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Predictors of quickly progressing from initiating alcohol use to engaging in binge drinking among adolescents[☆]

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ABSTRACT

Background: A short delay to first intoxication confers alcohol-related risk, but risk factors for a short delay have yet to be examined.

Methods: 230 high school students (55.7% male; age 16.52 [1.19] years; 70.9% White) were surveyed about alcohol use. We examined whether sex, race, parental history of alcohol problems, age of onset, type of alcohol consumed, drinking company, and subjective response to alcohol were associated with 1) delay to first binge episode and 2) binge drinking status (i.e., never bingers, individuals who binge drank on their first drinking occasion, and individuals who binge drank at a later date). Finally, we examined whether first-occasion bingers reported heavier drinking and alcohol-related problems than later-occasion and never bingers.

Results: Overall, a shorter delay was associated with being male an older age of onset, and, during one's first drinking experience, consuming liquor, drinking with friends or alone, and experiencing high arousal negative alcohol effects. First-occasion bingers were more likely to be male, consume liquor, and experience stronger high arousal positive and negative alcohol effects than never bingers and to have a later age of onset, experience stronger high arousal negative, and weaker low arousal negative alcohol effects than later-occasion bingers. First-occasion bingers also reported heavier current drinking and more alcohol-related problems.

Conclusions: Characteristics of underage drinkers that confer risk for a shorter delay and first-occasion bingeing may provide fruitful targets for intervention, as efforts to delay binge drinking may mitigate alcohol-related risk associated with underage alcohol use.

1. Introduction

Alcohol remains the most widely used substance among youth; recent estimates suggest that 62% of high school seniors have consumed alcohol and 45% have been drunk at least once (Miech et al., 2018). Unfortunately, while normative, underage drinking is associated with a range of negative consequences (e.g., motor vehicle crashes, suicides, sexual violence, homicides, academic problems, alcohol use disorder; SAMHSA, 2015). In order to develop and implement effective prevention and intervention programs, it is imperative to understand the risk factors associated with early alcohol use and the transition to more hazardous use over time.

To better understand the progression of alcohol use, a number of alcohol milestones have been identified in the research literature, with

each milestone representing greater alcohol risk (e.g., age at first sip of alcohol, first drink, first intoxication, first binge episode; Rogers & Jackson, 2017; Sartor et al., 2016). One of the most commonly studied alcohol-related milestones remains age of drinking onset (AO), with more recent research focusing on age of first intoxication (AI). Importantly, both an early AO and AI have been shown to increase risk for negative alcohol outcomes including binge drinking, alcohol-related problems, and the development of Alcohol Use Disorder (e.g. Dawson, Goldstein, Chou, Ruan, & Grant, 2008; Henry et al., 2011; Hingson, Heeren, & Winter, 2006; Hingson & Zha, 2009; Marino & Fromme, 2016; Patte, Qian, & Leatherdale, 2017; Warner & White, 2003; Warner, White, & Johnson, 2007). More recently, delay to first intoxication (i.e., the lag time between AO and AI) has been identified as an independent alcohol-related risk factor (Morean et al., 2014; Morean, Corbin, &

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Fromme, 2012; Morean, L'Insalata, Butler, McKee, & Krishnan-Sarin, 2018). Of note, delay to intoxication (AI – AO) is conceptualized as a more informative way of understanding early intoxication, as it deconstructs intoxication into two independent constructs: age of onset and delay to first intoxication. In conjunction, AO and delay account for more variance in drinking outcomes in samples of high school and college students than either AO or AI alone (Morean et al., 2012; Morean et al., 2014). Furthermore, recent research suggests that using concrete terminology to assess AO (i.e., the age at which an individual first consumes at least 1 standard drink) and AI (i.e., the age at which an individual first engages in a binge drinking episode) outperforms using subjective terminology (e.g., assessing first intoxication using first subjective “drunk”) when predicting alcohol-related outcomes (Morean et al., 2018). Although there is mounting evidence that both an early AO and a short delay confer alcohol-related risk, there has been no research examining risk factors for a short delay to first intoxication itself.

