

## COMPARING CONSUMPTION PATTERNS

# How Do College Students Estimate their Drinking? Comparing Consumption Patterns among Quantity-Frequency, Graduated Frequency, and Timeline Follow-Back Methods

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### ***Abstract***

*This exploratory study was designed to compare several commonly used measures of alcohol use among college students in order to appreciate how estimations of college drinking may be affected by the type of assessment tool used. Consumption patterns of 42 college student drinkers were compared using a quantity-frequency measure, a graduated frequency measure, and a timeline follow-back (TLFB) interview. Within subject repeated measures were used to compare drinking variables across the two self-report measures and the interview procedure. The results showed that both the specificity of the measure, as well as the type of administration, result in significant differences on variables that describe the quantity of alcohol consumed. Measures of frequency appeared to be less dependent on these assessment factors.*

## INTRODUCTION

For over a decade, the problem of college drinking has been afforded increasing attention through the application of specific interventions and campaigns; however, the issue remains a prevalent, if not obstinate, public health concern (Wechsler, Lee, Kuo, & Lee, 2000). The accurate measurement of college student drinking has important implications for policy makers, college administrators, and the mental health professionals who design interventions to decrease use. Assessment of alcohol consumption forms the basis for the estimations of prevalence rates that update longitudinal trends. These data are used to quantify the extent of the problem on national and local levels – driving theory, research, and funding at all strata of the issue. National trends have been used to directly inform governmental review bodies of consumption patterns, as well as the efficacy of specific interventions (The Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002). On a local level, assessment of campus drinking identifies the need for changes in counseling or other intervention services for the student population, and many universities incorporate some overall measure of use into primary prevention programming. Accuracy in measuring consumption is important for the development and specificity of these applications, in addition to other, perhaps more targeted interventions (i.e., norm-based messages). Given the significant uses and functions for assessment data, it is important to note that the results are only as good as the nature of the questions. Specifically, the types of questions asked determine the results.

Descriptive surveys are often used as the basis for determining a macro-level view of consumption. Much of the data on current estimates of college drinking are generated from summary statistics presented by several ongoing national studies (i.e., The College Alcohol Study; the Core Institute Project; and the Monitoring the Future study). These epidemiological studies are able to generate large pools of data from a national sampling of colleges and universities, providing an overview of current prevalence rates and a history of

consumption patterns. These surveys typically use quantity-frequency (QF) measures to query drink variables. While brief assessments provide invaluable information for describing the scope of college drinking, their inherent brevity limits the specificity of their focus. Only a few questions are used to capture typical consumption patterns; moreover, participants are required to generalize their drinking to match a relatively small set of predetermined response options. Survey items typically ask participants to estimate the frequency and average quantity of their typical alcohol use, as well as the number of times they recall drinking to binge levels (e.g., 4 drinks for women; 5 drinks for men) during the two to four weeks prior to the assessment. As critiqued by Del Boca, Darkes, Greenbaum, and Goldman (2004), the data gathered from these surveys are more "impressionistic summaries of behavior" than accurate consumption patterns.

Despite the necessary ease and utility of these QF measures, questions remain concerning the type of recall cues that are used by participants to estimate and globally represent potentially diverse drinking patterns. Several studies have found that participant drinking estimates are significantly improved by refining the nature of the questions to include either atypical drinking episodes (Armour & Polich, 1982) or by separately determining typically light from heavy drinking day estimates (Kuhlhorn & Leifman, 1993). As a result, more detailed survey methods have been developed that ask participants to estimate the number of quantity-specific episodes to account for their drinking over a given time. These graduated frequency (GF) measures have been found to provide higher estimates of alcohol use (Midanik, 1994; see Sobell & Sobell, 2002 for a review).

