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Personalized Mailed Feedback for College Drinking Prevention: A Randomized Clinical Trial

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Abstract

The current study was designed to evaluate the efficacy of a mailed feedback and tips intervention as a universal prevention strategy for college drinking. Participants ($N = 1,488$) were randomly assigned to feedback or assessment-only control conditions. Results indicated that the mailed feedback intervention had a preventive effect on drinking rates overall, with participants in the feedback condition consuming less alcohol at follow-up in comparison with controls. In addition, abstainers in the feedback condition were twice as likely to remain abstinent from alcohol at follow-up in comparison with control participants (odds ratio = 2.02), and feedback participants were significantly more likely to refrain from heavy episodic drinking (odds ratio = 1.43). Neither

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gender nor severity of baseline drinking moderated the efficacy of the intervention in these analyses, but more conservative analyses utilizing last-observation carryforward suggested women and abstainers benefited more from this prevention approach. Protective behaviors mediated intervention efficacy, with participants who received the intervention being more likely to use strategies such as setting limits and alternating alcohol with nonalcoholic beverages. Implications of these findings for universal prevention of college drinking are discussed.

Keywords

college; alcohol; skills; brief intervention; motivation

Preventing or reducing heavy drinking and related consequences on college campuses has been the focus of considerable research and administrative attention. A recent task force comprising researchers and college presidents devoted more than 2 years to reviewing the literature and making recommendations regarding those interventions most likely to be effective in combating this serious public health problem (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2002). Among those strategies identified as efficacious, motivational enhancement and multicomponent, skills-based approaches have received considerable support (Larimer & Cronce, 2002; NIAAA, 2002; Walters & Neighbors, 2005). These interventions usually combine a motivational interviewing style (W. R. Miller & Rollnick, 2002) with provision of personalized feedback, which typically includes drinking patterns and percentiles, accurate norms for alcohol use on campus, correction of myths regarding alcohol, negative drinking consequences, and protective behaviors or skills (Martens et al., 2004) individuals can use to reduce drinking and its consequences (Dimeff, Baer, Kivlahan, & Marlatt, 1999). Numerous studies support the efficacy of such interventions delivered in person with high-risk or heavy-drinking college students (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001; Borsari & Carey, 2000; Larimer et al., 2001; Marlatt et al., 1998; Murphy et al., 2001).

The provision of feedback in such interventions is designed to activate existing self-regulatory processes, in part through highlighting discrepancies between the individual's current behavior and his or her goals, values, or desired state of being. Development of discrepancies is believed to promote readiness to change behavior (Prochaska & DiClemente, 1986) as well as actual behavior change in order to reduce the experienced discrepancy (W. R. Miller & Rollnick, 2002). Feedback is also designed to help correct misperceptions and myths related to high-risk drinking, such as misperception of the normative nature of heavy drinking (Perkins, 2002) or perceptions of positive alcohol effects on socialization (Darkes & Goldman, 1998), which may promote or encourage heavy drinking in college even among those who have not previously consumed alcohol heavily (Dunn & Goldman, 1996). Finally, feedback is designed to highlight experienced consequences and personalized risks of drinking, as well as to provide a brief introduction to strategies the participant could use to reduce risks. Such protective behavioral strategies have been shown to be related to reductions in drinking and related risks in college populations (Martens et al., 2004).

Despite evidence of efficacy and strong theoretical support, there are several practical barriers to widespread implementation of motivational feedback and skills-based individual interventions on college campuses. Provision of these interventions requires specialized training and ongoing supervision, and many campuses do not have staffing and resources needed to implement researched approaches (Larimer, Kilmer, & Lee, 2005; Liddle et al., 2002; Simpson, 2002). In addition, many students are not interested in seeking in-person alcohol prevention services (Gries, Black, & Coster, 1995). Interventions that require

students to make a substantial investment of time may have considerable difficulty reaching students. In addition, provision of in-person motivational or skills interventions as a preventive intervention for students who currently do not drink or drink very little is not resource efficient. Some research has indicated these interventions serve a preventive role for abstinent and light-drinking students (E. T. Miller et al., 2002), whereas other research has suggested they are more efficacious for heavier drinkers (Murphy et al., 2001). Existing research has yet to evaluate theoretical concerns regarding potential iatrogenic effects of providing feedback and moderate-drinking tips to abstinent students. Thus, campuses seeking universal prevention strategies (Institute of Medicine, 1994) that can be implemented in a cost-effective manner with a broad spectrum of students have had few options.

