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Day drinking among college students and its association with risky substance use behaviors

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Abstract

Background: Day drinking, or drinking during the daytime, is a term used colloquially in the media and among college students based on anecdotal evidence. Drinking at tailgate parties, generally thought to be a type of day drinking, tends to be particularly heavy and reach levels comparable to drinking on holidays and special occasions. The objective of this paper was to assess how many and how often students day drank and whether day drinking days (i.e., days drinking began before 4:00 PM) were associated with heavy drinking, legal intoxication, negative alcohol-related consequences, and three risky substance use behaviors.

Methods: A longitudinal daily diary study of college students followed for their first seven semesters of college. The analytic sample included 7,633 drinking days nested with 619 student drinkers. Logistic and Poisson multilevel models tested associations between day drinking days and substance use outcomes and negative consequences.

Results: Approximately 50% of drinkers day drank at least once, and day drinking occurred on 9% of drinking days. Day drinking days were characterized by heavy drinking as evidenced by strong, positive associations between day drinking and drinking to heavy episodic (HED) and high-intensity drinking (HID) thresholds on a given day. In contrast, students were less likely to reach legal intoxication and experienced fewer negative alcohol-related consequences on day drinking days compared to days drinking began in the evening or nighttime. Students who reported day drinking more often throughout the study also reported more days of drinking to the HED and HID thresholds and played drinking games and mixed alcohol with energy drinks more frequently.

Conclusions: Day drinking was not uncommon among this sample of college students. Findings suggest day drinking days may be characterized by heavy drinking and may be a behavior most typically engaged in by heavy drinkers, including members of Greek organizations.

Keywords

Day drinking; college drinking; high-intensity drinking; multilevel modeling

INTRODUCTION

“Day drinking” is a term used colloquially among young adults based on anecdotal experience and media sources. A Google search of the term produces hits including internet articles, cocktail recipe books, and hit songs, many of which glamorize day drinking as a fun activity that involves partying or social drinking during the daytime. However, little, if any, empirical work on day drinking seems to exist in the college drinking scholarly literature. Limited empirical research has focused on the related behavior of tailgating, which refers to social drinking prior to major sporting events and which often occurs in the daytime and is characterized by particularly heavy drinking (Glassman et al., 2010; Neal and Fromme, 2007; Neighbors et al., 2006). Although this work suggests that tailgating is common at some colleges, it is unclear how prevalent and risky the broader behavior of day drinking is. This paper introduces to the scholarly literature the concept of day drinking, defined as drinking that starts during the daytime (i.e., before 4:00 PM) and is thought to typically occur in somewhat unique drinking contexts. We argue that day drinking *days* may be meaningfully different from other drinking days in which drinking may typically start later in the evening. In this way, we argue that day drinking may share some common elements with special occasions, such as 21st birthdays and holidays (Neighbors et al., 2006; Tremblay et al., 2010), in which drinking tends to be particularly heavy and may have somewhat different motives. We assess whether *days* on which drinking starts prior to 4:00 PM (subsequently called day drinking days) are associated with heavy drinking, legal intoxication, negative alcohol-related consequences, and three risky substance use behaviors.

Despite the lack of empirical research on day drinking (as the term is used here) among U.S. college students, there are three areas of research that have emerged in recent decades that are related to and support the importance of day drinking: pregaming, event-specific drinking, and tailgating. For each of these, research has shown that days including these types of drinking are associated with (very) heavy alcohol use and may occur in unique physical and social settings, have unique motives, and present unique risks, as described below.

Pregaming

Pregaming, also known as prepartying or front-loading, refers to drinking prior to going out to a social activity or gathering at which more drinking may occur (Pedersen, 2016; Zamboanga and Ulthuis, 2016). Pregaming has drawn attention in the college drinking literature because of its high prevalence and the risks that distinguish it from other types of drinking. Roughly two-thirds of college student drinkers report past-month pregaming (Zamboanga and Ulthuis, 2016), and pregaming occurs on approximately one-third of all drinking occasions (Barnett et al., 2013; Merrill et al., 2013). Its risk is derived from its typical fast pace and time-limited nature (Pedersen, 2016), as well as its consistent same-day association with heavy alcohol intake, high estimated blood alcohol concentrations (eBACs), and greater negative consequences (Barnett et al., 2013; Fairlie et al., 2015; Merrill et al., 2013; Radomski et al., 2016).

Pregaming is further distinguished by its location in unique physical and social settings. Pregaming often occurs in small, intimate settings, such as in student residences, and with

close groups of friends or roommates (DeJong et al., 2010; Pedersen and LaBrie, 2007). Pregaming motives also tend to differ from general drinking motives with more of an emphasis on getting drunk (Bachrach et al., 2012; LaBrie et al., 2012). The high prevalence of pregameing suggests that a substantial amount of college drinking occurs outside bars and parties, even though pregameing remains a relatively understudied part of college drinking culture. Given its rapid pace, time-limited nature, and association with heavy drinking and negative consequences, pregameing days tend to be more risky than non-pregameing days, even though not all drinking on pregameing days occurs while students are pregameing.

Event-Specific Drinking

College drinking is known to occur primarily on the social weekend (i.e., Thursday-Saturday; Del Boca et al., 2004), but some specific events are associated with heavier drinking and a greater likelihood of experiencing negative consequences, such as personally relevant events (e.g., 21st birthdays), holidays, and school breaks (Neighbors et al., 2011). One study found that approximately one in eight students consumed 21 drinks as part of their 21st birthday celebration, and roughly half drank above their previous maximum number of drinks (Rutledge et al., 2008). Studies have estimated that 30–40% of students blacked out (Wetherill and Fromme, 2009) or could not remember portions of the previous evening (Lewis et al., 2009) after 21st birthday drinking.

Some national (e.g., Independence Day, Halloween, Thanksgiving, New Year's Eve; Del Boca et al., 2004; Glindemann et al., 2007; Tremblay et al., 2010) and local (Guavaween, Del Boca et al., 2004; State Patty's Day, Lefkowitz et al., 2012) holidays are similarly associated with greater risk for heavy drinking and negative consequences. Similar findings are observed for spring break, particularly for students who take trips (Grekin et al., 2007; Lee et al., 2006, 2009; Patrick et al., 2011). Consistent with greater intentions to get drunk on pregameing days, students on spring break trips may be more likely than normal to intend to get drunk (e.g., Smeaton et al., 1998). Drinking during spring break and certain holidays may also be likely to occur in unique physical (e.g., beach during spring break) and social (e.g., around family or high school friends on Thanksgiving) settings and at different times of day. To the extent that day drinking days share similarities to or include some event-specific drinking occasions, day drinking days may also be associated with elevated risk for heavy drinking and negative consequences.

