Profiles of College Drinkers Defined by Alcohol Behaviors at the Week Level: Replication Across Semesters and Prospective Associations With Hazardous Drinking and Dependence-Related Symptoms

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ABSTRACT. Objective: Types of college drinkers have been identified using traditional measures (e.g., 12-month drinking frequency). We used an alternative multidimensional approach based on daily reports of alcohol behaviors to identify college drinker statuses, each with a unique behavioral profile. The current study aimed to (a) identify drinker statuses at the week level across four semesters, (b) examine the predictive utility of drinker status by testing associations with senior-year hazardous drinking and dependence symptoms, and (c) identify concurrent predictors (gender, drinking motivations, hazardous drinking, any dependence symptoms) of senior-year drinker status. We also compared the week-level drinker statuses with drinker statuses identified using traditional measures. **Method:** A multi-ethnic sample of U.S. college students completed 14-day bursts of daily web surveys across college (91%–96% completed ≥6 daily reports of the sampled week). Analyses focus on nine alcohol-related behaviors (including estimated blood

alcohol concentration, pregameing, and drinking games) assessed daily in spring/sophomore year to fall/senior year and drinking motivations, hazardous drinking, and dependence symptoms assessed fall/senior year ($n = 569$; 56% women). **Results:** Four week-level drinker statuses were replicated across semesters: Nondrinker, Light Weekend, Heavy Weekend, and Heavy Frequent. Across semesters, drinker status was associated with senior-year hazardous drinking and any dependence symptoms. Senior-year fun/social motivations were also associated with senior-year drinker status. Differences in behavioral profiles between week-level drinker statuses and those identified using traditional measures were found. **Conclusions:** Replicable week-level drinker statuses were identified, suggesting consistency in possible types of drinking weeks. Drinker statuses were predictive of senior-year hazardous drinking and dependence symptoms. (*J. Stud. Alcohol Drugs*, 77, 38–50, 2016)

TRADITIONAL ALCOHOL MEASURES ask respondents to aggregate behavior across time (e.g., 12 months). Measures often include typical quantity consumed per occasion, frequency of heavy episodic drinking (HED), and frequency of getting drunk (Dauber et al., 2009; Reboussin et al., 2006). Aggregate estimates usefully describe how people differ from each other and how individuals change over time. The current study takes the alternative approach of using daily reports assessed over 1 week in each of four college semesters. First, we identified week-level behavioral profiles that we refer to as drinker statuses (rather than types or classes) to emphasize that these behavioral profiles describe the drinking week and need not be stable within individuals over time. We tested for replication of the drinker statuses across semesters; replication would suggest that types of drinking weeks that

students may experience are consistent. Next we evaluated the predictive utility of these week-level drinker statuses with respect to senior-year hazardous drinking and alcohol dependence symptoms and also evaluated concurrent predictors (e.g., drinking motivations) of senior-year drinker status. Last, we identified drinker statuses using traditional measures (e.g., 12-month drinking frequency) for comparison.

Identification of drinker statuses

Different types of drinkers have been identified with distinct behavioral profiles. Among adolescents and young adults, drinker statuses have been defined using quantity consumed, drinking frequency, and HED (Auerbach & Collins, 2006; Dauber et al., 2009; Reboussin et al., 2006). College student drinker statuses have also been identified

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based on dependence and consequences (Beseler et al., 2012; Kuvaas et al., 2014), use of multiple substances (Chiauzzi et al., 2013), and engagement in multiple behaviors (Kang et al., 2014). Drinker statuses have been identified using (a) a priori decision rules or (b) person-centered approaches. A priori approaches use decision rules reflecting hypothesized drinker statuses to categorize participants (Cable & Sacker, 2008; Steinhausen & Metzke, 2003; Windle, 1996). Windle (1996) used cutoffs for number of drinks (past month), number of occasions consuming six or more drinks (past month), and negative consequences (past 6 months) to form five adolescent groups (e.g., abstainer, heavy drinker). Alternatively, person-centered approaches, such as latent class analysis (LCA) used here (Collins & Lanza, 2010), have the advantage of empirically evaluating individuals' observed response patterns to ascertain a parsimonious set of drinker statuses (Auerbach & Collins, 2006; Reboussin et al., 2006). The latent class structure refers to the defining characteristics of the drinker statuses as shown by each drinker type's distinct behavioral profile.

Empirical studies using a priori or person-centered approaches have typically identified three to five drinker statuses among adolescents and young adults (e.g., Auerbach & Collins, 2006; Cleveland et al., 2013; Dauber et al., 2009). Drinker statuses commonly exhibit ordered patterns from no/low drinking to heavy, problematic drinking; exact characteristics of drinker statuses depend on measures used (Steinhausen & Metzke, 2003; Ward et al., 2013). Diverse measures may identify drinker statuses with greater specificity regarding the nature (e.g., drinking games) and timing (e.g., weekdays) of drinking (Auerbach & Collins, 2006).

Drinker statuses defined using traditional measures aggregated across time show some stability within persons over 1- or 2-year intervals, although stability is greater for drinker statuses with no/heavy drinking than moderate drinking (Auerbach & Collins, 2006; Dauber et al., 2011; Reboussin et al., 2006; Windle, 1996). Given the erratic, opportunistic nature of college drinking over short periods (Goldman et al., 2011; Maggs et al., 2011), it is likely that, at the individual level, drinker type membership may vary substantially within individuals over time (e.g., across weeks). However, behavioral profiles of drinker statuses may replicate, such that the types of drinking weeks that students may experience (e.g., heavy drinking week) would be similar at different points in time. Daily reports from a sampled week may include atypically low or high drinking days (Del Boca et al., 2004; Goldman et al., 2011; Hoepfner et al., 2012), but aggregated measures may suffer from errors in aggregation and recall bias and ignore atypical but important occasions (Lemmens et al., 1988; Mundt et al., 1995). Accordingly, we identify drinker statuses at the week level using daily reports and also with aggregated estimates from traditional measures because these approaches may provide complementary yet divergent findings about college drinking.

