Published in final edited form as:

Addict Res Theory. 2017 ; 25(3): 195–200. doi:10.1080/16066359.2016.1239081.

Comparisons of Alcohol Consumption by Time-Line Follow Back vs. Smartphone-Based Daily Interviews

Patrick L. Dulin, Corene E. Alvarado, James M. Fitterling, and Vivian M. Gonzalez

University of Alaska Anchorage

Abstract

This study compared alcohol consumption data collected through daily interviews on a smartphone with data collected via the Timeline Follow-Back (TLFB) during a 6-week pilot study of a smartphone-based alcohol intervention system. The focus of the study was to assess for discrepancies between the two measurement methodologies on commonly utilized alcohol outcome variables. Twenty-five participants between 22 and 45 years of age and were drinking heavily at study incipience completed a 6-week alcohol intervention delivered by a smartphone application that monitored drinking through a daily interview. Participants also completed a TLFB of their alcohol consumption during the intervention period. Difference scores were calculated by subtracting the average weekly outcome variables derived from the smartphone daily interview from the average weekly outcome variables derived from the TLFB which yielded six discrepancy scores for each of the 25 participants and resulted in 150 observations. Heirarchical linear modeling indicated that the TLFB and smartphone daily interview methods did not produce significant discrepancies over the 6-week interval when examining percent of heavy drinking days and percent of days abstinent. However, discrepancies on drinks per drinking day increased substantially over time, suggesting that it is susceptible to recall bias when assessed by the TLFB. Results also indicated that participants under-reported their drinking on the TLFB compared to the daily smartphone-based assessment. Results indicate that outside of assessing for extreme drinking (binge or no drinking), the TLFB should be used cautiously and that smartphone apps represent a promising method for accurately assessing alcohol consumption over time.

Introduction

Accurately assessing alcohol consumption is essential for measuring treatment outcomes in research and clinical practice settings. Retrospective self-report measures such as the Timeline Follow-Back (TLFB; Sobell, Maisto, Sobell, & Cooper, 1979) are widely utilized alcohol consumption assessment methods. The TLFB is a calendar-based interview method in which the individual retrospectively identifies the days when alcohol was consumed and the number of standard drinks consumed on those days (Sobell & Sobell, 2003). Numerous drinking variables that are commonly used in alcohol studies such as drinks per drinking day (DDD), percentage of heavy drinking days (PHDD), and percentage of days abstinent (PDA) can be generated from the TLFB. The TLFB has been shown to have adequate validity for

short-term (30 days) and long-term (90–365 days) estimations when compared to other retrospective methods of assessing alcohol, drug, and tobacco use (Brown, et al., 1998; Fals-Stewart et al., 2000; Harris et al., 2009). In addition, computerized and telephone based TLFB provide alcohol use data comparable to data collected through paper-pencil formats (Sobell, Brown, Leo, & Sobell, 1996).

While it has gained wide acceptance, the TLFB is not without limitations. Recall bias can reduce accuracy of retrospective consumption measures, even among individuals who are motivated to recall their drinking accurately (Hufford et al., 2002; Toll, Cooney, McKee, & O'Malley, 2005). When compared to results from daily reports, retrospective reports tend to underestimate drinking (Perrine & Schroder, 2005; Searles et al., 2002). In addition, current drinking habits influence self-reports of past consumption, whereby individuals may estimate that past drinking patterns are similar to current drinking patterns (Collins, Graham, Hansen, & Johnson, 1985; Searles, Helzer, & Walter, 2000).

