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A Controlled Trial of Web-Based Feedback for Heavy Drinking College Students

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Abstract *Objective*: Alcohol consumption has been a growing concern at U.S. colleges, particularly among first-year students, who are at increased risk for problems. This study tested the efficacy of the "electronic Check-Up to Go" (e-CHUG), a commercially-available internet program, at reducing drinking among a group of at-risk college freshman. *Method*: The design was a randomized controlled trial: 106 freshmen students who reported heavy episodic drinking were randomly assigned to receive feedback or to assessment only. Assessment measures were completed at baseline, 8 weeks, and 16 weeks. *Results*: At 8 weeks, the feedback group showed a significant decrease in drinks per week and peak BAC over control. By 16 weeks, the control group also declined to a point where there were no differences between groups. Changes in normative drinking estimates mediated the effect of the intervention. An additional 245 abstainers and light drinkers who were also randomized to condition did not show any intervention effect. *Conclusions*: This study provides preliminary support for the efficacy of this intervention at reducing short-term drinking among at-risk students.

Keywords Alcohol · Brief intervention · Web · College students

Introduction

Heavy episodic drinking at U.S. colleges is a significant public health problem. Although on average students drink only

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slightly more than older adults, college drinking tends to be more risky; students are much more likely to "bunch" drinks together in heavy episodes. In nationwide surveys, 40% of students report a heavy drinking (i.e., "binge") episode in the past two weeks (Johnston, O'Malley, & Bachman, 2000; Wechsler et al., 2002). This pattern is associated with poorer school performance, drinking and driving, rape and violence, and a substantial cost to the community (Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002; Schuckit, Klein, Twitchell, Springer, 1994). First year students seem to be at particular risk for alcohol misuse (Wechsler et al., 2002); young adults tend to greatly increase their drinking upon entrance to college (O'Malley & Johnston, 2002) and are more likely to experience drinking-related consequences than older students (Turrisi, Wiersma, & Hughes, 2000).

One brief intervention that has shown support in the literature is motivational feedback (Walters & Neighbors, 2005). Drawing from motivational interviewing (Miller & Rollnick, 2002) and social psychology (Bandura, 1994) approaches, feedback interventions rely on a presentation of discrepant information such as a quantity/frequency summary, drinking-related consequences, risk factors, and a comparison of the student's drinking to campus or national norms. Most feedback programs include components of the FRAMES intervention model (Miller & Rollnick, 2002), such as *F*eedback given to the individual about consumption and risk factors; an emphasis on personal *R*esponsibility for change; *A*dvice provision; a *M*enu of options; an *E*mpathic, nonjudgmental style; and a support of *S*elf-Efficacy.

As part of a brief motivational interview (Miller & Rollnick, 2002), feedback has been shown to reduce drinking whether presented by an empathic therapist (Baer et al., 1992; Borsari & Carey, 2000; Marlatt et al., 1998) or a trained peer (Larimer et al., 2001). Other studies have found reductions

in drinking as the result of feedback delivered through the mail (Agostinelli, Brown, & Miller, 1995; Collins, Carey, & Sliwinski, 2002; Walters, 2000; Walters, Bennett, & Miller, 2000) or computer (Neighbors, Larimer, & Lewis, 2004). For instance, Walters, Bennett, and Miller (2000) found reductions at a 6-week follow-up from students receiving mailed feedback, as compared to an assessment-only control condition. Likewise, Neighbors, Larimer, and Lewis (2004) found 6-month reductions in drinking as the result of a brief computerized feedback report. Collins, Carey, and Sliwinski (2002) found reductions at 6-weeks using mailed feedback, though decreases were no longer evident at 6-months.

The electronic-Check-Up to Go (e-CHUG; http://www. e-chug.com) is a commercially available feedback program that is managed by the non-profit San Diego State University Foundation. After completing an online assessment, students are presented with a personalized feedback report consisting of: (1) A quantity/frequency drinking summary (number of standard drinks consumed, peak blood alcohol level, caloric "cheeseburger" equivalent), (2) Comparison to U.S. adult and college drinking norms, (3) Estimated level of risk (AUDIT score, genetic risk of alcoholism, tolerance), (4) Amount of money spent per year on alcohol, (5) cigarettes smoked per month, and (6) Explanation, advice, and local referral information. Currently, 250 colleges and universities subscribe to e-CHUG, with more than 150,000 students having taken the program since it was implemented in 2002 (Personal communication, Richard Moyer, May 19, 2006). In past studies, Walters and colleagues have reported significant effects of the mailed version of the program prior to its web-based adaptation (Walters, 2000; Walters et al., 2000; Walters & Woodall, 2003). However, to date no published studies have evaluated this web-based program in a randomized trial. In addition, based on recent research (Lewis & Neighbors 2006; Neighbors et al., 2004; Perkins, Haines, & Rice, 2005) we were interested in whether changes in perceived norms might mediate an intervention effect.