Multidimensional approach

We identified young adult drinker statuses using a multidimensional approach, focusing on multiple types of alcohol-related behaviors that provide information beyond typical quantity and frequency. In addition to week-level indicators on HED, getting drunk, and number of drinking days, we included (a) drinking games and pregameing, which are associated with negative consequences (Foster & Ferguson, 2014; LaBrie et al., 2013; Paves et al., 2012; Zamboanga et al., 2014); (b) estimated blood alcohol concentration (eBAC), an estimate of peak intoxication level; and (c) day of the week drinking occurred (weekday, Thursday, Friday/Saturday). Because of its lower prevalence (Hoepfner et al., 2012; Wood et al., 2007), college student drinking on weekdays or Thursdays may be a defining feature of drinker status. In total, we used daily reports of nine alcohol-related behaviors collected on 7 consecutive days to identify drinker statuses.

Drinker statuses, defined using traditional measures, have been associated with a range of factors, including depressive symptoms and delinquency among adolescents (Dauber et al., 2009; Windle, 1996), and employment status and urban residency among non-college-attending young adults (Cleveland et al., 2013). Here we determined whether week-level drinker statuses were differentiated by gender, senior-year drinking motivations, hazardous drinking, and the presence of any dependence symptoms. Drinking motivations, or reasons for drinking, are presumed to underlie drinking behaviors, such that drinking can serve different functions (Cooper, 1994; Cox & Klinger, 1988). Although measures vary, enhancement and social motivations are commonly reported (Kuntsche et al., 2005, 2006) and predict drinking and consequences among college students (Martens et al., 2008; Mezquita et al., 2010; Norberg et al., 2011; Patrick & Maggs, 2010).

We also examined associations between drinker statuses and hazardous drinking and dependence using the Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 2001; Saunders et al., 1993). The AUDIT was developed by the World Health Organization to screen for (a) hazardous drinking defined as alcohol consumption that increases risk for harm and (b) harmful drinking defined by the presence of physical or psychological consequences resulting from use (Saunders et al., 1993). The AUDIT has been used to screen college students and is associated with indicators of health (DeMartini & Carey, 2009, 2012). Evidence indicating that, across a sample of individuals, person-level characteristics are associated with drinker-status membership in a given week would provide support for week-level drinker statuses.

Current investigation

We sought to characterize college students' alcohol behaviors at the week level using daily reports of multiple

behaviors in four semesters (spring/sophomore year to fall/senior year). The present aims were to (a) identify and replicate week-level drinker statuses in each semester, (b) evaluate the predictive utility of drinker statuses from each semester by examining associations with senior-year hazardous drinking and dependence symptoms, and (c) identify concurrent predictors of senior-year drinker status, specifically gender, drinking motivations, hazardous drinking, and dependence symptoms. We also identified drinker statuses using traditional measures for comparison to week-level drinker statuses. The present study was exploratory because drinker statuses were not known *a priori*; however, alcohol-related behaviors used to identify the drinker statuses were selected based on theory and prior empirical work.

Method

Participants and procedure

The University Life Study (Patrick & Maggs, 2011; Small et al., 2013), a longitudinal measurement burst study on alcohol and sex, recruited first-time, full-time college students who were U.S. citizens/permanent residents, younger than 21 years old, and who resided within 25 miles of campus ($N = 744$; 65% of invited provided consent and participated). A stratified random sampling procedure was used to achieve a diverse sample with respect to gender and race/ethnicity. Beginning fall/freshman year, students were mailed a letter, pen, and \$5 cash pre-incentive. For seven semesters, students received email invitations to complete an extensive web survey, followed by 14 daily web surveys. All procedures were approved by the university's institutional review board; data were protected by a federal Certificate of Confidentiality.

Present analyses focus on spring/sophomore year through fall/senior year when daily data on pregameing were available. In spring/sophomore year, men were more likely to have dropped out, $\chi^2(1, N = 744) = 5.73, p < .05$, which was the case through fall/senior year. Within semesters, analyses included cases with at least one week-level alcohol indicator and senior-year predictors ($ns = 550$ – 569), retaining 86%–96% of those who completed any daily surveys. Most students (91%–96%) completed 6–7 days of the sampled week. Based on self-reports, the senior-year analytic subsample ($n = 569$; 56% women; $M_{\text{age}} = 21.48$, $SD = 0.41$ years, range: 19.92–23.33) can be described as 26% Hispanic/Latino American, 27% European American non-Hispanic/Latino (NHL), 23% Asian American NHL, 15% African American NHL, and 9% multiracial American NHL. In fall/senior year, 37% of the subsample met a 5+/7+ (women/men) cutoff for hazardous drinking, and 58% endorsed at least one dependence item, with “unable to remember” and “guilt or remorse” being most common (Barry et al., 2015; DeMartini & Carey, 2012).

Measures

A drink was defined as 0.5 oz of absolute alcohol (a 12-oz can [or bottle] of beer or cooler, a 5-oz glass of wine, or a drink containing 1 shot of distilled spirits). Drinker-status indicators were coded into discrete variables as required for LCA. Most indicators were dichotomized to reflect whether the behavior occurred. Other indicators were coded with three to four response categories to retain valuable categorical distinctions.

