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How Many versus How Much: 52 Weeks of Alcohol Consumption in Emerging Adults

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Abstract

In previous research using time-line follow-back methods to closely monitor drinking and related variables over the first year of college (9 month), we showed that drinking varied considerably over time in accord with academic requirements and holidays. In a new community sample of emerging adults (576, 18 and 19 year olds who reported having begun drinking prior to recruitment), we used similar methods to compare drinking patterns in college and noncollege individuals over a full calendar year (including summers). To reduce the extreme distortion in computations of average drinking over restricted time spans (i.e., one week) that arise because large numbers of even regular drinkers may not consume any alcohol, we analyzed data using recently developed two-part latent growth curve modeling. This modeling distinguished consumption levels from numbers of individuals drinking in a given period. Results showed that drinking levels and patterns generally did not differ between college and noncollege drinkers, and that both groups responded similarly to even those contexts that may have seemed unique to one (i.e., Spring Break). We also showed that computation of drinking amounts without accounting for “zero drinkers” could seriously distort estimates of mean drinking on some occasions; for example, mean consumption in the total sample appeared to increase on Thanksgiving, whereas actual average consumption for those who were drinking diminished.

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In addition, the magnitude of the peak depends upon not only how many more individuals drink in that week, but also how much each drinker consumes. More drinkers who are also drinking greater amounts will lead to a very large peak. More drinkers who drink less than normal amounts (e.g., in connection with a religious holiday) will also produce a peak, albeit smaller. In both cases, though, the value of the peak is closer to the average amount consumed by only the drinkers in the sample.

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Keywords

College drinking; Non-college drinking; Time-line follow back methods; Two-part latent growth curve modeling; Emerging adulthood; Event contingent drinking

In the general population, alcohol consumption has been found to increase rapidly during the teen years to reach lifetime peaks during young adulthood (age 18–24), and the prevalence of heavy drinking, binge drinking, and alcohol dependence (as defined by DSM-IV), to peak in this same age range (Dawson, Grant, Stinson, & Chou, 2004; Naimi, Brewer, Mokdad, Denny, Serdula & Marks, 2003). This life period (sometimes called “emerging adulthood;” Arnett, 2000) also overlaps with college attendance, which has been linked to many alcohol-related adverse outcomes (Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002). Whereas some large surveys have shown little difference in overall consumption between individuals in this age range who do and do not attend college (Chen, Dufour, & Yi, 2004; Schulenberg, O’Malley, Bachman, Wadsworth, & Johnston, 1996), some also have shown college attendees specifically to consume more alcohol per occasion (Gfroerer, Greenblatt, & Wright, 1997; Schulenberg et al., 1996; White, Labouvie, & Papadaratsakis, 2005), or more frequently (Chen et al., 2004; Schulenberg et al., 1996; Gfroerer et al., 1997), or to experience more alcohol-related adverse consequences (consensus across studies). Regardless of the distinctions between college and noncollege drinking patterns, however, it is evident that alcohol consumption during this life period is worthy of close attention (see Carter, Brandon, & Goldman, in press, for further review).

Most information on young adult drinking has come from yearly self-reported estimates. The reliability of such self-reports has been shown to be acceptable, and, in the absence of an ultimate “gold-standard,” reasonably valid (Del Boca & Darkes, 2003). Due to the need for brevity in these wide-ranging epidemiological studies, however, the consumption metric most frequently used has been global quantity and frequency, reported over some recent time period, e.g., last two weeks, last month, or some unspecified “customary” period, using a few questions. Some studies simplified even further by collapsing quantity and frequency into frequency of “binge” drinking (5/4 or more drinks per occasion in males/females).

Researchers were aware, of course, that these self-reported estimates did not reflect the full extent of variability of drinking over limited time periods, nor did they adequately represent consumption during all similar time periods in the calendar year (e.g., Del Boca, Darkes, Greenbaum, & Goldman, 2004). In most epidemiological studies, it took many months to fully assess hundreds, or even thousands of participants, but each participant was asked only about the few weeks before *they* responded. When these individual estimates for different two-week or one-month periods were combined into group drinking parameters, calendar-related variation was easily masked. Recent research has shown that drinking varied considerably in response to calendar-related secular and personal events (e.g., holidays, friends 21st birthday, family gatherings; see below).

Adding data collection approaches that reveal localized patterning of drinking to longitudinal designs would bring us closer to the complexities of human alcohol consumption. To highlight the patterning in college student drinking over an extended period, we recently reported on frequent, detailed assessment of drinking over the nine month academic year after entry into college (Del Boca, et al., 2004; Greenbaum, Del Boca, Darkes, Wang, & Goldman, 2005). Each month of the academic year, 301 first year college students completed Timeline Followback Interviews (TLFB) for the previous 30 days, thereby producing a continuous, daily record of drinking for that academic year. Because this information was collected with respect to the secular calendar, alcohol consumption

could be related to discrete events such as Thanksgiving, Christmas/New Year, and Spring break (among others). By applying latent growth curve analysis (LGC) over the nine-month span, we found that drinking varied considerably over time, apparently as a function of academic requirements and holidays. In addition, no overall linear slope was obtained; on average, drinking neither increased nor decreased steadily across the first academic year. Instead, a slight curvilinear pattern was observed (and was replicated in a recent study using time series analysis; Dierker et al., 2008).

