

# UC Office of the President

## Recent Work

### Title

Associations of Early Age of First Intoxication with Past Year Drinking Contexts and Problems

### Permalink

<https://escholarship.org/uc/item/3005v9nk>

### Journal

Subst Use Misuse, 54(7)

### Authors

Lipperman-Kreda, Sharon  
Grube, Joel W

### Publication Date

2019-01-24

Peer reviewed

**Associations of Early Age of First Intoxication with Past Year Drinking Contexts and  
Problems**

## **ABSTRACT**

**BACKGROUND:** Mechanisms underlying associations between early drinking and problems are largely unknown. **OBJECTIVES:** We investigated (a) associations between early age of first intoxication ( $\leq 15$  years) and past year drinking in different contexts and (b) whether early age of first intoxication is differentially associated with problems in these contexts. **METHODS:** We used survey data collected in 2013-2014 from 405 past-year adolescent drinkers in 24 midsized California cities. Data included demographics; drinking behaviors; age of first intoxication; frequency of being at and drinking at restaurants, bars/nightclubs, outdoor places, and home; and problems. We used multilevel logistic and negative binomial models to account for the clustering of adolescents within cities. Probabilities were corrected to maintain family-wise error rates. **RESULTS:** Early age of first intoxication was associated with a 120% increase in the odds of drinking at outdoor settings (OR=2.20,  $p_c < .05$ ). Early age of first intoxication was associated with increased numbers of problems related to drinking in restaurants (IRR=5.72,  $p_c < .001$ ), outdoor settings (IRR=3.40,  $p_c < .001$ ), and homes (IRR=2.84,  $p_c < .001$ ). Later intoxication ( $\geq 16$  years) was not significantly associated with increased drinking or problems in any of these contexts. **CONCLUSIONS:** Results suggest that underage drinkers who report early intoxication are more likely to drink at outdoor settings, but not other contexts. However, they may differentially experience drinking problems across contexts. To target youths who have experienced intoxication at an early age and to reduce problems, prevention interventions should focus on outdoor settings.

**KEYWORDS:** Early age of intoxication; Underage drinking; Drinking contexts; Drinking-related problems.

## INTRODUCTION

Despite the uniform legal drinking age of 21 years in the U.S., many adolescents initiate drinking at an early age. The 2016 NSDUH data show that 26% of the population  $\geq 12$  years old report having their first drink by age 15 (Center for Behavioral Health Statistics and Quality, 2017). In 2016, 23% of 8<sup>th</sup> graders reported having consumed more than just a sip or taste of alcohol (Miech et al., 2017). Thus, about a quarter of adolescents initiate drinking before age 15 years. Moreover, 9% of students in the 8<sup>th</sup> grade report ever being drunk. From a developmental perspective, many of the negative consequences of alcohol use may depend on the developmental timing of first alcohol use or exposure (Masten, Faden, Zucker, & Spear, 2008, 2009; Zucker, 2015). Early initiation of drinking, especially heavy drinking, has been associated with a range of adverse outcomes for adolescents, including increased risk for alcohol dependence, lower academic achievement, risky sex, assaults, traffic crashes, and other substance use (Dawson, Goldstein, Chou, Ruan, & Grant, 2008; Dawson, Grant, & Li, 2007; Grant & Dawson, 1997; R. Hingson, Heeren, Zakocs, Winter, & Wechsler, 2003; R. W. Hingson, Edwards, Heeren, & Rosenbloom, 2009; R. W. Hingson, Heeren, & Winter, 2006; Kim et al., 2016; Nelson, Van Ryzin, & Dishion, 2015; Ohannessian, Finan, Schulz, & Hesselbrock, 2015; Stueve & O'Donnell, 2005; Warner & White, 2003).

The mechanisms underlying the associations between early drinking and later problems are largely unknown. These associations may reflect the effects of neurological or physiological changes that result from early drinking (Monti et al., 2005). Alternatively, they may be due to the common effects of predisposing factors (e.g., genetic susceptibility, conduct disorder, impulsivity) that increase the likelihood of both early drinking and involvement in other problem behaviors (Dubow, Boxer, & Huesmann, 2008; Mason & Spoth, 2012; Masten et al., 2009;

Verweij et al., 2016; Ystrom, Kendler, & Reichborn-Kjennerud, 2014). In addition, however, the associations between early alcohol onset and progression to problems may result from the selection of and exposure to drinking environments that enable and maintain heavy drinking and alcohol-related problems. Importantly, some evidence suggests that early initiation to drinking may be largely attributable to environmental, rather than genetic or other predisposing factors (Pagan et al., 2006; Rose, Dick, Viken, Pulkkinen, & Kaprio, 2001).