In response to some of these concerns, several studies have examined effects of personalized feedback alone in reducing alcohol use and related consequences in college populations. The feedback used in these interventions, typically delivered via mail or computer, has varied from multicomponent feedback analogous to that used in person to single-component normative feedback alone. These studies have found written (White et al., 2006), mailed (Agostinelli, Brown, & Miller, 1995; S. E. Collins, Carey, & Sliwinski, 2002; Walters, Bennett, & Miller, 2000; Walters, Bennett, & Noto, 2000), or computerized feedback (Neighbors, Larimer, & Lewis, 2004; Neighbors, Lewis, Bergstrom, & Larimer, 2006) alone to be as efficacious or more efficacious than in-person group or individual interventions (Walters & Neighbors, 2005; White et al., 2006). Results of these interventions are promising, particularly given the easy accessibility of stand-alone feedback for the broad population of college students; however, the studies in general have been limited by small sample sizes and relatively short-term follow-up, ranging from 6 weeks to 6 months. Further, all studies of stand-alone feedback have focused on at-risk drinkers in an indicated prevention context, and relatively few have examined moderators and mediators of intervention efficacy.

S. E. Collins et al. (2002) improved upon earlier studies of mailed feedback by incorporating a 6-month follow-up and including a larger sample ($N = 100$) to test the discrepancy between self and others' drinking as a mediator of intervention effects. Results indicated that individuals who had received the mailed feedback intervention reported increased discrepancy between self and others' drinking and reductions in both heavy episodic drinking episodes and number of drinks consumed in their heaviest drinking week compared with the control group at 6 weeks; however, these effects were not maintained at 6 months. There were no intervention effects on negative consequences, and S. E. Collins et al. hypothesized that this might be because of failure to include negative consequences in the feedback. Neighbors et al. (2004) similarly found that changes in perceptions of descriptive drinking norms (perceptions of how much other students drink) mediated the results of their computerized normative feedback intervention; they reported drinking reductions at 3- and 6-month follow-ups in the intervention compared with assessment-only controls.

Although normative perceptions were shown to mediate efficacy of these mailed and computerized feedback interventions for high-risk drinkers, no research has evaluated other hypothesized mediators of multicomponent, feedback-based interventions, specifically, use of protective behavioral strategies to avoid high-risk drinking and related consequences. Recent research has suggested such strategies are related to reduced drinking and related harm (Martens et al., 2004), and thus it is possible that these strategies may be particularly relevant for maintaining low-risk drinking patterns over time in a universal prevention context.

The current study was designed to replicate and extend prior work on mailed feedback interventions by (a) broadly implementing a comprehensive mailed feedback intervention in a universal prevention context with a large population of college students and (b) conducting follow-up 1 year postintervention to assess longterm effects on drinking. We expected that feedback would be associated with reduced drinking overall, reduced likelihood of heavy episodic drinking (Wechsler et al., 2002), and increased likelihood of remaining abstinent compared with assessment-only controls (E. T. Miller et al., 2002). We further hypothesized that perceived descriptive norms (Neighbors et al., 2004) and increased use of protective behavioral strategies (Martens et al., 2004) would mediate intervention efficacy. Finally, on the basis of prior research, we hypothesized that women (Murphy et al., 2004; Saunders, Kypri, Walters, LaForge, & Larimer, 2004) and heavier drinkers (Murphy et al., 2001) would be more responsive to the feedback intervention.

Method

Participants and Recruitment

Participants were students in the Wave 3 assessment of a larger, 5-year, longitudinal, multisite study of campuswide and individual alcohol interventions. Prior to Wave 3, only campuswide socialnorms-based, social marketing interventions were implemented. The personalized feedback intervention was tested at a mediumsized, 4-year West Coast public university beginning in fall of 2001. Participants were eligible for the longitudinal feedback study if they participated in Wave 3 and were not graduating from the university prior to Wave 4, which was conducted 12 months later.

For each wave of the study (beginning with Wave 1), a random sample of enrolled students was provided by the registrar and received a mailed invitation to participate in the Web-based study. Nonresponders received e-mail and postcard reminders and a mailed survey. Incentives included a choice of a \$10 check, two movie tickets, or entry in a drawing for a \$1,000 gift certificate. Odds of winning the lottery depended on how many students selected the lottery option (versus receiving movie tickets or \$10) each year (odds were 1 in 369 for Wave 3; 1 in 373 for Wave 4). Participants were more likely to choose guaranteed incentives (42% chose \$10 and 41% chose movie tickets) compared with the drawing (17%). Procedures were approved by the Human Subjects Review Board at both the campus where data collection occurred and the parent institution where the principal investigator was located, and a federal certificate of confidentiality was obtained. There were no adverse events reported.

After initial enrollment, participants were followed annually until graduation via Web-based surveys. Thus, the sample for the current study consisted of both participants first invited for participation in Wave 3 and students who had first participated in the Wave 1 or Wave 2 surveys. Of the 2,109 (35% of those invited) who responded to Wave 3, 1,310 (62%) were new recruits at Wave 3, 602 (29%) first participated in Wave 2, and 197 (9%) first participated in Wave 1. Overall, the response rate to Wave 3 assessment was similar to the rate at Wave 2 (34.5%) and higher than response to Wave 1 (21%), which served as a pilot year and was conducted with the lottery incentive only. An additional 1.5% actively declined participation at Wave 3, and the remainder were nonresponders.