Tailgating

Tailgating refers to social drinking or partying before sporting events that often occurs outdoors in parking lots and areas surrounding football or other athletic facilities. Extant work suggests this behavior is associated with very heavy drinking. For instance, one study estimated that approximately three-fourths of individuals who attended tailgate parties drank (Neighbors et al., 2006), and several studies suggest that heavy episodic drinking (HED; 4+/5+ drinks for women/men) is a normative aspect of tailgating, with rates of HED while tailgating ranging from 36% to 59% and being comparable to those on well-known drinking holidays, such as New Year's Eve and Halloween (Glassman et al., 2010; Merlo et al., 2011; Neal and Fromme, 2007). Similarly, Glassman et al. (2010) estimated that approximately

one in six college students who attended tailgate parties drank at double the HED level while tailgating.

Of relevance here is that much drinking at tailgate parties likely occurs during the daytime, as most U.S. college football games start between noon and 8:00 PM. Although drinking on days students attend tailgating parties may continue into the evening or night, these days appear to be meaningfully different from other drinking days. Like pregame days, days that include drinking at tailgating parties seem to be associated with higher levels of alcohol intake and may involve unique drinking motives related to inebriation (Glassman et al., 2010; Merlo et al., 2011; Neal and Fromme, 2007). Tailgating is also like pregame in that, on days these behaviors occur, drinking may also take place outside these contexts (i.e., after pregame or tailgating), but the fact that students engage in these behaviors makes these drinking days particularly risky. It is important to clarify that although tailgating is generally used to describe drinking before sporting events, this is a distinct drinking behavior from pregame, which is generally described in the college drinking literature as drinking in smaller groups prior to going out to a social event or gathering, such as bars or parties (Pedersen, 2016; Zamboanga et al., 2016).

In sum, certain college student drinking days, such as those involving pregame or tailgating and those occurring around special events, may be unique types of drinking days that are differentiated from more general drinking days in their physical and social settings, motives, association with alcohol intake, and risk for negative consequences. We argue here that day drinking *days* may be similar in this regard.

Definition of Day Drinking Days

Day drinking days are defined here as days in which drinking *began* between 6:00 AM and 4:00 PM. The 6:00 AM cutoff was selected to differentiate drinking on the current day from drinking that began late the night before. The 4:00 PM cutoff was selected to differentiate drinking that occurs in the daytime from drinking during happy hours, which may be considered to occur in the early evening and to be different in nature. The focus of this paper is on *days* in which drinking began during the daytime and whether these are meaningfully different from those in which drinking began later in the evening or at night. We do not speculate that the physiological effects of alcohol consumption differ based on the time-of-day alcohol is consumed, all other variables being constant. Rather, we suspect that days in which drinking starts during the daytime may involve drinking in different physical or social contexts, have different motives and intentions, and be associated with different levels of use and negative consequences (as is the case with drinking on pregame, event-specific, and tailgating drinking days), though we do not test all these differences here.

Outcomes of Interest

Since day drinking has yet to be examined empirically, it is unknown what groups of college students are more likely to engage in day drinking. However, hypotheses can be made based on inferences from the college drinking literature more broadly. Although recent estimates of past 30-day alcohol use and HED show small or negligible gender differences among college students, males are more likely than females to engage in certain risky drinking

behaviors, such as high intensity drinking (HID; 8+/10+ drinks on an occasion) and mixing alcohol with energy drinks (Schulenberg et al., 2020). Members of Greek organizations and student athletes drink more often, consume more alcohol per occasion, and experience more negative consequences than non-Greek and non-athlete students (Turrisi et al., 2006; White and Hingson, 2013). In contrast, students enrolled in academic honors colleges appear to drink less frequently and in lesser quantities (Lanza et al., 2009; Long and Lange, 2002; Rhoades and Maggs, 2006) and to be less likely to engage in risky drinking behaviors (e.g., mixing alcohol with energy drinks; Patrick et al., 2016a) than non-honors students. Thus, we expected to find similar between-person differences in counts of day drinking days.

Due to some presumed similarities of day drinking days with pregame, event-specific, and tailgating drinking days, we suspected that day drinking days may be more likely to include drinking to the HED and HID thresholds in comparison to days drinking began in the evening or at night. These indicators of heavy drinking have consistently been associated with both acute consequences and longer-term problems (Linden-Carmichael et al., 2018; White and Hingson, 2013). Although the NIAAA definition of HED (NIAAA, no date), and thus HID, specifies that such drinking occur within two hours, it is important to note that we assessed whether these thresholds were reached throughout each day, similar to some other studies (e.g., Linden-Carmichael & Lanza, 2018; Patrick 2016b). If day drinking days do tend to be heavier drinking days, we would also expect these days to be associated with greater negative consequences, given the dose-response relationship between alcohol intake and consequences (Gruenewald and Mair, 2015). Since drinking may occur over longer periods of time on some day drinking days, especially if drinking continues into the evening or night, it is important to know not just whether students drink more on day drinking days but also whether they reach greater levels of intoxication. If eBACs are higher or lower on day drinking days, this could provide an explanation for the corresponding greater or fewer predicted negative consequences. Lastly, if day drinking days are meaningfully different from days drinking begins in the evening or nighttime and are associated with heavier drinking, it is important to understand whether the likelihood of other risky behaviors that may exacerbate risk is also elevated. Playing drinking games (Zamboanga et al., 2014), mixing alcohol with energy drinks (e.g., Linden-Carmichael and Lau-Barraco, 2017), and same-day marijuana co-use (Lee et al., 2020) are all risky behaviors linked with greater alcohol intake and/or risk for negative consequences.

