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First Drink to First Drunk: Age of Onset and Delay to Intoxication are Associated with Adolescent Alcohol Use and Binge Drinking

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Abstract

Background—Quickly progressing from initiating alcohol use to drinking to intoxication recently was identified as a novel risk factor for hazardous drinking in college students (Morean, Corbin, & Fromme, 2012). The current study evaluated the risk associated with age of onset (AO) and delay to first intoxication (Delay) in a high school sample.

Methods—Adolescent drinkers (N=295, age 16.29[1.14], 55.3% female, 80.3% Caucasian, AO = 13.51[2.29] years, Delay = 0.80[1.43] years) completed an anonymous survey about their substance use in February of 2010. Self-report questions assessed AO and age of first intoxication (i.e., “How old were you the first time you tried alcohol/got drunk?”) and past-month alcohol use/ binge drinking (i.e., How often did you drink alcohol/drink 5 drinks?).

Results—Bivariate correlations indicated that AO was positively correlated with AI and inversely correlated with Delay, the frequency of any drinking, and the frequency of binge drinking. When considered alone, Delay was not significantly correlated with either alcohol use outcome. In contrast, hierarchical regression analyses indicated that, when considered in concert, an earlier AO and a shorter Delay were each associated with heavier drinking (any drinking adjusted $R^2 = .08$; binge drinking $R^2 = .06$, p -values < .001) beyond demographic characteristics. Two-way interactions among study variables were non-significant, suggesting that AO and Delay conferred risk similarly by racial/ethnic status, gender, and grade in high school.

Conclusions—When considered simultaneously, both an early AO and a quick progression to drinking to intoxication appear to be important determinants of high school student drinking. In addition to continuing efforts to postpone AO, efforts designed to delay intoxication may modulate alcohol-related risk associated with early drinking.

Keywords

age of onset; binge drinking; adolescent alcohol use; age of intoxication; delay to intoxication

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Introduction

Despite efforts to prevent underage alcohol use, the average American adolescent starts drinking by age 16 (Substance Abuse and Mental Health Services Administration [SAMHSA], 2012). By senior year of high school, nearly 80% of youth have consumed alcohol, and 31.5% report binge drinking in the past month (Centers for Disease Control, 2011). Although underage drinking is normative, it is associated with many negative consequences that are costly at the level of the individual, family, and society (e.g., automobile crashes, accidental injuries, suicide, violent crime, risky sexual behavior, alcohol poisoning, alcohol use disorders; SAMSHA, 2012). Estimates place the annual financial burden attributed to underage drinking in the United States at \$62 billion (e.g., Pacific Institute for Research and Evaluation, 2011; Miller, Lew, Spicer, & Taylor, 2006). Improved prevention and intervention efforts are needed, but program efficacy depends on improving our understanding of the factors associated with hazardous use.

Starting to drink at an early age is one of the most frequently studied risk factors for heavy drinking and the experience of negative alcohol-related outcomes (e.g., Dawson, Goldstein, Chou, Ruan, & Grant, 2008; Hingson, Heeren, & Winter, 2006; Hingson & Zha, 2009); for example, in one of the largest studies to date on the topic (N = 43, 093 adults), Hingson and colleagues (2006) demonstrated that, relative to adults who reported that they started drinking at age 21 years or later, those with an AO prior to age 14 years were 1.78 times more likely to develop alcohol dependence. However, several studies, including a recent systematic review of prospective cohort studies on this topic, have found little evidence for associations between AO and heavy drinking or have posited more complex relationships (Afitska et al., 2008; Chou and Pickering, 1992; DeWit et al., 2000; Maimaris & McCambridge, in press). Inconsistent findings within the AO literature have prompted researchers to examine alternative indices of risk that may better account for alcohol-related outcomes, which, in turn, may better explain the body of contradictory AO findings. Several studies have found that early experiences of intoxication, specifically, may be associated with heavy drinking and related problems (e.g., Warner & White, 2003; Warner, White, & Johnson, 2007), leading researchers to explicitly evaluate the risk conferred by an early age of first intoxication (AI). For example, Hingson and colleagues (2003) demonstrated that college students who retrospectively reported drinking to intoxication prior to age 13 years were over three times as likely to develop alcohol dependence than those with an AI of 19 years or later. Similarly, a more recent study (Henry et al., 2011) found that American Indian youth with an AI of 14 years or younger were 2.35 times more likely to develop an alcohol use disorder by age 19 (40% versus 17%) than those with a later AI.

