High-risk alcohol use behavior and daily academic effort among college students

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Abstract

Objective.—It is not well understood whether heavy drinking interferes with academics on specific days or if this relationship simply reflects between-student differences.

Participants.—N=736 college students completed 14 consecutive daily assessments during 7 semesters.

Methods.—Days were classified as non-drinking, moderate drinking, heavy episodic drinking only (HED-only), or high-intensity drinking (HID) days. Multilevel models tested associations between drinking level and academic behaviors.

Results.—Students were more likely to skip class after engaging in HED-only or HID the previous day. On weekdays, students spent more time on schoolwork when they did not drink the previous day and spent less time on schoolwork when they engaged in HED-only and HID the previous day. On weekends, students spent less time on schoolwork after HED-only days.

Conclusions.—Heavy drinking is associated with lower academic effort the next day, highlighting the need for college programs targeting heavy alcohol use prevention and daily decision making.

Keywords

college; heavy alcohol use; skipping class; academic effort

Introduction

Heavy alcohol use among college students continues to be a serious public health problem, with college students reporting more occasions of heavy drinking than their non-college peers.[1] Based on a comprehensive review, White and Hingson[2] found that

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the preponderance of evidence links heavy drinking with decreased academic performance, including performing poorly on tests and projects, lower GPA, falling behind in school, and dropping out of college. Lower academic achievement and educational attainment have long-term implications for adult health, including increased risk for chronic conditions, functional limitations, and disability.[3]

There are two main gaps in the current research on the association between alcohol use and academic behavior among college students. First, little is known about differential risk for academic consequences in naturalistic settings as a function of *level of drinking*. The majority of prior research on harmful drinking among college students has focused on heavy episodic or binge drinking (4+/5+ drinks for women/men[4]). While a third of college students report drinking 5+ drinks in a row in the past two weeks,[1] many college students drink at two or more times this threshold.[5,6] Researchers have dubbed this behavior "high-intensity drinking" (8+/10+ drinks for women/men), and there have been increasing calls for researchers to distinguish between heavy episodic and high-intensity drinking when examining drinking behavior and associated consequences.[7,8] Differential risk for consequences based on level of drinking has been suggested by research on non-academic outcomes, with those drinking beyond the binge threshold at increased risk for meeting criteria for alcohol use disorder, driving after drinking, and experiencing injury, arrests, and other legal problems.[9,10]

Second, prior alcohol research has mainly focused on links of *between-person* categorizations of drinkers with longer-term or general academic outcomes, such as GPA or degree attainment.[11–14] Between-person associations between heavy alcohol use and shorter-term academic outcomes, such as missing class or performing poorly on a test, have also been established.[15–17] However, selection effects represent an alternative explanation for these links. That is, unmeasured stable characteristics (e.g., sensation seeking) may be underlying causes of both heavy drinking and lack of academic focus and success in college. Within-person designs can rule out time-stable causes for associations between drinking and academics. Studies following students across many occasions are needed to test whether heavy drinking episodes are linked with more immediate effects on academic behavior in the short-term.

To address these gaps, this study used an intensive repeated-measures design to examine whether students had differential likelihood of engaging in key micro-level academic behaviors (e.g., skipping class, spending time on schoolwork) as a function of their alcohol use the previous day. Of particular interest was comparing risk across non-drinking, moderate drinking (1–3/1–4 drinks for women/men), heavy episodic drinking only (4–7/5–9 drinks for women/men), and high-intensity drinking (8+/10+ drinks for women/men) days. Within persons across days, skipping class was hypothesized to be more likely and time spent on schoolwork was hypothesized to be less following heavy episodic or high-intensity drinking days compared to moderate drinking days. Between persons, it was hypothesized that on average across college, heavier drinkers would spend less time on schoolwork and be more likely to skip class when compared to lighter drinkers.

