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Authors

Schuckit, Marc A
Smith, Tom L
Clausen, Peyton
et al.

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Drinking Patterns Across Spring, Summer, and Fall in 462 University Students

Marc A. Schuckit, Tom L. Smith, Peyton Clausen, Jessica Skidmore, Alexandra Shafir, and Jelger Kalmijn

Background: Student heavy drinking and associated problems are common at most universities and fluctuate throughout the calendar year, with marked increases during celebrations. Most studies of student drinking are limited to the academic year itself, and relatively few focus specifically on special heavy drinking events. Even fewer studies include drinking during summer break and subsequent school return.

Methods: In the context of an experimental protocol, beginning in January 2014, alcohol-related characteristics were evaluated 8 times over 55 weeks for 462 college freshmen, including periods that incorporated a campus festival, summer, and school return. Baseline predictors of drinking quantities over time included demography, substance use patterns, as well as environmental and attitudinal characteristics. Product-moment correlations evaluated relationships between baseline characteristics and subsequent quantities, and simultaneous entry regression analyses evaluated which characteristics most robustly predicted usual and maximum drinks over time.

Results: Maximum drinks per occasion increased 18% from the early spring (4/8/14 to 5/6/14) to the campus festival period (5/7/14 to 6/3/14), decreased 29% in the summer (7/8/14 to 8/5/14), and increased 31% on school return (10/7/14 to 11/4/14). The most robust predictors of higher quantities in regression analyses included items from each of the 3 major domains with the most consistent results seen for most baseline alcohol-related items and descriptive drinking norms ($R^2 = 0.20$ to 0.31).

Conclusions: These data demonstrate important changes in students' drinking during the calendar year, including expected large increases during the month of a 1-day festival, large decreases over the summer, and resumption of relatively high quantities upon return to school.

Key Words: Alcohol, University, Prediction, Changes Over Time.

HEAVY DRINKING IS common during college years and is associated with potentially serious consequences. About 65% of students who have drunk so much became ill (Barnett et al., 2014); half consumed at least 4 to 5 drinks per occasion (Hingson et al., 2005, 2009; Johnston et al., 2015); a similar proportion experienced alcohol-related blackouts (ARBs; Schuckit et al., 2015a); 10% had an alcohol-related injury; while 2,000 students died each year from alcohol-related causes (Hingson et al., 2005, 2009; Turner and Shu, 2004).

These experiences are relatively ubiquitous across colleges and universities and relate to a wide range of preexisting characteristics (Brown et al., 1987; Fromme et al., 2010). Demographic items associated with higher drinking intensities include being European American (EA), sex (in some studies rates are higher among females) and, in adolescents,

an older age (Barnett et al., 2014; Eng et al., 2007; Schuckit et al., 2015a). Heavier past substance use patterns also predict college alcohol use and problems, as do several alcohol-related genetically influenced characteristics (Schuckit, 2014) such as how a person responds to alcohol (e.g., King et al., 2014; Schuckit et al., 2011a,b). The latter includes a low level of response (low LR), or the need for higher blood alcohol concentrations to experience the effects of this drug, which predicts heavier alcohol intake in a wide range of situations (Schuckit et al., 2011a, 2015b). Environment/attitude characteristics related to heavy drinking include substance use among peers, using alcohol to cope with stress, higher positive expectancies of alcohol's effects, beliefs that people have positive views about alcohol use and drunkenness (injunctive norms), and a person's belief that people around them are heavy drinkers (descriptive norms) (Borsari and Carey, 2003; Fromme and D'Amico, 2000; Larimer et al., 2009; Neighbors et al., 2007; Schuckit et al., 2011a; Veenstra et al., 2007).

Drinking patterns, however, fluctuate over time. Changes in college drinking can reflect periods of transition, such as moving from home to the freshman year of college (Barnett et al., 2014; Fromme et al., 2008; Mallett et al., 2013). Other transitions have less often been studied, such as when students return to their home environment over the summer (Miller et al., 2016), or the transition from summer back to

From the Department of Psychiatry (MAS, TLS, PC, JS, AS, JK), University of California, San Diego, La Jolla, California.