Although it seems at first glance that an early AI may confer elevated risk relative to an early AO (e.g., 1.78 versus 2.35 times the risk for alcohol dependence), making such a claim is not possible; the unique risk associated with an early AO versus an early AI cannot be determined. Firstly, none of the studies reviewed above considered both AO and AI. Secondly, even if AO and AI had been evaluated, it is not possible to evaluate the unique risk associated with each by considering them simultaneously. This is due to the fact that

AO and AI inherently share variance in that early intoxication necessarily requires early drinking.

In a recent longitudinal study of 1,160 college students, Morean and colleagues (2012) applied a novel approach to evaluating the risk associated with AO and AI. Specifically, they evaluated the relative risk for heavy drinking and alcohol-related problems over the course of college attributable to the age of onset of *any* alcohol use versus a quick progression to drinking to the point of intoxication (i.e., the number of years separating AO and AI; Morean et al., 2012). Their approach to studying the “Delay” between AO and AI is conceptually similar to that applied in the “telescoping” literature, which examines how factors like gender influence the lag time between AO (or AI) and a range of drinking milestones including the development of alcohol use disorders and treatment entry (e.g., Lewis & Nixon, in press).

Morean and colleagues found that, on average, college students reported an AO of 16.16 years ($SD = 2.14$), a finding that is consistent with national estimates (e.g., SAMSHA, 2012). Further, students delayed intoxication by 1.25 years ($SD = 1.95$). This finding is inline with the only prior study on this topic of which we are aware (Monshouwer, Smit, De Zwart, Spruit, & Van Ameijden, 2003), which found that Dutch high school students delayed intoxication by an average of 1.64 years. Replicating previous findings, Morean and colleagues found that an early AO conferred alcohol-related risk, predicting both heavy drinking and problems during senior year of college. In a novel finding, a short Delay to first intoxication conferred independent risk for heavy drinking and problems. To summarize with an example, starting to drink at age 14 years would be associated with greater alcohol-related risk than starting to drink at age 16 years. Further, initiating alcohol use and drinking to intoxication at age 14 (i.e., Delay = 0 years) would confer greater risk than starting to drink at age 14 and delaying intoxication until age 16 years (i.e., Delay = 2 years). Thus, part of the risk for negative alcohol outcomes that has been attributed to an early AO may be due to a short Delay to first intoxication for a subset of individuals.

The findings of the study by Morean and colleagues (2012) are promising and suggest that considering time latency between first use and first intoxication (i.e., Delay) as an alcohol-related risk factor in concert with age of onset may add to our understanding of the processes underlying the transition to hazardous drinking in emerging adults. However, no further research on this topic has been published, and it is unclear the extent to which AO and Delay are related to alcohol use among other age groups, including adolescents. As such, the current study evaluated the relative risk for alcohol use and binge drinking associated with an early AO and a short Delay in a sample of 295 high school drinkers (grades 9–12). A high school sample was chosen because we anticipated that most students would have initiated alcohol use/intoxication relatively recently which would reduce concerns about the potential impact of memory bias and/or alcohol-related memory deficits on retrospective reports of AO and AI.

Consistent with prior findings, AO and Delay to intoxication were expected to relate inversely to 1) one another, 2) to alcohol use (i.e., defined in terms of the frequency of *any* drinking [an index of frequency] and, 3) to the frequency of binge drinking [which

inherently indexes both frequency and quantity]). Specifically, we hypothesized that, when considered in concert, an earlier AO and a shorter Delay would be associated with heavier alcohol use. Exploratory regression analyses were conducted to evaluate whether AO and/or Delay confer risk for underage drinking similarly for males and females, for Caucasian and non-Caucasian students, and for students across grades 9–12.