Materials and Methods

Participants and procedure

Data came from the University Life Study (ULS), a longitudinal study of college students from a large, public university in the Northeastern U.S.[18] First-year, first-time, full-time students were eligible for participation if they were U.S. citizens or permanent residents, were under the age of 21, and lived within 25 miles of the university's main campus. Stratified random sampling was used to achieve a balanced sample with respect to gender and race/ethnicity. Study procedures were approved by the university's Institutional Review Board, and all participants provided informed consent. Additional information on the study design and sample is provided elsewhere.[18,19]

In a measurement-burst design,[20] $n = 744$ college students completed bursts of 14 consecutive web-based daily surveys in each of their first seven semesters (3.5 years) of college. Attrition was low, with retention at each measurement burst ranging from 96% in the first semester to 79% in the last semester of data collection. Participants were sent a link to a survey early each morning asking questions about their behavior the previous day. Given the study's focus on previous day alcohol use predicting academic behaviors, a maximum of 13 previous night/next day occasions per participant per semester were used in analyses. Students who had available data on gender and completed at least one daily survey of their alcohol use and academic behaviors were included in the analytic sample for the current study. Due to differences in academic demands by day of the week, occasions were divided for analysis into weekdays (Monday through Friday; 40,791 days nested within 4,418 person-semesters nested within 736 people) and weekends (Saturday and Sunday; 16,583 days nested within 4,356 person-semesters nested within 734 people). The analytic sample was 27% White Non-Hispanic/Latino (NHL), 25% Hispanic/Latino, 23% Asian NHL, 16% Black NHL, and 9% Multiracial NHL. Participants were 51% female and had a mean age of 18.5 years old during the first semester of data collection.

Measures

Alcohol use—On each daily survey, participants indicated the number of standard alcoholic drinks they had consumed the previous day. Dichotomous, dummy-coded variables were computed for each day to indicate *no alcohol use* days (0 drinks consumed), *moderate drinking* days (1–3/1–4 drinks for women/men), *heavy episodic drinking only* days (HED-only; 4–7/5–9 drinks for women/men), and *high-intensity drinking* days (HID; 8+/10+ drinks for women/men).

Academic behaviors—Each day, participants were asked if they attended all their classes, with response options including 'yes', 'no', and 'did not have any'. A dichotomous variable for *skipping class* was computed, with attending all their classes or not having any classes coded as 0 and missing at least one class coded as 1. Participants also reported the amount of time they spent on schoolwork each day (e.g., going to class, studying, doing other schoolwork), with response options including no time, up to 30 minutes, 30–60 minutes, 1–2 hours, 2–3 hours, 3–4 hours, 4–6 hours, 6–8 hours, 8–10 hours, and 10+ hours. Responses were coded at the midpoint of each response category [e.g., 2–3 hours

was recoded to 2.5 hours[21]], and the highest response option of 10+ hours was coded as 10 hours. Time spent on schoolwork was treated as a continuous variable.

Statistical analyses

SAS Version 9.4 was used for all statistical analyses. Three-level (daily, semester, and person), random-intercept logistic and linear multilevel models were used to predict skipping class (weekdays only) and time spent on schoolwork (separate models for weekdays and weekends) as a function of previous day's drinking level, with moderate drinking days as the reference group. Logistic and linear models used Bernoulli and Gaussian level-1 sampling models, respectively. Both weekday models also included a daily-level variable indicating whether or not the academic behavior occurred on a Friday in order to control for potentially heavier drinking on Thursday nights and lower academic effort on Fridays as compared to other weekdays.[22,23] Based on prior work in this sample showing females spend more time on academics than males,[21] gender was included as a person-level control variable. Variables were un-centered at the daily-level, person mean centered at the semester-level, and grand mean centered at the person-level to isolate the hypothesized day-level effects.[24]

Multilevel analyses, conducted using maximum pseudo-likelihood estimation for logistic models and restricted maximum likelihood estimation for linear models, included all days with complete data.

Results

Students reported skipping class on 19% of weekdays (Monday-Friday) and spent an average of 3.6 hours on schoolwork per weekday and 1.3 hours per weekend day (Saturday-Sunday). On days prior to weekdays (Sunday-Thursday), students reported no alcohol use on 94% of days, moderate drinking on 3% of days, HED-only on 2% of days, and HID on 1% of days. On days prior to weekends (Friday-Saturday), students reported no alcohol use on 69% of days, moderate drinking on 9% of days, HED-only on 13% of days, and HID on 8% of days.

Is level of drinking associated with academic effort at the daily level?