Method

Study design

The study was a randomized controlled trial. After completing baseline assessments, participants were assigned to receive personalized feedback or to an assessment-only control group. This project was approved by the Institutional Review Boards of the University of Texas Health Science Center at Houston and the University of Texas at Dallas.

Participants

Participants were first-year students at a large Southern public university. Participation was open to all first-year students, regardless of their drinking status. Participants were offered a chance to win one of ten $100 cash prizes awarded at the completion of each assessment point. Based on studies using a similar design but mailed feedback, the estimated number of persons required per group was 41 (Cohen, 1988).

Procedure

After providing consent, participants received an email directing them to a secure website where they entered their last name and personal identification number (PIN). After completing the baseline assessment, students were randomized to receive feedback or to an assessment-only control group. The feedback group received a personalized report, which was displayed immediately on the screen. At 8 and 16 weeks, participants were sent an email prompt to complete a follow-up assessment, followed by a reminder email (5 days later), and, if necessary, a telephone call (10 days later). The control group received feedback after the 16-week assessment.

Measures

Measures were completed at baseline, 8 weeks, and 16 weeks. All responses were self-report and entered into the research website. Alcohol consumption was measured using a 7-day drinking calendar similar to the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985). Participants were asked to think about a typical week during the last month and for each day, to record the number of standard drinks they typically consumed on that day. Such measures have been shown to be reliable and valid indicators of drinking whether delivered by traditional means (Williams, Aitken, & Malin, 1985; Wolber, Carne, & Alexander, 1990) or online (Miller et al., 2002). To obtain a peak blood alcohol concentration (BAC), similar questions were posed regarding the heaviest drinking episode during the past 30 days, the number of hours over which the alcohol was consumed, and the student's gender and weight. The 23-item Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989) measured consequences related to drinking in the last 30 days. The RAPI has good reliability in college student populations (Borsari & Carey, 2000; Neal & Carey, 2004). Participants also provided estimates of their drinking relative to other U.S. college students (i.e., "What percent of U.S. college students drink more than you?"). Finally, several additional questions (e.g., AUDIT screening questions, genetic risk of alcoholism, weight, amount of money spent on

alcohol) were included for the purpose of providing feedback on these variables.

Results

Of the 351 students who completed the baseline assessment, 106 (30.1%) reported at least one heavy drinking episode in the previous month (i.e., 5 or more drinks on one occasion for men, 4 or more drinks for women). (One additional case was excluded because of extreme values). The intervention was aimed at at-risk students and thus the remaining 245 students who reported no heavy episodes are excluded from analyses, except where mentioned. At baseline, there were no significant differences between the intervention and control groups in terms of gender, ethnicity or drinking. The sample was approximately half female (48.1%) and mostly Caucasian (72.7%). Seventy-six (71.7% of baseline) students completed the 8-week assessment, and 82 (77.4% of baseline) students completed the 16-week assessment. Although there were no significant differences between completers and non-completers in terms of gender, ethnicity or baseline drinking, missing data were multiply imputed and combined using the Markov Chain Monte Carlo method (Rubin, 1987; Schafer, 1997). Table 1 shows means and confidence intervals for drinks per week, peak BAC, RAPI score, and discrepancies in perceived norms at baseline, when no data were missing, and at the two follow-up times using imputed data. Means based on available cases fell within ± 20% of the corresponding imputed means.

For the entire group, there was a significant decrease from baseline to 8 weeks in drinks per week ($t = -4.87$, 64.2 d.f., $p < .001$) and peak BAC ($t = -5.28$, 64.2 d.f., $p < .001$) but not in RAPI score ($t = -1.53$, 45.1 d.f., $p = .134$). From baseline to 16 weeks there was a significant overall decrease in drinks per week ($t = -6.00$, 50.7 d.f., $p < .001$),

peak BAC ($t = -6.33$, 54.4 d.f., $p < .001$), and RAPI score ($t = -3.96$, 73.8 d.f., $p < .001$). There was also a significant decrease in the discrepancy of perceived norm estimates from baseline to 8 weeks ($t = -3.31$, $p < .01$) and from baseline to 16 weeks ($t = -4.61$, $p < .001$), meaning that participants became more accurate in estimating how their drinking compared to others.