Week-level drinker-status indicators. Each semester, daily reports (Days 1–7) on the prior day's behavior were used to construct nine week-level indicators. Day of the week drinking occurred was coded as *any weekday drinking* (Sunday through Wednesday), *any Thursday drinking*, and *any Friday/Saturday drinking*, each coded 1 (no) and 2 (yes).

The eBAC was calculated from the participant's gender, weight, number of drinks consumed that day, and time spent drinking using Matthews and Miller's (1979) formula, which accounts for average weight and gender differences in alcohol metabolism. For women, $eBAC = [(Total\ drinks / 2) \times (9 / \text{weight in pounds})] - [.017 \times \text{hours drinking}]$. For men, “9” is replaced with “7.50.” Maximum eBAC during the week was coded to distinguish four levels: 1 = .00%, 2 = .001%–.079%, 3 = .08%–.159%, and 4 = .16% or higher. The .08% cutoff reflects the U.S. legal limit for driving; .16% is twice the limit and poses considerable risk for acute negative consequences, including impaired balance and loss of consciousness (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2015).

Two contextual alcohol behaviors were assessed. On each drinking day, participants reported whether they participated in drinking games, and how many of their drinks were pregameing (that is, consumed before going out), each coded as 1 (*not reported during week*) and 2 (*reported on at least 1 day*).

Three traditional measures, assessed daily, were included. HED was based on having consumed four or more drinks for women [five or more for men] containing any kind of alcohol within a 2-hour period (NIAAA, 2004). Participants reported whether they got drunk. Both indicators were coded as 1 (*not reported during week*) and 2 (*reported on at least 1 day*). Number of days participants drank during the week was coded as 1 (*0 days*), 2 (*1 or 2 days*), and 3 (*3 or more days*).

Traditional drinker-status indicators. Six items assessed in fall/senior year were used as traditional indicators (NIAAA, 2003). To assess the 12-month frequency of drinking alcohol, participants reported how often in the last 12 months they usually had any kind of drink containing alcohol, from 0 (*never drank alcohol or did not drink any alcohol in past year*) to 10 (*every day*), recoded to 1 (*not in past year*), 2 (*past year but less than once a week*), and 3 (*at least once a week*). The 12-month quantity of alcoholic

drinks consumed on a typical drinking day was assessed in a range from 1 (*1 drink*) to 10 (*25 or more drinks*), recoded as 1 (*did not drink*, for those who reported no alcohol use in the past year), 2 (*1–4 drinks*), and 3 (*5 or more drinks*). Similar questions referred to the past 30 days: 30-day frequency, coded 1 (*did not drink*), 2 (*1–3 times*), and 3 (*at least once a week*); 30-day quantity of alcoholic drinks on a typical drinking day and 30-day maximum number of alcoholic drinks in a 24-hour period, both coded 1 (*0 drinks*), 2 (*1–4 drinks*), and 3 (*5 or more drinks*); and 30-day HED coded 1 (*did not engage in HED*), 2 (*1–3 times*), and 3 (*at least once a week*).

Predictors of drinker status. Five predictors assessed fall/senior year were used, including gender, coded 0 (female) and 1 (male). Continuous predictors were standardized to facilitate interpretation, $M(SD) = 0(1)$.

Drinking motivations were assessed with the Importance of Consequences of Drinking scale (Maggs et al., 2009; available from second author). Two subscales measured motivations for drinking, fun/social (five items [e.g., have more fun], $\alpha = .89$) and relaxation/coping (four items [e.g., relax after a stressful situation], $\alpha = .86$), and one subscale assessed motivations for not drinking, physical/behavioral (seven items [e.g., pass out], $\alpha = .91$). Participants were asked how important it was to experience (or avoid for negative) each consequence as a result of drinking that semester. Mean scores were computed using five-point response scales from 0 (*not at all*) to 4 (*very*).

The AUDIT has been shown to have good psychometric properties (Babor et al., 2001; de Meneses-Gaya et al., 2009). A two-factor structure has been found among college students: hazardous drinking (Items 1–3) and dependence/consequences (Items 4–10) (DeMartini & Carey, 2012; Shields et al., 2004). Items 1–3 were summed to assess hazardous drinking (scored 0–4): drinking frequency, drinks per occasion, and frequency of consuming six or more drinks on a single occasion (maximum possible = 12; observed range: 0–11). A 5+/7+ (women/men) cutoff was used to denote hazardous drinking, coded 0 (below cutoff) versus 1 (at or above cutoff) (Barry et al., 2015; DeMartini & Carey, 2012). Items 4–10 (scored 0–4) were summed to assess dependence and consequences (e.g., injury) (maximum possible = 28; observed range: 0–19). Scores were dichotomized to reflect any dependence symptoms, coded 0 (no items endorsed) versus 1 (one or more items endorsed).

Analytic strategy

Drinker statuses were identified using LCA, a person-centered approach for identifying distinct subgroups of individuals based on the patterns of responses to included indicators (Collins & Lanza, 2010). To identify week-level drinker statuses, LCA was conducted separately using week-level data from each semester (Aim 1). For fall/senior year, models with one to seven latent classes (i.e.,

drinker statuses) were considered. The selected model was then replicated using data from three semesters spanning spring/sophomore year to spring/junior year. All models were estimated using 1,000 sets of starting values to assess model identification. To determine predictive utility, LCA with covariates was conducted for each semester to determine the extent to which senior-year hazardous drinking and any dependence symptoms were associated with drinker status (Aim 2). Gender, senior-year drinking motivations, and AUDIT subscale scores (only administered fall/senior year) were included as concurrent predictors (Aim 3). Last, we conducted LCA with traditional measures for comparison. Analyses were conducted with SAS PROC LCA (Version 1.3.1; Lanza et al., 2014), using full-information maximum likelihood to address missing data on the indicators.