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Reprint requests: Marc A. Schuckit, MD, Department of Psychiatry, University of California, San Diego, 8950 Villa La Jolla Drive, B-218, La Jolla, CA 92037; Tel.: 858-822-0880; Fax: 858-822-1002; E-mail: mschuckit@ucsd.edu

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university. Drinking is also likely to escalate during celebrations, including 21st birthdays, spring-break parties, and campus-centered events such as football games (Lee et al., 2006; Merlo et al., 2010; Neighbors et al., 2005; Nelson and Wechsler, 2003; Patrick et al., 2012). An annual celebration at our university is the 1-day Sun God Festival, which on May 16, 2014 occurred during our study of the impact of a program aimed at decreasing campus heavy drinking (Schuckit et al., 2016). That year the festival attracted more than 16,000 participants, among which 155 attendees received student-conduct violations primarily for alcohol, 70 needed help to sober up on site, 21 required more intense medically monitored treatment for intoxication on site, 21 were transported to a healthcare facility, and 11 participants were arrested (Sun God Task Force, 2014).

Our 2014 campus heavy drinking prevention study gathered drinking-related data at 8 time points over 55 weeks. Ninety-two percent of students who entered the study completed at least 7 assessments, which allowed us to compare drinking patterns across a range of relatively rarely studied transitions, and to evaluate predictors of drinking patterns at each time point. In light of concerns expressed about heavy-episodic, or “binge,” drinking, the analyses focus on drinking quantities. These longitudinal data were used to test the following 4 hypotheses. Despite the single-day duration of the Sun God event, Hypothesis 1 predicted that drinking quantities will increase during the month of the Sun God Festival compared with earlier alcohol-related practices. Reflecting recent results with students mandated for counseling for drinking infractions (Miller et al., 2016) and potential dampening effects parents might have on drinking practices, Hypothesis 2 stated that students will decrease drinking quantities over the summer. Reflecting drinking practices related to specific environments (Beck et al., 2013), Hypothesis 3 anticipated students will resume higher quantities upon return to school. Hypothesis 4 stated that predictors of drinking patterns over time will encompass a wide range of characteristics that include demography, substance use, and environment as well as attitudes toward drinking.

MATERIALS AND METHODS

Following approval by our university’s Human Protections Committee, in November, 2013, questionnaires were emailed to 4,000 freshmen using questions derived from the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA) interview (Bucholz et al., 1994; Hesselbrock et al., 1999). Data were gathered as part of an experimental protocol in which subjects with low and high LRs were assigned either to watch 1 of 2 sets of videos aimed at decreasing heavy drinking or to a control group and followed over time (Schuckit et al., 2016). With about a 70% response rate to the mailings, we identified recent drinkers who did not meet lifetime criteria for alcohol or illicit drug dependence, bipolar disorder, antisocial personality disorder, or schizophrenia (American Psychiatric Association, 1994). Asian individuals

who became physically ill after 1 or 2 drinks, and who were probable homozygotes for aldehyde dehydrogenase mutations, were also excluded (Eng et al., 2007). The drinking-related questions included recent 30-day histories of the days on which alcohol was consumed, numbers of standard (10 g) drinks on usual and maximum drinking days, and alcohol problems. Subjects’ LRs to alcohol early in their drinking careers, and before tolerance was likely to develop, were evaluated using the Self-Rating of the Effects of Alcohol (SRE) questionnaire as the average number of standard drinks required for up to 4 effects the first 5 times of drinking (SRE First5). These included drinks to first feeling any effect, slurring speech, unsteady gait, and unwanted falling asleep, with higher scores indicating needing more drinks for effects, or a lower LR per drink (Schuckit et al., 2011a). The Cronbach alpha for the SRE in the current sample was 0.88, with repeat reliabilities in the literature >0.66 (Ray et al., 2007; Schuckit et al., 2011a).