Both considerations of atypical drinking days and inconsistent consumption pattern are relevant when assessing college drinking. Hasin and Carpenter (1998) have proposed that the irregular nature of college drinking may result in students' under-reporting use. Moreover, an ambitious study by Del Boca, Darkes, Greenbaum, and Goldman (2004) found that college student drinking is contingent on a variety of external factors, including day of the week, school

holidays, scheduled exam periods, and the week of the semester. Not only did the average of those who did drink vary from day to day, but Del Boca and colleagues also found that the composition of drinkers varied from week to week. Therefore, capturing this variability with an estimation that spans two weeks potentially leaves many questions regarding the validity of the data due to the inherent limitations of the questions. Brief assessment measures require student participants to estimate and then summarize a considerable amount of drinking variability.

An alternative to the QF and GF approaches is an interview procedure in which daily drinking is reconstructed by using a calendar of the time period. An advantage of interview methods, or timeline follow-back instruments, is the ability to identify atypical drinking days and patterns of consumption, as daily and episodic drinking variability is more easily captured with the specificity of the TLFB procedure (TLFB; Sobell & Sobell, 1992). In a recent review of the assessment literature, Sobell and Sobell (2002) reported that the increased detail found in the GF and TLFB measures result in significantly higher drinking estimates over QF measures. These authors further detail the nature of the problem; specifically QF measures underestimate quantity because they do not have the flexibility necessary to account for atypical heavy drinking days. This flexibility may be important for describing college student drinking. As mentioned previously, Del Boca, Darkes, Greenbaum, and Goldman (2004) found that students tend to drink opportunistically around an academic schedule, which produces considerable variability in who is drinking and when. Additionally, students may also consume non-typical beverages (i.e., PGA [pure grain alcohol] punch) or use non-standard containers (e.g., 20 oz. cup as opposed to 12 oz. can of beer), which they may not realize would count as more than one drink. This initial study attempts to gain a better understanding of how students are responding to survey questions by comparing QF, GF, and TLFB instruments.

## METHOD

### Participants

As one of several options for partial fulfillment of a course requirement, 42 undergraduate psychology students volunteered to participate in the two-session study. General psychology courses are typically made up of students across each academic year and include individuals from a variety of majors. The university's institutional review board reviewed the research and participants read and signed an informed consent prior to their entry into the study. Selection criteria stipulated that participants must have consumed alcohol on at least three occasions in the previous 30 days.

### Alcohol Use Measures

**Quantity-Frequency (QF) Measure.** A quantity-frequency (QF) measure based on work by Cahalan and Cisin (1968) was used to determine self-reported alcohol use (see Appendix). Participants responded to questions concerning their alcohol use during the past 30 days. The QF yields participant estimations regarding the frequency of drinking and both modal and maximum quantities consumed over the preceding 30-day interval. Students reported on: 1) the total number of drinking days, 2) the average number of drinks consumed on drinking days, and 3) the total number of days on which 5 or more drinks (4 for women) were consumed. In a review of verbal report methods in alcohol research, Babor, Stevens, and Marlett (1987) determined that quantity-frequency measures show uniformly high reliability across subject populations.

**Graduated Frequency (GF) Measure.** Self-reported alcohol use was also assessed using a graduated frequency (GF) measure (Hilton, 1989; Rogers & Greenfield, 1999). The GF initially asks the participants to estimate the total number of days on which alcohol was consumed during the past 30 days. Respondents then indicate on how many of those days 1, 2, 3, 4, 5, 6-7, 8-9, 10-11, 12-16, or more than 16 drinks were consumed (see Appendix).

***Interview Timeline Follow-back (TLFB).*** A detailed assessment of drinking quantity and frequency during the previous 30 days was gathered using the time line follow-back calendar-based interview (TLFB; Sobell et al., 1992). The TLFB method uses important events, calendars, and other memory prompts to enhance recall (refer to Appendix). A selection of plastic cups, glasses, and mugs were also used during the interview to aid in identifying the size of drinks consumed during a drinking episode. This procedure has been used in previous research and findings indicated that these choice options are essential since college students often drink at keg parties and fraternity/sorority events where cans and bottles are typically not used (Brown, 2001). Ample evidence supports the test-retest reliability and validity of the TLFB when used to assess alcohol use in college populations (Sobell, Sobell, Klajner, Pavan, & Basian, 1986).