Results

Descriptive information on alcohol-related behaviors

Table 1 shows observed proportions of students reporting each behavior at the week level. Proportions of students reporting no drinking days in the week varied across semesters (.37–.51). Among students who drank in a given week, roughly a third drank on 3 or more days, and the majority drank on a Friday or Saturday. In spring/sophomore year, the largest proportion of students drinking that week reached a maximum eBAC of .16% or higher, but in fall/senior year, a maximum eBAC lower than .08% was most common. Among students who drank, the proportion who played drinking games was .42–.61, and the proportion who pre-gamed was .58–.65. Across semesters, among students who drank, the proportion who reported at least 1 day of HED and getting drunk was .60 or higher.

Week-level drinker statuses across semesters

Latent class models were fit to data from fall/senior year, and model fit indices (Bayesian Information Criterion and consistent Akaike Information Criterion) suggested that a four-class model was optimal (Table 2). Class separation was strong; drinker statuses had unique and interpretable response patterns based on the item-response probabilities (Table 3; Collins & Lanza, 2010). Class measurement was good, as indicated by item-response probabilities closer to 1.0 or 0.0.

For the Nondrinker status (35% of sample in fall/senior year), all indicators clearly reflected no drinking during the sampled week (Table 3). Individuals in the Light Weekend Drinker status (26% of sample in fall/senior year) were likely to drink on 1–2 days. Drinking was likely to occur on Friday and/or Saturday and unlikely to occur on Thursday or a weekday. Maximum eBAC was likely to be .08% or lower.

TABLE 1. Observed proportions of participants reporting each alcohol-related behavior at the week level across the four semesters

Indicator	All students				Drank in week			
	Spring/ sophomore (n = 563)	Fall/ junior (n = 557)	Spring/ junior (n = 550)	Fall/ senior (n = 569)	Spring/ sophomore (n = 290)	Fall/ junior (n = 267)	Spring/ junior (n = 310)	Fall/ senior (n = 356)
No. of days drank								
0	.47	.51	.42	.37	—	—	—	—
1–2	.39	.35	.37	.42	.74	.73	.63	.67
≥3	.13	.13	.21	.21	.26	.27	.37	.33
Drank ≥1 weekdays	.17	.11	.30	.23	.33	.24	.54	.38
Drank Thursday	.18	.17	.15	.20	.35	.35	.27	.32
Drank Fri./Sat.	.45	.45	.50	.59	.87	.93	.87	.92
Maximum eBAC								
.00%	.48	.52	.43	.37	—	—	—	—
.001%–.079%	.13	.18	.23	.26	.25	.36	.40	.42
.08%–.159%	.16	.14	.15	.17	.31	.30	.27	.28
≥.16%	.23	.16	.19	.19	.44	.34	.34	.30
Drinking games	.32	.30	.25	.27	.60	.61	.42	.42
Pregaming	.34	.30	.34	.42	.64	.61	.58	.65
HED	.37	.32	.35	.39	.68	.64	.60	.60
Got drunk	.38	.32	.37	.41	.71	.64	.62	.63

Notes: The number of participants who have missing values varies by semester and indicator. No. = number; drank Fri./Sat. = drank Friday and/or Saturday; eBAC = estimated blood alcohol concentration; HED = heavy episodic drinking.

Individuals had low probabilities of drinking game participation, pregaming, HED, and getting drunk.

Individuals in the Heavy Weekend Drinker status (20% of sample in fall/senior year) drank on 1–2 days, were likely to drink on Friday and/or Saturday, and were unlikely to drink on Thursday or a weekday. It was likely that individuals reached a maximum eBAC above .08%. Individuals were likely to have reported drinking game participation, pregaming, HED, and getting drunk.

Last, in the Heavy Frequent Drinker status (19% of the sample in fall/senior year), individuals drank on 3 or more days. Drinking was likely across all days of the week. Individuals were likely to have reached a maximum eBAC above .08%. It was likely that individuals played drinking games at least once and very likely that individuals pregame, engaged in HED, and got drunk. Behavioral profiles of the drinker statuses were replicated across the four semesters. Figure 1 highlights the similarity of the drinker statuses by plotting the item-response probabilities. For example, for number of days drank, Response 3 (3 or more days; shaded black) was representative of the Heavy Frequent Drinker status.

Week-level drinker status, hazardous drinking, and any dependence symptoms

To examine the predictive utility of the week-level drinker statuses, AUDIT subscale scores were tested for an overall association with drinker status by comparing the log-likelihood values from the models with and without the predictors (Table 4). Logistic regression coefficients were interpreted from two models, one specifying Nondrinker status as the reference and the second specifying Heavy Frequent Drinker status as the reference.