Real-time daily assessment of alcohol consumption has potential to enhance accuracy over retrospective measures such as the TLFB (Searles et al., 2000; Shiffman, 2009). Emerging technologies such as the automated, telephone-based Interactive Voice Response (IVR) system (Searles, Helzer, Rose, & Badger, 2002) and handheld computers (Bernhardt, Usdan, & Burnett, 2005) have been employed for ecological momentary assessment (EMA) of alcohol use. EMA, which has been used for assessment of a variety of health-related behaviors, involves repeated sampling of target behaviors in real time in the natural environments in which they occur, thereby minimizing recall bias and maximizing ecological validity (Collins, Morsheimer, Shiffman, Paty, Gnys, & Papandonatos, 1998; Lukasiewicz, Benyamina, Reynaud, & Falissard, 2005; Shiffman, Stone, & Hufford, 2008). For example, Shiffman, Hufford, Hickcox, Paty, Gnys, and Kassel (1997) assessed the accuracy of retrospective reports of smoking lapse episodes compared to data recorded in near-real time using a handheld computer. A comparison of data 12 weeks later showed poor recall of lapses in the retrospective reports. This study also indicated that participants' recall of past smoking behavior was influenced by current smoking status. While representing a step forward in substance use assessment, IVR and handheld computer administration have practical shortcomings that limit their implementation. IVR requires individuals to make a phone call to an automated data system and some research participants have reported reluctance to use handheld computers in their natural environments because of concerns about privacy (Lukasiewicz et al., 2007).

In contrast to the drawbacks associated with IVR and handheld computers, smartphones hold great promise as a technology for assessing alcohol consumption due to their almost ubiquitous in their use and acceptance (Kuntsche & Laphart, 2014; Verster, Tiplady & McKinney, 2012). In developed countries such as the United States, Canada, and Europe, smartphones ownership among adults is in the 60–70% range, and it approaches 90% among the 18 to 34-year-old age group. Smartphone ownership in emerging economies is growing substantially, nearly doubling from 2013 to 2015 and is continuing to grow (Poushter, 2016). The high prevalence of smartphone use in a wide range of situations allows research and clinical participants to use them for discreetly reporting data in the actual contexts in which alcohol is consumed (Kuntsche & Laphart, 2014; Verster, Tiplady

& McKinney, 2012). Mobile applications for smartphones thus hold promise as pragmatic and socially acceptable tools for accurately assessing alcohol consumption as well as related contextual variables across time.

A number of studies have shown the utility of cellphone technology for collecting self-report data on alcohol consumption in real time (Alessi & Petry, 2012; Collins, Kashdan, and Gollnisch, 2003;). Of particular relevance to the current study is a recent study that utilized a sample of university students by Monk, Heim, Qureshi and Price (2015) in which retrospective self-reports of alcohol consumption were compared with real-time data reported by smartphone. Alcohol consumption reported during real-time assessment was higher than that reported retrospectively, particularly with respect to number of drinks consumed in a day. The authors identified contextual factors (e.g., alone vs. with two or more friends, and different places in which drinking occurred) that affected the degree of discrepancy between real-time and retrospective reports. They found that overall, retrospective accounts appeared to underestimate the amount of alcohol consumed and that increased consumption may exacerbate differences between real-time and retrospective accounts

A growing number of studies have indicated that utilizing technologically-based assessment methods can result in improved measurement validity when compared to traditional, retrospective methods. The current study's purpose was to extend this research by comparing data generated from a smartphone-based, daily alcohol assessment methodology with results from the TLFB amongst participants who met criteria for DSM-5 criteria for alcohol use disorder who were utilizing a smartphone intervention app to change their drinking on commonly utilized alcohol outcome variables. This study provided a unique opportunity to compare alcohol outcome variables collected retrospectively from the TLFB with EMA data collected via smartphone in the context of an alcohol intervention delivered by smartphone.

Method

Materials and Measures

This study utilized smartphone-based data collection in the context of a smartphone-based alcohol intervention called the Location-Based Monitoring and Intervention System for Alcohol Use Disorders (LBMI-A; Dulin, Gonzalez, King, Giroux, & Bacon, 2013; Dulin, Gonzalez, & Campbell, 2014; Gonzalez & Dulin, 2015). The LBMI-A provided a stepwise progression through seven treatment modules designed to enhance motivation to change, improve social support for sobriety, develop awareness of alcohol triggers, and improve coping methods. Each day at a pre-set time, participants received a smartphone prompt to record the number of standard drinks consumed during the previous 24 hours. Alcohol consumption in this study was measured using the calendar-based Timeline Follow-Back (TLFB; Sobell, Maisto, Sobell, & Cooper, 1979) and the daily reporting feature of the LBMI-A. Participants were also provided with the option of recording their drinking in real time by pressing on a "Drink Monitor" icon in the app.