Compared to moderate drinking days, students were about 1.5 times more likely to skip class when they engaged in HED-only the previous day (OR = 1.59) and almost twice as likely to skip class when they engaged in HID the previous day (OR = 1.91; Table 1). There was no difference in the odds of skipping class following non-drinking versus moderate drinking days. On weekdays, students spent less time on schoolwork when they engaged in HED-only ($B = -0.36$) and HID ($B = -0.41$) the previous day and spent more time on schoolwork when they did not drink the previous day ($B = 0.37$), all compared to moderate drinking days. These links were independent of differences between Thursday/Friday and other weekday combinations, although students were almost twice as likely to skip class (OR = 1.97) and spent significantly less time on school work ($B = -1.41$) on Fridays than on other weekdays. On weekends, HED-only drinking compared to moderate drinking the previous day was associated with less time spent on schoolwork ($B = -0.21$); however, there

was no difference in time spent on schoolwork on weekends following HID versus moderate drinking days.

Is lower academic effort more common among heavier drinkers?

Students who, on average, reported more non-drinking days across college were less likely to skip class (OR = 0.02) and spent more time on schoolwork on weekdays (B = 2.87) but not on weekends. Between persons, there was no consistent link between the average number of HED-only and HID days and academic behaviors. One counterintuitive finding was observed: students who reported more HED-only days across college spent more time on schoolwork on weekdays. Males spent less time on schoolwork on both weekdays (B = −0.59) and weekends (B = −0.34) than females.

Discussion

Compared to moderate drinking days, students expended less academic effort on days after they engaged in heavy drinking on both weekdays and weekends. These within-person associations comparing participants to themselves across varied types of drinking days are above and beyond between-person differences between types of students as observed in prior research.[2] Daily findings linking heavy drinking with diminished next-day academic effort might be explained by hangovers, fatigue, cognitive impairment, or other residual effects of heavy drinking[25,26] which may reduce students' ability to attend class or focus on learning and schoolwork the next day.

Whether decreased academic effort on specific days affects long-term academic and economic outcomes such as graduation, debt accumulation, and career success is an important future research question. Theories of college student development suggest that attending class and spending adequate time on schoolwork are important markers of academic effort related to overall academic achievement.[27] While it could be argued that missing a single day of classes after a particularly heavy drinking episode is unlikely to have a significant impact on a student's ability to meet long-term academic goals, persistent decreased academic effort attributed to heavy drinking could become problematic over time. Recent research on potential mediators of the relationship between heavy drinking and academic performance demonstrated that short-term academic behaviors such as arriving to class unprepared and lower class participation had significant indirect effects on the relationship between binge drinking and GPA.[28] Better understanding of when and how daily alcohol-related academic consequences begin to accumulate into long-term effects on achievement will help to prioritize efforts to reduce alcohol-related harms and promote academic success.

In this sample, heavy episodic drinking only did not have expected negative associations with time spent on schoolwork across semesters or between people. Whereas students spent *less* time on schoolwork on days following heavy episodic only drinking, they spent *more* time on schoolwork in heavier-drinking semesters. Additionally, students who drank at the HED-only level more often spent *more* time on schoolwork on weekdays. The opposing direction of associations at the semester- and person-levels compared to the daily-level may reflect different determinants of both alcohol use and academic effort.[29] Third variables

such as parental education and participation in academic and social activities during college might lead to positive links between heavy episodic drinking and academic engagement across longer periods of time, even when drinking heavily impedes academic effort in the short-term. Additionally, during semesters where students have difficult classes that require more time on schoolwork, or for students with a more demanding academic experience across college, academic stress may lead to increased heavy episodic drinking. There may also be a subset of college students who are able to balance spending time on schoolwork with heavy episodic drinking behavior, such that they are able to deliberately plan their drinking based around academic demands.

Findings should be interpreted in light of the study's limitations. Participants were from a single university, and results might not be generalizable to college students at other universities. Data on alcohol use and academic behavior were self-reported and collected the next day, leading to potential social desirability and recall biases.

College is an opportune time to intervene, and our results highlight the need for college student programming on daily decision making that supports both social and academic needs and responsibilities. Personalized feedback interventions and brief motivational interviewing have been identified as effective individual-level strategies for reducing alcohol use among college students, with program components that emphasize how alcohol use might affect students' goals.[30] Universities should provide students with opportunities to engage in social activities that do not involve alcohol use so that they might balance social involvement with academic demands,[31] increasing students' ability to meet their goals both during and after college.

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References

1. Schulenberg JE, Johnston LD, O'Malley PM, Bachman JG, Miech RA, Patrick ME. Monitoring the Future National Survey Results on Drug Use, 1975–2017: Volume II, College Students and Adults Ages 19–55. Ann Arbor, MI: Institute for Social Research, University of Michigan; 2018.