Relative to being in the Nondrinker status, individuals meeting the cutoff for senior-year hazardous drinking had greater odds of being in Heavy Weekend Drinker status and Heavy Frequent Drinker status; these associations were observed across semesters (Table 4). Using spring/sophomore year as an example, odds of being in the Heavy Frequent Drinker status were more than five times greater than odds of being in the Nondrinker status for individuals meeting the hazardous drinking cutoff in senior year. Across all semesters, individuals reporting any senior-year dependence

TABLE 2. Model fit indices for week-level latent class analysis models with one to seven classes using data from fall/senior year

No. of classes	Log- likelihood	G ²	AIC	BIC	CAIC	adj. BIC	Entropy	df	% Seeds best model
1	-3,273.71	3,298.5	3,322.50	3,374.63	3,386.63	3,336.54	1.00	1523	100
2	-2,199.44	1,149.97	1,199.97	1,308.56	1,333.56	1,229.20	.95	1510	22.3
3	-1,882.04	515.17	591.17	756.24	794.24	635.60	.89	1497	100
4	-1,830.59	412.26	514.26	735.79	786.79	573.89	.87	1484	52.1
5	-1,795.86	342.81	470.81	748.82	812.82	545.65	.86	1471	22.3
6	-1,769.66	290.39	444.39	778.87	855.87	534.43	.88	1458	34.8
7	-1,752.57	256.23	436.23	827.18	917.18	541.47	.90	1445	3.6

Notes: **Bold** row indicates the class solution selected as the best-fitting model. For the two-class model, light drinkers were included in the Nondrinker status for 75% of the random seeds, resulting in low nonzero probabilities for the drinking-related indicators. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; CAIC = consistent Akaike Information Criterion; adj. BIC = adjusted Bayesian Information Criterion.

TABLE 3. Week-level latent class analysis: Estimated class proportions (gamma parameters) for all semesters and item-response probabilities (rho estimates) for fall/senior year

Parameter	Drinker status			
	Non-drinker	Light Weekend	Heavy Weekend	Heavy Frequent
Estimated class proportions				
Spring/sophomore year	.47	.14	.25	.14
Fall/junior year	.51	.14	.22	.14
Spring/junior year	.42	.22	.17	.19
Fall/senior year	.35	.26	.20	.19
Item-response probabilities for fall/senior year				
No. of days drank				
0	1.00	.00	.00	.00
1–2	.00	.85	1.00	.00
≥3	.00	.15	.00	1.00
Drank ≥1 weekdays	.00	.31	.20	.66
Drank Thursday	.00	.13	.19	.71
Drank Fri./Sat.	.00	.85	.92	1.00
Maximum eBAC				
.00%	1.00	.00	.00	.00
.001%–.079%	.00	.86	.06	.06
.08%–.159%	.00	.14	.46	.31
≥.16%	.00	.00	.47	.64
Drinking games	.00	.16	.57	.69
Pregaming	.00	.30	.89	.93
HED	.00	.10	.94	.96
Got drunk	.00	.19	.88	1.00

Notes: The estimated class proportion is the probability of membership in each class, which reflects the proportion of individuals in each class. The item-response probabilities are the probabilities of reporting a specific response (e.g., 0 drinks) on the indicator (e.g., 12-month typical number of drinks) given membership in a class, which reflects how likely individuals in that class are to report each response. **Bold** item-response probabilities indicate a probability of endorsement that is greater than chance. The analysis sample included 569 participants. No. = number; Drank Fri./Sat. = drank Friday and/or Saturday; eBAC = estimated blood alcohol concentration; HED = heavy episodic drinking.

symptoms had greater odds of being in the other three drinker statuses relative to being in the Nondrinker status.

Relative to Heavy Frequent Drinker status, individuals meeting the cutoff on senior-year hazardous drinking and those reporting any senior-year dependence symptoms had lower odds of being in Light Weekend Drinker status; these associations were observed across semesters. Odds of being in the Heavy Weekend Drinker status relative to Heavy Frequent Drinker status differed only for associations between senior-year hazardous drinking with senior-year drinker status and for senior-year dependence with sophomore-year drinker status.

Concurrent predictors of senior-year week-level drinker status

Tests addressing concurrent predictors showed that higher fun/social motivations were associated with greater odds of being in the Heavy Weekend Drinker status or the Heavy Frequent Drinker status, relative to Nondrinker status (Table 5). For example, for every *SD* higher score on fun/social motivations, odds of being in the Heavy Frequent Drinker status were 2.73 times the odds of being in the Nondrinker status. Higher fun/social motivations were associated with lower

odds of being in the Light Weekend Drinker status relative to the Heavy Frequent Drinker status. Results for hazardous drinking and dependence symptoms were similar to those presented in Table 4 with two exceptions. First, when gender and motivations were included, the odds of being in the Heavy Weekend Drinker status versus the Heavy Frequent Drinker status did not differ based on hazardous drinking. Second, odds of being in the Light Weekend Drinker status versus the Nondrinker status did not differ based on dependence symptoms. Drinker status was not associated with gender, relaxation/coping motivations, or physical/behavioral motivations.

Drinker statuses using traditional measures

Table 6 presents LCA with traditional measures from fall/senior year. Individuals in the Typically Frequent, Heavy Drinker status (36% of sample) were likely to drink at least once a week and consumed five or more drinks on a typical drinking day. Probabilities of 30-day 5+ maximum drinks and HED at least once a week were also high. Individuals in the Frequent Light With Recent Heavy Drinker status (27% of sample) were likely to report typically drinking at least once a week and consuming one to four drinks on a typical

FIGURE 1. Similarity of the item-response probabilities for three of the drinker statuses across the four semesters. Across semesters, item-response probabilities for Nondrinker status were identical to those in Table 3 and are, therefore, not pictured. Although estimated class proportions varied across semesters, Nondrinker status was consistently the largest (Table 3). For Weekday, Thursday, and Fri./Sat., Response 1 (no) and Response 2 (yes). For Games, Pregame, HED, and Got drunk, Response 1 (not reported during week) and Response 2 (reported on at least one day). For Max. eBAC, Response 1 (.00%), Response 2 (.001%–.079%), Response 3 (.08%–.159%), and Response 4 ($\geq$.16%). For Days drank, Response 1 (0 days), Response 2 (1 or 2 days), and Response 3 (3 or more days). Spr. = spring; Soph. = sophomore; Fri./Sat. = Friday/Saturday; Max. eBAC = maximum estimated blood alcohol concentration; Games = Drinking games; HED = heavy episodic drinking.

