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## Alcohol assessment using wireless handheld computers:

### A pilot study

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### Abstract

The present study sought to test the feasibility of measuring quantity and frequency of self-reported alcohol consumption among college students using the Handheld Assisted Network Diary (HAND) by comparing results to a retrospective Timeline Followback (TLFB). A total of 40 undergraduate college students completed a HAND assessment during the two-week study period and completed a TLFB at follow-up. The HAND recorded similar levels of alcohol consumption compared to the TLFB. There were no significant differences in overall alcohol consumption, drinks per drinking day, or heavy drinking days between the two methods of assessment. Handheld computers may represent a useful tool for assessing daily alcohol use among college students.

### Keywords

alcohol assessment; college students; handheld computers

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## 1. Introduction

Heavy alcohol use among college students is a significant public health concern (National Institute of Alcohol Abuse and Alcoholism [NIAAA], 2002). Estimates indicate that 80% of college students drink alcohol and over 40% report recent heavy drinking (NIAAA, 2002). A number of negative consequences, including death, injury, violence, unsafe or unwanted sexual experiences, drinking and driving, legal and academic problems are commonly associated with collegiate alcohol consumption (Hingson et al., 2002; Wechsler et al., 2002).

Methodological issues complicate the measurement of alcohol use, including the reference period chosen and the questions selected to measure quantity and frequency of alcohol use (Dawson, 2003). The Timeline Followback (TLFB) assessment method has been shown to be a psychometrically sound method for obtaining retrospective estimates of alcohol consumption (Sobell et al., 1986). However, measurement of patterns and contexts of alcohol use among college students is particularly difficult because student drinking behaviors are characterized by erratic, heavy drinking episodes. Handheld computers may offer numerous advantages over traditional methods of measurement that may be useful in improving the assessment of the patterns and contexts of alcohol use among college students. These advantages include the potential to gather event-specific information through daily monitoring; the elimination of data entry and paper-based records; and the capability to check the range or response options, provide users with personalized questions and feedback, and allow for direct importation of information (Bernhardt et al., 2001). Further, using handheld computers for daily alcohol assessment may offer significant improvements in response rates and complexity of data collected. Searles and colleagues (1995), for example, found their daily assessment approach of alcohol to have an overall response rate of 93%.

Few studies have assessed the use of handheld computers for alcohol assessment among college students (Bernhardt et al., 2005). This pilot study sought to test the feasibility and consistency of measuring quantity and frequency of self-reported alcohol consumption among college students using the Handheld Assisted Network Diary (HAND) assessment by comparing individual results for the same reference period to the Time Line Followback (TLFB) (Sobell et al., 1986).

## 2. Method

### 2.1 Sample

The convenience sample consisted of 40 college students between 18 and 21 years of age at a private university in the southeastern United States. The mean age was 19.20 years (range 18-21 years; SD 0.911 years). The majority of the sample was female (55%) and White/Caucasian (78%). Students who reported drinking less than twice a week and non-traditional students (those under 18 years of age or attending the college as an exchange student) were excluded from the study.

## 2.2 Research Design and Procedures

Participants completed baseline measures and were given a wireless personal digital assistant (PDA) with the HAND assessment and instructions for how to complete and upload the daily survey. Participants were instructed to complete the HAND assessment each day for the two-week study period. The HAND assessment was designed using EntryWare™ Designer software developed by Techneos Systems, Inc., and was enabled to transmit data securely to a web-based server using wireless communication capabilities after completion. Participants who did not complete an assessment by noon each day were sent e-mail and phone call messages from the researchers reminding them to complete the assessment and transmit their data.

## 2.3 Measures

All participants completed baseline measures including a two-week TLFB assessment of alcohol use before receiving the HAND assessment. Standard drinks were defined on the TLFB and HAND as 12 ounces of beer, five ounces of wine or champagne, three ounces of fortified wine, or 1.5 ounces of hard liquor. All participants completed similar follow-up surveys two weeks after baseline sessions including a TLFB assessment covering the same reference period.