Current Study

To the authors' knowledge, this is the first paper in the college drinking literature to solely focus on day drinking in a similar way to how it is defined here. This paper introduces the concept of day drinking and operationalizes day drinking days as those in which drinking begins at or after 6:00 AM and before 4:00 PM. Here, we assess four research questions related to day drinking days. First, we assessed whether counts of day drinking days were higher for men compared to women, Greek organization participants compared to non-participants, athletes compared to non-athletes, and non-honors students compared to honors students. Next, we examined whether, on day drinking days compared to days drinking started in the evening or at night (hereafter referred to as evening or nighttime drinking days), students (2) were more likely to drink to heavy drinking thresholds and be

legally intoxicated, (3) experienced more negative consequences, and (4) were more likely to engage in other risky substance use behaviors (i.e., play drinking games, mix alcohol with energy drinks, and use marijuana).

MATERIALS AND METHODS

Participants and Procedure

Data came from a longitudinal study of risk behaviors and daily activities in 744 students at a large, public university in the Northeast United States (Greene and Maggs, 2015; Howard et al., 2015). In a longitudinal measurement-burst design, participants completed a longer, web-based survey followed by a series of 14 consecutive daily web-based surveys in each of seven successive semesters. The study was approved by the university's institutional review board and protected by a federal Certificate of Confidentiality.

Participants were selected using a stratified random sampling procedure to obtain a balanced sample in terms of gender and race/ethnicity. Eligible participants at the first wave were first-year, first-time, full-time students living within 25 miles of the university who were 21 years of age or younger and a US citizen/permanent resident. Of selected students, 66% ($N = 744$) provided informed consent and completed the baseline semester survey. The average age of participants in Semester 1 was 18.44 years ($SD = .43$); 50.8% were female; 27.4% were European American Non-Hispanic/Latinx (NHL), 25.1% Hispanic/Latinx, 23.3% Asian American/Pacific Islander NHL, 15.7% Black/African American NHL, and 8.5% multi-racial NHL. Retention was high with 79.6% ($n = 592$) of participants completing at least one daily survey in the final (7th) semester. Students completed an average of 12.8 daily surveys each semester across the entire study, and the number completed each semester ranged from 1 to 14 days.

Measures

Each day, students were asked to report the number of drinks they consumed the previous day (Dimeff et al., 1999). Students were instructed: "By one drink we mean half an ounce of absolute alcohol, for example, [a] 12 ounce can or bottle of beer or cooler, [a] 5 ounce glass of wine, [or] a drink containing one shot of liquor or spirits," then asked, "How many drinks of alcohol did you drink?" in reference to the previous day. Students selected the number of drinks (0 to 25+) consumed from a pull-down menu.

Heavy drinking.—Two dichotomous, gender-specific heavy drinking variables were computed from the number of drinks reported each day. First, daily *heavy episodic drinking* (HED; Wechsler et al., 1995) indicated days women/men consumed four/five or more drinks (coded 1) and days they consumed fewer than four/five drinks (0). Second, daily *high-intensity drinking* (HID; Patrick et al., 2016b, 2017; White et al., 2006) indicated days women/men consumed eight/ten or more drinks (1) and days they consumed seven/nine or fewer drinks (0).

Day drinking.—On drinking days, students were asked questions about the time they started drinking with the prompt, "What time did you start your first drink?" From three

pull-down menus students selected the hour (ranging from 1 to 12), minutes (response options “0,” “15,” “30,” and “45”), and whether this time was before or after noon (“am” or “pm”). To increase accuracy, students were reminded that midnight is 12:00 AM and noon is 12:00 PM. Day drinking days were operationalized as drinking days that alcohol use began between 6:00 AM and 3:45 PM (i.e., before 4:00 PM).

Estimated blood alcohol concentration (eBAC).—Daily eBAC was computed using total drinks, number of hours between first and last drink, weight, and sex using Matthews and Miller’s (1979) formula. These values were dichotomized to indicate estimated BACs at or above (1) or below (0) the US legal limit for driving (.08%).

Negative alcohol-related consequences.—On daily surveys students indicated they drank the previous day, they were asked, “As a result of drinking alcohol on [*previous day*], did you...” followed by 11 negative alcohol-related consequences (Lee et al., 2011; Patrick and Maggs, 2011). Experienced negative consequences were coded as 1, and those not experienced were coded as 0. The total number of negative consequences students reported experiencing each day was summed.

Drinking games.—Each drinking day, students were asked, “Did you participate in any drinking games?” with response options “Yes” (1) and “No” (0).

Mixing alcohol with energy drinks.—Beginning in Semester 4 (i.e., spring, second year of college), each drinking day students were asked, “On [*previous day*], how many (1) high-energy (caffeinated) drinks like Red Bull, not containing alcohol did you drink? [and how many] (2) high-energy drinks with alcohol (e.g., Red Bull + vodka, or a premixed drink) did you drink?” Students responded to each using a pull-down menu (0 to 25+). As in Patrick et al. (2016a), days students endorsed either item thereby indicated they drank alcohol and energy drinks (1) versus days students endorsed neither (0).

Marijuana use.—Each day, students were asked, “Did you use any illegal drugs on [*previous day*]?” with response options “Yes” and “No.” On days drug use was reported, students were asked “Which of the following substances did you use?” Days marijuana use was endorsed were coded as 1 and days marijuana was not endorsed (but other drugs were) and days no marijuana or other drugs were used were coded as 0.

Greek organization participation.—Each semester, students were asked, “What extracurricular activities do you participate in?” and instructed to check all that applied from a list of 16 (e.g., intercollegiate athletics, student government, volunteering) and “No Clubs.” The first activity was “Fraternity/Sorority (social).” Students who participated in a Greek organization in at least one semester were coded as 1, and those who did not were coded as 0.

Student athlete status.—Two of the 16 extracurricular activities (as described above) were “Intercollegiate Athletics” and “Intramural Athletics/Club Sports.” Students who participated in either type of athletics in at least one semester were coded as 1, and those who did not were coded as 0.

Honors college enrollment.—Each semester, students were asked, “Are you in the academic honors program (*[name of program]*) at *[university]*?” with response options “Yes” and “No”. Students enrolled in at least one semester were coded as 1, versus never coded 0.

Social weekend day.—Because the vast majority of college student heavy drinking occurs on the “social weekend” (Del Boca et al., 2004; Maggs et al., 2011), a dichotomous social weekend day variable was coded as Thursday-Saturday (1) and Sunday-Wednesday (0).

