notably high prevalence of risky patterns of drinking and negative consequences associated with alcohol and other substance involvement during this period.<sup>2,3</sup> Specifically, Substance Abuse and Mental Health Services Administration (SAMHSA) indicated that not only did 58.0% of college students report past-month alcohol consumption, 37.9% reported past-month binge drinking (i.e. four/five or more alcoholic drinks for females and males in two hours, respectively),<sup>3,4</sup> higher than non-college peers.<sup>5</sup> Alarming, many college students (e.g. 37.5%) also meet criteria for hazardous drinking (i.e. a pattern of alcohol use that increases the risk of harmful consequences) based on screening tools.<sup>6</sup> Relatedly, unintentional injuries and other problems (e.g. comorbid psychological disorders) are often reported to be associated with drinking among college students.<sup>7–9</sup>

Beyond alcohol consumption, cannabis use has become increasingly common among this group, with past 30-day prevalence rates over 20%.<sup>5,10</sup> Further, despite the dramatic decline of cigarette smoking over the past decade (i.e. past 30-day prevalence rate of 8% in 2017 contrasted to 20% in 2007),<sup>5</sup> concurrent cigarette and other substance use (e.g. alcohol) have been well-documented and continues to be a public health concern.<sup>11–14</sup> In contrast, electronic cigarettes (e-cigarettes) have seen a rise in prevalence rates among

young adults. The Surgeon General's Report noted a past 30-day prevalence rate of 13.6% among young adults in 2014, doubling its rate in 2013.<sup>15</sup>

### Sex and racial/ethnic differences and substance use

Demographic variables such as sex and race/ethnicity can impact substance use involvement among college students.<sup>16</sup> Monitoring the Future (MTF) reported past 30-day prevalence rates of alcohol use (63% vs. 61%), binge drinking (39% vs. 29%), cigarette smoking (11% vs. 6%), vaping nicotine (19% vs. 9.4%), and cannabis use (24% vs. 19%) were higher for male than women, respectively.<sup>5</sup> Notably, these differences appear to be narrowing, with prevalence rates of female usage becoming higher for various substances.<sup>5,16</sup> With regards to racial/ethnic differences, Hispanic/Latinx youth and young adults tend to report the highest prevalence of alcohol and substance use compared to other minority groups, usually second to White peers.<sup>17</sup> For example, 43% of Hispanic/Latinx youth reported alcohol use in the past month, higher than other racial/ethnic groups except for Whites (57.7%).<sup>3</sup> In contrast, other minority groups generally report lower prevalence of substance use.<sup>5</sup>

### Impulsivity-like facets and substance use

Research into the development and maintenance of various psychopathology has pointed to the importance of

transdiagnostic vulnerability (i.e. a single vulnerability being relevant for several diagnostic categories), particularly impulsivity.<sup>18</sup> Impulsivity is one of the most cross-cutting, transdiagnostic symptom criterion in the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5*; e.g. attention-deficit/hyperactivity disorder (ADHD), bipolar disorders, alcohol/substance use disorders).<sup>19</sup>

“Impulsivity” as a construct can be measured in several ways. One of the widely recommended methods is conceptualizing impulsivity as multidimensional, or facet-level personality traits associated with impulsivity-like behavior (e.g. acting without premeditation).<sup>20</sup> As defined by one model of impulsivity, the five facets of the UPPS-P Impulsive Behavior Scale include positive and negative urgency (the tendency to act rashly in response to positive or negative affect, respectively), lack of premeditation (the tendency to act without thinking), lack of perseverance (the lack of ability to remain focused), and sensation seeking (the tendency to seek out novel experiences).<sup>18</sup> Congruent with the transdiagnostic perspective, for example, positive urgency has been linked to externalizing problems that cut across several psychopathology (e.g. risk taking, behavioral disinhibition)<sup>21–23</sup> and negative urgency has evidenced the largest correlational effect sizes across all forms of psychopathology examined by a meta-analysis.<sup>24</sup>