Based on the time frame described at the bottom of Fig. 1, 90% of subjects who were invited to participate agreed to enter the experimental protocol where they were paid \$20 for each of 8 Internet-based assessments. As part of the prevention study (Schuckit et al., 2016), students were randomly assigned to either a control condition with no intervention or watched 5 alcohol-related educational videos over the first 3 months. Subjects were then followed and evaluated with Internet-based assessments similar to the baseline SSAGA-based questionnaire (Schuckit et al., 2016). Among the 500 students enrolled, 462 (92.4%) completed at least 7 of the 8 assessments and were included in these analyses, with any missing data handled using SPSS multiple imputation

Fig. 1. Means and standard errors for maximum drinks (closed circles) and usual drinks (closed squares) over 55 weeks for 462 University of California, San Diego students. Data relate to the 30 days before periods beginning with baseline (Period 1 began on 1/14/14) through returning to school (Period 8 began on 2/3/15). The 2 vertical bars demarcate the periods that were the focus of these analyses (Periods 5, 6, 7). *Spring quarter began on 3/27/14 and ended on 6/13/14; fall quarter began on 9/29/14.

(Released 2009, PAWS Statistics for Windows, version 18.0; SPSS Inc., Chicago, IL) (Shafer and Graham, 2002).

Potential baseline predictors representing the 3 domains had to be limited to those included in the campus heavy drinking prevention study. For demography, for reasons stated in the Introduction, we selected age, sex, and self-reports of an EA ethnicity, with the latter representing the largest ethnic background that related to heavy drinking in a past university-based study (Barnett et al., 2014). Regarding substance use patterns, reflecting our long-term interest in LR, we included SRE-based LR scores along with SSAGA-based alcohol problems and usual and maximum quantities in the prior month. Recent cannabis use from the SSAGA was included because of the high prevalence of experience with this drug on campus as well as the relationship between alcohol and cannabis use patterns (Subbaraman and Kerr, 2015).

Finally, several environment and attitude items that have related to higher drinking quantities in our prior studies were selected as baseline predictors, including a short version of the Alcohol Expectancy Questionnaire (AEQ) (Brown et al., 1987; Schuckit et al., 2011a) that has a Cronbach alpha of 0.88 in this population and similar retest reliabilities. As described elsewhere (Schuckit et al., 2011a), this AEQ version included 3 items with the highest factor loadings from each of 4 AEQ subscales (Social Behavior, Cognitive and Motor abilities, Sexual enhancement, and Arousal). The second relevant measure was the Beck Depression Inventory (BDI; Beck et al., 1961) with Cronbach alpha of 0.91 and retest reliability of 0.93 (Beck and Steer, 1984). Using alcohol to cope with stress was measured by the 6-item Drinking to Cope scale (DTC; Cooper et al., 1988) that used a 4-point scale to measure frequencies of using alcohol to cope with specific stressors (Cronbach alpha 0.85). Injunctive norms were evaluated using a modification of the scale of Lewis and colleagues (2010) as the sum of the subject's estimate of approval on a 7-point scale regarding 14 drinking behaviors (e.g., playing drinking games; drinking shots; consuming alcohol every day; passing out from alcohol; or drinking to blow off steam) by the typical same-sex person, with higher scores indicating greater approval (Lewis et al., 2010) (Cronbach $\alpha > 0.74$), and descriptive norms related to the usual number of drinks per occasion estimated for typical students (Baer, 1994; Neighbors et al., 2007). Finally, the perceptions of drinking in 4 close peers were based on the Important People and Activities Scale that included an estimate of whether each peer drank alcohol in the prior month, and, if so, the frequency and maximum number of drinks per day (Longabaugh et al., 2001).

Statistical analyses included product-moment correlations between baseline characteristics and drinking usual and maximum quantities during the 30 days prior to each assessment. Baseline items that related significantly to a relevant outcome were simultaneously entered into multiple linear regression analyses to determine which predictors were most robust when considered in the context of other significant predic-

tors, as well as the proportion of the variance explained (the R^2). As alcohol outcomes are sometimes evaluated as count variables, the regression analyses were also run using Poisson and negative binomial approaches. Differences in drinking quantities between assessments were evaluated with repeated measure analyses of variance. Reflecting non normal distributions of drinking quantities, square-root transformations were used for these variables in correlations, multiple linear regressions, and repeated measure analyses.