Statistical Analyses

Group differences in counts of day drinking days were tested with a single negative binomial regression (Question 1). This model was estimated in the *MASS* package (Venables & Ripley, 2002) of R 4.0.3 (R Core Team, 2020) and only included students who reported drinking on at least one sampled day. All four dichotomous predictor variables were grand-mean-centered.

Questions 2 through 4 were tested using three-level logistic and Poisson multilevel models (MLMs) that nested days within semesters within persons. These models were estimated using maximum likelihood estimation based on Laplace Approximation in the *lme4* (Bates et al., 2015) R package. Random intercepts were included at the person and semester levels, and a daily-level random variable accounted for overdispersion in Poisson models. Only drinking days (and therefore only drinkers) were included. Daily-level variables were semester-mean-centered, semester-level variables were person-mean-centered, and person-level variables were grand-mean-centered (Brincks et al., 2017). A semester number variable, centered at its midpoint (i.e., Semester 4), was included to account for trends over time in predictor and/or outcome variables, per recommendation by Wang and Maxwell (2015). Multicollinearity was assessed using the `check_collinearity()` function in the *performance* (Lüdtke et al., 2021) R package and was determined to be low.

RESULTS

Descriptive Statistics

Drinking was reported on at least one sampled day by 619 (84.1%) of the 736 students who completed at least one daily survey and on 7,633 (12.3%) of the 62,160 sampled days. Thus, the analytic sample consisted of 7,633 drinking days nested within 619 student drinkers. Day drinking was reported at least once by 307 students (49.6% of drinkers and 41.7% of all students) and occurred on 690 (9.0%) drinking days (Table 1). Figures 1 and 2 show the distribution of drinking start and end times, respectively, by hour across all drinking days. The mean number of hours from first to last drink on day drinking days ($M = 10.40$, $SD = 5.81$) was three times greater than that on evening or nighttime drinking days ($M = 3.31$, $SD = 2.78$, $F(1, 7,454) = 3111.0$, $p < .001$). The number of day drinking days students reported throughout the study ranged from 0 to 10 ($M = 1.11$, $SD = 1.67$) out of 98 possible surveyed days. Students drank to HED thresholds on 74.1% of day drinking days and 63.6% of evening or nighttime drinking days. Drinking to HED thresholds on at least one day drinking

day was reported by 38.0% of students, whereas 80.9% of students drank to HED thresholds on at least one evening or nighttime drinking day. Students drank to HID thresholds on 43.2% of day drinking days and 22.0% of evening or nighttime drinking days. Drinking to HID thresholds on at least one day drinking day was reported by 23.9% of students, whereas 49.6% of students drank to HID thresholds on at least one evening or nighttime drinking day.

Question 1: Were There Group Differences in Counts of Day Drinking?

A negative binomial regression testing group differences in counts of day drinking across the study indicated that Greek organization participants day drank on 51% more days than non-participants on average ($IRR = 1.51$, 95% $CI = 1.17, 1.96$, $p < 0.01$; Table S1). However, there was no difference in day drinking counts between males and females, student athletes and non-athletes, or honors and non-honors students.

Question 2: Were Heavy Drinking and Legal Intoxication More Likely on Day Drinking Days?

Results of three logistic MLMs testing whether heavy drinking and legal intoxication were more likely on day drinking days than evening or nighttime drinking days are presented in Table 2. At the daily level, students had 1.32 and 2.76 times greater odds on average of drinking to HED and HID thresholds across the full day, respectively, on day drinking days than on evening or nighttime drinking days. However, students had 74% lower odds of reaching legal intoxication, or an eBAC $> .08$, on day drinking days. At the semester level, the number of day drinking days in a given semester was *positively* associated with the number of days students drank to HID thresholds and *negatively* associated with the number of days they reached legal intoxication, on average. At the person level, students who reported more day drinking days throughout the study drank to HED and HID thresholds more often than students who reported fewer day drinking days, on average. However, there was no statistically significant person-level association between the number of day drinking days and the number of days students were estimated to reach legal intoxication throughout the study.

Question 3: Did Students Experience More Negative Consequences on Day Drinking Days?

Results of two models testing whether students experienced more alcohol-related consequences on day drinking days than evening or nighttime drinking days are shown in Table 3. Prior to controlling for alcohol intake at the daily, semester, and person levels, there were no within-person associations between day drinking and number of alcohol-related negative consequences at the daily or semester levels. However, at the person level, students who day drank more often throughout the study experienced *more* negative consequences on drinking days, on average, than students who day drank less often. After controlling for alcohol intake at each level, a negative within-person association between day drinking and negative consequences was observed at the daily level such that students experienced an average of 41% *fewer* negative consequences on day drinking days than on evening or nighttime drinking days. The negative, within-person, semester-level association between day drinking and negative consequences became statistically significant and the positive,

between-person, person-level association between day drinking and negative consequences became non-significant after alcohol intake was controlled.

Question 4: Were Other Risky Behaviors More Likely on Day Drinking Days?

Three models tested the likelihood of engaging in other risky substance use behaviors on day drinking days versus evening or nighttime drinking days (see Table 4). At the daily level, students were *more* likely to play drinking games and to use marijuana, but not to mix alcohol with energy drinks, on day drinking days. At the semester level, there was a positive, within-person association between the number of times students day drank in a given semester and the number of times they played drinking games, but there were no significant semester-level associations between day drinking and mixing alcohol with energy drinks or using marijuana on drinking days. At the person level, students who day drank on more days throughout the study played drinking games and mixed alcohol with energy drinks on drinking days more often, on average, than students who day drank on fewer days.

DISCUSSION

This paper introduced the concept of day drinking and documented links between day drinking *days* and heavy drinking, legal intoxication, negative alcohol-related consequences, and other risky substance use behaviors in a U.S. college student sample. Day drinking was not uncommon as approximately 50% of drinkers reported day drinking on at least one occasion in the study, and day drinking occurred on 9% of sampled drinking days. The average number of hours from first to last drink was more than three times as high on day drinking days as on evening or nighttime drinking days. Within persons, students were more likely to drink to the HED and HID thresholds, play drinking games, and use marijuana on day drinking days than on evening or nighttime drinking days. However, students were less likely to have eBACs at or greater than the legal level of intoxication and experienced fewer negative consequences on day drinking days than on evening or nighttime drinking days. Between persons, Greek organization participants reported more day drinking occasions than non-participants throughout the study, and students who day drank more often also drank heavily and engaged in other risky substance use behaviors more frequently.