More specific to the clinical relevancy of impulsivity-like facets and alcohol and other substance use behaviors, the literature has demonstrated robust and consistent relations between them.<sup>25–27</sup> Several theoretical models (e.g. affect regulation, genetic diathesis, pharmacological vulnerability) also point to impulsivity’s role in the etiology of problematic alcohol and other substance use.<sup>25</sup> The pharmacological vulnerability model, for instance, suggests that personality traits can relate to differential vulnerability to the effects of alcohol.<sup>25</sup> Indeed, distinct patterns and associations have been found between specific impulsigenic traits and alcohol use outcomes, such as heavy drinking.<sup>23,25</sup> For example, a meta-analysis found that although all five impulsivity-like facets predicted drinking frequency, lack of perseverance was the strongest predictor of drinking quantity.<sup>28</sup> Positive and negative urgency were found have the strongest associations to alcohol-related problems and negative consequences.<sup>26–30</sup> Other studies indicated various facets of impulsivity as important correlates to other substances outcomes such as tobacco craving,<sup>31</sup> average weekly cannabis and tobacco use,<sup>32</sup> lifetime cannabis use,<sup>33</sup> problematic cannabis use,<sup>34</sup> and substance use disorder’s treatment outcomes.<sup>35</sup> Despite the large body of work implicating impulsivity-like facets in alcohol and other substance outcomes, limited research has examined relations between impulsivity-facets and co-occurring use of substances, specifically among the college population.

### **Variable- and person-centered approaches on substance users**

Much of the extant literature investigating substance use and impulsigenic traits has utilized variable-centered

approaches. However, these approaches may not fully capture complex patterns due to averaging patterns across individuals.<sup>36</sup> In contrast, person-centered approaches can classify substance users based on patterns of use that focus on within-person changes.<sup>11,36–38</sup> For example, Jackson et al.<sup>37</sup> identified four latent classes of drinkers and demonstrated variations in risk of alcohol-related outcomes and consequences among subgroups. Similar person-centered studies generally note around three to five types of substance users: polysubstance users, non-users or infrequent users, or users of specific combinations of types (e.g. hookah and cannabis) or levels of substance use (e.g. heavy drinking/nondaily smoking, low drinking/nondaily smoking).<sup>11,38</sup>

Despite growing literature on polysubstance use among college populations, research using mixture analyses to identify latent classes of substance users, including how these classes may differentially relate to impulsigenic traits, is lacking. Existing studies are particularly limited in their use of scales that conceptualized impulsivity as unidimensional (e.g. Impulsiveness Monotony Avoidance Scale),<sup>39</sup> use of binary indices (e.g. any versus no use),<sup>40,41</sup> or varied measures of only one substance (e.g. cannabis).<sup>42</sup>

### **Present study**

The present study integrates both person- and variable-centered approaches empirically. The aims are to (1) identify latent class(es) of substance users based on endorsement of various substance use indices (person-centered) and (2) examine how these classes may differentially relate to impulsivity-like facets and substance use outcomes (variable-centered). It was expected that potential latent class(es) characterized by polysubstance use would correlate highly with impulsivity-like facets compared to those characterized by single substance use or low-to-no substance use; however, due to limited evidence, no hypotheses were proffered for differential relations to specific facets of impulsivity.

## **Methods**

### **Participants and procedures**

A nonprobability sample of 702 undergraduate students ( $M_{age} = 19.30$ ,  $SD = 1.74$ ; 71.79% female; 63.96% White) at a large, southwestern university completed a battery of online, self-reported measures related to substance use behaviors. 82.48% of the participants were recruited from the introductory psychology course participant pool and were compensated via research credit. The remaining participants were recruited from an online, campus-wide announcement system, through which they were entered into a random drawing for a gift card. All procedures and measures were approved by the university’s Institutional Review Board (IRB).