We found particularly dramatic increases in average drinking for certain holidays and events, including Thanksgiving, Christmas/New Years, and spring break (Del Boca et al., 2004). Other research using briefer time frames for recording daily drinking has since confirmed the large influence on college drinking levels of celebratory events (e.g., spring break, college sporting events, holidays, 21st birthday; Lee, Maggs, & Rankin, 2006; Neal & Fromme, 2007; Neighbors, Spieker, Oster-Aaland, Lewis, & Bergstrom, 2005). Also, in keeping with Rabow and Duncan-Schill (1995) and Rabow and Neuman (1984) who studied relatively short time frames, Del Boca et al. (2004) noted considerable variability in drinking across days of the week during the first year of college, with drinking elevated toward the end of the week (Thursday, Friday, Saturday; again, replicated by Dierker et al., 2008).

None of these data revealed, of course, whether this patterning applied to young people who did not attend college. Given the significance of emerging adulthood with respect to alcohol consumption, and to clarify the influence of college factors on detailed consumption patterns, the present paper reports on one full calendar year of data obtained from a new sample of late adolescents using methodology that extended our previous studies in a number of significant ways. First, our new sample was recruited from a four-county area in central Florida and not from a specific college/university (as was the previous study sample), and was stratified by college attendance. In this way, we were able to distinguish drinking characteristics that were associated, in our sample, with college attendance from those associated with this age range. Our recent review of the published findings on college drinking suggested that college status may serve as a proxy for other variables that may be more directly related to drinking, such as living situation (e.g., dormitory, off-campus housing, home with parents, etc.), age (governing exposure to alcohol opportunities and legality of use), full versus part-time attendance, and type of college (Carter, et al., in press). Second, because we followed our new sample over an extended longitudinal period, rather than only during the academic (9-month) college year, we were able to report on drinking patterns during summer months, which were not included in the previous report, and may have been less related to contextual factors associated with college attendance.

Third, we used methods that separated *probability* of drinking in a given time frame from the *amount consumed*, given that a large percentage of any sample might not drink in a particular time frame. Averaging (computing means) consumption across drinkers and non-drinkers in a given week can significantly distort actual drinking patterns and amounts (i.e., can confound variations in amounts consumed with variations in the number of individuals consuming). Considerable room exists for non-drinkers to move into the drinker category; over 60% of college students in our recent study did not drink at all in a given week, excluding weeks known to involve heavier drinking (e.g., Spring Break; Del Boca et al., 2004). This estimation problem can contribute more than just imprecision; it may render ineffective the use of transformations to adjust for the excessive skew and kurtosis in most drinking data (see Olsen & Schafer, 2001).

In the present report, we examined average amount consumed for each of 52 weeks (8/16/04 to 8/15/05) for college and non-college students including those who chose not to drink in any given week. We contrasted this display with a depiction of the average amounts

consumed *after* non-drinkers were removed from the computation of means. For each weekly mean, we also showed the percentage of the sample drinking in that week. Such plots could not have addressed, however, average *individual* trajectories over the calendar year because each week's drinking in these plots was a function of a somewhat different set of drinkers (i.e., only that subset of the sample who were drinking in that week). To reveal drinking patterns while accommodating the large proportion of zero drinking in any given week, we then used a second approach to data analysis, two-part latent growth curve modeling (Olsen & Schafer, 2001; Muthén, 2001). This approach allowed representation of all participants at all data points by applying missingness algorithms to zero drinking weeks, and treating probability of use and the amount consumed conditional on use as separate, simultaneous, growth processes.

After this overview of drinking across the calendar year, we focused on selected weeks that contained notable events (e.g., Thanksgiving, New Year's Eve) to show how customary metrics of alcohol consumption (absent two-part analysis) might distort actual drinking practices.

Method

Participants

The participants were 576, 18 (59%) and 19 year olds, recruited over a 20 month period within an approximately four county geographic area in the vicinity of Tampa FL, who were willing to be repeatedly assessed over a longitudinal time frame. The recruiting strategy began with calls to households identified as likely to have a resident falling within this age range (identified through a telemarketing list service), and then extended to include more targeted approaches, such as distributing fliers in both urban and rural locations known for attracting a high density of older adolescents (e.g., Malls, skate parks, beaches, concert venues, clubs on nights that they catered to an underage crowd, high schools, colleges/universities), and offering incentives for already recruited participants to refer others within the identified age range.