## **Procedure**

***First Session.*** The order of presenting the assessment measures was selected in an attempt to minimize improved recall over repeated queries of the same time period. Participants attended one of several group sessions run by a member of the research team who explained the study format and detailed the nature of informed consent. The students then completed a short packet of questionnaires that included basic demographics, measures of alcohol-related consequences, and the GF alcohol use measure. Participants were then scheduled to return two days following the initial session.

***Second Session.*** Participants came in individually for this appointment. After completing a second packet of questionnaires, which included the QF measure, an experimenter individually interviewed the student using a Timeline Follow-back (TLFB) method. A pre-printed calendar was provided for the student to reference while the experimenter recorded the information. Alcohol use was assessed for the same 30-day period as the first session. A variety of typically used cups, glasses, and mugs were also present for participants to reference in order to specify the exact size of each drink consumed.

The experimenter first queried the participant for individual dates of significance, suggesting birthdays, academic test dates, collegiate events (e.g., home games), etc., and marking those indicated on the calendar to serve as memory prompts. Drinking days were then carefully queried. During this procedure the interviewer continued to prompt the participant for specifics regarding quantity and frequency variables, including types and amounts of liquor consumed and the size of the container. The interviewer also prompted with the question, "and what else?" until the student was certain they had included all of the alcohol consumed on the date in question. The TLFB interview typically took 20 minutes to complete. Finally, participants were debriefed, thanked, and dismissed.

## RESULTS

Three individuals did not return for the follow-up session. The final sample included 19 males (45.2%) and 23 females (54.8%). A disproportionate number of the students were freshman (54.8%); then sophomores (23.8%), juniors (14.3%), and seniors (7.1%). Approximately 17% of participants were members of the Greek system. Participants primarily resided in either residence halls (33%) or off-campus with friends (40%). The average age of participants was 20.9 and 81% were white. The average grade point average (GPA) of the students was 2.98. Participants were representative of the overall population of students at this university. Overall, 49% of the full time undergraduate student body is female, 18.3% are members of the Greek system, 40% reside in dormitories, the average age is 21.0, and 83% of the student body is white.

We examined drinking frequency and quantity through five indicators: (1) number of drinking days – a sum of days on which alcohol was consumed, (2) average number of drinks per drinking day – the total number of drinks divided by the number of drinking days, (3) number of heavy drinking days – a sum of the days on which 5 or more drinks (4 or more for women) were consumed in one sitting, (4) heaviest drinking day – the largest amount of alcohol consumed

on one day, and (5) total number of drinks during the past 30 days. Repeated-measures ANOVAs were used to compare within-subjects ratings of each of the identified drink variables across the assessment measures. Sphericity was assumed in the analysis after using the Greenhouse-Geisser correction method to assess for potential Type I errors.

As can be seen from Table 1, the number of drinking days captured by the self-report instruments was within one day of the interview method. While this difference was significant,  $F(2, 80) = 4.07$ ,  $p = .021$ , it may be rather negligible from a practical perspective; particularly since the addition of one drinking day per month did not increase related variables such as the total number of drinks consumed. The average quantity consumed per drinking episode was also significantly different across instruments,  $F(2, 82) = 23.39$ ,  $p < .001$ . As may be expected, more drinks are reported with increasing assessment detail, and this difference proved to be significant between each measure. However, increasing the level of specificity across these measures did not result in a significant difference in the number of heavy drinking days reported. As can be seen from reviewing Table 1, both the self-report methods (i.e., QF and GF) and the interview (i.e., TLFB) resulted in similar findings for this variable,  $F(2, 82) = .065$ ,  $p = .937$ . Also contrary to the findings reported for average quantity, increasing the detail and specificity of the assessment did not result in a linear increase in the amount reported on the heaviest drinking day. While the difference was significant between each measures,  $F(2, 82) = 2.45$ ,  $p < .001$ , the GF produced the smallest average for the heaviest day, followed by the QF and the TLFB, respectively. Finally, the total number of drinks reported during the assessment period was also dependent on the type of questions asked. More impressionistic summaries of drinking behaviors resulted in smaller totals of drinks consumed when comparing self-report measures with the TLFB,  $F(2, 80) = 10.55$ ,  $p = .001$ .