**Table 1.** Bivariate correlations of all variables of interest prior to latent class analysis.

	Sex	Race/Eth	PU	NU	LP	LPM	SS	AF	AQ	BF	AUD	CF	EF	CIGF
Sex	—													
Race/Eth	−.06	—												
PU	−.11***	.02	—											
NU	−.02	.05	.59***	—										
LP	.09**	.00	.16***	.10**	—									
LPM	.01***	−.01	.36***	.29***	.46***	—								
SS	−.35***	.02	.27***	.10*	−.12*	.04	—							
AF	−.00	−.04	.14***	.13***	.07	.19***	.13***	—						
AQ	−.06	.02	.13***	.10**	.08*	.18***	.15***	.69***	—					
BF	−.00	.01	.18***	.11**	.12**	.16***	.10**	.63***	.63***	—				
AUD	−.00	−.00	.19***	.16***	.10**	.16***	.09*	.54***	.55***	.56***	—			
CF	−.05	.04	.22***	.16***	.13***	.18***	.18***	.40***	.38***	.34***	.33***	—		
EF	.02	−.05	.20***	.18***	.11**	.15***	.13***	.37***	.36***	.40***	.35***	.34***	—	
CIGF	−.12**	.04	.21***	.16***	.07	.13***	.18***	.36***	.33***	.38***	.40***	.45***	.46***	—
CIGQ	−.15***	−.01	.10**	.14***	.03	.07	.11***	.26***	.27***	.27***	.32***	.29***	.35***	.72***

Note.  $N = 702$ ; \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Race/Eth = race/ethnicity, PU = positive urgency, NU = negative urgency, LP = lack of perseverance, LPM = lack of premeditation, SS = sensation seeking, AF = alcohol use frequency, AQ = alcohol use quantity, BF = binge drinking frequency, AUD = AUDIT (hazardous drinking), CF = cannabis use frequency, EF = e-cigarette use frequency, CIGF = cigarette use frequency, CIGQ = cigarette use quantity. All substance use indices except AUDIT reflect past 30-day use. AUDIT reflects past-year severity of alcohol use.

## Measures

### Demographics

Participants were asked to self-report on demographic information, including age, sex, race/ethnicity, year in school, and household income.

### Short UPPS-P impulsive behavior scale (S-UPPS-P)

The S-UPPS-P is a short version of the UPPS-P<sup>43</sup> that consists of 20 Likert-type items (0 *strongly agree* to 3 *strongly disagree*) with higher facet scores reflect higher impulsogenic traits (i.e. scores for each facet range from 0 to 12). Cronbach's alpha is considered acceptable for positive urgency ( $\alpha = .74$ ), negative urgency ( $\alpha = .76$ ), and lack of premeditation ( $\alpha = .75$ ), which were comparable to previous studies using the S-UPPS-P.<sup>43,44</sup> Cronbach's alpha values were lower for lack of perseverance ( $\alpha = .65$ ) and sensation seeking ( $\alpha = .64$ ), reflecting the strong connection between number of items and alpha estimates and is consistent with previous studies using the S-UPPS-P.<sup>45,46</sup>

### Substance use involvement

Past 30-day alcohol use frequency ("on how many days did you usually have any kind of drink containing alcohol?"), alcohol use quantity ("how many alcoholic drinks did you have on a typical day when you drank alcohol?"), binge drinking frequency ("on how many days did you have 5 or more (males) or 4 or more (females) drinks containing any kind of alcohol within a 2-hour period?"), cannabis use frequency ("on how many days did you use marijuana or hashish?"), e-cigarette use frequency ("on how many days have you used an electronic cigarette, or e-cigarette, even one or two puffs?"), tobacco use frequency ("on how many days have you smoked part of or all of a tobacco cigarette (non e-cigarette), even one or two puffs?"), and tobacco use amount ("on the days you smoked cigarettes, how many cigarettes did you smoke per day, on average?") were assessed.

### Alcohol use disorder identification test (AUDIT)

The AUDIT is a 10-item self-report measure that assesses past-year frequency of hazardous drinking.<sup>46</sup> The total scores range from 0 to 40. A score of below eight indicated low severity of alcohol problems, eight to 15 suggested moderate severity, and 16 and over indicated high severity of problematic drinking ( $\alpha = .84$ ). The AUDIT variable was treated as a three-level ordinal variable.