Of 2,109 Wave 3 respondents, 1,488 students ($M = 20.60$ years, $SD = 2.95$) were not graduating prior to Wave 4 and thus were eligible for participation in the longitudinal feedback study. Of these, 64% were first recruited in Wave 3, 28% in Wave 2, and 8% in Wave 1, as participants from earlier waves were more likely to graduate prior to Wave 4. These 1,488 participants were randomly assigned to feedback or assessment control conditions. Of these, 1,000 (67.2%) were retained at Wave 4. They consisted of 296 (29.6%)

men and 704 (70.4%) women. At baseline, 39.5% were freshmen, 27.1% were sophomores, 24.1% were juniors, and 9.2% were seniors. The sample included 0.8% African Americans, 7.8% Asian Americans, 80.8% Caucasians, 3.1% Hispanic/Latino/ Latinas, and 7.5% other. Compared with campus demographics, the participating sample included more women (57.4% of the campus), more freshmen (23.9% of the campus), and fewer seniors (28.4% of the campus). However, freshmen were oversampled and seniors were undersampled by design (because of graduation prior to Wave 4); thus, participants were representative of the invited sample other than in the overrepresentation of women. This was also the case in each of the previous study waves.

Measures

Assessments were conducted online during the same period each year, and there were no differences in assessment windows between intervention and control participants. The assessment battery for the larger study included a variety of constructs relevant to college drinking. Measures of relevance to the current study are described in detail below.

Quantity/Frequency/Peak questionnaire (QFP)—Drinking behavior was assessed with the QFP (Dimeff et al., 1999; Marlatt et al., 1998). Participants reported the number of drinks and hours spent drinking on a peak drinking occasion (used to estimate peak blood alcohol content; Dimeff et al., 1999) during the past month and how many days of the week they had drunk alcohol during the past month (0 = *I do not drink at all*, 1 = *about once a month*, 2 = *two to three times a month*, 3 = *once or twice a week*, 4 = *three to four times a week*, 5 = *nearly every day*, 6 = *once a day or more*). Participants also completed the Daily Drinking Questionnaire (DDQ; R. L. Collins, Parks, & Marlatt, 1985), wherein they reported their typical drinking on each day of the week, averaged over the past 3 months. The DDQ and QFP indices have been effective in documenting reductions in previous studies (Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990; Marlatt et al., 1998; Marlatt, Baer, & Larimer, 1995). Finally, participants completed selected items from the Core Institute's Campus Assessment of Alcohol and Other Drug Norms (CORE; Presley, Meilman, & Cashin, 1998), including the number of times they had consumed 5 or more drinks in the past 2 weeks and their frequency of alcohol consumption in the past year (0 = *never*, 1 = *1–2 times/year*, 2 = *6 times/year*, 3 = *once/month*, 4 = *twice/month*, 5 = *once/week*, 6 = *3 times/week*, 7 = *5 times/week*, 8 = *every day*). All measures included standard drink definitions.

Rutgers Alcohol Problem Index—Alcohol-related consequences were assessed with a modified version of the Rutgers Alcohol Problem Index (White and Labouvie, 1989). Students rated the frequency of 25 items reflecting alcohol's impact on a range of consequences (e.g., academic, physical) over the past 6 months. In the present study, 2 items related to drinking and driving were added to the original 23-item measure. Reliability in the present study was $\alpha = .91$. The sum of the frequency of experiencing each of the 25 consequences was used as an outcome variable.

Drinking Norms Rating Form (DNRF)—Perceived descriptive norms were measured with the DNRF (Baer, Stacy, & Larimer, 1991). Using a format parallel to the DDQ (R. L. Collins et al., 1985), participants estimated the drinking behavior of the “typical student.”

National College Health Assessment survey—Protective behaviors were measured with a scale derived from the National College Health Assessment survey (American College Health Association, 2000). The scale measured frequency of use of 10 strategies for reducing the negative consequences of drinking, including avoiding drinking games, choosing not to drink, setting consumption limits, and drinking substitute beverages.

Response options ranged on a 6-point scale from *never* engaging in that strategy to *don't drink*, which was considered the most protective response. Reliability in the present study was $\alpha = .94$. Scores were calculated as the mean of the 10 items. In this sample, the most commonly endorsed protective factors included using a designated driver, eating before drinking, and keeping track of how many drinks had been consumed. At baseline, 90% reported either usually or always using a designated driver, 72% reported eating before and/or during drinking, and 68% reported keeping track of how many drinks had been consumed.