Materials and Methods

Participants

As part of a parent study designed to develop a prevention/intervention program targeting cigarette smoking in high school students, the entire student body of a Connecticut high school (N = 1144) was recruited to participate in an anonymous, survey assessing attitudes and behaviors related to smoking and other substance use conducted during February of 2010. Of the 896 students (grades 9–12) who completed the survey, 41% reported drinking in the past month (n=366). Inclusion in the current analyses also required that students had drunk to intoxication so that delay could be calculated, resulting in a final sample of 295 drinkers. The study sample was 55.30% female and majority Caucasian (80.30%), with an average age of 16.29(1.14), an average AO of 13.51(2.29) years, and an average delay of 0.80(1.43) years. In the past month, 100% of participants drank alcohol and 71.2% binge drank (See Table 1 for additional demographic information).

Procedure

Prior to conducting the study, we obtained approval from the Yale University Human Subjects Committee and from the local school board. Two weeks prior to administering the survey, we mailed letters describing the study to the parents/guardians of all students. Parents were instructed to call the research staff or school if they did not want their child to participate. Passive parental permission was assumed for all students because no parents explicitly dissented. Research staff informed students of the potential limits to confidentiality and the voluntary nature of the study. Students provided assent prior to completing the survey.

Measures

Demographics—Data were gathered on grade in school, gender, and race/ethnicity.

Age of Onset and Age of Intoxication (AI)—The following questions assessed AO and AI: “How old were you the first time you tried alcohol (more than just a few sips and not including drinking as part of religious activities)?” and “How old were you the first time you got drunk?” Response options included 8 (or younger), 9, 10, 11, 12, 13, 14, 15, 16, 17, and 18 (or older). Delay was calculated by subtracting AO from AI. Morean et al. (2012) demonstrated that retrospective self-reports of AO and AI (and thus, delay) are generally consistent with the ages at which individuals actually initiated use or intoxication (mean congruence = 77%).

Frequency of Alcohol Use and Binge Drinking—Participants reported the frequencies with which they 1) consumed any alcohol over the past month (i.e., drinking

frequency) and 2) engaged in binge drinking over the past month (i.e., binge frequency). Binge drinking was defined within the survey as follows: “5 or more drinks on the same occasion...by ‘occasion,’ we mean at the same time or within a couple of hours of each other.” Response options for both questions included 0, 1–2, 3–5, 6–9, 10–19, 20–29, and 30 days.

Analytic Plan

Prior to conducting statistical analyses, we evaluated the normality of relevant study variables. We then used bivariate correlations to examine relationships among the following variables: AO, AI, Delay, frequency of any drinking, and frequency of binge drinking. Next, we used hierarchical multiple regression to examine cross-sectional relationships between AO/Delay and alcohol use above and beyond demographic factors. Specifically, at Step 1 of all regression models, gender, race (Caucasian versus non), and grade in school were entered as demographic covariates. We covaried for grade to account for potential cohort effects and for the fact that older students may drink more. Race and gender were included as covariates based on prior research linking both Caucasian ancestry and male gender to an earlier AO and heavier drinking (e.g., Faden, 2006; Swendsen et al., 2012). At Step 2 of all regression models, AO and Delay were entered. At Step 3, a series of interactions was entered. First the interaction between AO and Delay was entered to evaluate whether risk for underage drinking is best accounted for by a combination of an early AO and a short Delay. Interactions between the covariates (i.e., grade, race, gender) and AO and Delay, respectively also were entered to evaluate whether AO and/or Delay confer risk for underage drinking similarly for males and females, for Caucasian and non-Caucasians, and for high school students across grades 9–12.

Results

Data Distribution

The frequencies of any drinking and of binge drinking were non-normally distributed, but were successfully log-transformed to approximate normality. Delay was also highly skewed and kurtotic due to the fact that much of the sample reported AO and AI within the same year. Based on the distribution of Delay, we discretized Delay to reflect 0 years (59%), 1 year (24.6%), and 2 or more years (16.4%) for inclusion in the regression analyses.