RESULTS

From among the original 500 students enrolled in the campus prevention protocol, the subjects in the current analyses were 462 individuals who completed at least 7 of the 8 assessments over the 55 weeks, of which all but 12 participated in all 8 periods. As shown in the first data column of Table 1, regarding demography, at the time of the baseline assessment used in these analyses (1/14/2014), subjects were an average of 18 years old, 63% were female, and about a third were EA. While not shown in the table, 36% were Asian, 16% Hispanic, and 14% listed other ethnic backgrounds (e.g., Pacific Islander, Filipino, and Middle Eastern). Substance use patterns in the month prior to baseline included an average of 4 standard drinks on a usual occasion and a maximum of 6 drinks at any occasion in the past month, with more than 40% having used cannabis in that same time period. Early in their drinking careers, these students required an average of 4 drinks to produce up to 4 potential alcohol effects as measured by the SRE questionnaire. While at baseline no subject was alcohol dependent, 45% reported 1 or more of 19 possible alcohol problems in the prior month, including about 20% each for ARBs and/or drinking more or for longer periods than intended, with about 15% each reporting needing more drinks to get effects (tolerance) and/or consuming 4 or more drinks per occasion and/or drinking heavily for at least 2 consecutive days (e.g., most of a weekend). Table 1 also lists scores for several environment and attitude characteristics shown in our prior work to relate to heavier drinking, including alcohol expectancies (AEQ), depressive symptoms, using alcohol to cope with stress (DTC), descriptive and injunctive drinking norms, and drinking among peers. The final item in Table 1 reports that in the prevention protocol, 86% viewed educational videos, while 14% were controls, and, as discussed below, the assignment to active intervention versus control groups did not relate to patterns of increases and decreases in drinking over time.

Table 2 and Fig. 1 present maximum and usual drinks per occasion across Periods 5, 6, and 7 that include the spring-summer-fall periods of the study. To place these dates into perspective, the legend in Fig. 1 presents dates for the academic quarters. While the emphasis in these analyses is on the Sun God-summer-return to school time frames set off by vertical bars in Fig. 1, the previously described school-year drinking patterns for Times 1 to 4, and 8 are also shown

Table 1. Correlations of Baseline Characteristics and Drinking Quantities During Spring (Sun God), Summer, and Return to School Time Periods for 462 Students

Baseline variables	Baseline period descriptives mean (SD) or %	Correlations with absolute values					
		5 (Sun God)		6 (Summer)		7 (School return)	
		Maximum	Usual	Maximum	Usual	Maximum	Usual
Demography							
Age	18.1 (0.45)	−0.08	−0.11 ^a	−0.02	−0.03	−0.14 ^c	−0.12 ^b
Female (%)	62.8	−0.00	0.01	−0.11 ^a	−0.07	−0.09	−0.03
European American (%)	34.4	0.16 ^c	0.12 ^b	0.16 ^c	0.11 ^a	0.22 ^c	0.16 ^a
Alcohol							
LR SRE (first 5 times drank)	4.2 (2.14)	0.28 ^c	0.25 ^c	0.21 ^c	0.25 ^c	0.23 ^c	0.21 ^a
Maximum quantity/occasion*	6.5 (4.59)	0.51 ^c	0.46 ^c	0.45 ^c	0.41 ^c	0.49 ^c	0.43 ^c
Usual quantity/occasion*	4.2 (2.89)	0.41 ^c	0.42 ^c	0.38 ^c	0.37 ^c	0.41 ^c	0.39 ^c
1+ Alcohol problem* (%)	45.0	0.32 ^c	0.30 ^c	0.27 ^c	0.22 ^c	0.28 ^c	0.23 ^c
Other substances							
Any cannabis* (%)	42.2	0.20 ^c	0.18 ^c	0.25 ^c	0.17 ^c	0.24 ^c	0.18 ^a
Environment/Attitudes							
Alcohol Expectancy Questionnaire total*	6.3 (2.19)	0.09	0.08	−0.01	−0.03	0.05	0.01
Beck Depression Inventory*	7.7 (7.25)	−0.05	−0.06	−0.11 ^a	−0.12 ^a	−0.11 ^a	−0.13 ^b
Drink to cope*	9.1 (3.21)	0.11 ^a	0.13 ^b	0.14 ^b	0.13 ^b	0.12 ^a	0.09 ^a
Descriptive drinking norms quantity	17.8 (5.97)	0.33 ^c	0.31 ^c	0.28 ^c	0.27 ^c	0.28 ^c	0.30 ^c
Injunctive drinking norms	64.2 (12.23)	0.14 ^b	0.13 ^b	0.06	0.07	0.11 ^a	0.08
Peer drinking maximum quantity*	5.1 (2.24)	0.32 ^c	0.28 ^c	0.26 ^c	0.25 ^c	0.31 ^c	0.26 ^a
Intervention							
Viewed videos (%)	85.5	−0.06	−0.05	0.03	0.02	0.04	0.06