Participants and Procedures

Participants were recruited from a Northwest community of approximately 300,000 individuals using radio and newspaper advertisements and flyers. Recruitment materials indicated that the study was for individuals interested in making a positive change in their drinking. To be included in the study participants had to meet *Diagnostic and Statistical Manual of Mental Disorders* 5th edition (DSM-5) diagnostic criteria for an alcohol use disorder (American Psychiatric Association, 2013) and be at least minimally motivated to change their drinking. Selected participants also needed to be drinking a minimum of: (a) 14 standard drinks (females) or 21 standard drinks (males) on average per week over a consecutive 30 days in the 90 days prior to evaluation, and (b) 2 heavy drinking days (4 or more standard drinks—females, 5 or more—males) in the same 30 day period as above. Further eligibility criteria included being between the age of 18 to 45 years old and having a basic working knowledge of technology (i.e., could text and use email).

Individuals who were eligible at the baseline interview ($N = 30$) were scheduled within a week in most cases for a one-hour appointment where they were introduced to the LBMI-A. An initial 90-day TLFB was administered by a graduate-level research assistant (RA) to provide a baseline of each participant's alcohol consumption. Another TLFB was administered by an RA at the end of the 6-week study going back 42 days (the time that participants used the LBMI-A). In this study, heavy drinking was defined as five or more drinks per day for males and four or more drinks per day for females. This definition was utilized for the TLFB variable "percentage of heavy drinking days". Participants recorded daily alcohol consumption into their LBMI-A enabled smartphones when prompted at a specific time determined by the participants when they set up the app. In so doing, it was presumed that it would provide highly accurate accounts of their drinking across time. Participants were compensated \$60 at each of the baseline and six-week follow-up assessments. LBMI-A participants also were compensated \$5 for each day they completed a daily interview of alcohol consumption and cravings that was administered by the system.

The 25 participants who completed both alcohol consumption measures included men (52%, $n = 13$) and women (48%, $n = 12$) between ages 22 and 45 ($M = 33.6$, $SD = 6.5$). The sample was 50.0% White, 25.0% multiethnic, 10.7% Alaska Native or American Indian, 7.1% African American, 3.6% Hispanic, and 3.6% Pacific Islander. Inclusionary criteria included drinking a minimum of 14 or 21 standard drinks (for females and males, respectively) on average prior to the study and 2 heavy drinking days in the same period, met DSM-5 criteria for an alcohol use disorder (American Psychiatric Association, 2013), and had at least minimal motivation to change their drinking as measured by the University of Rhode Island Change Assessment Scale (DiClemente & Hughs, 1990). Exclusion criteria included being more than 21 days abstinent at the baseline interview; currently in alcohol or drug abuse treatment; pregnant or nursing; severe alcohol dependence, as indicated by a score of 30 or above on the Severity of Alcohol Dependence Questionnaire (Stockwell, Murphy, & Hodgson, 1983); having delusions, hallucinations, or Bipolar I Disorder. A total of 28 participants completed the study, of which 25 provided sufficient data on alcohol consumption measures on the LBMI-A. Three participants were excluded due to lack of

compliance with the LBMI-A daily interviews (more than 10% of daily interviews were missing).

Statistical Analysis

Alcohol consumption data from the TLFB and LBMI-A were compared across three commonly reported clinical outcome measures: DDD, PHDD, and PDA. Correlational analyses were conducted to determine the association between the TLFB and daily interviews from the LBMI-A during a 6-week time period with those participants who completed the 6-week follow-up assessment (see Table 1). Discrepancies in reported drinking at each 1-week time point after the introduction of the LBMI-A intervention were also examined. Difference scores were calculated by subtracting the average weekly outcome variable (DDD, PHDD, PDA) derived from the smartphone daily interview from the average weekly outcome variable derived from the TLFB. Hence, there were six discrepancy scores for each of the 25 participants for a total of 150 discrepancy data points. Power analyses conducted using the method described by Aarts and colleagues (Aarts, Verhage, Veenvliet, Dolan, & van der Sluis, 2004) revealed limited power (.20) to detect a small effect, but adequate power (.80) to detect moderate to large effects in the multilevel analyses.