2. White A, Hingson R. The burden of alcohol use: Excessive alcohol consumption and related consequences among college students. Alcohol Res. 2013;35(2):201–218. [PubMed: 24881329]

3. Zajacova A, Lawrence EM. The relationship between education and health: Reducing disparities through a contextual approach. Annual Review of Public Health. 2018;39:273–289.

4. National Institute on Alcohol Abuse and Alcoholism. Drinking levels defined. https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking. Accessed June 20, 2019.

5. White HR, Anderson KG, Ray AE, Mun EY. Do drinking motives distinguish extreme drinking college students from their peers? Addict Behav. 2016;60:213–218. [PubMed: 27163187]

6. White AM, Kraus CL, Swartzwelder HS. Many college freshmen drink at levels far beyond the binge threshold. Alcohol Clin Exp Res. 2006;30(6):1006–1010. [PubMed: 16737459]

7. Patrick ME, Azar B. High-intensity drinking. Alcohol Res. 2018;39(1):49–55. [PubMed: 30557148]

8. Patrick ME. A call for research on high-intensity alcohol use. Alcohol Clin Exp Res. 2016;40(2):256–259. [PubMed: 26842244]

9. Linden-Carmichael AN, Vasilenko SA, Lanza ST, Maggs JL. High-intensity drinking versus heavy episodic drinking: Prevalence rates and relative odds of alcohol use disorder across adulthood. Alcohol Clin Exp Res. 2017;41(10):1754–1759. [PubMed: 28800154]

10. Hingson RW, Zha W, White AM. Drinking beyond the binge threshold: Predictors, consequences, and changes in the U.S. Am J Prev Med. 2017;52(6):717–727. [PubMed: 28526355]

11. Thombs DL, Olds RS, Bondy SJ, Winchell J, Baliunas D, Rehm J. Undergraduate drinking and academic performance: A prospective investigation with objective measures. J Stud Alcohol Drugs. 2009;70(5):776–785. [PubMed: 19737503]

12. Singleton RA. Collegiate alcohol consumption and academic performance. J Stud Alcohol Drugs. 2007;68(4):548–555. [PubMed: 17568960]

13. Singleton RA, Wolfson AR. Alcohol consumption, sleep, and academic performance among college students. J Stud Alcohol Drugs. 2009;70(3):355–363. [PubMed: 19371486]

14. Jennison KM. The short-term effects and unintended long-term consequences of binge drinking in college: A 10-year follow-up study. Am J Drug Alcohol Abuse. 2004;30(3):659–684. [PubMed: 15540499]

15. Presley CA, Pimentel ER. The introduction of the heavy and frequent drinker: A proposed classification to increase accuracy of alcohol assessments in postsecondary educational settings. J Stud Alcohol. 2006;67(2):324–331. [PubMed: 16562416]

16. Wechsler H, Lee JE, Kuo M, Lee H. College binge drinking in the 1990s: A continuing problem. Results of the Harvard School of Public Health 1999 College Alcohol Study. J Am Coll Health. 2000;48(5):199–210. [PubMed: 10778020]

17. Powell LM, Williams J, Wechsler H. Study habits and the level of alcohol use among college students. Educ Econ. 2004;12(2):135–149.

18. Howard AL, Patrick ME, Maggs JL. College student affect and heavy drinking: Variable associations across days, semesters, and people. Psychol Addict Behav. 2015;29(2):430–443. [PubMed: 25347017]

19. Patrick ME, Maggs JL, Lefkowitz ES. Daily associations between drinking and sex among college students: A longitudinal measurement burst design. Journal of Research on Adolescence. 2015;25(2):377–386.

20. Sliwinski MJ. Measurement-burst designs for social health research. Soc Personal Psychol Compass. 2008;2(1):245–261.

21. Greene KM, Maggs JL. Revisiting the time trade-off hypothesis: Work, organized activities, and academics during college. J Youth Adolesc. 2015;44(8):1623–1637. [PubMed: 25381597]

22. Wood PK, Sher KJ, Rutledge PC. College student alcohol consumption, day of the week, and class schedule. Alcohol Clin Exp Res. 2007;31(7):1195–1207. [PubMed: 17451400]

23. Maggs JL, Williams LR, Lee CM. Ups and downs of alcohol use among first-year college students: Number of drinks, heavy drinking, and stumble and pass out drinking days. Addict Behav. 2011;36(3):197–202. [PubMed: 21106298]