Intervention Procedures

Participants were randomized to feedback ($n = 737$) or assessment-only control ($n = 751$). Randomization was completed automatically when the students entered their data online using a simple randomization algorithm. Feedback was custom programmed to draw information from the Web-based baseline assessment to merge into the feedback form, which was then printed by a research assistant and mailed to each intervention-condition participant. Within 2 weeks, participants were mailed the 1st of 10 weekly generic (i.e., not personalized) postcards with additional information regarding alcohol's effects, costs of drinking, and specific protective strategies they could use to avoid drinking-related negative consequences. Feedback content and style were similar to the Brief Alcohol Screening and Intervention for College Students (BASICS) program (Dimeff et al., 1999; Larimer et al., 2001; Marlatt et al., 1998). The feedback included each participant's current drinking behavior, his or her percentile rank in comparison with the campus average (and the percentage of students who didn't drink in a typical month), estimated peak and typical blood alcohol levels, and the effects of alcohol at different blood alcohol levels. Feedback also included a comparison of each participant's perceived descriptive norms with actual campus drinking rates, his or her alcohol outcome expectancies with embedded text indicating that many social effects of alcohol are influenced by placebo effects, feedback regarding negative consequences of drinking the participant had reported in a number of domains (i.e., alcohol and sex, alcohol and weight), and specific protective behaviors the participant was already engaging in as well as those he or she could initiate. Postcard tips expanded on these topics by providing information about calculating blood alcohol levels on the basis of weight, sex, and number of drinks per hour, protective behaviors students could use (such as setting limits, alternating alcoholic with nonalcoholic beverages, and choosing not to drink), reasons why students might choose not to drink (both general and situation specific), and additional tips about avoiding negative consequences associated with alcohol use at parties, alcohol and sexual behavior, and alcohol poisoning incidents. Each postcard also included accurate information about the campus descriptive norm (i.e., 85% of students had 0, 1, 2, 3, or at most 4 drinks when they partied), and 1 postcard specifically highlighted the percentage of students on campus (more than 25%) who never drank alcohol.

Results

Preliminary Analyses

Implementation—A small percentage (2.6%, $n = 16$) of feedback sheets were returned in the mail or were not mailed because of participants' privacy concerns. An additional 41 participants (5.6%) did not receive some or all of the postcard series because of an incorrect address or their request that the postcards be stopped after 1 or more cards had been received. These individuals were included in the intent-to-treat analyses.

Drinking outcomes composite—For data reduction to reduce Type I error, we created a composite drinking variable for use as a dependent variable (Marlatt et al., 1998) for analyses of drinking outcomes. The composite consisted of the sum of the standardized

scores on four dimensions of drinking behavior: peak blood alcohol content and frequency of use in the past month from the QFP, total drinks per week from the DDQ, and frequency of drinking in the past year from the Core Institute's Campus Assessment of Alcohol and Other Drug Norms survey. These dimensions were highly correlated (baseline r s ranged from .61 to .89, $p < .001$, $\alpha = .90$; follow-up r s ranged from .64 to .88, p s $< .001$, $\alpha = .90$) and reflected both variability and stability of student drinking.

Baseline equivalence of samples—We examined the baseline comparability between the feedback and assessment-only control groups on demographics and outcome variables using Pearson's chi-square for categorical data and independent t tests for continuous data. There were no statistically significant differences found between the feedback condition and control group on ethnicity, $\chi^2(5, N = 1,460) = 3.45$, ns ; gender, $\chi^2(1, N = 1,487) = 1.69$, ns ; class standing, $\chi^2(5, N = 1,473) = 2.36$, ns ; or age, $t(1,482) = 0.05$, ns . Additionally, there were no significant differences between the feedback group and the control group on drinking at baseline, $t(1373) = 1.04$, ns ; number of negative consequences experienced, $t(1443) = .56$, ns ; or perceived descriptive norms for the typical student, $t(1326) = -1.06$, ns .

We conducted analyses to determine whether loss to follow-up was differentially based on the intervention condition or baseline characteristics. Two thirds (66.3%) of students in the control group filled out the 1-year follow-up, and 68.1% of those in the feedback group filled out the follow-up survey. This difference was not significant. However, results indicated differences between completers and those lost to follow-up on the basis of gender, $\chi^2(1, N = 1,487) = 18.01$, $p < .001$; alcohol use, $t(1373) = 5.07$, $p < .001$; and negative consequences, $t(843) = 4.16$, $p < .001$, experienced at baseline. Women (70.8%), students who drank less ($M = -0.24$; $SD = 3.34$), and those who experienced fewer negative consequences ($M = 2.65$, $SD = 3.80$) at baseline were more likely to complete the follow-up than men (59.9%), heavier drinkers ($M = 0.76$, $SD = 3.74$), and those who experienced more consequences ($M = 3.63$, $SD = 4.47$). Logistic regression analyses indicated no interaction between intervention group and baseline drinking on follow-up completion. To explore the effect of missing data, we repeated the analyses using the last-observation carryforward method, substituting participants' baseline values if follow-up data were missing. Conclusions did not differ from those reported below, with one noted exception.