Because we were interested in studying the dynamics of alcohol consumption over this period of life using daily records of drinking and associated antecedents and consequences, some of which required in-laboratory methods repeated over an extended time period, efficiency became a prime consideration in recruitment. That is, to increase the likelihood that we captured the phenomena of interest (e.g., drinking), we recruited so as to obtain a high representation of individuals in this age range who consumed alcohol (we required for study entry at least one drink per month at enrollment). Even with the relatively high drinking levels known to occur on average in this period of life, many individuals at this age do not drink at all (approximately 21% of students in Del Boca et al., [2004] did not drink at all across the academic year). Because our purpose did not include the examination of the initiation of drinking, our sample was not fully representative of the population of this age. Our sample did provide, however, for an intensive examination of customary drinking patterns among young adults who had initiated drinking before the late teen years.

The final sample was stratified so that approximately half were enrolled in nine or more (full-time student status) higher education credits (the 2006 average national rate of enrollment for college attendance in this age group is about 58%; Davis & Bauman, 2008; Census Bureau Report). Stratification required only a slight adjustment because forty-eight percent were enrolled in nine or more college credits at the time of recruitment. Of those classified as non-students, 7% were enrolled in a few college credits. Although we did not stratify for gender, the final sample was about 50% female. Inclusion required a 6th grade reading level and those with obvious psychosis were excluded. Consistent with the Tampa

Bay population, the final sample was 60% non-Hispanic White, 21% Hispanic, 13% African American, and 6% “Other.”

Our sample size goal was 600 individuals; because this population moves frequently and changes contact information even more frequently, our recruitment strategy called for replacing any individuals who, during the 20 month enrollment period, missed three assessments in a row (were lost to contact for 9 months). As a consequence, 646 participants were originally recruited; 47 participants were lost to attrition during the 20-month recruitment period. The sample in this report includes 576 individuals for whom we had sufficient data during the 52 calendar weeks on which we focused (see below for calendar synchronization procedures).

The present report describes alcohol consumption over a single calendar year by extracting, for each individual participant, the data that were synchronous with events in the selected calendar year from the full data set obtained over the longer period of the extended study. That is, a span of one calendar year during ongoing data collection which maximized the number of available participants for analysis for each day in that calendar year (or event, e.g., New Years day) was selected for review.

Procedure

Potential participants answered flyers and notices for a study of their “real life,” were referred by a friend in the study, or were identified by a commercial service for finding people within our age and geographic range. This paper reports on data from only a single year from a larger five year study called “Project reaLife,” supported by the National Institute on Alcohol Abuse and Alcoholism. Individuals who met requirements during telephone screening for age, minimum drinking, and college status were scheduled for initial in-person assessment. In our laboratory, participants again were screened for all inclusion criteria and introduced to the study. Eight individuals were excluded during initial in-person assessment (four did not meet the reading level requirement, two were non-drinkers, and two ultimately declined participation). Participants were asked to agree to participate in four assessments per year over a five year period, and to provide the names of two collaterals who could verify their drinking, as well as two “locator” individuals who would know how to contact them if they should move or change phone numbers.

During initial assessment, participants provided comprehensive information on alcohol use and myriad antecedents and consequences of drinking through interview, computerized tasks, and questionnaires. Additional yearly in-person assessments included the same battery of assessments. Three telephone interviews were completed every 3 months following each annual assessment, using brief versions of the most central questionnaires administered during annual assessment. Participants were paid \$100 for baseline assessment, \$75 for yearly assessments thereafter, and \$20 for each telephone assessment (increased to \$30 later in the study).

Measures

Demographic and lifestyle variables were assessed by the *Personal Background and Lifestyle Questionnaire (PBLQ)*, a paper-and-pencil questionnaire developed in our laboratory (Del Boca et al., 2004). *Student status* was assigned using a 9-credit (full-time) load criterion: college student status represented a minimum credit load of 9 credits upon entry to the study; non-college status represented 8 or fewer credits (91% of non-college participants were not enrolled in any course credits).

A modified *Timeline Followback Interview (TLFB)*; Sobell & Sobell, 1992) was administered at each assessment to ascertain daily alcohol consumption. To facilitate recall,

customized calendars that noted national and local holidays, community events (e.g., local festivals), personal calendar events (e.g., family and friends birthdays), and other noteworthy occurrences (e.g., hurricanes) were used. During initial assessment, participants estimated, using a variety of aided recall techniques, the number of standard drinks (i.e., 12 oz [360 ml] of beer; 5 oz [150 ml] of wine; 12 oz of wine cooler; or 3.5 oz [105] ml of fortified wine; a mixed drink or 1 shot [1.5 oz; 45 ml] of 86–100 proof hard liquor) consumed each day on a calendar commencing 30 days earlier and ending the preceding day. Subsequent TLFB assessments began on the prior interview date and ended “yesterday,” producing a continuous daily drinking record over the participant’s time in the study. Anchored in this fashion, the TLFB has been shown to have good reliability and validity over 90 day intervals (Sobell & Sobell, 1992; Tonigan, Miller & Brown, 1997). Although individual variation in the precise synchrony (exact day-to-day correspondence) between retrospective reports and those obtained from prospective daily recording methods has been observed, concordance between the different methods over relatively short time periods has been excellent (Leigh, 2000). Also, analyses of daily process data examining short-term temporal trends suggested that the reactivity associated with frequent monitoring was likely to be minimal (Carney et al., 1998). The drinking data herein reflected project weeks 56 through 107, synchronized to a true calendar year. Because daily drinking varies and tends to follow a weekly pattern, weekly estimates were computed as the number of standard drinks consumed over a 7-day period. Of the nearly 30,000 time points in the data set, 12.5% were missing by design; that is, participants included in this percentage were not yet enrolled in the study in the very early weeks of the calendar year chosen for synchronization (recall that this year was chosen so as to maximize participant availability; see above). For another 29% of data points, participants missed one or more of the extensive full complement of assessments each was expected to complete (4X per year with 90 day look-backs at each time period). As we show in results, no relationship was found between missingness and any dependent variable or covariate in the study, indicating no systematic relationship any results reported herein. We discuss the handling of missing data in the analysis strategy section below, and report more extensively on the missingness analyses in results.