A potentially important, but largely neglected factor, is the context in which early drinking occurs. Drinking context refers to the location (e.g., home, outdoor setting), type of event (e.g., party, family get-together), and the social (e.g., number of people, age composition) and situational (e.g., time of the day, adult supervision) characteristics of a specific drinking event (Freisthler, Lipperman-Kreda, Bersamin, & Gruenewald, 2014). Previous research has shown that where adolescents drink, as well as the social and situational characteristics of that setting, are associated with drinking rates, problems, and simultaneous use of alcohol and other substances (Bersamin, Lipperman-Kreda, Mair, Grube, & Gruenewald, 2016; Lipperman-Kreda, Gruenewald, Bersamin, Mair, & Grube, 2017; Lipperman-Kreda, Gruenewald, Grube, & Bersamin, 2017; Lipperman-Kreda, Mair, Bersamin, Gruenewald, & Grube, 2015; Mair, Lipperman-Kreda, Gruenewald, Bersamin, & Grube, 2015). Missing, however, is a consideration of the role of early alcohol initiation and intoxication in the selection and use of drinking contexts and resulting problems in those contexts. Focusing on drinking locations, as one aspect of drinking contexts, the current study investigated differential associations between first intoxication at an early age ( $\leq 15$  years) and (a) past year drinking in specific contexts and (b) problems related to drinking in those contexts.

A limited number of studies have investigated contexts of early alcohol and heavy use and

their associations with problems. For example, one study suggested that early heavier drinking primarily takes place in a peer context, whereas early lighter drinking often takes place in either a family context or peer context (Jackson et al., 2016). A longitudinal study among Dutch adolescents found that drinking at home predicted increased levels of drinking both at home and outside the home and problem drinking, even after controlling for previous alcohol use in both contexts (van der Vorst, Engels, & Burk, 2010). Focusing on contexts of initiation, Warner and White found that early initiators, whether they first drank at a family gathering or in another context, were more likely to develop problems associated with alcohol use compared with youths who initiated drinking at older ages at a family gathering (Warner & White, 2003). Additional research is needed, however, to better understand associations between early initiation or intoxication and selection of drinking contexts and problems related to drinking in these contexts. Such research can help inform the development of preventive interventions specific to those contexts.

## **METHODS**

*Sample of cities.* Our study included adolescents (15-18 years old) who participated in a study in 24 mid-sized California cities. These cities were purposively selected from a geographically diverse sample of 50 non-contiguous California cities with populations between 50,000 and 500,000. The selection of the subset of 24 cities was described elsewhere (Bersamin et al., 2016; Lipperman-Kreda, Gruenewald, Bersamin, et al., 2017). Although these cities were part of a randomized trial to evaluate the effects of environmental strategies to reduce community alcohol problems, data used for the current analyses were collected before the interventions began.

*Survey methods.* Households within each city were randomly sampled from purchased lists of landline and cell phone exchanges. The list of landlines included address information. An invitation letter describing the study and inviting participation was mailed to these households, followed by telephone contact. Households sampled from the lists of cell phone exchanges were contacted by cell phone only. Households and participants were screened for eligibility based on city of residence and age. Of the total completed interviews, 6% were from the cell phone sample list. The estimated overall response rate was 42%. Respondents received \$20 as compensation for their participation in the study. Institutional review board approval was obtained prior to implementation of the study.

*Survey sample.* Participants were surveyed through a computer-assisted telephone interview (CATI). The interviews were given in either English or Spanish at the respondent's request and lasted approximately 20 minutes. Twenty youths (1.6%) asked to do the interview in Spanish. The survey took place in 2013-2014. This paper is based on 405 adolescents who were past year drinkers and who provided complete data (55% male, M age = 16.5 years,  $SD = .09$ ).

### *Measures*

*Early age of first intoxication.* Participants who reported ever having a whole drink (more than a sip or a taste) of an alcoholic beverage (i.e., lifetime drinkers) were asked whether they have ever had enough to drink to feel drunk. Those who responded “yes” were also asked how old they were the first time they had enough to drink to feel drunk. We created a trichotomous variable: (a) never had enough to drink to feel drunk, (b) first intoxication by age 15 years and (c) first intoxication after age 15 years.

*Frequency of drinking and heavier drinking.* To measure past-year alcohol use frequency (F), lifetime drinkers were asked: “In the past 12 months, on how many days did you have a whole

drink of an alcoholic beverage?” Respondents who had consumed alcohol in the past 12 months were asked: “In the past 12 months, on the days when you drank alcohol, how many drinks did you typically have?” Heavier drinking was calculated as  $[(F \times \text{typical number of drinks}) - F]$ , representing the total past-year volume consumed beyond one drink per occasion. This measure is based upon a validated dose-response model and it allows us to better distinguish effects related to occasions of use from those related to heavier use on those occasions (Gruenewald & Mair, 2015; Gruenewald, Wang-Schweig, & Mair, 2016).