Efficacy of the Feedback Intervention

Analysis of covariance was used to examine follow-up drinking as a function of treatment condition, controlling for baseline drinking. Results revealed a significant intervention effect, $F(1, 872) = 7.18$, $p < .01$, with students who received feedback reporting less drinking at follow-up ($M = 0.21$, $SD = 2.17$) relative to students in the assessment control group ($M = 0.60$, $SD = 2.18$). This represents a small effect size ($d = 0.18$). For ease of interpretation, we conducted additional analyses examining the four outcome variables making up the composite score (see Table 1). Results revealed a significant intervention effect for three of the four outcomes: total drinks per week, frequency of use during the past month, and frequency of drinking in the past year.

Next, our focus turned to heavy drinkers. A logistic regression analysis was conducted examining heavy episodic drinking status (consumption of five or more drinks in a row in the past 2 weeks; Johnston, O'Malley, Bachman, & Schulenberg, 2005) at follow-up as a function of the intervention controlling for drinking status at baseline. Students in the control group were 1.43 times more likely to report heavy episodic drinking at follow-up relative to students in the feedback group, $B = -0.36$, $\chi^2(1, N = 983) = 5.23$, $p < .05$. At baseline, 36% of the control group and 35% of the intervention group had reported heavy

episodic drinking. At follow-up, 40% of the control group drank heavily, compared with 33% in the intervention group.

We further examined the effect of personalized feedback on students who had abstained from drinking at baseline. Logistic regression analysis was conducted evaluating abstinence status at the 1-year follow-up as a function of intervention. Results indicated that abstainers in the control group were twice as likely (odds ratio [OR] = 2.02) to drink at follow-up relative to abstainers who had received personalized feedback, $B = 0.70$, $\chi^2(1, N = 234) = 6.88$, $p < .01$. Of students in the control group who abstained at baseline, 52% had initiated drinking at the 1-year follow-up, compared with 35% in the feedback intervention group.

We also conducted analysis of variance to evaluate the effect of personalized feedback on reducing the number of negative consequences experienced. In contrast to results for consumption, there was no intervention effect on the number of negative consequences at 1-year follow-up, $F(1, 946) = 0.58$, *ns*.

Moderators of Intervention Efficacy

Gender and baseline drinking were evaluated as potential moderators of the effect of feedback on the composite drinking variable. Gender was also examined as a moderator of heavy drinking and abstinence status at follow-up. Moderation was evaluated by including the proposed moderator and its product with intervention condition in the above-described analyses. The results revealed no moderation effects for gender, $F(1, 869) = 0.15$, *ns*, or baseline drinking, $F(1, 869) = 0.00$, *ns*, on the composite drinking variable. Additionally, logistic regression analyses found no moderation effects for gender on abstinence status, $B = -0.53$, $\chi^2(1, N = 234) = 0.795$, *ns*. Moderation effects for gender on heavy drinking status approached significance, $B = 0.62$, $\chi^2(1, N = 983) = 3.28$, $p = .07$. At baseline, 29.0% of women and 40.4% of men in the control group and 28.3% of women and 40.3% of men in the intervention group had reported heavy drinking. At follow-up, 37.6% of women and 43.9% of men in the control group drank heavily, compared with 28.7% of women and 44.6% of men in the intervention group. When we repeated analyses using last observation carryforward, substituting participants' baseline values for heavy drinking status at follow-up if data were missing, the Gender \times Feedback status interaction became significant, $B = 0.72$, $\chi^2(1, N = 1,477) = 5.13$, $p < .05$, indicating that the effect of feedback on reduced likelihood of heavy drinking at follow-up was stronger among women.

Although we did not find intervention outcome differences as a function of drinking status, we were interested in evaluating effect sizes and ORs separately for baseline abstainers and drinkers. When we examined drinkers only, treatment effect sizes were small and not significant for both the alcohol consumption composite ($d = 0.12$) and alcohol-related problems ($d = 0.04$). However, logistic regression indicated a significant effect (OR = 1.43) in which those individuals who received feedback were less likely to engage in heavy episodic drinking, $B = -0.36$, $\chi^2(1, N = 745) = 4.58$, $p < .05$. When we examined abstainers only, there was a medium and significant treatment effect for alcohol consumption ($d = 0.49$) and a small and nonsignificant effect size for alcohol-related consequences ($d = 0.08$). Logistic regression indicated no significant impact of feedback on likelihood of engaging in heavy episodic drinking at follow-up among baseline abstainers, $B = -0.87$, $\chi^2(1, N = 232) = 1.52$, *ns*.