LR, level of response to alcohol; SRE, Self-Rating of the Effects of Alcohol questionnaire.

*Prior month.

Shading is used to highlight correlations that are $p < 0.05$ or better with ^a $p < 0.05$, ^b $p < 0.01$, and ^c $p < 0.001$.

Table 2. Drinking Patterns Over Time for Key Periods for 462 Students: Mean (SD)

Key epochs	Maximum	Usual
4. Early spring	5.4 (4.22)	3.7 (2.66)
5. Sun God	6.4 (4.62) ^c	4.2 (2.98) ^c
6. Summer break	4.5 (4.05) ^c	2.9 (2.59) ^c
7. Return to school	5.9 (4.22) ^c	3.8 (2.72) ^c

Data are for estimates of standard drinks (12 oz for beer, 1.5 oz for 80-proof beverage, and 4 oz for wine).

Repeated measures analysis of variance results for changes over the 2 time points from one time period to the next (4 to 5, 5 to 6, 6 to 7) are given as superscripts where ^c $p < 0.001$.

(Schuckit et al., 2016). The current results demonstrate changes from prior to subsequent periods, including 18% increases in maximum drinking quantities during the Sun God Festival Period (the 20-week assessment at Time 5: 5/7/14 to 6/3/14), 29% reductions in alcohol quantities over the summer (29-week evaluation at Time 6: 7/8/14 to 8/5/14), and 31% increases when students returned to school in the fall (42 weeks at Time 7: 10/7/14 to 11/4/14). Note that if the time frame prior to the Sun God Festival is used as a base, the decrease from Time 4 to summer was almost 17%. During summer months, 60.0% of these students lived with their parents, 22.1% were away from campus but not with parents, and 18.1% remained in campus dorms. While not shown in the figure, the patterns of drinking across the key time periods (e.g., highest quantities regarding the Sun God Period, lowest values over the summer, and increases in

quantities upon return to school) were similar for students in the control group and those in the active educational groups during the campus prevention protocol.

Returning to Table 1, the remaining 6 data columns give product-moment correlations between baseline characteristics and drinking quantities the 30 days prior to Sun God, summer, and school return assessments. Regarding demography, on a univariate level an EA ethnicity was associated with higher drinking quantities in all follow-up periods, older age related to lower drinking during Sun God and school return periods, but female sex was only related to lower maximum drinks over the summer. All baseline substance-related variables correlated with higher quantities over the year, including higher SRE scores that indicated a lower LR per drink, higher baseline alcohol quantities, and cannabis use. Among environment/attitude baseline measures, higher depression scores correlated with lower drinking during the summer and return to school periods, and higher injunctive norms (higher scores indicated a perception that the alcohol-related item was felt to be more acceptable to people) only related to heavier drinking during the Sun God and school return periods. Other than for AEQ, higher scores for all remaining variables in this group of potential predictors were more consistently related to higher alcohol intake across time frames. The experimental condition in which a person was placed (controls or videos) did not relate to whether drinking at any time period across the 55 weeks was higher or lower.