### Data analysis

Preliminary data analyses indicated that impulsivity-like facets were normally distributed, with skewness and kurtosis between  $-1.00$  and  $+1.00$ .<sup>47</sup> Substance users were classified using a type of mixture analysis utilizing ordinal indicators (i.e. latent class analysis [LCA]),<sup>48</sup> conducted in Mplus Version 7.11.<sup>49</sup> LCA can be used to empirically assign most-likely latent classes, such that individuals who responded similarly on manifest measures are grouped in the same classes.<sup>50</sup> In the current study, latent classes were defined by past 30-day substance use involvement indices and hazardous drinking.

Following identification of latent classes, descriptive analyses revealed that several substance use outcomes had sparse responses (i.e.  $< 5\%$  endorsement) across one or more latent classes; therefore, response options were collapsed. Two chi-square tests of independence were conducted to examine whether sex and racial/ethnic identification differed across latent classes. Then, multinomial logistic regression analyses were conducted. The latent class variable was treated as the multinomial dependent variable and race/ethnicity as well as each impulsivity-like facet were used as independent variables. Lastly, Fisher's exact tests were utilized to test the relations between the latent classes and substance use outcomes given the low endorsement of multiple categories.<sup>51</sup> Data cleaning, management, coding, and variable-centered analyses were conducted using SAS 9.4<sup>TM</sup> software.<sup>52</sup>

The best-fitting model was determined after examining model fit statistics, class interpretability, and size. Model fit was evaluated with Akaike's information criterion (AIC),

**Table 2.** Model fit indices.

	Number of classes					
	2-class	3-class	4-class	5-class	6-class	7-class
AIC	9432.193	8726.036	8580.171	8510.108	8489.613	8489.447
BIC	9547.120	9035.703	8994.579	9029.256	9113.502	9218.077
Adjusted BIC	9404.235	8819.789	8705.635	8667.282	8678.498	8710.043
Entropy	.865	.911	.916	.920	.873	.870
VLMR	–	2- vs. 3-class –4626.096, $p = .014$	3- vs. 4-class –4295.018, $p = 1.000$	4- vs. 5-class –4199.086, $p = .846$	5- vs. 6-class –4143.180, $p = .761$	6- vs. 7-class –4109.609, $p = .761$

Note.  $N = 702$ . AIC = Akaike's information criterion; BIC = Bayesian information criterion; VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio.

Bayesian information criteria (BIC), and adjusted BIC.<sup>53</sup> Entropy values closer to 1.0 reflect clearer delineation of classes.<sup>54</sup> The Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR) was used to compare  $k$  class solution versus  $k - 1$  class solution, such that a significant  $p$ -value ( $< .05$ ) indicates the model fit of  $k$  class solution is superior.<sup>55,56</sup>

## Results

### Person-centered analyses

Bivariate correlations are presented in Table 1. Model fit statistics from two- to seven-class solutions were examined (Table 2). Although a four-class solution was suggested by AIC, BIC, adjusted BIC, and entropy, the three-class solution was supported by the VLMR likelihood ratio and provided the most parsimonious class solution. Upon consideration of conditional probabilities (i.e. item probabilities that are conditional upon the specific class, which informs probability that members of latent classes to endorse certain items)<sup>51,53</sup> and meaningfulness, a three-class solution was selected for further analyses.

"Non-Alcohol Abstaining Users" (NAA) was the largest class with 41.0% of the total sample ( $n = 288$ ) and was characterized by (1) high endorsement of alcohol use indices and (2) low or no endorsement of other substance use indices. "Minimal Users" (MU) contained 29.8% of the sample ( $n = 209$ ), characterized by users who endorsed zero or low substance use involvement. "Polysubstance Users" (PSU) was comprised of 29.2% of the sample ( $n = 205$ ), characterized by endorsement on all substance use indices (Table 3).