**Table 1**  
**Means of Drink Indicators across Assessment Measures**

Drink Indicator	Assessment Measure		
	QF	GF	TLFB
Number of Drinking Days	10.80 <sup>a</sup>	10.61 <sup>a</sup>	9.93 <sup>a</sup>
Average Number of Drinks per Drinking Day	4.27 <sup>a</sup>	5.00 <sup>b</sup>	7.12 <sup>c</sup>
Number of Heavy Drinking Days	5.90 <sup>a</sup>	6.02 <sup>a</sup>	5.86 <sup>a</sup>
Heaviest Drinking Day	9.14 <sup>a</sup>	7.81 <sup>b</sup>	16.35 <sup>c</sup>
Total Number of Drinks in the Past 30 Days	51.18 <sup>a</sup>	57.06 <sup>a</sup>	77.98 <sup>b</sup>

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Number of Heavy Drinking Days	5.90 <sup>a</sup> (5.79)	6.02 <sup>a</sup> (5.14)	5.86 <sup>a</sup> (5.15)
Heaviest Drinking Day	9.14 <sup>a</sup> (5.71)	7.81 <sup>b</sup> (4.55)	16.35 <sup>c</sup> (13.40)
Total Number of Drinks in the Past 30 Days	51.18 <sup>a</sup> (47.31)	57.06 <sup>a</sup> (52.53)	77.98 <sup>b</sup> (73.68)

Different letters indicate a significant ( $p < 0.05$ ) difference between means

## DISCUSSION

This preliminary study was designed to compare several commonly used assessment measures of drinking among college students. The purpose was to examine the differences in consumption variables elicited by these measures in order to appreciate how the type of assessment tool that is used may effect estimations of college drinking. These early results suggest that both the specificity of the measure, as well as the type of administration used, result in appreciable differences on variables that describe the quantity of alcohol consumed. Measures of frequency appear to be less dependent on these assessment factors.

Separating the issues of the instrumentation and administration is necessary in order to determine how each of these may effect the resulting information. Comparing the QF and GF reveals that the latter results in more reported drinks per drinking day. As both are relatively brief self-report measures, this difference is likely the result of the increased specificity of the GF. The GF requires less averaging and consolidation of drinking behavior than does the QF. As described in the Methods section, average quantity is assessed by the QF as a single quantity that attempts to represent the number of drinks consumed on multiple occasions into a single estimate. The GF provides increased specificity by providing ten categories that are used to help account for multiple drinking occasions. This difference suggests that college student drinkers may tend to underestimate the average number of drinks consumed when trying to summarize their drinking behavior into a single representative score. As previously discussed, most of the current epidemiological data is generated by brief, single answer survey questions. Application of this finding indicates that widespread use of brief survey data may be limiting an accurate estimation of the typical amount consumed by college drinkers. Increased specificity in assessment measures may be crucial for providing accurate estimates of how much alcohol college students typically consume.

It should be noted that the increased specificity of the GF does

not result in greater estimates of the amount consumed on the heaviest day. In fact, this variable is significantly lower for the GF than the QF (see Table 1). However, there is no difference in specificity for this question between these two measures. This single-response answer requires the same estimation process for both. The significant difference may be an artifact produced by different demand features of the measures. Another possibility in this unexpected difference is how the instruments were scored in this study. If a participant did not answer the question of amount consumed on the heaviest day than this amount was assumed from the highest drink category reported. That is, if the participant placed the number four by the "three drinks" category, and the a two by the "six drinks" category, than six drinks was assumed to be the amount consumed on the heaviest day; yet this may not be accurate. Moreover, as described above, the GF has a ceiling of "16+" drinks – any drinking days that included more than 16 drinks are included in this category. Therefore, the total for amount consumed on the heaviest day for the GF may have been reduced by this ceiling effect.