*Frequency of being in different contexts.* We asked participants the number of days in the past 12 months they went to restaurants, bars/nightclubs, and outdoor places such as parks, beaches, parking lots, sidewalks or street corners. Respondents were also asked the number of hours they spent in their own home or someone else’s home on (a) a typical weekday during school year, (b) a typical weekday during school summer vacation/break, and (c) a typical day on the weekend. We calculated a weighted total number of hours at home or someone else’s home based on 170 weekday school days (47%), 91 summer vacation weekdays (25%), and 104 weekend days (28%).

*Frequency of drinking in different contexts.* Those who reported both past-year alcohol use and having been in each of the four locations (restaurants, bars/nightclubs, outdoor places, own home or someone else’s home) were asked about the number of days in the past year they drank alcohol in each place.

*Number of problems associated with drinking in the different contexts.* Participants who reported drinking in a given context were asked about the number of days they experienced problems either during or shortly after drinking in that context. Problems included (a) getting into a verbal argument or a physical fight, (b) getting hurt or injured, (c) having unprotected



vaginal sex (e.g., sex without a condom), (d) having vaginal sex or oral sex with someone they had met that day, (e) using illicit drugs, (f) riding with a driver who had been drinking alcohol, and (g) driving after drinking alcohol. Given the skewed distributions of these variables, we recoded them to indicate whether participants had experienced each specific problem in each context in the past year (e.g., any argument related to drinking in restaurants). Table 1 shows the percentages of participants reporting each problem by drinking context. For the primary analyses we summed the number of drinking-related problems participants experienced in each of the four contexts.

*Demographics.* Respondents reported their gender, age, and race/ethnicity. Race/ethnicity was treated as a dichotomous variable (non-Hispanic White versus other). They were also asked about the highest level of education their mother or female guardian and father or male guardian had completed. Response options included (a) less than 8<sup>th</sup> grade; (b) eighth grade, (c) some high school; (d) high school graduate or GED; (e) technical, vocational, or trade school; (f) some college; (g) completed junior college graduate (Associate's degree); (h) college graduate (Bachelor's degree); and (i) graduate or professional school after college (Master's, Ph.D., Lawyer, Doctor). These items were recoded into the number of years of education using the highest reported education for either parent. Lastly, as a measure of disposable income, youths were asked, "How much spending money do you receive or earn in a typical week? Please count only money that you can spend on whatever you want. Do not count money that is given to you to spend only on things like bus fare or lunch."

#### *Data analysis*

The primary analyses consisted of logistic and negative binomial regression models, using Stata v.15, with a sandwich variance estimator to correct for loss of unit independence because

of nesting of respondents within cities. Early and late first intoxication were entered as dummy variables. Drinkers who had not experienced intoxication comprised the excluded comparison group. First, we investigated associations of early age of first intoxication with any past year drinking at (a) restaurants, (b) bars/nightclubs, (c) outdoor places, and (d) home or someone else's home. We controlled for youths' drinking patterns (i.e., past-year drinking frequency and heavier drinking), past year frequency of being in each place, and background characteristics (age, gender, non-Hispanic White, parental education and weekly disposable income). Next, we examined associations of early age of first intoxication with the number of past year drinking problems experienced at (a) restaurants, (b) bars/nightclubs, (c) outdoor places, and (d) home or someone else's home. We adjusted for youths' drinking patterns, past year frequency of being in each place, the number of days they drank in these places in the past year, and background characteristics. Because of the sparseness of drinking in bars or nightclubs in our young sample, these places were dropped from the primary analyses. To maintain the family-wise error rate, we obtained corrected  $p$ -values ( $p_c$ ) using the sequential Holm-Bonferroni approach (Abdi, 2010; Holm, 1979).

## RESULTS

*Sample characteristics.* Sample characteristics are in Table 2. Of the drinkers, 134 (33%) reported experiencing first intoxication by age 15 years, 120 (30%) reported experiencing first intoxication after age 15 years, and 151 (37%) reported they had never had felt intoxicated. On average, participants reported drinking alcohol on 12.9 days in the past year ( $SD=24.4$ ). They reported drinking most frequently in a home setting (own home or someone else's home), followed by outdoor settings, restaurants, and bars or nightclubs. The number of problems associated with these contexts followed similar pattern, with a greater number of past year

problems associated with drinking at home, followed by outdoor settings, bars or night clubs, and restaurants.