### Variable-centered analyses

Two chi-square tests of independence were conducted: latent classes did not differ by sex,  $\chi^2 (2, N = 702) = 3.04, p = .218$ , but significantly differed by race/ethnicity,  $\chi^2 (6, N = 702) = 27.26, p < .001$ . A series of multinomial logistic regression analyses were conducted by treating the latent class variable as a multinomial dependent variable. Specifically, the first set of analyses used the race/ethnicity independent variable with White identification as reference and NAA was used as the reference group for the dependent variable (i.e. MU vs. NAA, PSU vs. NAA), followed by each impulsivity-like facet as independent variables. Subsequently, all multinomial logistic regression analyses were conducted with the PSU as reference group (i.e. MU vs. PSU). Although as expected, mean levels of each impulsivity-like

facet are highest among PSU, followed by NAA, and lastly MU, differential relations emerged from the multinomial logistic regression analyses. For example, only lack of pre-meditation was significantly different across all three latent class comparisons (i.e. MU-NAA, PSU-NAA, MU-PSU), whereas lack of perseverance seems to be the least distinguishing in that it was only significantly different between the MU and PSU classes (see Table 4 for summarized results). Furthermore, pairwise comparisons were made to further explore differences between the latent classes on each of the impulsivity-like facet. Benjamini and Hochberg's procedure was used to control for false discovery rate.<sup>57</sup> Multiple Fisher's exact tests indicated that, as expected, latent classes differed significantly across all substance use outcomes. Due to low or zero cell counts of multiple categories, no additional inferential analyses were completed.

To further investigate how PSU and NAA differ, multiple logistic regression analyses were conducted to examine differences with respect to alcohol use outcomes (i.e. alcohol use frequency, alcohol quantity, binge drinking frequency, heavy drinking in the past month [coded as binary based on responses to binge drinking], and hazardous drinking). First, categories were collapsed due to low endorsement of cells (i.e.  $< 5\%$ ) among NAA to facilitate comparisons to PSU (see Table 3 for details on response endorsements). Next, multiple logistic regression analyses revealed PSU had significantly higher odds than the NAA class of endorsing higher alcohol use frequency and consumption (Table 5). Results remained significant after adjusting for sex and race/ethnicity.

## Discussion

The present study identified Non-Alcohol Abstaining Users, Minimal Users, and Polysubstance Users with LCA, and studied the relations among latent classes, sex, race/ethnicity, impulsivity-like facets, and substance use among a nonprobability sample of undergraduate students.

Although exploratory in nature, relations between demographic variables and latent substance user classes are worth noting. The null finding that latent classes did not differ by sex is consistent with narrowing of differences between the sexes over the past decade for alcohol consumption, cannabis use, and cigarette smoking,<sup>5,16,58</sup> which could further explain the relatively equal proportions of the sexes across latent classes. Studies have noted an increase in frequent binge drinking and marijuana use among females and a decrease in daily drinking among college males.<sup>5,58,59</sup> The