drinking day. However, individuals were also likely to report 5+ maximum drinks and HED one to three times per week in the last 30 days. Individuals in the Less Frequent Light Drinker status (22% of sample) typically drank less than

once a week and consumed one to four drinks on a typical drinking day; past-30-day heavy drinking was unlikely. Last, individuals in the Non-Recent Drinker status (15% of sample) either did not drink in the past year or drank less

TABLE 4. Latent class analysis models testing associations of week-level drinker status (identified spring/sophomore year to fall/senior year) with AUDIT subscales (fall/senior year): Odds ratios for subgroup comparisons

Predictor	Change in 2LL ^a	Reference group: Nondrinker status			Reference group: Heavy Frequent status	
		Light Weekend OR [95% CI]	Heavy Weekend OR [95% CI]	Heavy Frequent OR [95% CI]	Light Weekend OR [95% CI]	Heavy Weekend OR [95% CI]
Spring/sophomore year						
Hazardous drinking ^b	42.78***	1.32 [0.69, 2.52]	3.58 [2.14, 5.97]	5.64 [2.97, 10.69]	0.23 [0.11, 0.50]	0.63 [0.33, 1.23]
Any dep. symptoms ^c	54.31***	2.43 [1.36, 4.34]	3.91 [2.28, 6.69]	11.10 [4.37, 28.20]	0.22 [0.08, 0.62]	0.35 [0.13, 0.96]
Fall/junior year						
Hazardous drinking	59.60***	1.31 [0.69, 2.48]	4.95 [2.65, 9.26]	8.51 [4.20, 17.27]	0.15 [0.07, 0.35]	0.58 [0.25, 1.36]
Any dep. symptoms	42.28***	1.81 [1.04, 3.15]	5.01 [2.49, 10.07]	7.15 [2.84, 18.02]	0.25 [0.09, 0.70]	0.70 [0.23, 2.14]
Spring/junior year						
Hazardous drinking	53.20***	0.88 [0.47, 1.64]	3.53 [1.85, 6.71]	6.79 [3.57, 12.93]	0.13 [0.06, 0.27]	0.52 [0.24, 1.11]
Any dep. symptoms	53.33***	2.52 [1.52, 4.18]	5.22 [2.53, 10.75]	8.69 [3.84, 19.63]	0.29 [0.12, 0.70]	0.60 [0.22, 1.68]
Fall/senior year						
Hazardous drinking	70.56***	1.31 [0.70, 2.45]	4.93 [2.64, 9.23]	10.38 [5.23, 20.61]	0.13 [0.06, 0.26]	0.48 [0.23, 0.99]
Any dep. symptoms	45.99***	1.72 [1.05, 2.80]	5.26 [2.73, 10.15]	7.27 [3.31, 15.95]	0.24 [0.10, 0.53]	0.72 [0.28, 1.86]

Notes: Drinker statuses were identified using week-level data from the semester indicated. All analyses use Alcohol Use Disorders Identification Test (AUDIT) scores from fall/senior year. Odds ratios (OR) in **bold** indicate estimates for which the 95% confidence interval (CI) does not include 1.0. Any dep. symptoms = any dependence symptoms. ^aThe log-likelihood (LL) values from the models with and without the predictor are compared. After doubling the change in the LL (change in 2LL), the chi-square distribution can be used to test for significance. All change in 2LL tests were 3 df; ^bhazardous drinking was assessed with the AUDIT-C (sum of Items 1–3 of the AUDIT); hazardous drinking was based on scoring five or more for women and seven or more for men; ^cany dependence symptoms was based on a sum score of Items 4–10 of the AUDIT, contrasting endorsement of no items (0) with one or more items (1).

*** $p < .001$.

TABLE 5. Week-level latent class analysis testing concurrent associations (fall/senior year) between predictors and drinker status with odds ratios for subgroup comparisons

Predictors ^a (entered simultaneously)	Change in 2LL ^b	Reference group: Nondrinker status			Reference group: Heavy Frequent status	
		Light Weekend OR [95% CI]	Heavy Weekend OR [95% CI]	Heavy Frequent OR [95% CI]	Light Weekend OR [95% CI]	Heavy Weekend OR [95% CI]
Male gender	4.19	0.67 [0.41, 1.10]	1.05 [0.57, 1.94]	1.24 [0.65, 2.37]	0.54 [0.28, 1.06]	0.84 [0.43, 1.66]
Fun/social motivations	26.87***	1.30 [0.94, 1.79]	2.37 [1.56, 3.61]	2.73 [1.71, 4.37]	0.47 [0.29, 0.77]	0.87 [0.53, 1.43]
Relaxation/coping motivations	5.29	1.17 [0.86, 1.60]	0.77 [0.53, 1.14]	0.81 [0.54, 1.22]	1.45 [0.96, 2.18]	0.96 [0.63, 1.45]
Physical/behavioral motivations	3.77	1.17 [0.92, 1.48]	1.03 [0.74, 1.43]	0.83 [0.59, 1.18]	1.40 [0.97, 2.03]	1.24 [0.84, 1.83]
Hazardous drinking ^c	48.89***	1.12 [0.59, 2.12]	3.80 [1.98, 7.32]	7.77 [3.82, 15.82]	0.14 [0.07, 0.30]	0.49 [0.23, 1.04]
Any dep. symptoms ^d	26.02***	1.41 [0.83, 2.39]	3.91 [1.94, 7.89]	5.09 [2.24, 11.59]	0.28 [0.12, 0.65]	0.77 [0.29, 2.02]