Day Drinking Co-Occurs with Other Risky Substance Use Behaviors

Descriptively, the percentage of day drinking days in which heavy drinking took place was very high. Students drank to HED thresholds on nearly three-fourths of day drinking days but on less than two-thirds of evening or nighttime drinking days. Similarly, they drank to HID thresholds on more than two-fifths of day drinking days but on less than one-quarter of evening or nighttime drinking days. Day drinking was characterized by heavy drinking more than evening or nighttime drinking, as day drinking was positively associated with drinking to both HED and HID thresholds at the daily and person levels. Stated differently, students who day drank more often also tended to drink heavily more often, and heavy drinking was more likely on days that drinking started before 4:00 PM.

These findings are consistent with past work in the related areas of pre-gaming (Pedersen, 2016; Zamboanga and Ulthuis, 2016) and event-specific drinking (e.g., Lefkowitz et al.,

2012; Neighbors et al., 2011; Patrick et al., 2011a) showing days that include these behaviors tend to be heavier drinking days. The findings also extend prior research on tailgating, a specific type of day drinking. Drinking while tailgating tends to be very heavy, with levels comparable to traditionally heavy-drinking holidays such as St. Patrick's Day (Del Boca et al., 2004; Tremblay et al., 2010). Cross-sectional studies suggest that between one-third and three-fifths of tailgate party attendees engage in HED (Merlo et al., 2011; Neal and Fromme, 2007) and one-sixth engage in HID (Glassman et al., 2010). Heavy drinking prevalence among day drinkers as a group and on day drinking days reported here appears consistent with these prior findings. However, it is unknown what percentage of the day drinking days reported here also included tailgating or occurred on special occasions.

Day drinking was also generally linked with other risky substance use behaviors both within- and between-persons. Given that drinking games facilitate rapid alcohol intake to get participants drunk and are linked with higher levels of alcohol intake (LaBrie et al., 2013; Zamboanga et al., 2014), the daily-level association between day drinking and playing drinking games suggests a potential reason why day drinking days tend to be heavy drinking days. That is, students may be more likely to play drinking games on day drinking days which, in turn, leads to greater overall amounts of drinking that day. Future work should test these ideas. Although this paper did not examine simultaneous alcohol and marijuana use, the greater likelihood of marijuana use on day drinking days, coupled with heavier drinking and drinking for longer periods of time on these days, may suggest a greater likelihood of cross-fading motives (i.e., simultaneous use to enhance effects of alcohol or marijuana) on day drinking days (e.g., Patrick et al., 2020). Between persons, students who day drank more often throughout the study also played drinking games and mixed alcohol with energy drinks on more drinking days. This may indicate that day drinking and these two risky drinking behaviors are part of a constellation of risky behaviors among the heaviest drinkers (e.g., Evans-Polce et al., 2016).

Is Day Drinking Actually Safer Than Nighttime Drinking?

Students experienced *fewer* negative consequences on day drinking days when controlling for alcohol intake, despite being *more* likely to engage in other risky substance use behaviors. This raises the question of whether day drinking days are safer or less harmful than evening or nighttime drinking days. Given that students' eBACs were less likely to reach the level of legal intoxication on day drinking days than on evening or nighttime drinking days, it makes sense that they experienced fewer negative consequences on day drinking days. However, the negative, daily-level association between day drinking days and number of consequences experienced may have also been related to the specific consequences assessed or that the outcome measure was counts of consequences rather than the odds of experiencing specific consequences individually. Reporting consequences between the two types of days may have also varied as a function of social norms, expectations, and acceptability (Lee et al., 2010; Mallett et al., 2011). Further, motivations for drinking differentially predict the use of protective behavioral strategies that drinkers can use to minimize negative consequences (e.g., designated driver, watching one's drink; Martens et al., 2004; Patrick et al., 2011b). Students may have different motivations (e.g.,

conformity) on day drinking days, leading to a greater likelihood of protective behavioral strategy use and, in turn, fewer negative consequences.

Importantly, the average number of hours from first to last drink was more than three times longer and heavy drinking and marijuana use were more likely on day drinking days than on evening or nighttime drinking days. Even though fewer acute negative consequences may be experienced on day drinking days, the increased likelihood of several risky substance use behaviors may contribute to higher risk for more distal alcohol problems, such as impaired brain development and poorer cognitive functioning (Cservenka and Brumback, 2017; Squeglia and Gray, 2016). Lastly, given that students are more likely to report positive than negative alcohol consequences (Lee et al., 2011), it is important for future work to test whether day drinking days are associated with greater odds of experiencing positive consequences which may serve to reinforce expectancies and risky drinking behaviors.

Is Day Drinking Mostly a Greek Thing?

Greek organization participants reported more day drinking occasions throughout the study. Although testing different hypotheses, this finding complements Glassman et al.'s (2010) finding that Greek members were twice as likely as non-Greeks to engage in HID on home football game days. Glassman et al. also found that few students (16%) reported drinking during the game and nearly half (46%) reported typically not drinking after the game, which suggests (but does not confirm) that much of the drinking on game days occurs before the game (i.e., during the day). The number of day drinking days reported did not differ by gender or by athlete or honors college status. Thus, perhaps day drinking is a phenomenon most typical of students in or associated with Greek organizations (Greek students reported 35.8% of day drinking days but were only 27.0% of the sample).

Strengths and Limitations

Strengths—This paper's strengths include the sample and measurement-burst design. The probability-based sample achieved through stratified random sampling across gender and four major U.S. ethnic groups enhanced generalizability. By design, the sample was fairly homogenous, consisting of first-time, full-time, traditionally aged US college students, making generalizability more defined than in more heterogeneous samples of college students. Finally, rates of retention and completion were high (Howard et al., 2015).

The measurement-burst design resulted in a large daily-level N (i.e., 7,633 drinking days). The study spanned seven consecutive semesters over three-and-a-half years, enhancing representation of typical drinking days compared to studies with a single burst or no daily-level assessments. Frequent next-day measurements of drinking, risky behaviors, and consequences likely reduced recall bias (Gmel and Rehm, 2004). Finally, multilevel models tested within-person associations while controlling for stable between-person differences (Wang and Maxwell, 2015), improving validity.