Bivariate Correlations

A strong, significant positive correlation was observed between AO and AI ($r = .78$) as anticipated (see Table 2). A moderate, negative correlation was observed between AO and Delay ($r = -.38$), suggesting that an early AO was associated with a shorter Delay. AI and Delay were correlated modestly, yet positively with one another, suggesting that, as expected, a longer Delay was associated with a later AI ($r = .16$). Furthermore, while both AO and AI were correlated inversely and significantly with the frequency of any alcohol use and the frequency of binge drinking, Delay was not correlated significantly with either drinking outcome on its own.

Regression Analyses

The demographic variables (block 1) accounted for 1.8% of the variance in the frequency of any alcohol use at baseline, $F(3, 285) = 2.79, p < .05$, with students of non-Caucasian ancestry evidencing a trend toward reporting more frequent drinking (see Table 3). The demographic variables were not associated with binge drinking frequency. An earlier AO and a shorter Delay were associated with more frequent engagement in any drinking (adjusted $R^2 = .08, p < .001$) as well as with binge drinking (adjusted $R^2 = .06, p < .001$). Block 3, which comprised the series of interactions between 1) AO and delay and 2) the demographic variables with AO or Delay, was not associated significantly with the frequency of any drinking or of binge drinking ($p > .05$).

Discussion

While AO is an established risk factor for negative alcohol outcomes, a quick progression to drinking to intoxication has been identified only recently as a risk factor for heavy drinking and alcohol-related problems in college students (Morean et al., 2012). The current study extends this work, demonstrating that both an early AO and a short Delay also may be important determinants of alcohol use in high school students above and beyond demographic characteristics including gender, race, and grade in school. Consistent with Morean and colleagues' (2012) findings, an early AO and a short Delay conferred independent risk for heavy drinking; risk was not limited to individuals who had both an early AO and a short delay. Further, AO and Delay conferred risk similarly for males and females and for Caucasian and non-Caucasian individuals as evidenced by the absence of significant interactions between these demographic characteristics and either AO or Delay in predicting alcohol use outcomes. The current study also suggests that AO and Delay conferred similar risk for high school student drinkers across all grades. It is worth emphasizing that AO and Delay seem to be important determinants of alcohol use when considered in concert, as correlations between Delay alone and alcohol use were not significant. Thus, AO and Delay may be best conceptualized as more nuanced and informative way of examining the risk associated with AI.

Although retrospective reports of AO and AI have often been gathered decades after initiation of alcohol use, a central strength of the current study is that students reported initiating alcohol use an average of only 2.78 years prior and initiating intoxication only 1.98 years prior. This mitigates concerns about the potential impact of memory bias and alcohol-related memory deficits. When considering the results of the present study in concert with the Morean et al (2012) findings, there is mounting evidence that Delay to first intoxication is a valid risk factor for heavy drinking during adolescence and emerging adulthood.

While the present study yielded novel findings, several limitations merit note. 1) The study was conducted in one high school, which may limit the generalizability of the results. 2) The study relied on retrospective self-report data, and was therefore limited by participants' ability and willingness to respond reliably and honestly. While the reliability and validity of self-report measures of alcohol use generally are supported (e.g., Del Boca & Noll, 2000; Lintonen, Ahlstrom, & Metso, 2004; Morean et al., 2012), there is some evidence that

estimates of AO, in particular, may be biased; Sartor, Bucholz, Nelson, Madden, Lynsky & Health (2011) found that, when AO was assessed at multiple time points over the course of several years, adolescents and emerging adults who were lighter drinkers were more likely than heavier drinkers to report increasingly older AOs at subsequent assessments relative to their initial reports. Although it was not possible to evaluate this possibility explicitly in the current study, if heavier drinkers were, in fact, overrepresented as early onset drinkers, the relationships between AO (and perhaps Delay) and alcohol use could be artificially inflated.