Some baseline predictors of drinking quantities are unlikely to be independent of others (e.g., among baseline drink-

ing measures). Therefore, to better identify baseline characteristics that are more likely to stand alone as predictors, all significant predictors of drinking for each follow-up period were entered into a simultaneous entry multiple linear regression analysis to evaluate which items performed most robustly when evaluated in the context of others. As shown in Table 3, the most consistent predictors of higher drinking quantities across multiple periods included higher SRE scores (lower LRs), higher baseline maximum quantities, and descriptive (but not injunctive) norms (note that only items significantly related to drinking quantities in each relevant time period in Table 1 were entered into that specific regression analysis). Less consistent contributors to those regression analyses included age (older students drank less during the Sun God period and on school return), female sex (lower maximum drinks over the summer), EA ethnicity (only related to higher maximum drinks at school return), cannabis use (which related to higher maximum drinks over the summer), and DTC with stress (where a suppressor effect related to entering this variable in the context of maximum drinks, added significantly to only maximum drinks in the Sun God Period). When considered in the context of other predictors in these regression analyses, usual drinking quantities, baseline alcohol problems, alcohol expectancies, and peer drinking did not add significantly. The proportions of the variance (R^2) explained across regression equations for each key time point ranged from 0.20 to 0.31. While not significantly related to drinking patterns in Table 1, assignment to an experimental condition (e.g., the video-based active intervention) was added to each regression analysis in

Table 3 but did not contribute significantly to any of the results. When these regression analyses were repeated using the nontransformed usual and maximum drinks that were considered as counts, the 6 Poisson regressions (usual and maximum drinks for each of the 3 key time periods) had Pearson χ^2/df values from 1.54 to 2.36. As a result, the negative binomial regressions were run yielding ratios ranging from 0.80 to 1.02. For both Poisson regressions and negative binomial analyses, the results were essentially the same as those shown in Table 3.

DISCUSSION

This paper describes patterns of drinking quantities in 462 freshmen university students across 3 periods of their initial stages of college. As predicted by Hypothesis 1, and consistent with the literature regarding celebrations, high drinking quantities characterized the Sun God Festival Period (Time 5) (Merlo et al., 2010; Patrick et al., 2012). The average of 6 maximum drinks exceeds the National Institute on Alcohol Abuse and Alcoholism guidelines for “binge” or heavy-episodic drinking (White et al., 2006). Such high alcohol intake carries risks for many alcohol consequences, as discussed above (e.g., Barnett et al., 2014; Hingson et al., 2009). The rise in usual and maximum drinks was observed even though the entire month was considered, not just the single day of the Sun God celebration. That finding may indicate that the heavy drinking associated with a campus-wide festival or, perhaps, those associated with championship football games or other college celebrations, may have an impact beyond

Table 3. Regressions (Simultaneous Entry): Baseline Demography and Characteristics Predicting Spring (Sun God), Summer, and Return to School Time Periods for 462 Students*

Baseline variables	Standardized betas					
	5 (Sun God)		6 (Summer)		7 (School return)	
	Maximum	Usual	Maximum	Usual	Maximum	Usual
Demography						
Age		−0.10 ^a			−0.11 ^b	−0.11 ^b
Female (%)			−0.11 ^b			
European American (%)	0.06	0.03	0.07	0.03	0.10 ^b	0.07
Alcohol						
LR SRE (first 5 times drank)	0.11 ^b	0.09 ^a	0.05	0.12 ^b	0.07	0.07
Maximum quantity/occasion**	0.46 ^c	0.27 ^b	0.34 ^c	0.25 ^b	0.41 ^c	0.25 ^b
Usual quantity/occasion**	−0.10	0.08	−0.02	0.06	−0.03	0.02
1+ Alcohol problem** (%)	0.07	0.08	0.03	0.01	0.02	0.02
Other substances						
Any cannabis use** (%)	0.01	0.01	0.09 ^a	0.04	0.06	0.03
Environment/Attitudes						
Alcohol Expectancy Questionnaire total**						
Beck Depression Inventory**			−0.06	−0.07	−0.04	−0.08
Drink to cope**	−0.10 ^a	−0.06	−0.02	−0.02	−0.06	
Descriptive drinking norms quantity	0.11 ^a	0.10 ^a	0.12 ^b	0.09 ^a	0.05	0.11 ^a
Injunctive drinking norms	0.05	0.05			0.03	
Peer drinking maximum quantity**	0.05	0.01	0.00	0.03	0.05	0.01
R^2	0.31 ^c	0.26 ^c	0.25 ^c	0.20 ^c	0.30 ^c	0.23 ^c