Preparation of Data for Analysis

Calendar Synchronization—Secular influences on consumption were revealed by synchronizing participants who entered the study over an extended time on a common calendar year. That is, data were extracted for the same calendar dates for each participant, regardless of the time since study entry. Daily reports were aggregated into weekly estimates because 365 data points were too many for current computers to process within a reasonable time, and to display efficiently. As noted earlier, we used daily drinking records when we zoomed in on local portions of the curves to highlight weeks in which specific events occurred. The reader should keep in mind when reviewing these two data domains that, based on two-part modeling, results are displayed as units of consumption and as units representing probability of drinking in the referenced time frame.

Analytic Strategy

In contrast to the conventional approach of combining the reports from drinkers and non-drinkers into a single consumption variable, we decomposed average consumption into two distinct variables (percentage [probability of] drinking, and consumption by drinkers). Decomposition was carried out twice: First, non-drinkers were removed from each week’s participant sample to reveal amounts consumed for only drinking individuals; this adjustment allowed visual inspection of actual weekly drinking, but could not reveal within-individual patterns over time because different individuals appeared among each weeks drinkers. Second, to model individual drinking trajectories over time, two-part LGC

modeling was undertaken. In this two-part model, the first part described the binary decision to engage in drinking (zero/nonzero) as a latent categorical growth curve; the second part treated the non-zero amount consumed, after log transformation, as a latent continuous growth curve.

Two-part LGC provided two benefits over more traditional approaches (e.g., treating reported drinking as a normally distributed continuous variable): a) By constructing separate latent variables for use/non-use and amount consumed, this approach took into account that the observed drinking distribution was a semi-continuous variable (i.e., “a non-normal distribution with a high frequency of zeros representing non-use and the remaining values being continuously distributed and often positively skewed;” Blozis et al., 2007, p. s86). b) The latent variable approach allowed all participants to be represented at all time points on both latent variables representing the drinking constructs by treating the drinking amount for any participant who reported non-use on any given week to be modeled as missing data (i.e., as a probabilistic or sampling zero) rather than as a censored observation. For respondents who reported zero drinks for a given week, continuous consumption data were treated in two-part modeling as missing at random (MAR; i.e., missingness as a function of the observed variables, but not on unobserved data, Schafer & Graham, 2002); model estimates of an individual’s growth parameters for consumption were based on data from the other weeks in which the respondent drank, and from other respondents who were similar in their drinking across the study period (using full information maximum likelihood [FIML] estimation of the drinking amount latent variable). The two parts of the model were analyzed simultaneously.

Because in this sample of often difficult-to-reach late adolescents, missingness for any specific data point could be substantial at times, we were cautious about the models that resulted from the two-part approach. We were reassured, however, by Olsen and Schafer (2001, p. 741) who used simulation procedures to show that, as long as model convergence was achieved, “the estimated coefficients and standard errors are quite reliable.”

Results

Variation in Drinking Amounts and Probabilities over the Calendar Year

Unadjusted Consumption Levels—Figure 1 shows the observed average number of drinks consumed each week across the calendar year (2004–2005) by college status. Each weekly data point included all available participants for that data point; therefore the set of participants for each point varied across the calendar year. Because the binary logit or continuous log-transformed growth curves generated by the Mplus program used transformed values at each data point, the transformed growth curves could obscure the visual appreciation of actual drinking patterns. For ease of interpretation, therefore, raw data curves are shown (each hash mark on the abscissa denotes a two-week period beginning with the first week noted [8/15 – 8/21/04], but data points for each of 52 weeks are represented in the curves). As in Del Boca et al. (2004), drinking varied considerably from week to week and peaked in concert with identifiable secular events (e.g., Thanksgiving, New Years). Also consistent with Del Boca et al. (2004), some peaks appeared quite elevated (true elevations are described below in connection with the drinkers-only curves). The average weekly drinking of college students and non-college individuals overlapped considerably (except around Labor Day), as did the elevations in conjunction with secular events. For comparison with later graphs of alcohol consumption by drinkers only, note that mean weekly drinking across the year for the full sample (including both drinkers and non-drinkers) was slightly less than five drinks (3.71 for females, 5.95 for males).