### *Multi-level analyses*

*Drinking contexts.* Results of the multilevel logistic regression models assessing associations between first intoxication at an early age and drinking contexts are in Table 3. Adjusting for past year frequency of drinking and heavy drinking, frequency of being in each context in the past year, and background characteristics, first intoxication at an early age ( $\leq 15$  years), compared with never experiencing intoxication, was significantly associated with increases in the odds of drinking in outdoor settings (OR=2.20,  $p_c < .05$ ), but not with drinking in other contexts. Later intoxication ( $\geq 16$  years) was not significantly associated with increased odds of drinking in any of the contexts in these analyses.

*Problems.* Results of multilevel negative binomial models to examine associations between early age of first intoxication and number of problems associated with drinking in each of the contexts are in Table 4. Adjusting for past year drinking patterns, the frequency of being in and drinking in each context in the past year, and demographics, early age of first intoxication was uniquely associated with increased numbers of drinking-related problems in restaurants (IRR=5.72,  $p_c < .001$ ), in outdoor settings (IRR=3.40,  $p_c < .001$ ), and in home settings ((IRR=2.84,  $p_c < .001$ ). Later age of first intoxication was not significantly associated with numbers of problems in all these contexts.

## **DISCUSSION**

Overall, one third of the drinkers in our sample reported first intoxication at an early age ( $< 15$  years). We found a significant positive association between early first intoxication, compared with never experiencing intoxication, and likelihood of drinking in outdoor contexts, but not in

other contexts. No associations were found between later first intoxication and drinking in any of the contexts. These results suggest that underage drinkers who experience intoxication at an early age are more likely to drink in outdoor settings and to experience problems related to drinking at different settings. These associations may result from the selection of drinking environments that enable and maintain risky drinking and related problems. Outdoor contexts may represent environments with less enforcement, supervision, or social control that, as a result, allow youth to engage in risky behaviors such as heavier drinking. Indeed, another study found that heavier drinking was associated with increased likelihood of drinking at parking lots or street corners (Lipperman-Kreda et al., 2015).

Based on the principles of the Niche Theory, individuals not only select contexts for drinking, but also construct and influence those environments to be supportive of their drinking behaviors (Gruenewald, 2007). This perspective suggests that underage drinkers seek, select and actively shape environments that allow them to establish contexts in which they can use alcohol and other substances. Future research should investigate the processes by which young drinkers self-select themselves into these contexts and shape these contexts to allow risky alcohol use. For example, early onset adolescent drinkers with low self-control (i.e., impulsivity) may be more likely to choose unsupervised contexts, which, in turn, promote riskier drinking and increase the likelihood of experiencing short- and long-term alcohol-related problems.

We also found that early first intoxication, compared with no intoxication, was associated with greater of drinking-related problems in all of the contexts (restaurants, outdoor places, and homes). Importantly, the associations between early age of intoxication and context-specific drinking-related problems remain after adjusting for overall frequency of drinking and heavier drinking and time spent in each specific context. These results are consistent with previous

studies showing associations between initiation of heavy drinking at early age and problems among adolescents (Dawson et al., 2008; Dawson et al., 2007; Grant & Dawson, 1997; R. Hingson et al., 2003; R. W. Hingson et al., 2009; R. W. Hingson et al., 2006; Kim et al., 2016; Nelson et al., 2015; Ohannessian et al., 2015; Stueve & O'Donnell, 2005; Warner & White, 2003). However, our findings go beyond previous research by addressing adolescents' experience of alcohol-related problems in specific drinking contexts.

Our results suggest that underage drinkers who report early first intoxication are more likely to drink at outdoor settings and to consistently experience problems across contexts. However, a few study limitations should be noted. First, outdoor contexts represent many different types of settings (e.g., parks, beaches, parking lots, sports events), which may include situations and behaviors that were not fully captured in this study. Second, we used a subjective retrospective measure of early age of intoxication. Previous research has shown that measures of age of initiation are subject to recall bias (Sartor et al., 2011) and that objective measures of age of initiation (e.g., age of first having 5 or more drinks in one sitting) may outperform subjective intoxication measures (Morean, L'Insalata, Butler, McKee, & Krishnan-Sarin, 2018). Third, we only assessed problems related to risky vaginal or oral sex but no other types of sexual intercourses (e.g., anal sex). Fourth, we did not assess the specific contexts in which initiation of alcohol use and first intoxication occurred. Fifth our data are drawn from mid-to large-sized California cities. As a result, the results are not necessarily representative of more rural or urban areas. Sixth, our study is based on self-report survey measures of alcohol frequencies over 12-month period, which may have been limited by recall and social desirability biases. Finally, data for this study were cross-sectional and did not allow us to determine temporal sequencing of exposures and problems nor examine long-term associations between early intoxication,

contexts, and progression to problems. This is an important consideration since not all early initiators experience serious alcohol-related problems later in life.