Notes: All data were collected in fall/senior year. Odds ratios (OR) in **bold** indicate estimates for which the 95% confidence interval (CI) does not include 1.0. Any dep. symptoms = any dependence symptoms. ^aContinuous predictors (i.e., three motivation subscales) were standardized; ^bthe log-likelihood (LL) values from the models with and without the predictor are compared. After doubling the change in the LL (change in 2LL), the chi-square distribution can be used to test for significance. All change in 2LL tests were 3 df; ^chazardous drinking was assessed with the Alcohol Use Disorders Identification Test–Consumption (AUDIT-C) (sum of Items 1–3 of the AUDIT); hazardous drinking was based on scoring five or more for women and seven or more for men; ^dany dependence symptoms was based on a sum score of Items 4–10 of the AUDIT, contrasting endorsement of no items (0) with one or more items (1).

*** $p < .001$.

TABLE 6. Latent class analysis with traditional measures for fall/senior year: Estimated class proportions (gamma parameters) and item-response probabilities (rho estimates)

Parameter	Drinker status			
	Non-recent	Less Frequent Light	Frequent Light With Recent Heavy	Typically Frequent, Heavy
Estimated class proportions	.15	.22	.27	.36
Item-response probabilities				
12-month frequency				
Not in past year	.54	.00	.00	.00
Past year but < once a week	.41	.91	.13	.12
At least once a week	.06	.09	.87	.88
12-month quantity of drinks on a typical drinking day				
0 drinks	.55	.00	.00	.00
1–4 drinks	.35	.95	.91	.13
5 or more drinks	.10	.04	.09	.87
30-day frequency				
Did not drink	1.00	.00	.00	.00
1–3 times	.00	.90	.14	.10
At least once a week	.00	.09	.86	.90
30-day quantity of drinks on a typical drinking day				
0 drinks	1.00	.00	.00	.00
1–4 drinks	.00	1.00	.99	.03
5 or more drinks	.00	.00	.01	.97
30-day maximum no. of drinks				
0 drinks	1.00	.01	.00	.00
1–4 drinks	.00	.84	.30	.01
5 or more drinks	.00	.15	.70	.99
30-day HED				
Did not engage in HED	1.00	.71	.21	.03
1–3 times	.00	.29	.63	.25
At least once a week	.00	.01	.16	.72

Notes: The estimated class proportion is the probability of membership in each class, which reflects the proportion of individuals in each class. The item-response probabilities are the probabilities of reporting a specific response (e.g., 0 drinks) on the indicator (e.g., 12-month typical number [no.] of drinks) given membership in a class, which reflects how likely individuals in that class are to report each response. **Bold** item-response probabilities indicate a probability of endorsement that is greater than chance. The analysis sample included 569 participants. HED = heavy episodic drinking.

than once a week, and 30-day indicators clearly reflected no recent drinking.

Discussion

To identify college drinker statuses at the week level, daily reports on multiple alcohol-related behaviors were used, expanding on recommendations by Auerbach and Collins (2006). Four drinker statuses were identified and replicated using data from a sampled week in each of four semesters, beginning spring/sophomore year to fall/senior year. Week-level drinker statuses were Nondrinker, Light Weekend Drinker, Heavy Weekend Drinker, and Heavy Frequent Drinker. Cleveland et al. (2013) identified similar drinker statuses among non-college-attending young adults using past-month drinking and day of the week. Drinker statuses were replicated here, suggesting that the types of drinking weeks that students may experience were consistent, even though prevalence rates varied across semesters (e.g.,

weekday drinking). Prevalence rates of HED and pregameing were similar across semesters and comparable to those reported by Johnston et al. (2014) and Paves et al. (2012), respectively. Among drinkers, prevalence rates of drinking game participation varied across semesters, although rates were generally comparable to those reported using 30-day timeframes (Zamboanga et al., 2014). Drinking on Friday/Saturday was common, a fact that is well documented in college students (Hoeppe et al., 2012; Maggs et al., 2011). Maximum eBAC clearly distinguished a light drinker status (maximum eBAC < .08%) from two heavy drinker statuses (maximum eBAC ≥ .08%). Students in the Light Weekend Drinker status may consume less alcohol on specific occasions and at a slower rate, given that they were unlikely to report HED.

All students in the Heavy Weekend Drinker status drank 1–2 days, whereas all students in the Heavy Frequent Drinker status drank 3 or more days. Although similar proportions of students reported drinking behaviors such as

HED and pregameing at least once during the week, perhaps these statuses differed in the maximum amount consumed while engaging in these specific behaviors. The amount of alcohol consumed while playing drinking games predicts acute negative consequences (Borsari et al., 2013) and dependence symptoms and consequences (Zamboanga et al., 2010a, 2010b). Pregameing on a given night has also been associated with acute negative consequences (Labhart et al., 2013; Merrill et al., 2013). Regarding the current findings, the high probability of maximum eBAC above .16% for the Heavy Frequent Drinker status may be the result of greater consumption while playing drinking games or pregameing. Future work on the context in which an individual's maximum eBAC occurs may be especially relevant for reducing negative consequences and may inform future strategies for environmentally based (e.g., restrictions on drink specials at bars, campus regulations for fraternity/sorority parties), event-specific (e.g., Spring Break, 21st birthday), and individually based (e.g., brief motivational interviewing) prevention strategies. Recognizing that daily data collection may not be feasible, web-based Timeline Followback methods represent a viable and effective alternative for collecting reliable data on recent alcohol behaviors in order to further examine drinker statuses (Hoeppner et al., 2010; Rueger et al., 2012). Design alterations can also decrease total costs (e.g., small pre-incentive; Patrick et al., 2013).