Although Del Boca et al. (2004) did not have data available from the summer months (outside of the traditional academic year), note that the general characteristics of academic year drinking seen in that study carried over beyond the academic year into the summer months; the July 4th holiday revealed increased drinking in a pattern similar to holidays during the academic year, and Memorial Day had an increased number of drinkers. In addition, traditional college-related drinking occasions (e.g., Spring Break) served as a context for increased drinking for *both* college and non-college individuals, although seemingly less so for non-college drinkers. All college-related differences were more apparent than real, however; LGC modeling showed no significant differences between college and non-college participants in the present study on the six growth factors examined (intercept, slope and holiday factor in both parts of the model). To simplify subsequent graphs, therefore, further data analyses were collapsed across college and non-college drinkers.

Weekly Consumption among Drinkers—Figure 2 shows weekly drinking for only those individuals who actually drank in the referenced week. Consumption is presented as a histogram to highlight that the weekly levels derived from varying sets of individuals; the weekly drinking levels presented should not be construed as reflecting within-participant change (trajectories). Average drinking represented by these histogram bars increased dramatically when compared with the amounts depicted in Figure 1, which were derived from all available participants *including* zero drinkers. Instead of slightly less than five drinks per week, actual drinkers averaged closer to 10 drinks per week (9.82 drinks overall; 8.07 for females, 11.39 for males) and, when elevations occurred, they approached 12 or even 15 drinks per week. (Because, as shown later, most drinking occurred on 2–3 days each week, drinks per occasion hovered at the binge drinking level.)

Prevalence of weekly drinking—Figure 3 presents the proportion of drinkers in the weeks that corresponded to the amounts shown in Figure 1. The number of individuals upon whom the drinking amounts were based relative to all individuals available for that data point varied considerably across the calendar year. For some weeks, high levels of consumption derived from as few as 40% of the available individuals; for other weeks, the percentage of drinkers rose as high as 80%. The influence of these variations on computations of consumption becomes apparent later, when we address specific holiday/event weeks; suffice it to say here that confounding amounts consumed with numbers of drinkers in the calculation of customary drinking metrics may distort the appreciation of consumption patterns.¹

Two-part Latent Growth Curve Modeling—Because growth curves were latent variables and could only be generated within-participants (growth curves represent *individual* trajectories), and because inferential analysis was better performed in an omnibus fashion than in the context of the 52 statistical tests that would be required to compare each week's drinking in each of the raw data graphs above, LGC modeling was used to distinguish the amounts consumed (shown above) from the probability of drinking in any given week across the calendar year. The resulting estimated consumption and probability curves can be seen in Figure 4. Recall that all participants were represented at all time points. (The assumption of MAR [no systematic influence of missingness] was supported by

¹Including non-drinkers in any given week distorts calculations of mean consumption because zero values pull the mean down, thus leading to underestimates of actual consumption by drinkers. In most weeks, these underestimates are severe because approximately 50% of the sample does not drink. On holiday weeks, we see the average number of drinks calculated rise substantially, primarily because there are fewer non-drinkers, i.e. zeros, included in the average. As a result, calculated average values fall closer to the true average of those who drink. (Imagine everyone drank in a given week; the calculated average would be the same as the average for drinkers-only).

an examination in the current data set of correlations between the amount of missing data and all dependent variables and covariates used in the study. With alpha adjusted to .01 to accommodate the large number of correlations, no correlations between missingness and any of the 52 weekly drinking reports, or with any of the covariates, were found to be significant.) Because of FIML estimation, the estimated curves reflected the patterns observed in the raw data (i.e., consumption and probability of drinking varying across the calendar year), but with adjustments for the proportion of zero-drinkers at any time point in the raw data curves and for measurement error.

Form of the growth curves—Table 1a and 1b display the goodness-of-fit statistics and likelihood ratio tests for the series of unconditional models. The model that included intercept, slope, and holiday factors was selected as best-fitting as indicated by a significant likelihood ratio test (when compared to the next best-fitting linear slope model) and the smallest BIC value among the candidate models. Within this model, all freely-estimated latent means for the growth parameters were significant ($ps < .05$) except for the linear slope of the continuous part of the model (coefficient = $-.002$, $SE = 0.0015$, pseudo $z = 1.37$, $p > .05$), as were all random variances for the intercept and slope parameters ($ps < .05$). Variances for the holiday factors were fixed at zero. This pattern suggested that, for the continuous part of the model (Figure 4a), significant linear changes in alcohol consumption (increases and decreases in drinks per week) were present over time for some *individuals*; but for the *sample as a whole* these individual differences “washed out” with no significant overall linear trend in amount consumed. A significant negative slope was seen, however, for the binary model indicating that the probability of drinking declined during the year (Figure 4b).