The primary aim of the current study was to identify risk factors for a shorter delay to first binge episode. Potential risk factors were selected for inclusion in the study based on research identifying each as a broader alcohol-related risk factor. Specifically, sex, race, and age, were included based on research identifying males (Miech et al., 2018), White students (Miech et al., 2018), and older students (Patrick et al., 2017) as being at increased risk for heavy drinking and alcohol-related problems. Further, AO was included based on prior research showing that an earlier AO is associated with heavier drinking and the experience of alcohol-related problems, overall, while an older AO is associated with a shorter delay (Morean et al., 2012). Parental history of problematic alcohol use also was included based on research linking a positive family history of alcoholism to heavy drinking in offspring (e.g., Barnow, Schuckit, Lucht, John, & Freyberger, 2002; Coffelt et al., 2006; Lieb et al., 2002). Further, alcoholic beverage type was included based on research suggesting that drinking liquor is more likely to produce intoxication compared to beer and wine (e.g., Smart, 1996) and that drinking liquor or beer is disproportionately associated with heavy drinking and the experience of alcohol-related problems in youth (Siegel, Naimi, Cremeens, & Nelson, 2011). Next, we included who adolescents were drinking with during their first drinking experience based on prior research suggesting that drinking with peers is associated with an increased risk for heavy drinking, and that - while rare compared to drinking with peers - drinking with parents also may increase risk for further adolescent drinking, binge drinking, and alcohol-related problems (e.g., Kaynak, Winters, Cacciola, Kirby, & Arria, 2014; Kuntsche, Kuntsche, Thrull, & Gmel, 2017). Finally, we assessed adolescents' subjective response to the acute effects of alcohol during their first drinking episode based on research demonstrating that differences in how individuals experience the effects of alcohol during early drinking episodes are associated with heavy drinking and the experience of alcohol-related problems later on (Morean, Zellers, Tamler, & Krishnan-Sarin, 2016; Schuckit et al., 2007; Schuckit, Smith, Danko, & Isacescu, 2003; Schuckit, Smith, & Tipp, 1997).

Given that some adolescents binge drink on their very first drinking episode (i.e., first-occasion binge drinkers) and therefore have a delay of only hours between first alcohol use and first binge, some engage in binge drinking at a later date (i.e., later-occasion binge drinkers), and some never engage in binge drinking (i.e., never binge drinkers), we also examined how the aforementioned characteristics predicted membership in these three groups.

Finally, we evaluated whether first-occasion binge drinking may have a lasting negative impact by examining whether first-occasion binge drinking was associated with heavier current alcohol use and the experience of alcohol-related problems.

2. Material and methods

2.1. Participants

250 students from a high school in Connecticut completed a survey about alcohol use. The analytic sample comprised 230 students with non-missing data on the central study variables (55.7% male; mean age 16.52 [1.19] years; 70.9% White).

2.2. Procedures

The Institutional Review Board of Yale University approved the survey used in the study. Fliers advertising a health behaviors study were distributed during students' lunch periods. Students who were interested in participating completed a brief screener, distributed by study staff. Students who endorsed lifetime alcohol use on the screener were invited to complete the full survey in the library immediately after school. All students were informed that participation was voluntary and anonymous and that their data were confidential prior to completing the survey; consent/assent was obtained verbally to ensure anonymity. Participants were paid \$5.

2.3. Measures

2.3.1. Screener

Participants completed ten questions, nine of which were filler questions (e.g., “Do you smoke cigarettes?; Who do you live with?”). After the screener was completed, a member of the study staff reviewed students' answers to the following question: “Have you ever had a drink of alcohol?” Students who reported lifetime alcohol use (“yes”) were deemed eligible and invited to complete the full survey.

2.3.2. Demographic information

Participants reported on their biological sex, racial/ethnic identity, and age.

2.3.3. Perceptions of parental problem drinking

Participants answered the following question: “Have either of your parents had a problem with drinking (either now or in the past)?” (no; yes, my mother only; yes, my father only; and yes, both parents). Given low rates of endorsement, a dichotomous variable was created reflecting any parental problems with alcohol (no, yes).

2.3.4. Age of onset of alcohol use

Participants reported the age (in years) at which they “had at least 1 standard alcoholic drink for the very first time.” A standard drink was defined within the survey as a 12-ounce bottle or can of beer, a 5-ounce glass of wine, or a shot of hard liquor like vodka, rum, whiskey, or tequila. Pictures accompanied the description.

2.3.5. AO demographic information

Participants were asked to recall the first time they ever consumed at least one standard drink and to respond to the following questions: 1) “who were you with?” (parents, siblings, friends, alone), 2) “what type of alcohol did you drink?” (beer, wine, liquor), and 3) “how many alcoholic drinks did you drink?” Data from the last question were used to determine whether participants engaged in a binge drinking episode on their first drinking occasion (≥ 4 drinks).