Nevertheless, results of this study suggest that to target youths who have experienced intoxication at an early age and to reduce problems, prevention interventions should focus on outdoor settings. For example, policymakers can target policies and enforcement efforts toward those contexts. Family-based interventions can inform parents that outdoor contexts may bring together youths who have experienced intoxication at an early age and that early intoxication can result in problems across different contexts. More research, however, is needed to investigate the contribution of specific contexts and contextual characteristics (e.g., number of people, social relationships, adult supervision) to the development of early drinking onset and the progression to problems to inform effective interventions targeting specific groups, specific contexts, and specific problems in relation to early alcohol use.

**Funding:** This research and preparation of this manuscript were supported by grant P60-AA006282 from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) of the National Institutes of Health (NIH) and grant 25IR-0029 from the California Tobacco-Related Disease Research Program (TRDRP). The content is solely the responsibility of the authors and does not necessarily represent the official views of the TRDRP, NIAAA or NIH.

## REFERENCES

- Abdi, H. (2010). Holm's sequential Bonferroni procedure. In N. J. Salkland (Ed.), *Encyclopedia of research design* (pp. 573-577). Thousand Oaks, CA: Sage.
- Bersamin, M., Lipperman-Kreda, S., Mair, C., Grube, J., & Gruenewald, P. (2016). Identifying Strategies to Limit Youth Drinking in the Home. *J Stud Alcohol Drugs*, 77(6), 943-949. doi: <http://dx.doi.org/10.15288/jsad.2016.77.943>
- Center for Behavioral Health Statistics and Quality. (2017). *National Survey on Drug Use and Health 2016*. Retrieved from Rockville, MD: <https://datafiles.samhsa.gov/study-dataset/national-survey-drug-use-and-health-2016-nsduh-2016-ds0001-nid17185>
- Dawson, D. A., Goldstein, R. B., Chou, S. P., Ruan, W. J., & Grant, B. F. (2008). Age at first drink and the first incidence of adult-onset DSM-IV alcohol use disorders. *Alcohol Clin Exp Res*, 32(12), 2149-2160. doi:10.1111/j.1530-0277.2008.00806.x
- Dawson, D. A., Grant, B. F., & Li, T. K. (2007). Impact of age at first drink on stress-reactive drinking. *Alcohol Clin Exp Res*, 31(1), 69-77. doi:10.1111/j.1530-0277.2006.00265.x
- Dubow, E. F., Boxer, P., & Huesmann, L. R. (2008). Childhood and adolescent predictors of early and middle adulthood alcohol use and problem drinking: the Columbia County Longitudinal Study. *Addiction*, 103 Suppl 1, 36-47. doi:10.1111/j.1360-0443.2008.02175.x
- Freisthler, B., Lipperman-Kreda, S., Bersamin, M., & Gruenewald, P. J. (2014). Tracking the When, Where, and With Whom of Alcohol Use: Integrating Ecological Momentary Assessment and Geospatial Data to Examine Risk for Alcohol-Related Problems. *Alcohol Res*, 36(1), 29-38.

- Grant, B. F., & Dawson, D. A. (1997). Age at onset of alcohol use and its association with DSM-IV alcohol abuse and dependence: results from the National Longitudinal Alcohol Epidemiologic Survey. *J Subst Abuse, 9*, 103-110.
- Gruenewald, P. J. (2007). The spatial ecology of alcohol problems: niche theory and assortative drinking. *Addiction, 102*(6), 870-878. doi:10.1111/j.1360-0443.2007.01856.x
- Gruenewald, P. J., & Mair, C. (2015). Heterogeneous dose-response and college student drinking: examining problem risks related to low drinking levels. *Addiction, 110*(6), 945-954. doi:10.1111/add.12887
- Gruenewald, P. J., Wang-Schweig, M., & Mair, C. (2016). Sources of Misspecification Bias in Assessments of Risks Related to Alcohol Use. *J Stud Alcohol Drugs, 77*(5), 802-810.
- Hingson, R., Heeren, T., Zakocs, R., Winter, M., & Wechsler, H. (2003). Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among U.S. college students. *J Stud Alcohol, 64*(1), 23-31.
- Hingson, R. W., Edwards, E. M., Heeren, T., & Rosenbloom, D. (2009). Age of drinking onset and injuries, motor vehicle crashes, and physical fights after drinking and when not drinking. *Alcohol Clin Exp Res, 33*(5), 783-790. doi:10.1111/j.1530-0277.2009.00896.x
- Hingson, R. W., Heeren, T., & Winter, M. R. (2006). Age at drinking onset and alcohol dependence: age at onset, duration, and severity. *Arch Pediatr Adolesc Med, 160*(7), 739-746. doi:10.1001/archpedi.160.7.739
- Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics, 6*(2), 65-70.