**Table 3.** Descriptive statistics of sample characteristics and variables of interest by latent classes.

	Non-alcohol abstaining users ( <i>n</i> = 288)	Minimal users ( <i>n</i> = 209)	Polysubstance users ( <i>n</i> = 205)
Ethnicity			
White	187 (64.93%)	117 (55.98%)	145 (70.73%)
Hispanic/Latinx	71 (24.65%)	42 (20.10%)	42 (20.49%)
Other	18 (6.25%)	26 (12.44%)	8 (3.90%)
Asian	12 (4.17%)	24 (11.48%)	10 (4.88%)
Sex			
Female	217 (75.35%)	145 (69.38%)	142 (69.27%)
Male	71 (24.65%)	64 (30.62%)	63 (30.73%)
Alcohol use frequency			
0 days	0 (0%)	206 (98.56%)	1 (0.49%)
1–2 days	106 (36.81%)	1 (0.48%)	9 (4.41%)
3–5 days	98 (34.03%)	0 (0%)	29 (14.22%)
6–9 days	54 (18.75%)	0 (0%)	67 (32.84%)
10–30 days	30 (10.42%)	2 (0.96%)	98 (48.04%)
Alcohol use quantity			
0 drinks	0 (0%)	206 (98.56%)	2 (0.98%)
1 drink	135 (46.88%)	3 (1.44%)	13 (6.34%)
2 drinks	0 (0%)	0 (0%)	0 (0%)
3–4 drinks	110 (38.19%)	0 (0%)	58 (28.29%)
5–6 drinks	31 (10.76%)	0 (0%)	59 (28.78%)
7–8 drinks	8 (2.78%)	0 (0%)	37 (18.05%)
9–25+ drinks	4 (1.39%)	0 (0%)	36 (17.56%)
Binge drinking frequency			
0 days	132 (45.83%)	199 (95.22%)	11 (5.39%)
1–2 days	124 (43.06%)	6 (2.87%)	42 (20.59%)
3–5 days	30 (10.42%)	2 (0.96%)	71 (34.80%)
6–9 days	0 (0%)	1 (0.48%)	49 (24.02%)
10–30 days	2 (0.69%)	1 (0.48%)	31 (15.20%)
AUDIT			
low severity	237 (82.58%)	202 (97.12%)	35 (17.07%)
medium severity	47 (16.38%)	5 (2.40%)	128 (62.44%)
high severity	3 (1.05%)	1 (0.48%)	42 (20.49%)
Cannabis use frequency			
0 days	241 (83.97%)	200 (96.62%)	86 (41.95%)
1–9 days	32 (11.15%)	4 (1.93%)	77 (37.56%)
10–30 days	14 (4.88%)	3 (1.45%)	42 (20.49%)
E-cigarette use frequency			
0 days	237 (82.58%)	198 (94.74%)	86 (42.36%)
1–9 days	36 (12.54%)	7 (3.35%)	65 (32.02%)
10–30 days	14 (4.88%)	4 (1.91%)	52 (25.62%)
Cigarette use frequency			
0 days	278 (96.86%)	202 (96.65%)	95 (46.34%)
1–5 days	9 (3.14%)	5 (2.39%)	68 (33.17%)
6–30 days	0 (0%)	2 (0.96%)	42 (20.49%)
Cigarette use quantity			
0 cigarettes/day	286 (99.65%)	204 (98.08%)	136 (66.34%)
1–35 cigarettes/day	1 (0.35%)	4 (1.92%)	69 (33.66%)
Short UPPS-P			
Positive Urgency	3.99 (1.90)	3.94 (2.56)	4.89 (2.15)
Negative Urgency	5.20 (2.40)	4.97 (2.89)	5.89 (2.36)
Lack of Perseverance	2.81 (1.61)	2.67 (1.93)	3.09 (1.77)
Lack of Premeditation	3.06 (1.84)	2.59 (1.78)	3.52 (1.86)
Sensation Seeking	6.92 (2.35)	6.44 (2.60)	7.32 (2.28)

Note. *N* = 702. All substance use indices except AUDIT reflect past 30-day use. AUDIT reflects past-year severity of alcohol use. Categories were truncated to correct for low endorsement (i.e. < 5% endorsement). Short UPPS-P means (and standard deviations) reflect average of summed scores of impulsivity-like facets.

present results could be accounted for by diminishing differences on perceptions regarding how much same- and opposite-sex peers are drinking and whether they perceive the quantity or manner of substance consumption are approved.<sup>60,61</sup> Although the present study cannot address the potential influences of norms, future studies may examine how specific social and gender norms, as well as substance consumption norms, interplay with impulsivity-like facets and alcohol or other substance use behaviors.<sup>60,61</sup>

Our findings that nonwhite and non-Hispanic/Latinx minorities had significantly greater odds than White students to belong in the MU class than in the NAA or the PSU class are parallel with the trend that White college students report higher levels of substance use relative to

minority groups.<sup>62–64</sup> However, to our knowledge, few studies have examined how race/ethnicity and latent substance user classes relate. The extant research suggests that minority groups may consume alcohol in less risky manners due to sociocultural considerations, such as wanting to avoid contributing to negative stereotypes or to avoid unequal treatment from institutions.<sup>65</sup> Furthermore, minority groups of immigrant backgrounds may be protected by heritage orientation, cultural values, and traditional gender roles.<sup>66–68</sup> Future studies should delineate what specific sociocultural and protective factors are salient for minority students with regards to substance use.

The current variable-centered analyses found distinct patterns of latent classes and impulsigenic traits. Notably,

**Table 4.** Multinomial logistic regression results for race/ethnicity and impulsivity-like facets among latent classes.