Senior-year hazardous drinking and dependence symptoms were associated with week-level drinker statuses identified in spring/sophomore year through fall/senior year, providing evidence of the predictive utility of the drinker statuses; overall associations were reliably detected using week-level reports of alcohol behaviors. Unlike some past research showing that men were more likely than women to be in heavier drinking groups, gender was not associated with drinker status. Whereas other studies (Reboussin et al., 2006; Windle, 1996) used similar indicators of drinking for men and women, our HED and eBAC measures accounted for gender differences in alcohol metabolism. Our alcohol indicators may be less likely to differ by gender in full-time, residential college samples where students share similar social roles. Other work has found that gender differences in drinking patterns may be converging (Keyes et al., 2008; Simons-Morton et al., 2009), which lends support to the drinker statuses identified here. In samples in which participants differ in parenting, marital, or work roles, gender differences in drinking behaviors may be observed (Staff et al., 2010). In contrast, in the present sample, men and women were recruited as first-time, full-time students and did not have spouses, children, or full-time jobs. Gender differences may have been observed if we had considered the proportion of drinking days participants engaged in pregameing and drinking games (e.g., all drinking days), rather than whether these behaviors were reported at least once during the week (Barnett et al., 2013; Merrill et al., 2013).

Evidence that higher fun/social drinking motivations were associated with greater odds of membership in the drinker statuses characterized by drinking relative to Nondrinker status coincides with findings that fun/social or enhancement motivations were linked to heavy drinking (Cooper et al., 1995; Kuntsche et al., 2005; Lee et al., 2006). Relaxation/coping motivations were not associated with drinker status, possibly because of the high correlation between fun/social and relaxation/coping motivations (see Piasecki et al., 2014). Windle (1996) reported that coping motivations were higher among a heavy drinking group of adolescents with five or more negative consequences in the last 6 months compared with a heavy drinking group who reported fewer consequences; however, social motivations were not included as a covariate. Coping motives have been associated with drinking onset during weeks that college students reported high anxiety (Armeli et al., 2008), and coping and enhancement motives have been associated with negative consequences among college students (Merrill & Read, 2010). No association was observed between physical/behavioral motivations for avoiding drinking and drinker status, although physical/behavioral motivations have been negatively associated with heavy drinking (Maggs et al., 2011). The majority of—although not all—students viewed physical/behavioral consequences as negative (Patrick & Maggs, 2011); however, these evaluations may not trigger effortful behavioral decisions to avoid drinking in the presence of social drinking cues (Moss & Albery, 2009).

Week-level and traditional drinker statuses

Senior-year week-level drinker statuses and drinker statuses using traditional measures provided alternative, yet complementary, depictions of college drinking. Across all semesters, the most prevalent week-level drinker status was the Nondrinker status, and one of the least prevalent was Heavy Frequent Drinker status; in any given week, a large proportion of students abstained from alcohol. In contrast, the Typically Frequent, Heavy Drinker Status was the most prevalent of the traditional drinker statuses, whereas Non-Recent Drinker status was least prevalent. The heavier drinking statuses may have been more prevalent using traditional measures that referred to the past 12 months or the past 30 days, because our assessment of 30-day HED may have captured erratic HED and risk of consequences among typically lighter drinkers (Gruenewald & Mair, 2015).

Research demonstrates there is increased risk associated with pregameing and playing drinking games on a given day (Fairlie et al., 2015; Hummer et al., 2013; Ray et al., 2014), which suggests that alcohol measures from specific occasions may elucidate social contextual factors that are associated with risky week-level drinking that differ from individuals' typical patterns (see Mubayi et al., 2011). Social contextual and academic factors may affect an individual's

week-level drinker status. For example, attendance at sports events, such as football games, may influence the likelihood that students pregame. Future work to identify contextual predictors that promote or discourage heavy drinking could inform adaptive interventions or interventions using mobile technology because messages can be tailored to specific drinking occasions (Collins et al., 2004; Heron & Smyth, 2010). Future research should also evaluate the extent to which weekday drinking may be indicative of dependence while considering the potential influences of celebratory drinking (e.g., birthdays) and class schedules.

Limitations

First, we focused on data from one sampled week within each semester. Although bursts of daily data spanned four consecutive semesters and two seasons, data may not be representative of the entire semester or college experience. Second, maximum eBACs may be overestimated, especially at intoxication levels over .08% (Carey & Hustad, 2002; Hustad & Carey, 2005). Third, data were collected from an ethnically diverse sample of college students at a single campus, and observed proportions on alcohol behaviors and prevalence estimates of the drinker statuses may not generalize. Samples with more White students may observe higher rates of alcohol behaviors, including pregameing (O'Malley & Johnston, 2002; Paves et al., 2012). Although results are mixed, pregameing may be more prevalent among underage students because, for them, obtaining alcohol at on-premise establishments such as bars may be more difficult (Foster & Ferguson, 2014).

Conclusions

The current study extends previous work by identifying four week-level drinker statuses, each with a unique behavioral profile, using daily reports on multiple alcohol behaviors. Replication suggests that the types of drinking weeks that college students experience are consistent from spring/sophomore year through fall/senior year. In conjunction with evidence of their predictive utility, findings provide initial support that drinker statuses defined by daily reports of multiple behaviors capture meaningful information.

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