Mediators of Intervention Efficacy

We were also interested in evaluating perceived descriptive norms and protective factors as potential mediators. Mediation was evaluated with criteria described by Baron and Kenny (1986). The effect of feedback on composite drinking at 1-year follow-up was evident, as

previously described. Next we evaluated whether feedback had a significant impact on each of the proposed mediators. We examined perceived descriptive norms for typical student drinking (as measured by the DNRF; Baer et al., 1991) at follow-up as a function of treatment condition, controlling for baseline norms, and used the same strategy to evaluate whether feedback had a significant impact on protective factors. Only protective factors changed as a function of treatment condition, $F(1, 854) = 8.17, p < .01$, with participants in the feedback condition increasing the frequency of protective behaviors relative to the control group.

We then evaluated the relationship between protective behaviors and drinking and whether controlling for protective behaviors reduced the impact of feedback on drinking. We examined follow-up drinking as a function of follow-up protective factors and treatment condition, controlling for baseline protective factors and drinking. Protective factors did not vary as a function of intervention group at baseline, $F < 1$. However, protective factors at follow-up were strongly associated with drinking at follow-up, $F(1, 765) = 213.68, p < .001$. The effect of the feedback on drinking was no longer significant when controlling for protective factors, $F(1, 765) = 0.44, ns$, thus providing evidence of mediation.

Discussion

Personalized mailed feedback has previously been found to be efficacious in reducing alcohol use in college student populations (Agostinelli et al., 1995; S. E. Collins et al., 2002; Walters, Bennett, & Miller, 2000; Walters, Bennett, & Noto, 2000; Walters & Neighbors, 2005). Although results have been encouraging, many of the studies have had relatively short follow-up periods (usually 6 weeks to 6 months). In addition, research to date has typically focused exclusively on convenience samples of heavy-drinking students. The current study extended prior work on mailed feedback interventions by implementing the intervention in a universal prevention context (i.e., with a large population of college students, including both drinking and nondrinking students) and conducting follow-up 1 year postintervention to assess the long-term effects on drinking. In addition, we evaluated theoretically relevant moderators and mediators of intervention efficacy.

Intervention Efficacy

The impact on alcohol use from this brief, mailed intervention is modest but promising. As indicated by scores on the composite drinking variable, feedback was associated with reduced drinking in comparison with the control group at 1-year follow-up. This finding is consistent with studies evaluating other stand-alone feedback interventions (S. E. Collins et al., 2002; Walters & Neighbors, 2005), although the effect size corresponding to the treatment effect on drinking is smaller than in previous research. The smaller effect size may be the result of the longer follow-up time frame compared with other studies, as well as the relatively low drinking rates in this universal-prevention context. To better illustrate the trajectory of alcohol use following a mailed feedback intervention, future studies could use more frequent, intermediate follow-up assessments to capture potential differences in slope of change over time.

The impact on heavy episodic drinking is also encouraging. Participants in the control condition were 1.4 times more likely to report heavy episodic drinking at 1-year follow-up relative to those in the intervention condition. These findings suggest this relatively low-cost intervention may be a viable option as a first step for preventing heavy episodic drinking on college campuses.

As with prior research (S. E. Collins et al., 2002), there was no significant effect on alcohol-related consequences following the feedback intervention. Because of the universal

prevention focus, participants experienced relatively few consequences at baseline on average, creating a potential floor effect. Although direct comparisons are difficult because of slight differences in the assessment instruments and time frames used in different studies, the average number of negative consequences in this study was approximately half the level reported in other recent studies of stand-alone feedback (S. E. Collins et al., 2002), even when only drinkers were included in analyses. It is also possible that enhancements are needed for mailed feedback interventions to produce negative-consequence reductions. Increasing personalization of suggested skills and tips, rather than using generic postcards to reinforce behavioral strategies, might improve the impact of such interventions on consequences.

A unique contribution of the current study to college drinking prevention is the inclusion of a large group of abstinent students in the randomized trial and evaluation of the preventive effects of personalized feedback with this group. Abstainers who received the feedback intervention were twice as likely to continue to abstain at 1-year follow-up, compared with abstainers in the control group. This finding replicates and extends previous work (E. T. Miller et al., 2002) suggesting that skills-based interventions can serve a preventive function for abstinent students, and it alleviates concerns regarding potential iatrogenic effects of personalized normative feedback for abstinent students (DeJong, 2001). The results suggest that the provision of mailed feedback, including skills information and personalized normative feedback, appears to be appropriate as a universal prevention strategy and can potentially replace other universal strategies (i.e., awareness or information campaigns alone) not found to be efficacious in drinking prevention (NIAAA, 2002).