	MU vs. NAA		PSU vs. NAA		MU vs. PSU	
	OR	95% CI	OR	95% CI	OR	95% CI
Hispanic/Latinx <sup>†</sup>	.95	.61–1.48	.76	.49–1.18	1.24	.76–2.23
Asian <sup>†</sup>	3.20**	1.54–6.64	1.08	.45–2.57	2.97**	1.37–6.47
Other <sup>†</sup>	2.31**	1.21–4.40	.57	.24–1.36	4.03**	1.76–9.23
Positive urgency	.99	.91–1.07	1.20***	1.11–1.31	.82***	.75–.90
Negative urgency	.96	.90–1.03	1.11**	1.04–1.19	.87***	.80–.94
Lack of perseverance	.96	.96–1.06	1.10	.99–1.21	.87*	.78–.98
Lack of premeditation	.87**	.78–.96	1.15**	1.04–1.27	.76***	.68–.84
Sensation seeking	.92*	.85–.99	1.07	.10–1.16	.86***	.79–.93

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ; NAA = Non-Alcohol Abstaining Users, MU = Minimal Users, PSU = Polysubstance Users. <sup>†</sup>Reference group for racial/ethnic group is White. OR = odds ratio; CI = confidence interval. A series of multinomial logistic regressions were conducted by treating latent class variable as multinomial dependent variable with NAA as the reference group (i.e. MU vs. NAA; PSU vs. NAA), lastly with PSU as the reference group (i.e. MU vs. PSU). Race/ethnicity was first entered into the model followed by each impulsivity-like facet.

**Table 5.** Odds ratios of specific category endorsements between PSU and NAA.

	Wald $\chi^2$	OR	95% CI
Alcohol frequency			
0–2 days <sup>†</sup>	0.00	1.00	0.40, 2.51
3–5 days	8.48**	3.14	1.45, 6.77
6–9 days	46.46***	13.15	6.27, 27.59
10–30 days	82.14***	34.63	16.09, 74.53
Alcohol use amount			
0–2 drinks <sup>†</sup>	0.00	1.00	0.47, 2.13
3–4 drinks	24.15***	4.75	2.55, 8.83
5–6 drinks	65.46***	17.13	8.61, 34.09
7–25+ drinks	93.64***	54.75	24.34, 123.17
Binge drinking frequency			
0–2 days <sup>†</sup>	0.00	1.00	0.66, 1.52
1–2 days	84.57***	11.43	6.80, 19.21
6–30 days	51.77***	193.15	46.05, 810.17
Heavy drinking			
No <sup>†</sup>	0.00	1.00	0.14, 7.27
Yes	39.07***	92.23	22.32, 381.07
AUDIT			
low severity <sup>†</sup>	0.00	1.00	0.61, 1.65
moderate to high severity	167.67***	23.02	14.32, 37.01

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

<sup>†</sup>Denotes reference category. All ORs are compared to NAA. All substance use indices except AUDIT reflect past 30-day use. AUDIT reflects past-year severity of alcohol use.

lack of premeditation was the only impulsogenic trait that was significantly different for all three comparisons (i.e. MU-NAA, PSU-NAA, MU-PSU). Previous research noted that lack of premeditation is strongly associated with alcohol dependence and consumption frequency,<sup>23</sup> and this impulsogenic trait, but not the others, differentiated between heavy drinkers with versus without co-occurring marijuana use.<sup>69</sup> The current findings indicate that lack of premeditation may be especially robust in differentiating between distinct groups of substance users. Furthermore, both positive and negative urgency were significantly higher in PSU than MU and PD, indicating that affective impulsogenic traits can be utilized to distinguish between polysubstance users and single-substance or minimal users. Prior research has supported both urgency traits have predictive roles in initiation of single substance use and subsequent increase in risk-taking

behaviors,<sup>70</sup> which is generally consistent with the current findings.