Negative scores indicated greater drinking reported on the smartphone daily interview. Mixed linear modelling (MLM), using SPSS 21 was used to examine the within subjects effects of time on discrepancy scores for the three drinking outcomes over the 6-week course of the study. For MLM analyses, models were examined prior to analyses to ensure model assumptions were met (e.g., residuals are normally distributed and homoscedastic). All mixed linear models were estimated using restricted maximum likelihood (REML) given the small sample size (Singer & Willett, 2003).

Results

The “Drink Monitor” feature of the LBMI-A was very seldom utilized. Only 4 of the 25 initiated the feature and none of the 4 utilized it regularly. Given the very low utilization rate, this data was not included in the analysis. Daily interview compliance of the 25 participants was high. Participants completed 96% of the daily interviews. Missing data in this study were managed with the last observation carried forward (LOCF) method. This method of data imputation was chosen as there was a relatively small amount of missing data and the number of drinks between two consecutive days was highly correlated ($r=.92$). Pearson correlations were calculated to assess whether the LBMI-A and the TLFB showed differences in reported consumption across the two measurement methods. Correlations between the LBMI-A and the TLFB showed high positive association on PDA and PHDD throughout all 6-week intervals (see Table 1). However, when assessing DDD, the correlations between the LBMI-A and the TLFB diminished as more time elapsed between consumption and recall.

Mixed linear modeling procedures were employed to determine if discrepancies between the two methods of measurement changed significantly over time for each drinking variable. The unconditional models examining growth revealed no significant effect for time for

PHDD ($B [SE] = .61 [.81], p = .450$) or PDA ($B [SE] = .61 [.81], p = .450$). This finding suggests that the discrepancy between what participants reported on the TLFB and the smartphone daily interview did not change significantly over time on those two variables. However, for DDD, the discrepancy in the TLFB and EMA data grew significantly over time ($B [SE] = .34 [.17], p = .040$), with more distal time points showing greater discrepancy than more proximal time points.

Discussion

This study compared the consistency of alcohol consumption data collected through two different methods; daily prompted interviews through a smartphone app and retrospective TLFB interviews. We chose to examine three commonly calculated alcohol consumption variables, percentage of days abstinent (PDA), percentage of days spent hazardously drinking (PHDD) and drinks per drinking day (DDD). Results suggest agreement between the retrospective TLFB and smartphone-based daily interviews when evaluating PDA and PHDD. This finding is in line with other recent research comparing technology-based assessment of daily drinking with Form-25 (Miller & Del Boca, 1994), another calendar-based retrospective recall measure in finding good correspondence between the two measurement methods for PHDD and PDA (Krennek, Lyons & Simpson, 2016). With regard to DDD, this study found significant disagreement between the two assessment methods over time, suggesting a deterioration of participants' ability to recall the number of drinks consumed on a given drinking day with accuracy at more distal time points. Calculating drinks per drinking day is a multi-stage procedure, requiring the determination on which days drinking occurred and then recalling the specific number of drinks consumed on that particular day. Results from this study suggest that distal recall of DDD through TLFB does not coincide with daily assessment of drinking and should be used cautiously.

Another noteworthy trend that emerged in this study is that participants consistently underreported their drinking on the TLFB when compared to the smartphone-based daily interview method. Scores reflected less drinking for the TLFB method across all weeks for DDD and PHDD. Recent research suggests that there are important contextual variables that interact with this discrepancy. Monk et al (2015) found that being with multiple friends decreased the discrepancy between in-the-moment assessment and retrospective measures while being in a public drinking venue increased the discrepancy. Future research in this area should include contextual variables in order to further understand how environmental variables impact retrospective recall of drinking.