2.3.6. Age of first binge drinking episode

Participants reported the age at which they “drank four or more drinks in one sitting for the very first time” (i.e., AI binge). Delay to the first binge drinking episode was calculated as age of first binge episode – age of first standard drink.

2.3.7. Subjective response to alcohol on the first drinking occasion

The original Subjective Effects of Alcohol Scale (SEAS; Morean, Corbin, & Treat, 2013) was developed to assess adults' experiences of acute alcohol effects during a drinking episode. The retrospective SEAS, which has been validated for use with adolescents (Morean et al., 2016), was used to assess adolescents' subjective experience of 14 alcohol effects during their first drinking episode. Subscales include: high arousal positive (e.g., sociable), high arousal negative (e.g., rude), low arousal positive (e.g., relaxed), and low arousal negative (e.g., woozy).

2.3.8. Alcohol use

Participants reported on the average number of drinks they consume during a drinking episode and on their past-month drinking frequency. A composite variable was calculated reflecting the total number of drinks consumed in the past month. Participants also reported on the maximum number of drinks they had ever consumed on a single occasion, which is an endophenotype for developing Alcohol Use Disorder (Saccone et al., 2000).

2.3.9. Alcohol-related problems

Participants completed the Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989), reporting on the frequency of experiencing 23 negative drinking consequences over the past 3 months using a five-point scale (never to > 10 times). Research suggests that an 18-item, dichotomously scored version of the RAPI is psychometrically superior to the original (Neal, Corbin, & Fromme, 2006), so we recoded the 18 items as 0 (no problem) or 1 (any problem) and a calculated a summary score of problems experienced.

2.4. Data analytic plan

Descriptive statistics were run on all study variables. A Cox proportional hazard model was then run to examine predictors of delay. The time variable for the survival function comprised delay to first intoxication for binge drinkers and duration of alcohol use (current age – AO) for never binge drinkers. Engaging in binge drinking was entered as the event (or failure variable) and never binge drinkers were censored. Proportional hazard ratios and 95% confidence intervals were calculated for the following potential risk factors: sex, race, parental history of alcohol problems, age of onset, type of alcohol consumed, drinking company, and subjective response to alcohol.

Next, a multinomial logistic regression was run in which the independent variables were included as predictors of binge drinking status (i.e., first-occasion bingers, later-occasion bingers, and never bingers). Of note, drinking with parents was not included in the model, given that no adolescents reported binge drinking during their first drinking episode when drinking with their parents. Finally, we ran a series of ANOVAs to evaluate whether binge drinking status was associated with the total number of drinks consumed in the past month, the maximum number of drinks consumed on a single occasion, or the experience of alcohol-related problems.

3. Results

Descriptive statistics for the full sample and by binge drinking status are presented in Table 1.

The Cox regression model indicated that a shorter delay was associated with being male (HR = 1.50, $p = .022$), an older age of onset (HR = 1.22, $p < .001$); and, on one's first drinking experience, with drinking liquor (HR = 1.57, $p = .43$); drinking with friends (HR = 2.21, $p = .048$) or alone (HR = 2.86, $p = .018$); and experiencing more high arousal negative alcohol effects (HR = 1.08, $p = .048$; Table 2). No significant differences in delay were observed based on race, parental history of problem drinking, drinking beer or wine, or the subjective experience of high arousal positive, low arousal positive, or low arousal negative alcohol effects.

In total, 43.0% of students were first-occasion bingers, 40.4% were later-occasion bingers, and 16.5% were never bingers. The multinomial logistic regression model predicting binge drinking status was statistically significant ($\chi^2(26) = 76.51$, $p < .001$, Nagelkerke $R^2 = 0.35$; Table 3). Compared to never bingers, first-occasion bingers were more likely to be male (OR = 7.06, $p = .001$), and to report consuming liquor (OR = 8.59, $p = .002$), experiencing stronger high arousal positive alcohol effects (OR = 1.35, $p = .008$) and experiencing stronger high arousal negative alcohol effects (OR = 1.29, $p = .045$) on their first drinking occasion. Compared to never bingers, later-occasion bingers were more likely to be male (OR = 4.05, $p = .014$), have an earlier age of onset (OR = 0.68, $p = .015$), report experiencing stronger high arousal positive alcohol effects (OR = 1.33, $p = .012$), and report experiencing stronger low arousal negative alcohol effects (OR = 1.24, $p = .039$). Finally, compared to later-occasion bingers, first-occasion bingers had a later age of onset (OR = 1.36, $p = .008$), reported experiencing stronger high arousal negative alcohol effects (OR = 1.37, $p < .001$), and reported experiencing weaker low arousal negative alcohol effects (OR = 0.85, $p = .26$). No other model covariates were significantly associated with binge drinking status.