The HAND asked whether participants consumed alcohol during the previous day and if so, how many standard drinks were consumed. If participants reported alcohol consumption, they were asked further questions about the context and consequences of their drinking experience. The content of the HAND was informed by focus groups with college students held earlier in the year.

## 2.4 Analyses

Statistical tests were performed using SPSS 14.0 to assess agreement between the HAND and the follow up TLFB in measuring overall levels of alcohol consumption. Paired samples t-tests were conducted to assess the differences in levels and patterns of alcohol consumption captured by the two methods. Plots of agreement between the HAND and TLFB using the method suggested by Ludbrook (2002) for sample sizes of less than 100 participants are presented.

## 3. Results

### 3.1 Consistency between the HAND and TLFB

Out of 14 possible daily HAND assessments, the mean number of completed daily HAND assessments per participant was 11.13 (SD=2.17), with an average completion rate of 79.46% (SD=15.53%) per participant. All participants promptly returned their HAND devices at the end of the study period. The HAND recorded a total of 132 drinking days and the TLFB recorded 153 drinking days. The mean total alcohol reported on the HAND was 22.6 drinks (SD=17.6) and 23.7 drinks (SD=21.6) on the TLFB ( $t=0.418$ ,  $p=.679$ ). The mean number of drinks per drinking day reported over the course of the study on the HAND was 6.15 (SD=2.79) drinks and 5.67 (SD=3.41) drinks on the TLFB ( $t=1.34$ ,  $p=.191$ ). The mean

number of heavy drinking episodes reported over the course of the study on the HAND was 2.13 (SD=1.90) vs. 2.15 (SD=1.77) on the TLFB ( $t=-0.110$ ,  $p=.913$ ).

The difference in drinks per drinking day on the HAND and the TLFB were within one standard drink for 64% of participants, higher within two standard drinks on the HAND for 25% of participants, and higher within two standard drinks on the TLFB for 38% of participants (Figure 1). The mean difference in drinks per drinking day for each participant on the HAND and TLFB was 0.48 (SD=2.05). The 95% limits of agreement for drinks per drinking day measure using the HAND and TLFB using Ludbrook's (2002) comparison method for small sample sizes were -2.66 to 1.66. A total of 77.8% of the data fell within this agreement interval.

#### 4. Discussion

The present study provides preliminary evidence for the feasibility of measuring self-reported quantity and frequency of alcohol use among college students using the HAND assessment by comparing it to a retrospective TLFB measure. Although the TLFB captured drinking data on more days than the HAND for most participants, the HAND nonetheless proved feasible for the successful collection of drinking data from all participants. Further, data were collected in real time using wireless technology and all devices were promptly returned at the study's end in good working condition.

No significant differences were revealed when comparing several alcohol consumption variables measured on the HAND and TLFB, including overall level of alcohol consumption, drinks per drinking day, and heavy drinking episodes, indicating that the two methods obtained similar levels of reported alcohol consumption over the course of the study. Additionally, using a more conservative method for the 95% limits of agreement analyses offered by Ludbrook (2002) for smaller samples, nearly 80% of the data were still within the agreement interval. These results indicate a high level of agreement in drinks per drinking day between the HAND and TLFB.

The present study demonstrates that the HAND is capable of capturing levels of alcohol consumption similar to the TLFB among college student drinkers. The feasibility and consistency of the HAND among college students is important for future research due to the prevalence of heavy drinking within this population. Research has identified brief, personalized intervention strategies as one of the few effective approaches to reduce heavy drinking among college students (Larimer & Cronce, 2002) and utilizing technology such as the HAND to accurately identify drinking patterns may increase the success of such prevention programs.

The results of this study must be considered in light of a number of limitations. The study used a convenience sample of college students who reported moderate alcohol consumption prior to the study. While previous research has illustrated that self-reports of alcohol use are reliable (Midanik, 1988), all drinking behaviors are based on self-report, and results presented should be interpreted with this limitation in mind. Although both measures captured largely consistent data, the TLFB captured data for more study days than the

HAND for most participants. The retrospective nature of the TLFB is subject to memory recall bias which may have an impact on these findings. The act of completing the daily questionnaire on the HAND assessment over the course of the study may have made participants more cognizant of their drinking behavior, thus affecting either their actual drinking patterns or their reporting of alcohol use at follow up. Another limitation to this study is that the reference period used (two weeks) was short, and one would expect to see greater variability among participants studied over a longer time period.