LR, level of response to alcohol; SRE, Self-Rating of the Effects of Alcohol questionnaire.

*Missing values reflect relationships that were not significant in Table 1.

**Prior month.

Shading is used to highlight correlations that are $p < 0.05$ or better with ^a $p < 0.05$, ^b $p < 0.01$, and ^c $p < 0.001$.

the special day itself. This extended period of heavier drinking might reflect both anticipation of the upcoming heavy drinking celebration (perhaps similar to drinking in anticipation of a later football game) as well as feelings of a continuing festival atmosphere following the event. These speculations aside, universities should recognize such extended high drinking activities on their campuses and take steps to mitigate such heavy alcohol consumption, perhaps by implementing some of the suggestions offered below.

Consistent with Hypothesis 2, but as demonstrated in only one other recent paper (Miller et al., 2016), during the summer both usual and maximum drinks per occasion decreased by about 30% from the Sun God Period. In the summer, students are likely to leave the relatively heavy drinking campus environment, live with their parents, and associate with high school friends, situations similar to their precollege environments. During that time, parents might mitigate heavy drinking by monitoring their offspring's behaviors (Fairlie et al., 2012). This raises the possibility that, looking toward a likely rebound in drinking quantities as they return to school, campus heavy drinking prevention programs might consider incorporating both students and their parents into drinking-related education seminars during the period between the freshman and sophomore college years. Using as models the results of several recent intervention studies related to specific heavy drinking vulnerabilities, different types of prevention approaches, including those offered through the Internet, might be useful in diminishing heavy drinking during the subsequent college year (Conrod et al., 2013; Schuckit et al., 2016).

The prediction of relatively high drinking when returning to school (Hypothesis 3) was also supported by the current data, as maximum drinking quantities increased 31% compared with summer levels. The latter phenomenon underscores the importance of also considering the beginning of the sophomore year as a period of vulnerability toward heavy drinking that might rival the increased quantities seen in the transition from high school to college. The beginning of the sophomore year might also be an important time to implement prevention protocols to minimize a predisposition toward heavy drinking similar to those that can be offered to entering students (Schuckit et al., 2016). Perhaps similar increases might be seen in later college years, although the current study did not evaluate those potential phenomena.

Hypothesis 4 was supported, as the regression analysis in Table 3 indicated significant contributions from baseline items representing demography, substance use, as well as environment/attitude domains. The variability of drinking practices documented in this study across the 55 weeks is also important to note. These findings underscore the importance of longitudinal research regarding college drinking practices, as data from 1 period or 1 type of predictor alone did not adequately describe campus drinking patterns over the year.

While not the major emphasis of these analyses, the relationship of the low LR to alcohol to drinking patterns over the year is worth comment. For many years, our group has been interested in how the low LR to alcohol predicts higher

alcohol quantities in the near and distant future in adolescents and young adults (Schuckit et al., 2011a,b). In the current study of college freshmen, on a univariate level in Table 1 the low LR correlated significantly with higher usual and maximum alcohol quantities at all 3 drinking periods. In the regression analyses, for both Sun God and summer periods the low LR remained a robust predictor of heavy drinking even when considered in the context of baseline drinking quantities and problems. These data indicate that universities interested in predicting which students might be more likely to drink heavily during celebrations and who might, therefore, benefit from additional education about the risks of alcohol might consider screening for the low LR as a marker of a vulnerability toward excessive alcohol use.