ANOVA models indicated that there were significant differences in the total number of drinks consumed in the past month ($F[2, 227] = 12.65$, $p < .001$), the maximum number of drinks ever consumed on a single occasion ($F[2, 227] = 36.93$, $p < .001$), and the experience of alcohol-related problems ($F[2, 227] = 8.70$, $p < .001$) by binge drinking status. Bonferroni-adjusted post-hoc comparisons (Table 4) indicated that first-occasion bingers consumed significantly more drinks in the past month and a greater lifetime maximum number of drinks than later-occasion and never bingers. Further, later-occasion bingers consumed significantly more drinks and a greater maximum number of drinks than never bingers. Finally, first-occasion and later-occasion bingers reported experiencing significantly more problems than never bingers.

4. Discussion

This study was the first to examine risk factors for a shorter delay to first intoxication, which previously has been shown to confer risk for negative alcohol-related outcomes (Morean et al., 2012; Morean et al., 2014; Morean et al., 2018). Overall, male sex, an older age of onset, drinking liquor on one's first drinking occasion, drinking alone or with peers on one's first drinking occasion (relative to drinking with parents), and experiencing stronger high arousal negative alcohol effects on one's first drinking occasion were associated with a shorter delay to first binge drinking episode. Our findings are consistent with prior research indicating that these characteristics are associated with broader alcohol-related risk (e.g., Kaynak et al., 2014; Miech et al., 2018; Morean et al., 2013; Morean et al., 2016; Patrick et al., 2017; Smart, 1996), and, in the case of a later age of onset, risk for a shorter delay to intoxication (Morean et al., 2012). With regard to age of onset, our findings, in concert with those of Morean et al. (2012), suggest that the relationship between age of onset and alcohol-related risk is complex. While delaying the onset of alcohol use generally is thought to be protective, initiating drinking at an older age also is associated with more quickly progressing to binge drinking (i.e., a phenomenon of "catching up") and, as described below, with bingeing on one's first drinking occasion. These findings suggest that efforts to prevent alcohol use and binge drinking, specifically, are needed for adolescents of all ages.

Of note, neither race nor parental history of problematic alcohol use was associated with delay. The null findings regarding race may be linked to the lack of diversity within the sample. Future research is needed using a more diverse sample in order to conduct more nuanced analyses. The null findings regarding parental alcohol history may be linked to the limited sample size of those who endorsed a positive family history and/or to the quality of the question that was used to

Table 1
Descriptive statistics for all study variables presented for the full sample and by binge drinking status.

	Total sample	Binge drinkers first occasion	Binge drinkers later date	Never binge drinkers
Sample size	230	99	93	38
Sex (% male)	55.7%	63.6%	57.0%	31.6%
Age	16.52 (1.19)	16.71 (1.13)	16.53 (1.13)	16.03 (1.39)
Race (% White)	70.9%	70.7%	75.3%	60.5%
Parental problem drinking (% yes)	15.2%	11.1%	19.4%	15.8%
Age of onset (standard drink)	14.03 (1.73)	14.32 (1.43)	13.59 (1.77)	14.34 (2.10)
Type of alcohol consumed				
Beer	43.9%	43.4%	47.3%	36.8%
Wine	10.9%	5.1%	10.8%	26.3%
Liquor	60.9%	70.7%	55.9%	47.4%
Drinking company				
Parents	6.1%	0.0%	9.7%	13.2%
Siblings	5.7%	4.0%	6.5%	7.9%
Friends	76.5%	85.9%	67.7%	73.7%
Alone	11.7%	10.1%	16.1%	5.3%
Subjective response to alcohol				
High arousal positive	5.80 (2.90)	6.31 (2.60)	5.83 (2.94)	4.43 (3.17)
High arousal negative	2.52 (2.51)	3.15 (2.65)	2.33 (2.46)	1.41 (2.09)
Low arousal positive	4.27 (2.52)	4.53 (2.35)	4.17 (2.62)	3.84 (2.70)
Low arousal negative	3.96 (2.87)	4.10 (2.65)	4.34 (2.94)	2.67 (2.94)
Current alcohol use				
Total drinks (past month)	23.25 (37.25)	35.80 (43.04)	18.56 (33.05)	1.87 (3.57)
Maximum drinks ever consumed	9.46 (6.61)	12.12 (6.40)	9.43 (5.97)	2.66 (2.59)
Alcohol-related problems	7.08 (6.20)	8.60 (6.43)	6.78 (5.90)	3.87 (5.01)