Limitations

The most substantial limitation of this study is the small sample size. A sample of twenty-five participants is a decidedly small N and power was lacking to detect small differences between the TLFB and smartphone-based assessment methods. However, despite limited statistical power we still found effects for the DDD variable, which indicates that the DDD estimate from the TLFB may evidence substantial discrepancies between estimated and actual drinking, particularly at longer (more than one month) recall intervals. Another limitation is a restricted sample. Participants self-selected into the study were drinking

heavily and met criteria for an alcohol use disorder. While these results are instructive to researchers focused on assessment of individuals with an alcohol use disorder in a treatment context, results may not generalize to the larger population of drinkers. This study demonstrated that the TLFB may underestimate actual participant drinking due to the retrospective nature of the assessment. Given that the methodology employed in this study was a daily interview of participant drinking and reliant on recalling the previous days drinking, the results possibly underestimate actual participant drinking, given the finding by Monk et al. (2015) that daily recording underestimated quantity of alcohol compared with immediate recording of drinking. If that is true, the actual underestimation of drinking by the TLFB in this study is likely even more substantial than what we found. Obtaining drinking data that is truly “in the moment” (within the time frame of the drinking episode) represents ideal measurement but is very difficult to employ. Participants in our study had this option through the “Drink Monitor” feature, but utilization was extremely poor.

Conclusions and Implications

This study demonstrated that the TLFB likely underestimates actual participant drinking due to the retrospective nature of the assessment, a finding that has been shown in multiple studies (Krenek, Lyons & Simpson, 2016; Monk et al., 2015, Perrine & Schroder, 2005; Searles et al., 2002). Researchers and clinicians should be mindful that retrospective, calendar based assessments of drinking are most likely underestimating actual drinking and that the variable drinks per drinking day may be particularly unreliable when recalling alcohol consumption a month or more in the past. It is possible that calendar based assessment methods provide accurate measurement of the extreme ends of drinking (no drinking or a binge episode on a certain day), but their ability to accurately assess drinks per day over time is questionable.

A unique element of this study is its use of a smartphone app to assess daily drinking. Smartphones have numerous advantages as assessment and intervention tools due to their high utilization and computing power. They hold potential to significantly advance research and clinical practice regarding accurate assessment of alcohol use (Knutsche & Labhart, 2013). Results of this study suggest that further exploration into how smartphone apps can be meaningfully integrated into clinical and research protocols for measurement of drinking outcomes is warranted. Ideally, smartphone apps will measure drinking when it actually occurs, but this study found that participants are reluctant to utilize such features if they require participants to take action to record the event. Perhaps new wearable technology that measures alcohol consumption and communicates with an app without input from the user will provide a way forward (“This Wristband can Measure Alcohol,” 2016). Utilizing apps and inconspicuous wearable assessment devices to accurately assess actual participant alcohol consumption is an exciting area of future research that may one day obviate the need for retrospective recall of drinking.

References

- Aarts E, Verhage M, Veenvliet JV, Dolan CV, van der Sluis S. A solution to dependency: using multilevel analysis to accommodate nested data. *Nature Neuroscience*. 2014; 17:491–496. [PubMed: 24671065]