The total number of drinks was also not significantly different between the QF and the GF. Yet as a quantity variable, it is confounded by the method by which it is devised since it is a composite variable created by multiplying average quantity times frequency. Given that frequency of drinking was not significantly different between these two measures, a significant difference in total number of drinks may have been attenuated by the similarities of frequency. The method of administration may also make a difference in the information gathered during assessment. Differences due to administration cannot be completely dismantled by these results, as this study did not include a self-report measure with the level of specificity found in the TLFB interview method. However, comparing this and a recently published study by Sobell et al. (2003) may allow speculation on the significance that administration may have on quantifying drinking behaviors. Sobell et al. compared the same five drink variables used in this study via the Quick Drink Screen (QDS), which is comparable with the QF, and a self-administered TLFB, which

was mailed to participants. Their results revealed only negligible differences between drinking variables across the two measures. Thus, despite the significant methodological differences between these studies it is still worth noting a mailed TLFB and a QF instrument resulted in similar findings. Comparatively, in this study the TLFB was administered via an interview and resulted in significant differences across several drink indicators (refer to Table 1) compared to the self-report measures.

While there are numerous problems to comparing these studies directly, there are several interesting explanations as to why this study and that of Sobell et al. (2003) resulted in different outcomes. Perhaps the most salient to this discussion is the difference between the specificity made possible by a one-on-one administration of the TLFB. For example, with self-report instruments, the definition of a "drink" is the same regardless of how detailed the survey is. In the study by Sobell et al., because both instruments used are self-report, it is not only dependent on the participant to understand what constitutes "one drink" (e.g., 1.5 ounces of ethanol), but also to take time and effort make this calculation for each non-standard drink consumed. Despite clear definitions of what constituted a drink, and even using pictures as aids, we have found in previous work that college student drinkers are still unlikely to report a mixed drink as more than one standardized drink on self-report measures.

Moreover, our participants were likely to consume alcoholic beverages out of unusually sized containers. In short, a carefully queried administration of the TLFB proved necessary to gather an accurate assessment of drinking within this population. Specifically, the interviewers were able to gather important data regarding quantity. However, this does not in any way question the results of the study by Sobell and colleagues, as their population was composed of problem drinkers in the community who may not drink "garbage can punch" out of 32 ounce cups. It should also be noted that a one-on-one interview can also decrease certain drink variables, as Brown and Fishburne (2005) found that females reported less quantity with this format than in a group administered TLFB. These authors specu-

lated that the stigma of heavy drinking may have been more evident in the presence of an interviewer.

### **Limitations**

This present study was limited in several ways. One of the greatest limitations is the limited sample size. While this is of some concern, the demographics of the sample in this study were not consistently different from that of the enrolled student body. Therefore, while small, this sample appears to be fairly representative of the campus as a whole. Additionally, the consistency of the results lends support for the adequacy of the sample size. While it is not unusual for exploratory studies using the TLFB, a fairly time-consuming measure, to initiate with even smaller sample sizes than were used here (Curtis, Borsol, Cunningham, & Koski-Jaenes, 2001; Searles, Helzer, & Walter, 2000), future studies should engage more participants to address this concern. A second limitation is the generalizability of these findings to other campus populations. Previous research has demonstrated distinct consumption patterns across different regions and demographic compositions (Engs, Diebold, & Hanson, 1996), to include ethnic differences in alcohol use (Keefe & Newcomb, 1996). Consequently, the results from this sample may differ from campuses in other regions and/or ethnic compositions.