- Jackson, K. M., Merrill, J. E., Barnett, N. P., Colby, S. M., Abar, C. C., Rogers, M. L., & Hayes, K. L. (2016). Contextual influences on early drinking: Characteristics of drinking and nondrinking days. *Psychol Addict Behav*. doi:10.1037/adb0000184
- Kim, M. J., Mason, W. A., Herrenkohl, T. I., Catalano, R. F., Toumbourou, J. W., & Hemphill, S. A. (2016). Influence of Early Onset of Alcohol Use on the Development of Adolescent Alcohol Problems: a Longitudinal Binational Study. *Prev Sci*. doi:10.1007/s11121-016-0710-z
- Lipperman-Kreda, S., Gruenewald, P. J., Bersamin, M., Mair, C. F., & Grube, J. W. (2017). Adolescent drinking in different contexts: What behaviors do parents control? *Addict Behav Rep*, 6, 39-44. doi:10.1016/j.abrep.2017.05.003
- Lipperman-Kreda, S., Gruenewald, P. J., Grube, J. W., & Bersamin, M. (2017). Adolescents, alcohol, and marijuana: Context characteristics and problems associated with simultaneous use. *Drug Alcohol Depend*, 179, 55-60. doi:10.1016/j.drugalcdep.2017.06.023
- Lipperman-Kreda, S., Mair, C. F., Bersamin, M., Gruenewald, P. J., & Grube, J. W. (2015). Who drinks where: youth selection of drinking contexts. *Alcohol Clin Exp Res*, 39(4), 716-723. doi:10.1111/acer.12670
- Mair, C., Lipperman-Kreda, S., Gruenewald, P. J., Bersamin, M., & Grube, J. W. (2015). Adolescent Drinking Risks Associated with Specific Drinking Contexts. *Alcohol Clin Exp Res*, 39(9), 1705-1711. doi:10.1111/acer.12806
- Mason, W. A., & Spoth, R. L. (2012). Sequence of alcohol involvement from early onset to young adult alcohol abuse: differential predictors and moderation by family-focused

- preventive intervention. *Addiction*, 107(12), 2137-2148. doi:10.1111/j.1360-0443.2012.03987.x
- Masten, A. S., Faden, V. B., Zucker, R. A., & Spear, L. P. (2008). Underage drinking: a developmental framework. *Pediatrics*, 121 Suppl 4, S235-251. doi:10.1542/peds.2007-2243A
- Masten, A. S., Faden, V. B., Zucker, R. A., & Spear, L. P. (2009). A developmental perspective on underage alcohol use. *Alcohol Res Health*, 32(1), 3-15.
- Miech, R. A., Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Patrick, M. E. (2017). *Monitoring the Future national survey results on drug use, 1975–2016: Volume I, Secondary school students*. Retrieved from Ann Arbor: <http://monitoringthefuture.org/pubs.html#monographs>
- Monti, P. M., Miranda, R., Jr., Nixon, K., Sher, K. J., Swartzwelder, H. S., Tapert, S. F., . . . Crews, F. T. (2005). Adolescence: booze, brains, and behavior. *Alcohol Clin Exp Res*, 29(2), 207-220.
- Morean, M. E., L'Insalata, A., Butler, E. R., McKee, A., & Krishnan-Sarin, S. (2018). Age at drinking onset, age at first intoxication, and delay to first intoxication: Assessing the concurrent validity of measures of drinking initiation with alcohol use and related problems. *Addict Behav*, 79, 195-200. doi:10.1016/j.addbeh.2017.12.017
- Nelson, S. E., Van Ryzin, M. J., & Dishion, T. J. (2015). Alcohol, marijuana, and tobacco use trajectories from age 12 to 24 years: demographic correlates and young adult substance use problems. *Dev Psychopathol*, 27(1), 253-277. doi:10.1017/s0954579414000650