- Alessi S, Petry N. A randomized study of cellphone technology to reinforce alcohol abstinence in the natural environment. *Addiction*. 2012; 108:900–909.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5. Arlington, VA: American Psychiatric Publishing; 2013.
- Bernhardt J, Usdan S, Burnett A. Using handheld computers for daily alcohol assessment: Results from a pilot study. *Journal of Substance Use*. 2005; 10:347–353.
- Collins LM, Graham JW, Hansen WB, Johnson CA. Agreement between retrospective accounts and earlier reported substance use. *Applied Psychological Measurement*. 1985; 9:301–309.
- Collins RL, Kashdan T, Gollnisch G. The feasibility of using cellular phones to collect ecological momentary assessment data: Application to alcohol consumption. *Experimental and Clinical Psychopharmacology*. 2003; 11:73–78. [PubMed: 12622345]
- Collins RL, Morsheimer E, Shiffman S, Paty J, Gnys M, Papandonatos G. Ecological momentary assessment in a behavioral drinking moderation training program. *Experimental and Clinical Psychopharmacology*. 1998; 6:306–315. [PubMed: 9725114]
- DiClemente C, Hughes S. Stages of change profiles in outpatient alcoholism treatment. *Journal of Substance Abuse*. 1990; 2:217–235. [PubMed: 2136111]
- Dulin P, Gonzalez V, Campbell K. Results of a pilot test of a self-administered smartphone-based treatment system for alcohol use disorders: Usability and early outcomes. *Substance Abuse*. 2014; 35:168–175. [PubMed: 24821354]
- Dulin P, Gonzalez V, King D, Giroux D, Bacon S. Development of a smartphone-based, self-administered intervention system for alcohol use disorders. *Alcoholism Treatment Quarterly*. 2013; 31:321–336.
- Fals-Stewart W, O'Farrell TJ, Freitas TT, McFarlin SK, Rutigliano P. The Timeline Followback reports of psychoactive substance use by drug-abusing patients: Psychometric properties. *Journal of Consulting and Clinical Psychology*. 2000; 68:134–144. DOI: 10.1037/0022-006X.68.1.134 [PubMed: 10710848]
- Gonzalez VM, Dulin P. Comparison of a smartphone app for alcohol use disorders with an internet-based intervention plus bibliotherapy: A pilot study. *Journal of Consulting and Clinical Psychology*. 2015; 83:335–345. [PubMed: 25622202]
- Harris KJ, Golbeck AL, Cronk NJ, Conway K, Catley D, Williams KB. Timeline follow-back versus global self-reports of tobacco smoking: A comparison of findings with nondaily smokers. *Psychology of Addictive Behaviors*. 2009; 23:368–372. [PubMed: 19586155]
- Huffman MR, Shields AL, Shiffman S, Paty J, Balabanis M. Reactivity to ecological momentary assessment: An example using undergraduate problem drinkers. *Psychology of Addictive Behaviors*. 2002; 16:205–211. [PubMed: 12236455]
- Kang, YM., Cho, C., Lee, S. Analysis of factors affecting the adoption of smartphones. Paper presented at the 2001 IEEE International Technology Management Conference; San Jose, CA. 2011 Jun. Abstract retrieved from <http://ieeexplore.ieee.org/xpls/icp.jsp?arnumber=5995985>
- Krenek M, Lyons R, Simpson TL. Degree of correspondence between daily monitoring and retrospective recall of alcohol use among men and women with comorbid AUD and PTSD. *The American Journal of Addictions*. 2016; 25:145–151.
- Kuntsche E, Labhart F. Using personal cell phones for ecological momentary assessment: An overview of current developments. *European Psychologist*. 2013; 18(1):3–11.
- Kuntsche E, Labhart F. The future is now: Using personal cellphones to gather data on substance use and related factors. *Addiction*. 2014; 109:1052–1053. [PubMed: 24754712]
- Lukasiewicz M, Benyamina A, Reynaud M, Falissard B. An in vivo study of the relationship between craving and reaction time during alcohol detoxification using the ecological momentary assessment. *Alcoholism: Clinical and Experimental Research*. 2005; 29:2135–2143.
- Lukasiewicz M, Fareng M, Benyamina A, Blecha L, Reynaud M, Falissard B. Ecological momentary assessment in addiction. *Expert Review of Neurotherapeutics*. 2007; 7(8):939–950. DOI: 10.1586/14737175.7.8.939 [PubMed: 17678488]
- Miller WR, Del Boca FK. Measurement of drinking behavior using the Form 90 family of instruments. *Journal of Studies on Alcohol*. 1994; 12:112–118. [PubMed: 7722987]