Demographic Predictors of Growth Curve Parameters (Covariates) in the Two Part Model

Because the percentage of non-drinkers in any given week was so high, and the amounts consumed by those drinking in a week were higher than typical quantity/frequency metrics might normally portray, we assessed whether any of the standard demographic variables distinguished those variables that predicted the choice to drink in a given week from those that predicted the amount consumed once drinking occurred. This assessment served as a kind of control by determining if any distinctions generalized to the entire sample, or were limited to subgroups of drinkers. Two part modeling allowed for such independent prediction. For amounts consumed, covariates were used to predict the continuous distribution of drinking quantity; for probability of drinking, covariates predicted binary assignment to either drinking or non-drinking categories. For each covariate tested, a main effect term for that covariate was entered along with a term for college/noncollege status and their interaction.

As noted earlier, college attendance did not predict any growth factor in either drinking amount (continuous), or in probability of drinking in a given week (i.e., for those emerging adults with at least minimal drinking experience). Age (which varied only within about a two year span) predicted a different likelihood of engaging in drinking in any given week; as might be anticipated, older participants were more likely to have consumed alcohol during the year, $\beta = .116$, $se = .051$, pseudo- $z = 2.27$, $p < .05$. Age also predicted quantity consumed for those weeks in which drinking occurred; this relationship was only significant, however, for college participants, with older college participants drinking more than their younger counterparts, $\beta = .101$, $se = .049$, pseudo- $z = 2.06$, $p < .05$. Additionally, as might be anticipated, females consumed less alcohol when they drank ($\beta = -.260$, $se = .046$, pseudo- $z = 5.64$, $p < .001$), although males and females were equally likely to drink. Consistent with many epidemiological studies, African-Americans and Hispanics consumed less when they drank ($\beta = -.136$, $se = .056$, pseudo- $z = 2.42$, $p < .05$; $\beta = -.104$, $se = .045$, pseudo- $z = 2.30$,

$p < .05$, respectively) and were less likely to drink in a given week than are non-Hispanic Whites ($\beta = -.226$, $se = .045$, pseudo- $z = 5.00$, $p < .001$; $\beta = -.119$, $se = .047$, pseudo- $z = 2.52$, $p < .05$, respectively). Overall, these distinctions were minimal and mimicked previous research, showing that factors influencing amount and probability of drinking were common to most drinkers.

“Zooming”-in on Holidays and Events

Our last report showed exaggerated drinking patterns for weeks that had embedded “holiday” events; Guavaween (a holiday unique to the Tampa, Florida, area celebrated in temporal proximity to Halloween), Thanksgiving, the Christmas/New Year’s period, and Spring Break in a college-only sample (Del Boca et al., 2004). In this data set that included students and non-students over a full calendar year, the specified “holiday” factor represented 9 specific weeks of the secular year: the weeks of July 4th, Labor Day, Halloween, Thanksgiving, Christmas, New Years, Superbowl Weekend, Spring Break, and Memorial Day. As in our previous report, specific holiday days were not considered in isolation, but within the drinking pattern of the week in which the holiday was embedded (due to the extensive nature of this material, within week patterns will be highlighted in a forthcoming report).

Using raw data, the separation of the number of individuals who drank from the quantity of drinking revealed unique holiday-specific drinking patterns. The number of individuals drinking increased for all of the identified holiday weeks. For quantity, however, four weeks (Labor Day, Thanksgiving, Christmas, and Memorial Day) were not associated with significantly increased drinking. In sum, although the likelihood of drinking increased during holiday weeks, the quantity of drinking fluctuated differentially across the holidays. Figure 5 shows an example of the distortion that occurred when the number of drinkers was confounded with the amounts consumed. As can be seen in Figure 5, if all available individuals for a particular week were included (averaging those who were not drinking with those who were), mean consumption appeared to increase on Thanksgiving Day from about ½ drink to over 1 full drink. In contrast, if only those who were actively drinking over the days of this week were examined, consumption on the day of the Thanksgiving holiday actually decreased from about five or more drinks to about 3 ½ drinks. That is, consumption of smaller amounts of alcohol became more likely at Thanksgiving, potentially reflecting the ostensible “family nature” of that holiday. Two holiday weeks demonstrated this pattern: the Thanksgiving holiday, and the week before New Year’s Day (i.e., the Christmas holiday week, see Figure 4). Figure 4 also showed that on Memorial and Labor Days more people drank, but no significant change in average consumption by drinkers occurred. All other holiday periods showed increases both in the numbers of drinkers and the amounts consumed.

Average Week Pattern

The observed average non-holiday weekly drinking replicated the pattern previously reported in Del Boca et al. (2004) and elsewhere: lower levels of drinking for Sunday through Wednesday evenings, with a steady rise thereafter through Saturday night. What was notable in the present findings was that this pattern replicated both for college students *and non-college individuals*. Even absent the constraints of classes and other college requirements, individuals in this age range showed a similar pattern of daily drinking across the week. Although job or other contextual constraints might dictate this pattern, it is also possible that young people in this age range create their own context; that is, all participate in drinking-related activities in synchrony with others in their age range.