- Ohannessian, C. M., Finan, L. J., Schulz, J., & Hesselbrock, V. (2015). A long-term longitudinal examination of the effect of early onset of alcohol and drug use on later alcohol abuse. *Subst Abus*, *36*(4), 440-444. doi:10.1080/08897077.2014.989353
- Pagan, J. L., Rose, R. J., Viken, R. J., Pulkkinen, L., Kaprio, J., & Dick, D. M. (2006). Genetic and environmental influences on stages of alcohol use across adolescence and into young adulthood. *Behav Genet*, *36*(4), 483-497. doi:10.1007/s10519-006-9062-y
- Rose, R. J., Dick, D. M., Viken, R. J., Pulkkinen, L., & Kaprio, J. (2001). Drinking or abstaining at age 14? A genetic epidemiological study. *Alcohol Clin Exp Res*, *25*(11), 1594-1604.
- Sartor, C. E., Bucholz, K. K., Nelson, E. C., Madden, P. A., Lynskey, M. T., & Heath, A. C. (2011). Reporting bias in the association between age at first alcohol use and heavy episodic drinking. *Alcohol Clin Exp Res*, *35*(8), 1418-1425. doi:10.1111/j.1530-0277.2011.01477.x
- Stueve, A., & O'Donnell, L. N. (2005). Early alcohol initiation and subsequent sexual and alcohol risk behaviors among urban youths. *Am J Public Health*, *95*(5), 887-893. doi:10.2105/ajph.2003.026567
- van der Vorst, H., Engels, R. C., & Burk, W. J. (2010). Do parents and best friends influence the normative increase in adolescents' alcohol use at home and outside the home? *J Stud Alcohol Drugs*, *71*(1), 105-114.
- Verweij, K. J., Creemers, H. E., Korhonen, T., Latvala, A., Dick, D. M., Rose, R. J., . . . Kaprio, J. (2016). Role of overlapping genetic and environmental factors in the relationship between early adolescent conduct problems and substance use in young adulthood. *Addiction*, *111*(6), 1036-1045. doi:10.1111/add.13303

Warner, L. A., & White, H. R. (2003). Longitudinal effects of age at onset and first drinking situations on problem drinking. *Subst Use Misuse, 38*(14), 1983-2016.

Ystrom, E., Kendler, K. S., & Reichborn-Kjennerud, T. (2014). Early age of alcohol initiation is not the cause of alcohol use disorders in adulthood, but is a major indicator of genetic risk. A population-based twin study. *Addiction, 109*(11), 1824-1832.  
doi:10.1111/add.12620

Zucker, R. A. (2015). Alcohol use and the alcohol use disorders: A developmental-biopsychosocial systems formulation covering the life course. In *Developmental Psychopathology* (pp. 620-656): John Wiley & Sons, Inc.

Table 1: Percentages of participants reporting each problem by drinking contexts

Problem	Restaurants	Bars/nightclubs	Outdoor Places	Home
Argument or Fight	0.5%	0.5%	12.3%	14.8%
Hurt or Injured	0.5%	0.5%	8.4%	10.4%
Unprotected Sex	0.0%	0.5%	6.4%	9.6%
Sex with Someone Just Met	0.0%	0.5%	5.7%	8.6%
Using Illicit Drug	1.0%	1.7%	20.5%	29.9%
Rode with Drinking Driver	0.5%	0.7%	9.1%	13.3%
Drove after Drinking	0.0%	0.0%	2.0%	4.7%

Table 2: Sample characteristics and descriptive statistics ( $N=405$  youth past year drinkers)

Variables	Percent	Mean (SD)	Range
Never had enough to drink to feel drunk	37.0		
Later age of first intoxication ( $\geq 16$ years)	30.0		
Early age of first intoxication ( $\leq 15$ years)	33.0		
<b>Drinking patterns</b>			
Drinking frequency, past year	---	12.9 (24.4)	1.0-200.0
Heavier drinking [(F*Q)-F], past year	---	39.1 (118.1)	0.0-1495.0
<b>Frequency of attending different contexts</b>			
Number of days at restaurants, past year	---	61.7 (68.7)	0.0-365.0
Number of days at bars/nightclubs, past year	---	1.2 (15.1)	0.0-300.0
Number of days in outdoor places, past year	---	90.2 (107.9)	0.0-365.0
Number of hours a day at home <sup>1</sup>	---	13.4 (3.7)	3.7-24.0
<b>Frequency of drinking in different contexts</b>			
Number of days drank at restaurants, past year		0.3 (1.8)	0.0-25.0
Number of days drank at bars/nightclubs, past year		0.2 (1.5)	0.0-20.0
Number of days drank in outdoor places, past year		5.5 (22.9)	0.0-360.0
Number of days drank at home		8.8 (19.2)	0.0-230.0
<b>Problems related to drinking in specific contexts</b>			
Problems, restaurants past year	2.2	0.03 (0.2)	0.0-2.0
Problems, bars or nightclubs past year	3.7	0.08 (0.5)	0.0-6.0
Problems, outdoor places past year	31.6	0.8 (1.7)	0.0-8.0
Problems, home past year	53.1	1.3 (1.7)	0.0-8.0
<b>Demographics</b>			
Age	---	16.5 (0.9)	15.0-18.0
Female	45.2		
Non-Hispanic White	69.9		
Parent education	---	16.0 (2.0)	6.0-18.0
Weekly disposable income	---	42.7 (77.9)	0.0-600.0