### **Conclusions**

This study suggests that the specificity and type of administration may be important variables to consider for assessing college drinking. While one-on-one interviews are not practical for national surveys, increasing the specificity of questions dealing with quantity may yield significantly different results, especially among variables related to quantity. This is a significant consideration given how important assessment data is to our understanding of college drinking and how to best address it. Relying on brief survey data may be resulting in an underestimation of how much college drinkers are consuming per occasion. This misrepresentation may be negatively affecting the ability of administrators and college health profession-

als at identifying the very nature of the problem and adequately intervene. If these results are replicated with larger samples and in other regions, they may indicate that the current national estimates of how much alcohol is being consumed is low. At a broad level this would question a number of conclusions reported from survey data, including prevalence rates, as well as other statistically driven concepts such as what constitutes a heavy drinking or binge occasion (Weschler, Dowdall, Davenport & Rimm, 1995). At a local level, these data may question the accuracy and applicability of campus-specific interventions, such as norm-based social marketing programs. Depending on the nature of how the data is to be used, mental health professionals need to be aware of the consequences of the specificity and type of administration used to gather college drinking data.

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## Appendix

### Quantity-Frequency Measure

**1. DURING THE PAST 30 DAYS, on how many days did you have any beverage containing alcohol (including beer, wine, or liquor)?**

\_\_\_\_\_ DAYS (out of the past 30 days) when I had any alcohol beverage

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For Question 2 and 3, any of the following count as ONE DRINK

one glass (or one can) of beer or  
one glass (4 ounces) of wine or  
one shot (one ounce) of liquor or other distilled spirits or  
one single-shot mixed drink (a double shot counts as 2 drinks)

**2. DURING THE PAST 30 DAYS, on days when you did drink alcohol, how many drinks did you usually have?**

\_\_\_\_\_ DRINKS per drinking day

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**3. DURING THE PAST 30 DAYS, on how many days did you have 5 or more drinks (4 if you are a female)?**

\_\_\_\_\_ DAYS (out of the past 30 days) when I have five (males) / four (females) or more drinks.

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### Graduated Frequency Measure

**1. On how many days during the past 30 days did you have any drink containing alcohol?**

\_\_\_\_\_ days when I drank any alcohol

Here are the things to count as ONE DRINK

12 ounces of BEER    4 ounces of WINE    1 shot of LIQUOR

½ pint liquor = 8 drinks

1 pint liquor = 16 drinks

1 bottle wine = 6 drinks

Also:

Bar drinks often count as *more than one drink* if they have several kinds of liquor in them.

**2. On days when you did drink, how many of these days did you have:**

\_\_\_\_\_ days, 1 drink

\_\_\_\_\_ days, 2 drinks

\_\_\_\_\_ days, 3 drinks

\_\_\_\_\_ days, 4 drinks

\_\_\_\_\_ days, 5 drinks

\_\_\_\_\_ days, 6 or 7 drinks

\_\_\_\_\_ days, 8 or 9 drinks

\_\_\_\_\_ days, 10 or 11 drinks

\_\_\_\_\_ days, 12 to 16 drinks

\_\_\_\_\_ days, more than 16 drinks

Total: \_\_\_\_\_ Check your total. This line should equal Question #1 above for the *total number of drinking days in the past month.*

**Calendar Measure**

**Font** indicates preprinted items.

*Script* font represents memory prompts the participant may have provided.

Normal font is used for examples of how drinking was detailed, with letters indicating the size of the container.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5	6	7	8 Pep Rally	9	10 Home Game 2 "1/2 C" rum
11	12 3 "A" beer	13	14	15	16	17 5 "G" margaritas (1.5 oz tequila/.5 oz triple sec)
18	19	20 3 "A" beer	21	22 5 "A" beer	23 <i>Test</i>	24
25	26	27 Spirit Week <i>M's B-day</i> 2 "J" beer	28	29	30 <i>Concert</i>	31 3 "A" beer

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