Moderators of Intervention Efficacy

Both gender and baseline drinking were evaluated as moderators of the relationship between treatment condition and the drinking composite variable. In the first set of analyses, neither gender nor baseline drinking significantly moderated prevention effects, although the effect for gender approached significance with respect to prevention of heavy episodic drinking. However, a more conservative approach utilizing last-observation carryforward methods to account for missing data indicated the feedback intervention's effect on heavy episodic drinking was significantly stronger at follow-up for women than for men. It is possible the discrepancy between analyses with and without last-observation carryforward resulted from the increase in power obtained through inclusion of participants lost to follow-up. Prior research examining the moderating effect of gender on the efficacy of stand-alone feedback has been mixed; some studies have reported no differential effect of the intervention (S. E. Collins et al., 2002), and other studies (Bendtsen, Johansson, & Akerlind, 2006; Murphy et al., 2004; Saunders et al., 2004) have reported women may be more responsive to this type of intervention than men. Although the results of the current study are somewhat equivocal, as gender moderated only one outcome, our findings suggest women may benefit more than men when feedback is used in a universal prevention context for prevention of heavy episodic drinking. More research is necessary to determine under what conditions mailed feedback may be more effective for women versus men and whether there might be differential mechanisms associated with increased responsivity to feedback for women.

Similarly, more research is necessary to determine whether feedback and skills-based interventions may be differentially effective for participants with different drinking histories. The current study found no moderating effects of baseline drinking status on intervention outcomes in the primary analyses, and the intervention was found both to increase likelihood of maintaining abstinence and to reduce likelihood of heavy episodic drinking at follow-up. When analyses were conducted separately for abstainers and drinkers, however, effect sizes on the drinking composite variable were larger for baseline abstainers than for drinkers, and results on overall drinking became nonsignificant when abstainers were removed from the

sample. This represents a prevention effect, with abstainers in the feedback condition less likely to initiate drinking, and those who did initiate it tending to drink infrequently. In contrast, effects of the feedback on the likelihood of heavy episodic drinking were significant only for students who were already drinking at baseline. This represents a harmreduction effect, with students reducing the amount consumed on peak occasions consistent with feedback and tips, rather than reducing frequency or the typical amount of consumption. Our findings overall suggest that the intervention has broad applicability for universal prevention across a wide range of drinker types and that it impacts different drinking outcomes for students with different drinking patterns.

Mediators of Intervention Efficacy

We also evaluated two potential mediators of intervention efficacy: perceived descriptive norms for drinking (Borsari & Carey, 2000; Perkins, 2002; Walters & Neighbors, 2005) and use of protective behavioral strategies (Martens et al., 2004). Perceived descriptive norms did not mediate intervention efficacy, in contrast to prior research (Borsari & Carey, 2000; Neighbors et al., 2004). It is possible that the normative feedback component of the intervention was diluted by the other intervention components or that normative discrepancies in this sample were not as large as in previous heavy-drinking samples.

Protective behaviors were found to mediate the relationship between the intervention and drinking outcomes. Thus, this intervention reduced drinking at least in part because students in the intervention condition used more protective behavioral strategies or skills. Martens et al. (2004) found college students who used protective behaviors less frequently experienced more negative consequences of drinking. The current feedback highlighted both the protective behaviors the participant had already used as a means of supporting efficacy and reinforcing positive behaviors (W. R. Miller & Rollnick, 2002); it also listed other behaviors the participant had not endorsed, with a suggestion that the participant consider using these strategies to reduce risks. These protective behaviors were also directly targeted in the postcards. When used in conjunction with other motivational feedback, suggesting specific behaviors to avoid heavy drinking and negative consequences appears to influence drinking outcomes. This type of approach may be particularly suited to universal prevention contexts, as many of the strategies suggested can be used both to maintain moderate drinking and to maintain abstinence.

Limitations

Though encouraging, the current findings must be interpreted with caution in light of several study limitations. First, the recruitment rate in this study was relatively low, with 35% of eligible participants responding, raising concerns regarding generalizability. Research suggests response rates have declined over the past decade (Tourangeau, 2004), across all methods of recruitment and a variety of survey topics. A review of the literature on Web-based surveys of college populations indicates rates range from 19% (Thombs, Ray-Tomasek, Osborn, & Olds, 2005) to 63% (McCabe, 2004) depending on number of contacts, complexity and length of the survey, and incentives relative to participant burden. However, research suggests the extra effort required to obtain higher recruitment may not be warranted, as participants obtained after more intensive efforts appear similar to those obtained from initial contacts, with little effect on parameter estimates (Kypri, Stephenson, & Langley, 2004; Tourangeau, 2004). In the present study, participant burden was relatively high (students were asked to complete up to five annual surveys requiring an hour each and to participate in multiple alcohol-prevention activities) relative to incentives (\$10 –\$15 value per assessment), and the number of contacts (4 –5) was modest in comparison with recent recommendations of up to nine contacts (Kypri et al., 2004). Future efforts may need to increase the value of the incentive relative to the time required from the student, increase the

number of contacts to achieve better recruitment, and consider other methods of recruiting students (such as universal screening in campus health centers or class settings). Despite low recruitment, the obtained sample was demographically representative of the invited sample, except that women were more likely to respond and to be retained. Others have found similar tendencies for women to respond to Web-based surveys (Kypri et al., 2004; McCabe, 2002; McCabe, Boyd, Couper, Crawford, & D'Arcy, 2002). This suggests more intensive recruitment efforts targeted toward men may be necessary.