Note. Type of alcohol consumed, drinking company, and subjective response to alcohol were all retrospectively assessed to be based on the first drinking occasion on which students drank at least one standard drink.

Table 2
Cox regression indicating factors associated with delay to first binge drinking episode.**

Independent variables	B	SE	Hazard ratio	95.0% CI for HR	
Male sex	0.40	0.18	1.50*	1.06	2.11
Race (White)	-0.15	0.17	0.86	0.61	1.21
Parental problem drinking	0.01	0.21	1.01	0.67	1.54
Age of onset (standard drink)	0.20	0.05	1.22***	1.10	1.34
Type of alcohol consumed					
Beer	0.26	0.20	1.30	0.89	1.90
Wine	-0.19	0.31	0.83	0.45	1.53
Liquor	0.45	0.22	1.57*	1.02	2.42
Drinking company					
Parents (reference group)					
Siblings	0.49	0.48	1.63	0.63	4.19
Friends	0.79	0.40	2.21*	1.01	4.82
Alone	1.05	0.45	2.86*	1.20	6.85
Subjective response to alcohol					
High arousal positive	0.02	0.03	1.02	0.96	1.10
High arousal negative	0.08	0.04	1.08*	1.00	1.16
Low arousal positive	-0.04	0.04	0.96	0.89	1.03
Low arousal negative	0.05	0.03	1.05	0.98	1.12

Note. Type of alcohol consumed, drinking company, and subjective response to alcohol were all retrospectively assessed to be based on the first drinking occasion on which students drank at least one standard drink.

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

assess the construct.

When examining the potential risk factors in relation to binge drinking status (i.e., first-occasion bingers [the highest risk group], later-occasion bingers [the intermediate risk group], and never bingers [the lowest risk group]), several characteristics differentially predicted group membership. Relative to never bingers, first-occasion bingers were more likely to be male, to report drinking liquor on their first drinking episode, and to report experiencing stronger high arousal positive (e.g., funny) and high arousal negative (e.g., aggressive) alcohol effects during their first drinking episode. The findings regarding male sex, liquor consumption, and the experience of high arousal

negative effects were consistent with the results of the overall model predicting a shorter delay. In addition, experiencing stronger high arousal negative and high arousal positive effects previously has been associated with heavier alcohol use and related problems in adolescents (Morean et al., 2016), and experiencing stronger positive subjective effects has been associated with future binge drinking in longitudinal studies (King, De Wit, McNamara, & Cao, 2011). Furthermore, the fact that first-occasion bingers reported stronger high arousal positive effects is consistent with research showing that heavier drinking young adults are more sensitive to the stimulant effects of alcohol (King, Houle, De Wit, Holdstock, & Schuster, 2002) and that the experience of positive stimulant effects is associated with heavier within-session drinking in simulated bar studies (e.g., Corbin, Gearhardt, & Fromme, 2008).

Relative to never bingers, later-occasion bingers were more likely to be male, to have an earlier age of onset, and to experience stronger high arousal positive and low arousal negative effects (e.g., woozy) during their first drinking experience. The findings regarding male sex and an earlier age of onset are consistent with prior research identifying these characteristics as alcohol-related risk factors (e.g., Miech et al., 2018; Morean et al., 2012). Similar to first-occasion bingers, later-occasion bingers also reported experiencing stronger high arousal positive alcohol effects than never bingers, again suggesting that these types of early positive drinking experiences prompt further use (Corbin et al., 2008). Of note, the fact that later-occasion bingers also experienced stronger low arousal negative effects, which are experienced as aversive, suggests that these experiences may have deterred heavier drinking both within the first occasion and afterward, at least for a period of time. However, longitudinal work is needed to better understand the role that early subjective response plays in conferring risk for or protecting against a short delay to binge drinking.