It is also interesting to note how different types of baseline norms related to outcomes in the current analyses. Higher descriptive norms were among the most consistent correlates of higher alcohol quantities during all 3 periods in both univariate and regression analyses. Injunctive norms, however, did not contribute to regressions predicting drinking quantities at any time point. This finding is consistent with 1 study that suggested that descriptive norms might be more likely to be related to drinking parameters in the short run (Borsari and Carey, 2003), and with a study indicating that the 2 norms do not represent a unitary concept (Lee et al., 2007). However, longer term follow-ups and some experimental results suggest that in some contexts and after considering other characteristics of subjects, injunctive norms may be as closely related to drinking outcomes (Larimer et al., 2004; Lee et al., 2007; Merrill et al., 2014; Mollen et al., 2013). Thus, more work is needed regarding the relative usefulness of these measures as indicators of risks for campus heavy drinking.

One of the more unexpected findings in Table 1 related to the negative relationship between baseline scores on the BDI and alcohol drinking quantities in the summer and return to school periods. However, the BDI did not add to the prediction of drinking quantities when entered into the regression analyses in Table 3, and, thus, depression scores are not considered a major predictor of drinking quantities at any of the 3 key time points.

Another notable result is the general lack of relationship between alcohol expectancies and drinking quantities in these analyses. In Table 1, the AEQ score did not correlate significantly with drinking quantities at any time point. This result may have reflected the fact that, due to limited testing time available with these students, a 12-item short version of the adolescent AEQ was used. While this format related to heavier drinking in a large study of 17-year-olds from a British general population sample (Schuckit et al., 2011a), the short form may not have been powerful enough to perform in a more robust manner in the current study of college students.

In viewing the current results, it is important to remember that the data were extracted from a larger study that evaluated a prevention protocol aimed at reducing heavy drinking on campus (Schuckit et al., 2016). However, as shown at the bottom of Table 1, the experimental condition (controls vs.

viewing videos) did not relate to the pattern of either usual or maximum drinks across time periods. This probably occurred because the major impact of the prevention protocol was only on subjects with low LR who were in one of the video groups. Reflecting this nonsignificant relationship with alcohol quantities in any of the 3 time frames highlighted in the current analyses, the experimental condition was not entered as a separate item in the regression analyses in Table 3. When the group assignment in the larger study was forced into the regressions, the results reported in Table 3 did not change. It will be important to determine whether similar findings are observed in universities where no prevention protocol was present.

As is true with all studies, additional caveats should be considered in viewing the current results. First, the data were extracted from a campus prevention study that was not initially structured to address the questions raised in the current analyses. Thus, the data available were limited to those recorded for the prevention protocol, and some additional items that may have been of interest here were not gathered such as summertime activities, participation in other campus events, grades, and academic majors. Similarly, the analyses were limited to 8 time points built around the timing of the prevention protocol, and did not, for example, gather drinking data at multiple time points within any 1 period of interest. This might have been particularly informative during the month of the Sun God Festival. Second, the study was carried out at a single university in Southern California that has large Asian and Hispanic populations but few African Americans, and it is important to see whether similar results are observed at other universities. Third, only baseline predictors of outcomes were used in these analyses, and future work is needed to evaluate time-varying predictors. Fourth, all drinking information was gathered through self-reports. Fifth, due to unavoidable delays in funding, our planned start date of early October 2013 was delayed until January 2014, and results might be a bit different if baseline had occurred earlier in the freshman year. That change impacted on the specific time frames that were compared, where, for example, the baseline period became the time frame after returning to school from winter break. Sixth, while the predictors used in these analyses were selected based on their relationships to heavy drinking in prior reports, and the emphasis was placed on those that added significantly to the regression analyses, Type 1 errors could still occur. Finally, reflecting the interest in the literature on “binge drinking” and our historical focus of LR as a predictor of higher drinking quantities, the emphasis was on usual and maximum drinks, and future work is needed on additional outcomes such as alcohol problems and drinking frequencies.

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CONFLICTS OF INTEREST

No author has any conflict of interest to declare.

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