Figure 1 presents the means for drinks per week and peak BAC. Visually, the figure suggests larger decreases in the intervention group from baseline to 8 weeks, followed by larger decreases in the control group from 8 weeks to 16 weeks, reducing or eliminating the between group differences at 16 weeks. We tested this pattern via a mixed effects repeated measures analysis with linear and quadratic time effects. The interaction of the quadratic component with intervention group was significant at the .05 level, supporting the visual impression of different time paths.

To test the effect of the intervention on the three drinking outcomes from 0–8 weeks, we regressed the log transformed 8-week values on the corresponding baseline values and experimental group. Group differences were significant for drinks per week and peak BAC. For drinks per week, this regression coefficient was $-.565$ ($p = .0083$), indicating a 43% reduction in the intervention group relative to changes in the control group. For peak BAC the coefficient was $-.702$ ($p = .012$), indicating a 50% reduction relative to the control group. Eight-week group differences for RAPI and 16-week differences for all measures were not significant. Among the additional group of baseline abstainers and light drinkers, there were no significant changes in drinking over the 16-week period and no changes in drinking as a function of experimental group.

To a considerable extent, perceived norm estimates mediated the effect of the intervention on drinks per week and peak BAC at the 8-week follow-up. Following the logic of Baron and Kenny (1986), we tested for mediation via a series of regression models. For drinks per week,

Table 1 Drinks per week, peak BAC, RAPI, and perceived norm estimates at baseline and follow-ups, by experimental group[a]

Outcome	Group	Baseline		8 weeks[b]		16 weeks[b]	
		Mean	95% CI	Mean	95% CI	Mean	95% CI
Drinks per week	Intervention	8.92	6.62, 11.90	3.33	1.90, 5.46	3.17	1.67, 5.51
	Control	7.7	5.67, 10.35	5.83	3.89, 8.56	2.98	1.76, 4.72
Peak BAC	Intervention	0.179	0.152, 0.209	0.053	0.030, 0.088	0.052	0.027, 0.094
	Control	0.168	0.145, 0.194	0.11	0.073, 0.163	0.059	0.035, 0.093
RAPI	Intervention	2.34	1.58, 3.31	1.73	1.00, 2.74	1.51	0.90, 2.32
	Control	3.03	2.11, 4.23	2.75	1.75, 4.12	1.72	1.09, 2.55
Perceived norm estimates	Intervention	28.3	23.2, 33.5	7.8	−0.7, 16.3	10.3	2.5, 18.1
	Control	28.3	21.6, 35.0	26.1	17.6, 34.5	18.7	12.3, 25.0

[a] Drinks per week, peak BAC, and RAPI variables were log transformed for calculation of means and CIs, and back-transformed to display the estimates shown here.

[b] Based on imputed data.

Fig. 1 Peak BAC and drinks per week for binge drinkers at baseline and follow-ups, by experimental group
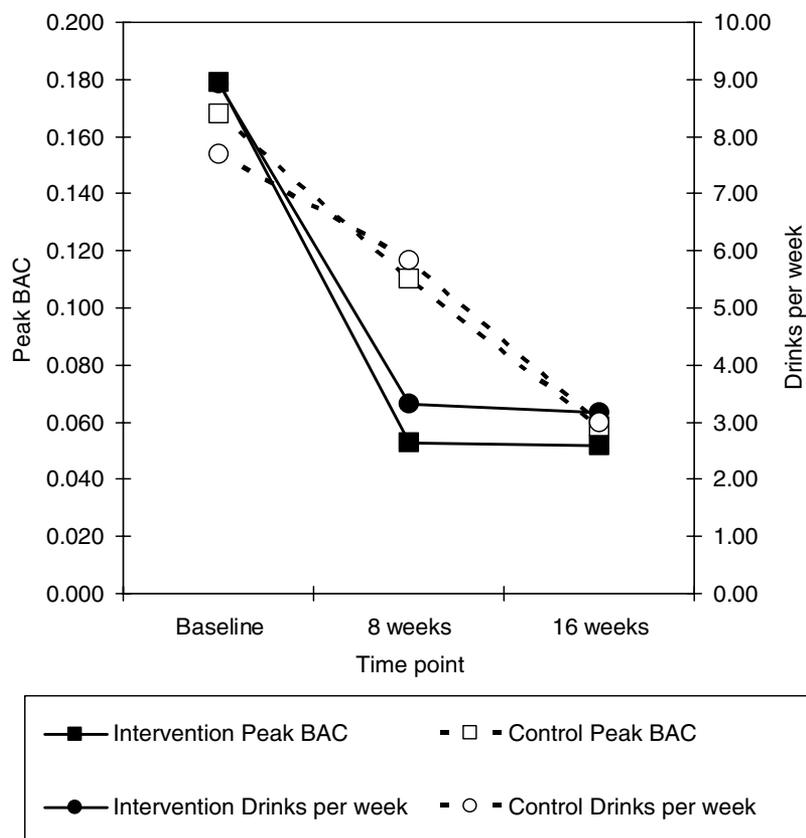
intervention group strongly predicted change at the follow-up; intervention group strongly predicted change in perceived norm estimates ($b = -19.5$, $p < 0.001$, indicating that the tendency to become more accurate in normative estimates was 20% greater in the intervention group); change in perceived norm estimates strongly predicted drinks per week at 8 weeks, holding baseline variables and intervention group constant ($b = 0.0140$, $p = 0.004$, indicating that a 1% change toward more accurate norm estimates corresponded to 1.4% decrease in drinking); and adding the mediator to the regression model reduced the magnitude of the intervention group coefficient by 48%, which made this reduced coefficient nonsignificant. Results were similar for peak BAC: intervention group strongly predicted change at follow-up; intervention group strongly predicted change in perceived norm estimates; change in perceived norm estimates strongly predicted peak BAC at 8 weeks, holding baseline variables and intervention group constant ($b = 0.0137$, $p = 0.004$, indicating that a 1% change toward more accurate norm estimates corresponded to a 1.37% decrease in peak BAC); and adding the mediator to the regression model reduced the magnitude of the intervention group regression coefficient by 65% and made it nonsignificant.