24. Linden-Carmichael AN, Calhoun BH, Patrick ME, Maggs JL. University students use fewer protective behavioural strategies on high-intensity drinking days. Drug Alcohol Rev. 2019;38(3):302–305. [PubMed: 31553497]

25. Rohsenow DJ, Howland J, Arnedt JT, Almeida AB, Greece J, Minsky S, et al. Intoxication with bourbon versus vodka: Effects on hangover, sleep, and next-day neurocognitive performance in young adults. Alcohol Clin Exp Res. 2010;34(3):509–518. [PubMed: 20028364]

26. Gunn C, Mackus M, Griffin C, Munafò MR, Adams S. A systematic review of the next-day effects of heavy alcohol consumption on cognitive performance. Addiction. 2018;113(12):2182–2193. [PubMed: 30144191]

27. Wolf-Wendel L, Ward K, Kinzie J. A tangled web of terms: The overlap and unique contribution of involvement, engagement, and integration to understanding college student success. J Coll Stud Dev. 2009;50(4):407–428.

28. An BP, Loes CN, Trolian TL. The relation between binge drinking and academic performance: Considering the mediating effects of academic involvement. J Coll Stud Dev. 2017;58(4):492–508.

29. Greene KM, Maggs JL. Academic time during college: Associations with mood, tiredness, and binge drinking across days and semesters. J Adolesc. 2017;56:24–33. [PubMed: 28130974]

30. Cronce JM, Toomey TL, Lenk K, Nelson TF, Kilmer JR, Larimer ME. NIAAA's College Alcohol Intervention Matrix: CollegeAIM. Alcohol Res. 2018;39(1):43–47. [PubMed: 30557147]

31. Layland EK, Calhoun BH, Russell MA, Maggs JL. Is alcohol and other substance use reduced when college students attend alcohol-free programs? Evidence from a measurement burst design before and after legal drinking age. Prev Sci. 2019;20(3):342–352. [PubMed: 29516357]

Table 1.

Association between previous day alcohol use and academic behavior on weekdays and weekends

Fixed Effects	Skipped class (Monday-Friday) OR (CI)	Time spent on schoolwork (Monday-Friday) B (SE)	Time spent on schoolwork (Saturday & Sunday) B (SE)
Daily Level			
n (days)	$n = 34,302$	$n = 37,029$	$n = 13,914$
Intercept, γ_{000}	0.15 (0.13, 0.18) ***	3.46 (0.08) ***	1.13 (0.07) ***
No alcohol use, γ_{100}	0.94 (0.80, 1.10)	0.37 (0.06) ***	0.08 (0.06)
Heavy episodic drinking only, γ_{200}	1.59 (1.28, 1.97) ***	−0.36 (0.08) ***	−0.21 (0.07) **
High-intensity drinking, γ_{300}	1.91 (1.47, 2.48) ***	−0.41 (0.11) **	−0.08 (0.09)
Friday, γ_{400}	1.97 (1.85, 2.10) ***	−1.41 (0.02) ***	-
Semester Level			
No alcohol use, γ_{010}	0.42 (0.27, 0.64) ***	0.53 (0.18) **	0.15 (0.12)
Heavy episodic drinking only, γ_{020}	0.68 (0.24, 1.87)	0.67 (0.43)	0.40 (0.16) *
High-intensity drinking, γ_{030}	1.86 (0.50, 6.94)	−0.20 (0.58)	0.29 (0.19)
Person Level			
No alcohol use, γ_{001}	0.02 (0.01, 0.05) ***	2.87 (0.57) ***	0.09 (0.36)
Heavy episodic drinking only, γ_{002}	0.08 (0.00, 1.59)	3.93 (1.80) *	0.49 (0.54)
High-intensity drinking, γ_{003}	1.31 (0.04, 44.44)	−0.28 (2.16)	−0.76 (0.47)
Male gender, γ_{004}	1.12 (0.94, 1.34)	−0.59 (0.11) ***	−0.34 (0.09) **

*
$p<0.05$;

**
$p<0.01$;

***
$p<0.001$

Note. Weekday models included $n = 736$ persons and the weekend model included $n = 734$ persons. Moderate drinking (reference group): 1–3/1–4 drinks for women/men. Heavy episodic drinking only: 4–7/5–9 drinks for women/men. High-intensity drinking: 8+/10+ drinks for women/men.