3) The study was cross-sectional by design, so temporal relationships among the study variables could not be evaluated. As such, it is unclear the extent to which an early AO and a short Delay cause alcohol use and heavy drinking. Relatedly, it is possible that the identified relationships between AO, Delay, and alcohol use are accounted for, at least in part, by constructs that were not accounted for in the current study (e.g., family history of alcoholism status). Future research is needed to evaluate the extent to which a causal relationship exists between AO, Delay, and alcohol use and to examine potential mediators or moderators of this relationship including family history.

4) Related to concerns about both self-reports and the cross-sectional study design, it is possible that contemporaneous measurements of AO, AI, alcohol use, and binge drinking may be especially vulnerable to sources of bias including social desirability. For example, a student who chooses to report that he or she started drinking at a later age than s/he actually did may also be more likely to underreport alcohol use.

5) The average age of onset in the current study was younger (13.51 versus 16.16 years) than those observed in the study by Morean and colleagues (2012) and within national surveys (SAMSHA, 2012). The average Delay (.80 versus 1.25 years) also was shorter than that reported by Morean et al (2012) and by Monshouwer and colleagues (2003), although this is likely a byproduct of the restricted age range of the participants included in this study. Thus, by way of our inclusion criteria, which required that all students had started to drink and had drunk to the point of intoxication, the current study sample may represent a subgroup of youth who are at particularly high risk for negative alcohol-related outcomes. While this is not inherently a limitation, it is unclear the extent to which the risk associated with an early AO and a short Delay in the current high school sample would generalize to all age groups. Although our findings are encouraging in that they are consistent with those observed in a college sample (Morean et al., 2012), future research is needed on this topic.

6) We only were able to assess Delay with a level of precision of 1 year. As such, it was not possible to discern whether individuals with a Delay of 0 years drank to intoxication the first time they consumed alcohol (i.e., AO and AI on the same occasion). This information could be important for several reasons. While a shorter Delay may confer alcohol-related risk in general, it is not clear the extent to which this would apply to individuals who drank to intoxication the first time they used alcohol. One could hypothesize that drinking to intoxication on the first drinking occasion could confer additional risk for a subset of individuals. For example, the Low Level of Response Model (e.g., Schuckit, 2009) suggests that alcohol-related risk is conferred via the experience of a blunted response to the effects of alcohol during early drinking episodes, which results in an inherent ability to drink more (perhaps to the point of intoxication) than individuals who are more sensitive to alcohol effects. However, one could also imagine that drinking to intoxication on the first drinking experience could deter further drinking for a subset of individuals if the experience of intoxication was particularly aversive (e.g., resulted in vomiting; punishment from parents/

authority figures). Future research is needed to evaluate the risk associated with drinking to intoxication on the first drinking occasion. 7) In the current study, we controlled for grade to help simultaneously address age effects on drinking (i.e., older students may drink more) and to address possible cohort effects. It merits note that alternative methods may be used to address cohort effects more directly, including multilevel modeling or explicitly controlling for clustering effects. 8) The definition of binge drinking used in the current study (i.e., 5 or more drinks on a single occasion) may have resulted in underestimates of binge drinking frequency for females, for whom a binge episode is defined as consuming 4 or more drinks (NIAAA, 2004). 9) Finally, we did not include a measure of the experience of alcohol-related problems, so it is not possible to speak to the relationship between AO, Delay, and problems in this sample.