Attrition is another limitation, as the follow-up rate of 67.2% is somewhat low, although not in comparison with recent published trials using similar methodology (S. E. Collins et al., 2002; Fromme & Corbin, 2004). Because of funding constraints, there was little contact with participants between assessment points, other than a thank-you letter following baseline assessment, an annual e-mail request for address updates, and a prenotification reminder letter for the follow-up survey for participants in both conditions. More intensive tracking and contact would likely yield improved retention rates (Kypri & Gallagher, 2003). Although women and lighter drinkers were somewhat more apt to complete follow-up, it is important that attrition was not differential across conditions; results were similar when last-observation carryforward methods were used, with the exception of the gender moderation results described previously.

Reliance on self-report is another potential limitation. However, the assurance of confidentiality and use of well-validated and reliable measures reduce the risk of biased data (Babor, Steinberg, Anton, & Del Boca, 2000; Chermack, Singer, & Beresford, 1998; Darke, 1998). Research suggests self-report is generally accurate under these circumstances (Laforge, Borsari, & Baer, 2005; Marlatt et al., 1998; Smith, McCarthy, & Goldman, 1995). Assessment reactivity is another factor to consider in interpreting the findings. It is possible that participation in the baseline assessment produced effects on follow-up drinking in both conditions, which may have led to an underestimate of the true effect size of the assessment and feedback intervention. Alternatively, it is possible that participants who received feedback about assessment and who subsequently received multiple mailings may have had increased reactivity to assessment or may have responded to the increased attention, which could have led to an overestimate of the efficacy of the intervention. Additional research is needed to evaluate assessment reactivity and demand characteristics in studies of feedback interventions.

Finally, it is not clear whether all participants received, read, and processed their feedback. Although only a very small percentage of mailed feedback was known not to have been delivered, students were not asked whether they had received the information or had found it helpful. Thus, we were unable to evaluate or account for effects of intervention dosage (i.e., receipt of full or partial intervention, degree of attention participants paid to the intervention materials, perceived utility) on outcomes. Previous research (S. E. Collins et al., 2002) suggests individuals find mailed personal feedback to be more useful and relevant than alternative mailed information, implying that students do read and attend to mailed interventions at least to some extent. Nonetheless, future studies would benefit from assessing these questions at follow-up.

Conclusions and Future Directions

Despite limitations, the current research has several strengths and adds significantly to the literature on brief universal prevention strategies for college drinking. In particular, the large sample size, randomized controlled design, and 1-year follow-up period extend prior research on this topic. In contrast to prior studies, the sample included abstainers as well as the full range of drinkers and thus allowed us to evaluate the intervention as a universal prevention strategy. Findings support this intervention as a low-cost universal prevention

approach that is appropriate for the full range of student drinking patterns and is associated with both maintenance of abstinence and prevention of heavy episodic drinking and overall drinking in comparison with controls. Though effects on overall drinking are small, findings suggest the intervention may have broad applicability and thus may have public health implications for universal prevention of college drinking.

Although the current intervention was relatively straightforward and low-cost to implement in comparison with in-person BASICS (Dimeff et al., 1999) interventions, little research has systematically compared in-person individual feedback with feedback alone (Murphy et al., 2004; White et al., 2006). Additional research is needed directly comparing in-person BASICS with BASICS feedback alone, including an assessment-only comparison condition to better evaluate comparative efficacy of these approaches, particularly with respect to the reduction of negative alcohol consequences. Additional components testing of multicomponent BASICS feedback is also needed. In addition, research investigating the implementation of BASICS feedback on the Internet, rather than through the mail, is warranted, as Web-based implementation further reduces costs associated with intervention and has the potential to reach a much broader audience (Saunders et al., 2004).

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Table 1

Baseline and Follow-Up Means and Standard Deviations by Intervention Group

Outcome variable	Control				Intervention				df	F
	Baseline		Follow-up		Baseline		Follow-up			
	M	SD	M	SD	M	SD	M	SD		
Peak BAC	0.09	0.09	0.10	0.09	0.08	0.09	0.09	0.10	1926	1.84
Drinks per week	4.59	6.34	5.61	6.33	4.61	7.45	4.80	7.01	1933	4.94*
Frequency past month	1.54	1.29	1.83	1.30	1.44	1.30	1.62	1.32	1928	7.08**
Frequency past year	3.01	2.17	3.53	2.16	2.85	2.06	3.19	2.11	1983	7.96**
Alcohol-related consequences	2.54	3.77	2.95	4.17	2.75	3.83	2.83	4.06	1946	0.58

Note. *F* = test of mean differences at follow-up controlling for baseline drinking; BAC = blood alcohol content.

* $p < .05$.

** $p < .01$.