Finally, relative to later-occasion bingers, first-occasion bingers were more likely to have had an older age of onset, experience stronger high arousal negative effects during their first drinking episode, and experience weaker low arousal negative alcohol effects during their first drinking episode. With regard to age of onset, our findings are consistent with research showing that a later age of onset is associated with a shorter delay among college students (Morean et al., 2012).

Table 3
Predictors of binge drinking status.

Independent variables	B	Std. error	OR	95% CI		B	Std. error	OR	95% CI	
	Binge drinkers (first occasion) vs. never binge drinkers					Binge drinkers (later date) vs. never binge drinkers				
Male	1.95	0.58	7.06**	2.27	21.99	1.40	0.57	4.05*	1.32	12.41
Race (White)	-0.19	0.51	0.83	0.31	2.24	-0.51	0.51	0.60	0.22	1.64
Parental problem drinking	0.79	0.70	2.19	0.55	8.71	0.34	0.66	1.40	0.39	5.07
Age of onset (standard drink)	-0.08	0.16	0.92	0.68	1.25	-0.39	0.16	0.68*	0.49	0.93
Type of alcohol consumed										
Beer	0.86	0.59	2.37	0.75	7.53	0.83	0.59	2.28	0.72	7.27
Wine	-0.68	0.81	0.51	0.10	2.49	-0.33	0.75	0.72	0.17	3.11
Liquor	2.15	0.70	8.59**	2.20	33.58	1.25	0.68	3.48	0.91	13.32
Drinking company										
Siblings	-1.41	1.30	0.25	0.02	3.12	-1.76	1.20	0.17	0.02	1.80
Friends	-0.94	0.90	0.39	0.07	2.27	-1.72	0.88	0.18	0.03	1.00
Alone (reference)										
Subjective response to alcohol										
High arousal positive	0.30	0.11	1.35**	1.08	1.69	0.28	0.11	1.33*	1.06	1.66
High arousal negative	0.26	0.14	1.29*	0.98	1.70	-0.06	0.14	0.95	0.72	1.24
Low arousal positive	-0.18	0.13	0.83	0.65	1.07	-0.19	0.13	0.83	0.65	1.06
Low arousal negative	0.05	0.11	1.05	0.85	1.30	0.22	0.10	1.24*	1.01	1.52
	Binge Drinkers (First Occasion) vs. Binge Drinkers (Later Date)					Never Binge Drinkers vs. Binge Drinkers (Later Date)				
Male	0.56	0.39	1.74	0.81	3.77	-1.40	0.57	0.25*	0.08	0.76
Race (White)	0.32	0.38	1.38	0.66	2.90	0.51	0.51	1.67	0.61	4.56
Parental problem drinking	0.45	0.49	1.57	0.61	4.06	-0.34	0.66	0.72	0.20	2.59
Age of onset (standard drink)	0.31	0.12	1.36**	1.09	1.70	0.39	0.16	1.48*	1.08	2.02
Type of alcohol consumed										
Beer	0.04	0.40	1.04	0.47	2.28	-0.83	0.59	0.44	0.14	1.40
Wine	-0.34	0.69	0.71	0.19	2.71	0.33	0.75	1.39	0.32	6.01
Liquor	0.90	0.48	2.46	0.96	6.34	-1.25	0.68	0.29	0.08	1.10
Drinking company										
Siblings	0.36	0.89	1.43	0.25	8.11	1.76	1.20	5.83	0.56	61.01
Friends	0.78	0.51	2.18	0.80	5.93	1.72	0.88	5.57	1.00	30.94
Alone (reference)										
Subjective response to alcohol										
High arousal positive	0.02	0.08	1.02	0.87	1.19	-0.28	0.11	0.75*	0.60	0.94
High arousal negative	0.31	0.09	1.37***	1.15	1.63	0.06	0.14	1.06	0.81	1.38
Low arousal positive	0.00	0.08	1.00	0.85	1.18	0.19	0.13	1.21	0.94	1.55
Low arousal negative	-0.17	0.07	0.85*	0.73	0.98	-0.22	0.10	0.81*	0.66	0.99

Note. Type of alcohol consumed, drinking company, and subjective response to alcohol were all retrospectively assessed to be based on the first drinking occasion on which students drank at least one standard drink. Drinking with parents was not included in the model given that no individuals who binge drank on their first drinking occasion reported drinking with their parents.