Study findings suggest that the HAND assessment represents a feasible method to assess alcohol use among college students. Because the HAND facilitates the daily collection of alcohol consumption information and offers the capability to collect in-depth information on the contextual factors and negative consequences of alcohol use, this tool may help to further the delivery of individualized interventions and harm reduction strategies. As such, tailored prevention messages could be automatically delivered to each individual HAND user based on their frequency and type of drinking patterns and any associated consequences.

Three research implications are proposed based on the present findings. First, the HAND should be tested in larger samples of college students in order to further establish the validity of the assessment. Second, future studies should utilize this method of data collection to assess the contexts of alcohol use and other substance use behaviors among more diverse populations in order to further validate the HAND. Finally, alcohol research using the HAND should be conducted over a longer period of time to determine if this assessment method can maintain its high rates of completion.

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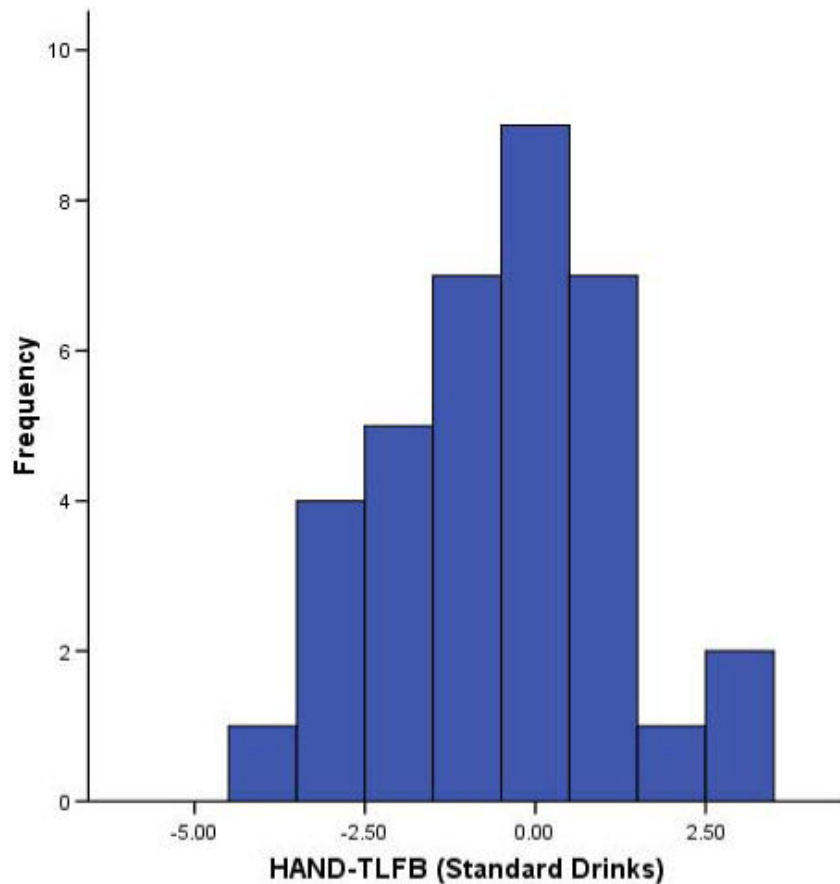
The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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**Figure 1. Difference in drinks per drinking day: HAND - TLFB**

Difference = standard drinks per drinking day on TLFB subtracted from standard drinks on HAND. Standard drinks were defined as 12 ounces of beer, 5 ounces of wine or champagne, 3 ounces of fortified wine, or 1.5 ounces of hard liquor. The differences in drinks per drinking day between the two measures were within one standard drink for 64% of participants, were higher within two standard drinks on the HAND for 25% of participants, and were higher within two standard drinks on the TLFB for 38% of participants.