Limitations—This paper also had some limitations. First, data came from one large, public university in the northeastern US, which may limit generalizability to other types of institutions or geographic areas. Second, students completed up to two weeks of daily

reports each semester, and it is unclear how well sampled weeks represented all weeks that semester or year (e.g., Winter break). Third, the criteria used to define day drinking were logical but should be systematically studied. Alternative definitions of day drinking could be drinking that started prior to 3:00 PM ensuring no overlaps with early happy hours or prior to 5:00 PM as that is often considered the end of the business day. Fourth, our definitions of HED and HID did not specify that such drinking occurred within a specified time period. The findings that drinking to the HED and HID thresholds was more likely and reaching an eBAC $\geq .08$ was less likely on day drinking days suggests drinks were often spaced out throughout the day but this variability was not captured. Fifth, we did not account for pre-gaming, tailgating, or event-specific drinking in analyses. It is unknown which day drinking days also included these risky drinking behaviors, which is important given that these behaviors are typically associated with greater experiences of negative consequences and day drinking days were not. Sixth, this paper did not account for the settings in which day drinking occurred. There is likely substantial heterogeneity in the environments and social contexts in which day drinking occurs. Perhaps only day drinking with large numbers of peers (e.g., tailgating or daytime parties) is characterized by heavy drinking. In contrast, drinking in smaller groups, with adult family members, and/or while eating at a restaurant during the day may be much lighter. Seventh, the times at which students reported consuming their first and last drink were based on self-reports. It is possible that students mistakenly reported AM instead of PM, or vice-versa, on some days.

Future Directions and Conclusion

Building on this work, future research should, first, develop a more evidence-based operational definition of day drinking. Qualitative studies, such as focus groups (e.g., DeJong et al., 2010), could elaborate the full range of contexts in which day drinking occurs and what differentiates this behavior from drinking in the evening or nighttime. Second, determining whether students are more (or less) likely to experience *specific* negative consequences of alcohol use (e.g., blacking out, being physically or sexually assaulted) on day drinking days than on evening or nighttime drinking days would clarify the level of risk posed by day drinking (e.g., Linden-Carmichael et al., 2018). Third, links between day drinking and medium- or long-term alcohol problems, such as alcohol use disorder or academic problems, should be tested. Fourth, given day drinking's presumed similarities to pre-gaming, tailgating, and event-specific drinking, the extent to which day drinking commonly includes or overlaps with these drinking behaviors should be examined. Similarly, future work should determine how many day drinkers are daily, dependent drinkers. Although it is still unclear how inherently risky day drinking is, it was not uncommon in this sample, and these initial findings suggest it is at least associated with several other risky substance use behaviors.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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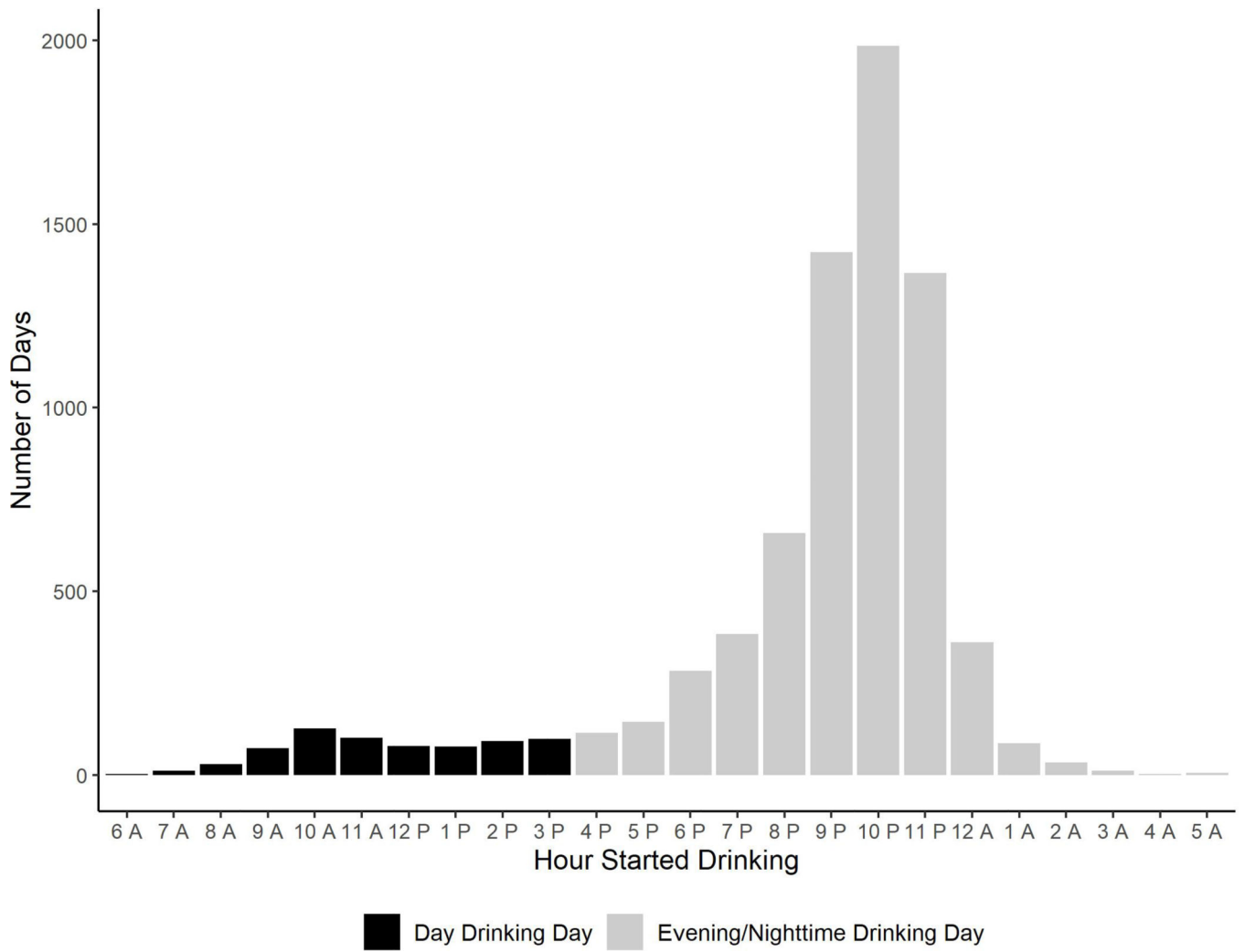


Figure 1. Bar plot of the number of drinking days by hour of the day at which drinking started.