Lastly, PSU had higher odds of endorsing moderate to high severity of hazardous drinking in the past year support the extant literature that not only polysubstance users report higher prevalence of alcohol use, they report more severe and risky drinking behaviors than single-substance or minimal users as well.<sup>41</sup>

### Limitations and future directions

Several limitations should be noted. First, this study's design was cross-sectional and survey-based, which precludes causal inferences or meaningful prediction of future behaviors and may be limited by retrospective self-report on substance use behaviors. Longitudinal or historical data on substance use preceding college may be useful in identifying trajectories of substance use and could result in alternative distinct latent classes of substance users. In addition, the current nonprobability sample may not be the best representation of the overall undergraduate population of the institution and thus limit the findings' generalizability. Specifically, this sample consisted of 71.79% females and 63.96% White students, both of which are higher than the approximate of 45% females and 58% White students using estimates from the institute's demographics information. Future studies may benefit from broader methods in recruitment to achieve better representation of the campus population and improved generalizability.

Secondly, latent classes were based on co-occurring use of substances rather than simultaneous substance use in one substance use episode.<sup>71–73</sup> Studies have indicated that simultaneous polysubstance use is associated with more substance-related problems compared to concurrent or single use.<sup>72,74,75</sup> Future research may benefit from including both co-occurring and simultaneous use of substances for a more nuanced level of assessment to identify potential mediating effects of simultaneous polysubstance use to risky behavioral outcomes.

Although the present racial/ethnic differences appeared consistent with broader trends, collapsing across categories potentially masked heterogeneity among each group. Iwamoto et al.<sup>76</sup> found notable within-group variability in Asian American college students' heavy episodic drinking. Larger sample sizes of each racial/ethnic group are warranted to allow for detailed analyses of group identification and substance use, including an examination of potential protective factors that may be culturally-specific.

### Implications

Notwithstanding limitations, the present study is important in several ways. The present study illustrated the utility of integrating person- and variable-centered approaches to study substance use among college students. A non-trivial amount of the sample (i.e. 70%) was either in the NAA or PSU groups, suggesting alcohol and other substance use are highly prevalent. More importantly, these findings suggest

that studies on college students cannot merely use variable-centered approaches that aggregate alcohol and other substance use behaviors, such as whether college students are using certain substances. Rather, our findings point to the distinctiveness and individual differences among college students who use alcohol more than any other substances, versus those who use a variety of substances in addition to alcohol.

This study additionally point to the potential for person-centered approaches in aiding the identification of specific groups for tailoring clinical intervention, as current results suggest that polysubstance users – especially those high in urgency and lack of premeditation facets – may be at increased risk for substance use-related issues compared to the non-alcohol abstainers. Although impulsigenic traits and personality traits, in general, are often considered stable across the lifespan, much evidence has supported the notion that traits can be amenable to change and interventions.<sup>77–80</sup> For example, a systematic review of 207 studies showed that clinical interventions have resulted in personality trait changes.<sup>79</sup> Other studies have noted the value of using behavioral interventions to target transdiagnostic personality traits such as neuroticism and conscientiousness.<sup>78,80</sup> Specific to impulsigenic traits, many cognitive and behavioral strategies, such as enhancing emotion regulation, learning to anticipate consequences or to plan, utilizing alternative and safe celebratory behaviors, have produced significant changes in impulsigenic traits and subsequent changes in health and treatment outcomes including substance use.<sup>81,82</sup>

Many alcohol interventions for college students have focused on the outcomes (e.g. quantity, frequency, binge drinking episodes<sup>83</sup>) of drinking and samples have typically been comprised of first- and second-year White students (see Carey et al., 2017 for a meta-analytic review).<sup>84</sup> The present study indicated that there is utility to empirically differentiate alcohol-using college students based on the prevalence of other substance use, as well as noting how impulsigenic traits are impacting substance use outcomes. Additionally, given the differential relations that emerged based on race/ethnicity, the findings further point to the need for future research to delineate what specific proximal and distal factors may be protective for minority students, or ones that may augment risk-taking for White students. Overall, more work can be built upon the current study to identify high-risk subgroups of college substance users and potentially use demographic information and impulsigenic traits to inform research and clinical work.

### Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Board of Texas Tech University.

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