In spite of its limitations, the current study 1) suggests that the first experience of intoxication represents an important drinking milestone in the progression toward heavy alcohol use among adolescents (i.e., binge drinking) and 2) provides further evidence that AO and Delay to intoxication are risk factors for alcohol use and binge drinking in youth. Importantly, these factors confer risk for heavy drinking by the time students enter high school, suggesting that prevention and intervention efforts targeting middle school students are warranted. With respect to informing the content of prevention efforts, the findings linking an early AO to heavy drinking argue for the necessity of continuing prevention efforts aimed at postponing AO. The current study also suggests that a novel intervention designed to postpone drinking to intoxication among youth who have already started drinking ultimately may be effective in modulating alcohol-related risk among underage drinkers. To this end, future research aimed at developing a better understanding of early intoxication and the progression to experiencing alcohol-related problems is needed. A critical first step, longitudinal research is needed to identify factors that contribute to the length of the delay to first intoxication (e.g., antisocial personality characteristics; family history of alcoholism, alcohol use norms). In turn, research examining the mechanisms through which a short Delay translates to heavy drinking, and subsequently, the experience of alcohol-related problems is necessary. In other words, what factors influence the delay between drinking to intoxication and the emergence of alcohol-related problems? In sum, when the findings of the current study are considered in concert with those of Morean and colleagues' (2012), there is accruing evidence that AO and Delay confer alcohol-related risk during the development period spanning adolescence through emerging adulthood. We hope that the current study serves as an impetus for future work on these important constructs.

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Table 1

Demographic and Past-Month Alcohol Use Characteristics of High School Student Drinkers (N = 295)

DEMOGRAPHICS (% of N = 295)		
Race		
<i>Caucasian</i>	80.3	
<i>Latino</i>	7.5	
<i>Biracial</i>	6.1	
<i>Other</i>	5.8	
Grade		
<i>9</i>	15.3	
<i>10</i>	18.6	
<i>11</i>	30.2	
<i>12</i>	35.9	
PAST-MONTH ALCOHOL USE		
# of Days	Any Use (%)	Binge (%)
0	--	28.8
1-2	43.4	37
3-5	22.4	12.7
6-9	15.6	11.3
10-19	11.5	5.1
20-29	2.7	2.4
30	4.4	2.7

Note. -- denotes that no participants reported 0 days of alcohol use in the past month because all participants were selected for inclusion in the current analyses on the basis of reporting using alcohol at least once in the past month.

Table 2

Correlations between Continuous Study Variables

	<u>Age of Intoxication</u>	<u>Delay to First Intoxication</u>	<u>Frequency (Any Drinking)</u>	<u>Frequency (Binge Drinking)</u>
Age of Onset	.78 ^{****}	-.38 ^{****}	-.31 ^{****}	-.21 ^{****}
Age of Intoxication		.16 [*]	-.32 ^{****}	-.25 ^{****}
Delay to First Intoxication			.02	.01
Frequency (Any Drinking)				.63 ^{****}

Table 3

Age of Onset, Delay to Intoxication, and Alcohol Use

Predictors	Any Drinking				Binge Drinking							
	R ²	df	F	Unstandardized B	Std. Error	β	R ²	df	F	Unstandardized B	Std. Error	β
Step 1												
DEMOGRAPHICS												
	.02**	(3, 285)	2.79				.01	(3, 282)	1.69			
<i>Grade</i>				-.02	.01	-.10				.00	.01	.00
<i>Race</i>				-.04	.03	-.10				-.07	.04	-.12
<i>Gender</i>				.03	.02	.09				.03	.03	.06
Step 2												
AO & DELAY												
	.08***	(2, 283)	13.33				.06***	(2, 280)	9.31			
<i>AO</i>				-.03	.01	-.36***				-.03	.01	-.31***
<i>Delay</i>				-.02	.01	-.15*				-.03	.01	-.17*
Step 3												
INTERACTIONS												
	.00	(7, 276)	.87				.02	(7, 273)	1.63			
<i>AO x Delay</i>				.02	.03	.11				-.01	.04	-.03
<i>AO x Gender</i>				-.02	.01	-.14				-.02	.02	-.08
<i>Delay x Gender</i>				-.04	.03	-.26				-.04	.04	-.17
<i>AO x Race</i>				.01	.03	.03				-.05	.04	-.17
<i>Delay x Race</i>				.01	.03	.02				.05	.04	.20
<i>AO x Grade</i>				.00	.01	.01				.04	.02	.14
<i>Delay x Grade</i>				-.01	.04	-.05				.03	.06	.11

Note.

* p < .05

** p < .01

*** p < .001

superscript T < .10

Reference groups were as follows: 9th grade; Caucasian race; female gender