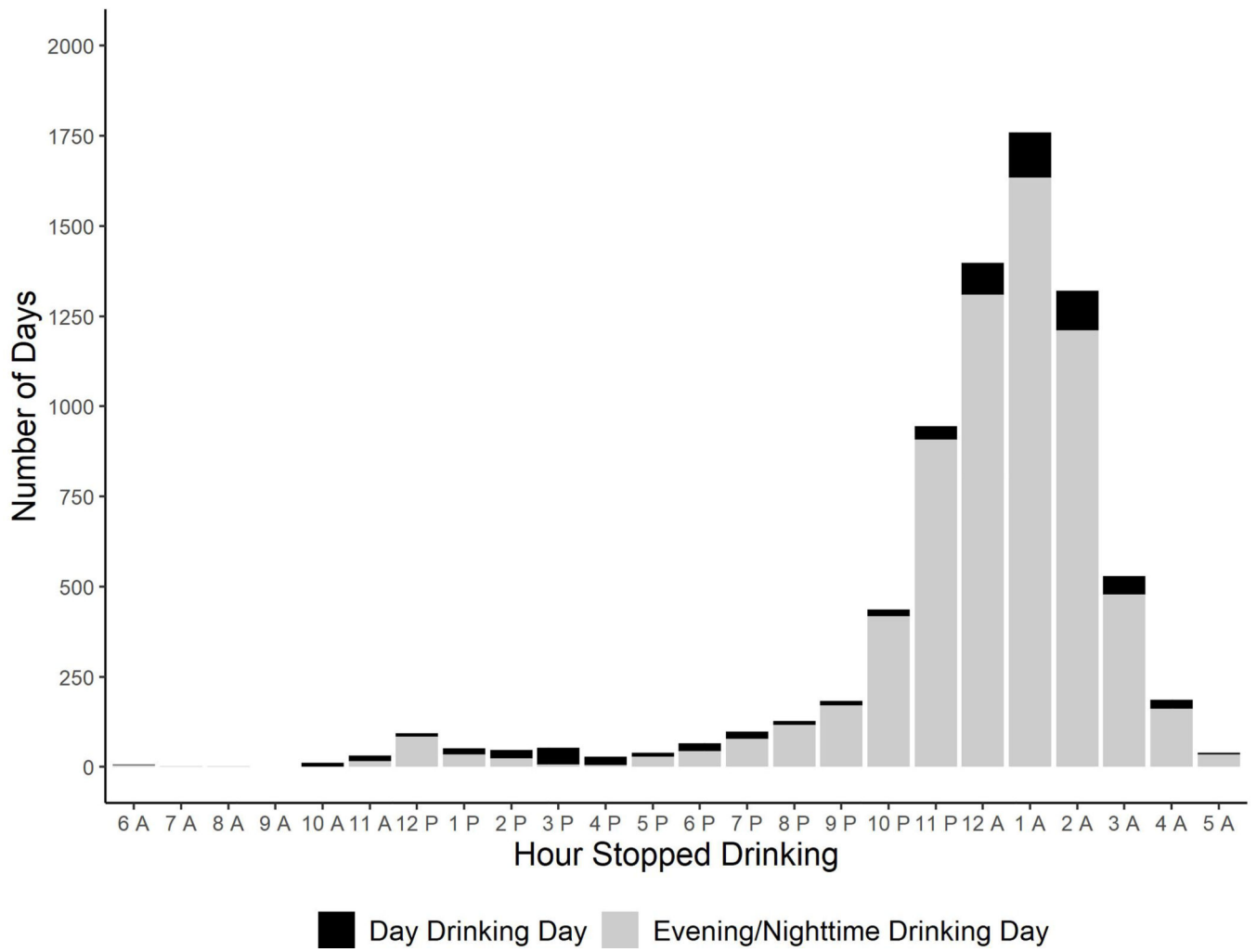


Figure 2. Bar plot of the number of drinking days by hour of the day at which drinking stopped. Evening/nighttime drinking days in which drinking stopped between 6 AM and 3 PM indicate participants reported stopping drinking the following day.

Table 1

Descriptive Statistics for Day Drinking and Outcome Variables

Variable	Students		Drinking Days		Day Drinking Days	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Day Drinking	307 (49.6)	690 (9.0)	690 (100.0)			
Heavy Episodic Drinking (HED)	516 (83.3)	4,930 (64.6)	511 (74.1)			
High-Intensity Drinking (HID)	326 (52.7)	1,838 (24.1)	298 (43.2)			
Any Negative Consequences	496 (80.1)	3,284 (43.0)	304 (44.1)			
Played Drinking Games	455 (73.5)	2,577 (33.8)	288 (41.7)			
Mixed Alcohol with Energy Drinks ^a	209 (38.2)	452 (9.6)	55 (11.9)			
Used Illegal Drugs	151 (24.4)	731 (9.6)	92 (13.3)			
Social Weekend Day	-	6,211 (81.4)	566 (82.0)			

Note. Total students, N= 619 students who reported drinking on at least one sampled day; total drinking days, N= 7,633. Day Drinking Days were those drinking started between 6:00 AM and 3:45 PM. Heavy Episodic and High-Intensity Drinking days were those women/men consumed 4+/5+ and 8+/10+ drinks, respectively. Social Weekend days were Thursday-Saturday (versus Sunday-Wednesday).

^a Alcohol mixed with energy drinks was only available in Semesters 4–7. Percentages are out of 547 students who reported drinking, 4,706 drinking days, and 462 day drinking days in those semesters.