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

Regarding subjective response, the findings are again consistent with previous research demonstrating that experiencing high arousal negative effects is associated with negative alcohol-related outcomes in adolescents and adults (e.g., Morean et al., 2013, 2016). Further, a dampened response to low arousal negative effects of alcohol, a key feature of the Low Level of Response Model of alcohol-related risk (Schuckit et al., 2007), has been shown to predict negative alcohol-related outcomes in samples of young adults (e.g., Morean et al., 2013) and adults, including risk for developing Alcohol Use Disorder up to 25 years after assessment (Schuckit, 1994).

Importantly, first-occasion binge drinking may have a lasting negative impact, as it was associated with several indices of risky alcohol consumption at the time of the survey. Specifically, first-occasion

bingers reported consuming a larger number of total drinks in the past month and a larger number of maximum drinks on a single occasion than both later-occasion and never bingers as well as more alcohol related problems than never bingers. Later-occasion binge drinking also conferred greater alcohol-related risk across all three alcohol use outcomes when compared to never bingers. Although longitudinal work is needed, our findings indicate that the risk associated with early binge drinking likely persists and suggest that additional efforts are needed to delay the onset of binge drinking both among never drinkers and among youth who have initiated alcohol use but have not yet engaged in binge drinking.

The study findings should be interpreted in light of several limitation. First, the study relied on self-report, which can be susceptible to

Table 4
Bonferroni-adjusted post-hoc comparisons of the total drinks consumed in the past month, the maximum number of drinks ever consumed on a single occasion, and the experience of alcohol-related problems by binge drinking status.

	Total drinks (past month)	Maximum drinks ever consumed	Alcohol-related problems
	Mean (SD)	Mean (SD)	Mean (SD)
Binge drinkers (first occasion)	35.80 (43.03) ^a	12.12 (6.40) ^a	8.60 (6.43) ^a
Binge drinkers (later date)	20.30 (30.13) ^b	9.43 (5.97) ^b	6.78 (5.90) ^a
Never binge drinkers	1.87 (3.57) ^c	2.66 (2.59) ^c	3.87 (5.01) ^b

Note. Superscript letters that differ within a column indicate statistically significant differences between group means at $p < .05$.

bias. Although bias may be present, prior longitudinal research (Morean et al., 2012) has found that young adults' (18–24 years) retrospective self-reports of AO and AI were generally consistent with the ages at which they actually began to drink and first experienced intoxication (77%). Further, when biased reporting about alcohol milestones occurs in youth, it typically is observed as forward telescoping, where individuals tend to self-report older ages of onset over time (Rogers & Jackson, 2017). If this were the case in the current study, it would suggest that participants' actual ages of onset and intoxication may be even younger than reported. Second, the study was cross-sectional which precludes making claims about causality. Future research is needed to prospectively evaluate how an early age of onset and a short delay to intoxication influence later drinking behavior. Third, data were collected from a single high school with limited racial/ethnic diversity, which may limit generalizability. Fourth, the question used to assess family history of alcohol use disorder was crude, and future research is warranted that uses established measures of the construct. Finally, the sample comprised underage drinkers, who inherently are a high-risk population that may behave differently than drinkers who are of legal age.

In sum, this study highlights several characteristics of underage alcohol use that are associated with a shorter delay to first binge drinking episode including male sex, an older age of onset, drinking liquor on one's first drinking occasion, drinking alone or with peers on one's first drinking occasion, and experiencing strong high arousal negative alcohol effects. In addition, the findings suggest that first-occasion bingers (i.e., those with the shortest possible delay) represent a unique group of underage drinkers that differs in meaningful ways from those who initiate binge drinking at a later date and those who have never engaged in binge drinking. Although replication is needed in larger, more diverse samples, the findings suggest that preventative efforts to delay the onset of binge drinking may have greater efficacy if they target risk factors identified in the current study. For example, reducing access to liquor and discouraging consuming alcohol with friends may help to delay binge drinking in youth. Further, efforts to educate youth about profiles of early subjective response that are associated with greater risk for binge drinking may help youth to self-identify risk. Finally, the findings suggest that efforts to delay binge drinking may help to protect against some of the alcohol-related risk associated with using alcohol at an early age, as never bingers consumed less alcohol and experienced fewer alcohol-related problems than first-occasion and later-occasion bingers.

Conflict of interest

No conflicts declared in relation to the current study.

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