Discussion

We found that personalized feedback accelerated a decline in drinking over 16-weeks, as compared to students who did not receive any feedback. Changes in perceived norm estimates mediated the effect of the intervention on drinks per week and peak BAC. The changes in drinking during this period also seem to be clinically significant: From 0–8 weeks, participants in the intervention group reported an additional decrease over control of 3.72 drinks per week and .068 mg% in peak BAC. Between 8 and 16 weeks, students in the control group also decreased their drinking, such that from baseline to 16 weeks there was a significant decrease in both groups, but no difference between them at the final assessment. The lack of effect among abstainers and light drinkers is also encouraging. Although interventions of this type have occasionally been associated with iatrogenic effects in other areas (e.g., Graboski, 1996), our findings are consistent with the bulk of the drinking literature that suggests that personalized feedback seems not to harm abstainers and light drinkers (personal communication, M. Larimer, January 15, 2004; Walters & Woodall, 2003).

This study was limited in that we used a captured sample of convenience, a relatively short follow-up period, self-report questionnaires, and had a relatively high rate of attrition. Our mediator findings may have been different if we had picked a different metric (e.g., number of heavy episodes), referent group (e.g., campus-specific norms), or time period. A more stringent procedure would have been to examine changes in perceptions from 0–8 weeks as a mediator of changes in drinking from 0–16 weeks; because there were no differences between groups at the 16 week follow-up, we could not use this more conservative strategy. We also assumed that data were missing at random. Despite these limitations, we did find results, in intervention and mediator effects, which were consistent with previous research (Collins, Carey, & Sliwinski, 2002; Neighbors, Larimer, & Lewis, 2004; Walters, 2000; Walters & Neighbors, 2005). Strengths of the study include a standardized randomization and intervention, and baseline and follow-up assessments. In addition, this trial was conducted in a naturalistic setting, which suggests that the results may better generalize to other college settings.

These findings suggest that this intervention led to earlier reductions in drinking, and did so at least partially by correcting normative perceptions. Most studies do not show a substantial decrease in drinking over the course of the freshman year, but do suggest substantial variability (Del Boca, Darkes, Greenbaum, & Goldman, 2004). We had picked our assessment times to capture what we thought would be more stable drinking periods—early October, December, and February. However, it is possible that our assessment periods captured atypical drinking or that the overall drinking decreases reflect regression to the mean. Some contamination of the experimental groups might explain the delayed effect in the control group. Although students in the experimental group were asked not to share their feedback, it is conceivable that some may have talked about or shown their report to other students. Finally, the repeated assessments may have contributed to the overall decrease in drinking. Indeed, self-monitoring alone may function as an intervention, though no college studies have specifically measured the effect of repeated assessments (Baer et al., 1992; Larimer et al., 2001; Marlatt et al., 1998). This possibility would argue for including a no- or minimal-assessment control group in future studies.

In sum, this study provides some support for the efficacy of the e-CHUG at reducing two indicators of risky alcohol use for heavy episodic drinkers and suggests that it does so, at least partially, by correcting normative perceptions. Further work would help determine the effective components of feedback interventions, as well as ways to more effectively market and integrate feedback into larger prevention and intervention systems.

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