Table 2

Logistic Multilevel Models Testing Whether Heavy Drinking and Legal Intoxication Were More Likely on Days Drinking Began During the Day Versus in the Evening or at Night

Fixed Effects	Heavy Episodic Drinking (HED)			High-Intensity Drinking (HID)			Estimated Blood Alcohol Concentration		
	N = 7,552 days			N = 7,552 days			N = 7,437 days		
	OR [95% CI]			OR [95% CI]			OR [95% CI]		
Level 1: Daily Level									
Intercept	1.50 [1.32, 1.71]	***		.10 [1.08, .12]	***		.82 [.72, .93]	***	
Day Drinking Day	1.32 [1.03, 1.70]	*		2.76 [2.14, 3.56]	***		.26 [.21, .33]	***	
Social Weekend Day ^a	4.09 [3.43, 4.87]	***		3.53 [2.84, 4.38]	***		2.69 [2.27, 3.20]	***	
Level 2: Semester Level									
Semester-Mean Day Drinking	1.80 [1.16, 2.78]	**		3.86 [2.31, 6.44]	***		.29 [.19, .45]	***	
Semester Number	.97 [.94, 1.00]			1.08 [1.03, 1.12]	***		.92 [.89, .94]	***	
Level 3: Person Level									
Person-Mean Day Drinking	15.50 [4.61, 52.10]	***		22.80 [5.24, 99.60]	***		2.87 [.86, 9.56]		
Male	.94 [.72, 1.24]			2.00 [1.41, 2.84]	***		.62 [.47, .81]	***	
Greek Participant	1.64 [1.23, 2.18]	***		1.46 [1.02, 2.10]	*		1.50 [1.13, 1.99]	**	
Student Athlete	1.62 [1.23, 2.13]	***		1.75 [1.22, 2.50]	**		1.36 [1.04, 1.79]	*	
Honors Student	.60 [.38, .95]	*		.37 [.20, .70]	**		.82 [.52, 1.28]		

Note. N = 614–618 students. OR = Odds ratio, CI = Confidence interval. Heavy episodic and high intensity drinking days were defined as those women/men consumed 4+/5+ and 8+/10+ drinks, respectively. Daily-level variables were semester-mean-centered, semester-level variables were person-mean-centered, and person-level variables were grand-mean-centered. Semester number was centered at its midpoint (i.e., Semester 4).

^a Social Weekend Day = Thursday-Saturday (versus Sunday-Wednesday).

* p < .05

** p < .01

*** p < .001.

Table 3

Poisson Multilevel Models Testing Whether Students Experienced More Negative Alcohol-Related Consequences on Days Drinking Began During the Day Versus in the Evening or at Night

Fixed Effects	Sum of Negative Consequences Experienced Each Day	
	<i>IRR</i> [95% <i>CI</i>]	<i>IRR</i> [95% <i>CI</i>]
Level 1: Daily Level		
Intercept	.46 [.42, .50] ***	.42 [.39, .46] ***
Day Drinking Day	1.05 [.92, 1.20]	.59 [.52, .67] ***
Total Drinks	-	1.24 [1.22, 1.25] ***
Social Weekend Day ^a	1.40 [1.26, 1.56] ***	.94 [.85, 1.03]
Level 2: Semester Level		
Semester-Mean Day Drinking	.94 [.72, 1.24]	.57 [.44, .74] ***
Semester-Mean Total Drinks	-	1.22 [1.20, 1.25] ***
Semester Number	.96 [.94, .98] ***	.95 [.93, .97] ***
Level 3: Person Level		
Person-Mean Day Drinking	3.57 [1.70, 7.47] ***	1.55 [.75, 3.21]
Person-Mean Total Drinks	-	1.18 [1.14, 1.22] ***
Male	1.07 [.89, 1.27]	.74 [.62, .88] ***
Greek Participant	1.19 [.99, 1.42]	1.07 [.90, 1.28]
Student Athlete	1.20 [1.01, 1.44] *	1.07 [.90, 1.27]
Honors Student	.69 [.51, .93] *	.83 [.62, 1.11]

Note. $N = 7,552$ days nested within 618 students. *IRR* = Incidence rate ratio, *CI* = Confidence interval. Daily-level variables were semester-mean-centered, semester-level variables were person-mean-centered, and person-level variables were grand-mean-centered. Semester number was centered at its midpoint (i.e., Semester 4).

^aSocial Weekend Day = Thursday-Saturday (versus Sunday-Wednesday).

* $p < .05$

** $p < .01$

*** $p < .001$.

Table 4

Logistic Multilevel Models Testing Whether Students Were More Likely to Engage in Risky Substance Use Behaviors on Days Drinking Began During the Day Versus in the Evening or at Night

Fixed Effects	Played Drinking Games	Mixed Alcohol with Energy Drinks	Used Marijuana
	<i>N</i> = 7,528 days	<i>N</i> = 4,638 days	<i>N</i> = 7,543 days
	<i>OR</i> [95% <i>CI</i>]	<i>OR</i> [95% <i>CI</i>]	<i>OR</i> [95% <i>CI</i>]
Level 1: Daily Level			
Intercept	.38 [1.34, .42]***	.04 [.03, .05]***	<.01 [<.01, <.01]***
Day Drinking Day	1.40 [1.12, 1.74]**	1.12 [.75, 1.70]	1.56 [1.01, 2.41]*
Social Weekend Day ^a	2.42 [2.03, 2.89]***	1.18 [.86, 1.63]	1.33 [.96, 1.84]
Level 2: Semester Level			
Semester-Mean Day Drinking	1.62 [1.04, 2.51]*	1.11 [.43, 2.86]	.88 [.23, 3.39]
Semester Number	.90 [.87, .93]***	1.04 [.91, 1.18]	1.08 [.97, 1.20]
Level 3: Person Level			
Person-Mean Day Drinking	3.72 [1.40, 9.91]**	6.90 [1.37, 34.80]*	6.52 [.43, 98.70]
Male	1.27 [1.03, 1.57]*	1.41 [.97, 2.07]	3.14 [1.56, 6.33]**
Greek Participant	1.26 [1.01, 1.57]*	1.33 [.90, 1.97]	1.89 [.93, 3.86]
Student Athlete	1.49 [1.20, 1.85]***	.79 [.54, 1.15]	.41 [.20, .82]*
Honors Student	.71 [.49, 1.02]	.59 [.30, 1.15]	.76 [.23, 2.59]

Note. *N* = 618 students. *OR* = Odds ratio, *CI* = Confidence interval. Daily-level variables were semester-mean-centered, semester-level variables were person-mean-centered, and person-level variables were grand-mean-centered. Semester number was centered at its midpoint (i.e., Semester 4).

^aSocial Weekend Day = Thursday-Saturday (versus Sunday-Wednesday).

* *p* < .05

** *p* < .01

*** *p* < .001.