Discussion

This extension of our earlier reports to include both college and non-college participants showed, perhaps counter-intuitively, that emerging adult drinkers living within the same extended community showed no appreciable differences in patterning (variation) of probability or quantity of alcohol use across a full calendar year. This overlap in patterning was observed even for what might be considered exclusively college-related high risk drinking occasions, such as Spring Break, as well as for a range of other holidays/secular events. Furthermore, the patterning previously observed for the academic year carried over throughout the summer months, with the weeks that included the Memorial Day and July 4th holidays showing the same characteristic spike in alcohol use as seen in the New Year or Spring Break weeks (although for Memorial Day this spike represented more drinkers rather than more drinking per individual). Day of the week drinking patterns also were not different; as noted in our earlier work, drinking was lower on Sunday, Monday, Tuesday and Wednesday, and then steadily increased from Thursday to Saturday for both college students and noncollege individuals.

Although these findings suggested that contextual factors specific to college attendance may exert less unique influence on consumption patterns than might previously have been assumed, it must be remembered that all participants entered this study as drinkers, and student participants attended colleges embedded primarily in an urban/suburban context, rather than in exclusively college towns. As a consequence, the local student and non-college emerging adult populations shared many common drinking locales and occasions. These drinking circumstances facilitated intermixing, thereby creating a contextual circumstance that was less distinctive than might be the case in purely college town environments.

Even in more distinctive environments (e.g., dedicated college towns), though, some influences (workdays/schooldays during the week, secular holidays) would carry over for both groups, perhaps inducing commonalities in drinking patterns. And the college town environment (as compared with a town without any college) might serve as a proxy for controlling influences that are not inexorably linked to college attendance. For example, young people living together in a relatively high density arrangement (as in a college town) might be a critical influence. Although a college environment usually reflects such an arrangement, it certainly is not unique in this regard. Consider military bases in this context. The recent NIAAA report on underage drinking highlights how alcohol consumption as a facilitator of social interaction can well serve the developmental demands of this life period (Faden & Goldman, 2008). As a consequence, high levels of drinking might become normative in any environment with a substantial representation of emerging adults. The density of individuals of this age might not only encourage drinking, but might stimulate the creation of more drinking contexts (bars, clubs) that cater to this age group.

The present data not only failed to show patterning differences between college and noncollege individuals, but also revealed no differences in mean drinking levels for the two groups. This finding contrasted with a number of national epidemiological studies that showed higher levels of drinking for college students (Dawson et al., 2005; Gfroerer et al., 1997; Chen et al., 2004; O'Malley & Johnston, 2002; Paschall, 2003; Schulenberg et al., 1996; Slutske, 2005; Slutske et al., 2004; Timberlake et al, 2007; White et al., 2005; and White et al, 2006) (Schulenburg found this true only for college men). It must again be remembered, however, that our sample did not include those who abstained or drank rarely (i.e., less than once per month) at screening. In other studies that reported percentages of abstainers or rare drinkers in both college and non-college samples (Dawson et al., 2005; Slutske et al., 2004; Slutske, 2005; Chen et al., 2004), abstainers and rare drinkers were

found to be more plentiful in non-college samples (from 4 to 19% more common). Lower mean drinking in non-college samples than in college samples may result, therefore, from the greater number of noncollege students who do not drink at all.

Another notable contribution of the current longitudinal data set and associated two-part analyses was the distinction between occasions on which individual drinking quantity increased and those occasions on which the likelihood of drinking increased (i.e., more drinkers). Given that these distinct patterns did occur on some (although not many) occasions, it was clear that combined measures of quantity/frequency over a particular time frame could distort average consumption in some circumstances, especially when dedicated abstainers are included in the samples. Even absent dedicated abstainers as in the present sample, the possibility of such a distortion was evident. To our knowledge, this is the first report of weekly drinking across an entire calendar year that employed two-part latent growth curve modeling to distinguish between numbers of drinkers in each week, and average amounts consumed by individuals.

“Zooming” in on Holiday Drinking

Previously we identified a set of holiday weeks in which consumption levels for college students were higher than the typical week (Del Boca et al., 2004; Greenbaum et al., 2005). In the present data, a set of weeks during the calendar year that included traditional (e.g., 4th of July, Christmas) and college-specific (i.e., Spring Break) holidays, as well as the Super Bowl, was worthy of note. Neither numbers of drinkers nor quantity of drinking among those who were drinking during these holiday/event weeks differentiated students from non-students, however. The failure to find the difference seen in many previous comparisons of college and non-college individuals might be due to the closer focus (i.e., more detailed nature) of the consumption, or, once again, due to the shared urban/suburban environment of all participants in the present study.

The observed pattern of amount consumed versus numbers of drinkers was not the same across all the holiday/events, however. Increases in numbers of drinkers occurred for all these occasions; that is, young adults in this sample were more likely to drink during event weeks than in other weeks. In contrast, amounts consumed did not increase similarly across all the identified weeks; significant increases in quantity consumed did not occur for the Labor Day, Thanksgiving, Christmas (i.e., week before New Year’s Day), and Memorial Day weeks; in fact, quantity decreased during Thanksgiving and Christmas weeks. These distinctions should perhaps not be surprising given the differing character of the event weeks. Spring Break is largely defined, for example, by peer group interactions, whereas Thanksgiving is a family occasion. Details of drinking on specific days/occasions will be addressed in a subsequent report.