<sup>1</sup> Weighted measure of number of hours at home or someone else's home on a typical day during: (a) school year (0.47), (b) school vacation (0.28), and (c) weekend (0.25)

Table 3: Results of multilevel logistic regression analyses examining associations between early age of first intoxication and past year drinking in different contexts among underage drinkers ( $N=405$  nested within 24 cities), OR (95% CI)

	Restaurants	Outdoor Places	Home
Later age of first intoxication ( $\geq 16$ years) <sup>1</sup>	1.73 (0.55, 5.46)	2.14 (1.21, 3.78)	1.17 (0.60, 2.28)
Early age of first intoxication ( $\leq 15$ years) <sup>1</sup>	0.83 (0.26, 2.71)	2.20 (1.35, 3.58)*	0.97 (0.44, 2.13)
Place frequency <sup>2</sup>	1.59 (1.07, 2.37)	1.43 (1.24, 1.65)***	2.91 (0.90, 9.32)
Drinking frequency	1.02 (1.01, 1.04)*	1.01 (0.99, 1.02)	1.39 (1.08, 1.79)
Heavier drinking	0.99 (0.99, 1.00)	1.01 (0.99, 1.02)	0.98 (0.96, 0.99)
Age	0.91 (0.51, 1.65)	0.94 (0.70, 1.25)	1.67 (1.12, 2.51)
Female	1.38 (0.69, 2.79)	1.20 (0.79, 1.83)	0.99 (0.44, 2.22)
Non-Hispanic White	0.74 (0.27, 2.08)	1.07 (0.64, 1.79)	0.65 (0.33, 1.28)
Parent education	1.31 (1.03, 1.66)	0.96 (0.88, 1.05)	1.07 (0.89, 1.29)
Disposable income	1.00 (0.99, 1.00)	1.00 (0.99, 1.00)	1.00 (0.99, 1.01)

<sup>1</sup> Compared with never intoxicated

<sup>2</sup> Logged transformed

Holm-Bonferroni sequentially corrected probabilities:

\* $p_c < .05$

\*\* $p_c < .01$

\*\*\* $p_c < .001$

Table 4: Results of multilevel negative binomial analyses examining associations between early age of first intoxication and number of problems related to drinking in different contexts among underage drinkers ( $N=405$  nested within 24 cities), IRR (95% CI)

	Number of problems Restaurants	Number of problems Outdoor Places	Number of problems Home
Later age of first intoxication ( $\geq 16$ years) <sup>1</sup>	2.10 (0.56, 7.52)	1.48 (0.84, 2.62)	1.79 (1.13, 2.84)
Early age of first intoxication ( $\leq 15$ years) <sup>1</sup>	5.72 (2.46, 13.30)***	3.40 (1.98, 5.82)***	2.84 (1.80, 4.49)***
Place frequency <sup>2</sup>	1.90 (1.24, 2.91)*	1.43 (1.24, 1.66)***	0.79 (0.44, 1.42)
Drinking in the place <sup>3</sup>	3.86 (1.47, 10.14)*	1.01 (0.99, 1.02)	1.01 (1.00, 1.02)
Drinking frequency	0.87 (0.78, 0.97)*	1.01 (0.99, 1.01)	1.00 (0.99, 1.01)
Heavier drinking	1.01 (1.00, 1.02)	1.00 (0.99, 1.00)	1.00 (0.99, 1.00)
Age	0.85 (0.46, 1.57)	0.82 (0.59, 1.12)	0.90 (0.73, 1.12)
Female	2.14 (0.79, 5.75)	0.69 (0.45, 1.10)	0.74 (0.57, 0.98)
Non-Hispanic White	0.85 (0.26, 2.76)	1.10 (0.67, 1.63)	0.82 (0.53, 1.29)
Parent education	1.38 (0.96, 1.99)	1.02 (0.94, 1.11)	0.97 (0.90, 1.05)
Disposable income	1.00 (0.99, 1.01)	1.00 (0.99, 1.01)	1.00 (0.99, 1.00)

<sup>1</sup> Compared with never intoxicated

<sup>2</sup> Log transformed

<sup>3</sup> Number of days drinking in the place in the past year

Holm-Bonferroni sequentially corrected probabilities:

\* $p_c < .05$

\*\* $p_c < .01$

\*\*\* $p_c < .001$