- Monk RL, Heim D, Qureshi A, Price A. "I have no clue what I drunk last night" Using smartphone technology to compare in-vivo and retrospective self-reports of alcohol consumption. *PLoS ONE*. 2015; 10(5):e0126209.doi: 10.1371/journal.pone.0126209 [PubMed: 25992573]
- Perrine M, Schroder KE. How Many Drinks Did You Have on September 11, 2001? *Journal of Studies on Alcohol*. 2005; 66:536–544. [PubMed: 16240561]
- Poushter, J. Smartphone ownership and internet usage continues to climb in emerging economies. 2016 Feb 22. Retrieved from Pew Research Center, Global Attitudes and Trends: <http://www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/>
- Searles JS, Helzer JE, Rose GL, Badger GJ. Concurrent and retrospective reports of alcohol consumption across 30, 90 and 366 days: Interactive voice response compared with the timeline follow back. *Journal of Studies on Alcohol*. 2002; 63(3):352–362. [PubMed: 12086136]
- Searles JS, Helzer JE, Walter DE. Comparison of drinking patterns measured by daily reports and Timeline Followback. *Psychology of Addictive Behaviors*. 2000; 14(3):277–286. [PubMed: 10998953]
- Shiffman S. Ecological momentary assessment (EMA) in studies of substance use. *Psychological Assessment*. 2009; 21:486–497. [PubMed: 19947783]
- Shiffman S, Hufford M, Hickcox M, Paty J, Gnys M, Kassel J. Remember that? A comparison of real-time versus retrospective recall of smoking lapses. *Journal of Consulting and Clinical Psychology*. 1997; 65:292–300. [PubMed: 9086693]
- Shiffman S, Stone AA, Hufford MR. Ecological momentary assessment. *Annual Review of Clinical Psychology*. 2008; 4:1–32.
- Sobell LC, Brown J, Leo GI, Sobell MB. The reliability of the Alcohol Timeline Followback when administered by telephone and by computer. *Drug and Alcohol Dependence*. 1996; 42:49–54. [PubMed: 8889403]
- Sobell LC, Maisto SA, Sobell MB, Cooper AM. Reliability of alcohol abusers' self-reports of drinking behavior. *Behaviour Research and Therapy*. 1979; 17:157–160. DOI: 10.1016/0005-7967(79)90025-1 [PubMed: 426744]
- Sobell LC, Sobell MB. Assessment of drinking behavior. In *National Institute on Alcohol Abuse and Alcoholism. A guide for clinicians and researchers* (2). 2003:75–100. Publication No. 03-3745.
- Stockwell T, Murphy D, Hodgson R. The severity of alcohol dependence questionnaire; Its use, reliability and validity. *British Journal of Addiction*. 1983; 78:145–155. [PubMed: 6135435]
- This wristband can measure your alcohol history from sweat. 2016 May 23. Retrieved from <http://www.telegraph.co.uk/technology/2016/05/23/this-wristband-can-measure-your-alcohol-history-from-sweat/>
- Toll BA, Cooney NL, McKee SA, O'Malley SS. Do daily interactive voice response reports of smoking behavior correspond with retrospective reports? *Psychology of Addictive Behaviors*. 2005; 19:291–295. [PubMed: 16187808]
- Verster J, Tiplady B, McKinney A. Mobile technology and naturalistic study designs in addiction research. *Current Drug Abuse Reviews*. 2012; 5:169–171. [PubMed: 23072287]

Table 1

Means, Standard Deviations and Correlations; TLFB and LBMI-A for 1-week intervals over 6 weeks.

<i>Ms and SDs</i>	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
LBMI-A DDD	7.01 (4.85)	7.41 (4.20)	5.83 (4.63)	6.45 (4.74)	5.89 (5.26)	6.10 (4.84)
TLFB DDD	5.63 (4.07)	5.58 (3.68)	5.74 (4.96)	5.52 (4.54)	5.66 (4.42)	5.69 (5.06)
LBMI-A PHDD	36.57 (26.75)	35.12 (26.32)	26.57 (25.59)	26.86 (25.19)	26.86 (29.54)	29.71 (34.73)
TLFB PHDD	30.10 (29.95)	29.59 (28.02)	25.00 (23.85)	21.94 (20.38)	24.51 (24.70)	25.51 (28.13)
LBMI-A PDA	42.86 (32.73)	48.81 (24.51)	57.14 (28.27)	59.43 (30.49)	56.57 (37.45)	55.43 (35.79)
TLFB PDA	43.88 (34.89)	49.49 (31.94)	57.14 (27.49)	60.21 (27.86)	54.60 (30.87)	53.57 (32.21)
Correlations						
DDD(LBMI-A and TLFB)	.49	.67	.64	.74	.88	.74
PHDD (LBMI-A and TLFB)	.85	.81	.78	.84	.74	.87
PDA(LBMI-A and TLFB)	.92	.79	.81	.88	.76	.76

Note. Week 1 refers to the most distal time between consumption and recall. Week 6 refers to the most proximal time between consumption and recall. All correlations are significant at $p < .01$. $N = 25$