Day of the Week Drinking Pattern

The pattern of daily drinking across the days of the week observed in this sample of college attendees and noncollege individuals was consistent with the weekly pattern previously observed in an exclusively first-year college student sample (Del Boca, et al., 2004). As before, lower levels of drinking characterized typical Sunday through Tuesday evenings, after which drinking steadily rose to peak on Saturday nights. Although this pattern often has been interpreted to reflect the academic demands of college, it did not appear to differ here as a function of student status; both students and non-students exhibited a similar pattern of escalation from Sunday to Saturday. Also note that, as quantity increased across the week, so did the number of those drinking. Once again, this overlap may have reflected the intermixing of the two groups in the environment in which this study took place. Perhaps with a sufficient representation of young adults in an environment, social goals overwhelm

local contingencies (even college attendance), and customary drinking patterns synchronize. In such a shared environment, for example, work schedules might come to conform to the weekly pattern inherent in academia, or vice versa (e.g., less work gets done on Fridays). All young people can, of course, adjust drinking schedules to the generally reduced absence of performance demands on Saturdays and Sundays in U.S. culture.

Limitations of This Study

Limiting the generalizability of these findings was the decision to trade off a true probability sample for a sample of only those emerging adults who reported at least some ongoing alcohol use and could be followed intensively. Dedicated abstainers were not represented, nor were those individuals who might have begun to drink after they were screened out of the study. It is also conceivable that our sampling methods (encouraging already recruited participants to identify familiars for recruitment) may have produced more homogeneity than might exist in randomly recruited college and noncollege samples. As a consequence (as noted earlier), the relative overlap between the drinking levels of the college and noncollege individuals may not have fully represented the levels that would be obtained with the inclusion of the relatively greater numbers of nondrinkers in a noncollege population. The collection of data within one large geographical location also may have diminished possible distinctions between college and noncollege participants. As one unique example, the middle west coast of Florida serves as a popular Spring break locale; it is likely that young adults in this area, regardless of student status, share in this atmosphere.

There is little reason to believe, however, that the general consumption *pattern* of college and noncollege *drinkers* is substantially misrepresented in the present sample, although specialized local variations might occur in different parts of the country (e.g., local holiday patterns may occur; e.g., Guavaween only exists in Tampa). In the final analysis, we feel safe in saying that drinking patterns of both college and noncollege individuals were marked by considerable variability, and heavily influenced by environmental events/contexts. The influence of these events/contexts varied, however; some increased both likelihood and amount of drinking, whereas others induced more individuals to drink, but in generally lesser amounts. We recommend that future research attend to the distinction between amount and probability of drinking when characterizing their target samples.

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Figure 2.
Mean observed drinks per week during the year among only those drinking during each week

Figure 3.
Observed percentage of participants consuming alcohol at each time point.

Figure 4.
Predicted weekly drinking quantity (4a) and probability of drinking (4b) derived from the latent growth curve two-part model.

Figure 5. An illustrative example of the discrepant patterns of daily drinking during a holiday (Thanksgiving) week based on including all available participants versus only those consuming alcohol. (Note: Percentages reflect the proportion of the sample consuming alcohol on each day of the week).

Table 1a

Goodness-of-Fit Indices for the Unconditional Two-Part Models.

Model	Loglikelihood	df	AIC	BIC	SSABIC
1. I only	-18469.69	57	37053.38	37301.68	37120.73
2. I + S	-17920.67	66	35973.33	36260.84	36051.31
3. I + S + Q	-17916.94	68	35969.88	36266.10	36050.23
4. I + H	-18213.85	75	36577.69	36904.40	36666.31
5. I + S + H	-17655.73	84	35479.47	35845.38	35578.72
6. I + S + Q + H	-17651.76	86	35475.52	35850.15	35577.13

Table 1b

Likelihood Ratio Tests for the Nested Model Comparisons.

Model	Loglikelihood	df	Model Comparison	LRT	df
1. I only	-18469.69	57	na	na	na
2. I + S	-17920.67	66	2 vs. 1	557.39*	9
3. I + S + Q	-17916.94	68	3 vs. 2	3.85	2
4. I + H	-18213.85	75	4 vs. 1	477.55*	18
5. I + S + H	-17655.73	84	5 vs. 2	488.35*	18
			5 vs. 4	558.67*	9
6. I + S + Q + H	-17651.76	86	6 vs. 5	4.18	2

Note. I = intercept, S = slope, Q = quadratic, H = holidays, df = degrees of freedom, AIC = Akaike Information Criteria, BIC = Bayesian Information Criteria, SSABIC = Sample Size Adjusted Bayesian Information Criteria, LRT = Likelihood Ratio Test.

* $p < .001$. The selected model is in **Bold**.