Feedback interventions for college alcohol misuse: What, why and for whom?

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Abstract

In response to the persistent problem of college drinking, universities have instituted a range of alcohol intervention programs for students. Motivational feedback is one intervention that has garnered support in the literature and been adopted on college campuses. This article reviews published outcome studies that have utilized feedback as a major component of an alcohol intervention for college students. Overall, 11 of the 13 reviewed studies (77%) found a significant reduction in drinking as compared to a control or comparison group. While the studies varied widely in terms of population, follow-up period, and feedback content, it appears that feedback can be effective whether delivered by mail, the Internet, or via a face-to-face motivational interview. Feedback seems to change normative perceptions of drinking and may be more effective among students who drink for social reasons. The addition of a group or individual counseling session does not appear to increase the short-term impact of the feedback.
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1. Introduction

Recent media attention to the alcohol-related deaths on college campuses has brought mainstream attention to the persistent problem of college drinking. Almost half of students report a heavy drinking episode over the last 2 weeks (Johnston, O'Malley, & Bachman, 2000; Wechsler et al., 2002), and one quarter engage in heavy or problematic drinking (Barnes, Welte, & Dintcheff, 1992; Berkowitz & Perkins, 1986). Surveys find a heavy episodic drinking pattern to be associated with poorer grade point averages, higher rates of drinking and driving, greater incidences of assault and rape, and a substantial cost burden to colleges, hospitals, and the legal system (Frinter & Rubinson, 1993; Hingson, Heeren, Zakocs, Kpostein, & Wechsler, 2002; Schuckit, Klein, Twitchell, & Springer, 1994). Residents who live close to college campuses report decreased quality of life in proportion to campus drinking rates (Wechsler et al., 2002), and students who live on campuses with high rates of drinking are more likely to be assaulted and to have their studies disturbed (Wechsler, Issac, Grodstein, & Sellers, 1994; Wechsler, Moeykens, Davenport, Castillo, & Hansen, 1995).

In response, colleges and universities have instituted a range of alcohol intervention and prevention programs. Unfortunately, relatively few have been shown to be effective at reducing consumption (Larimer & Cronce, 2002; Walters & Bennett, 2000). Even among those programs that have empirical support, outcome studies have often been limited to qualitative assessments, prospective estimates of change, and/or changes in something other than drinking (e.g., knowledge). Although there is empirical support for a subset of skills-based, attitudinal, and motivational interventions, these approaches are less well disseminated because of their relatively high cost (NIAAA, 2002).

One exception to this trend has been the proliferation of feedback-based interventions (Walters, 2000). Drawing on motivational (Miller & Rollnick, 2002) and social psychology (Bandura, 1982; 1994) literature, feedback interventions rely on a presentation of discrepant information, such as a personal drinking profile (e.g., quantity-frequency consumed, peak blood alcohol level, amount of money spent on alcohol, caloric intake), risk factors (e.g., genetic risk of alcoholism, tolerance, dependence, negative consequences), and normative comparisons (e.g., beliefs about peers' drinking, amount consumed in relation to peers). In two recent reviews of the college treatment literature (Larimer & Cronce, 2002; Walters & Bennett, 2000), nearly every individual intervention that showed a reduction in drinking employed personalized drinking feedback. In some contexts, feedback is used as an adjunct to an individual or group counseling session. For instance, a student might be asked to complete drinking assessments prior to meeting with a counselor. A drinking profile is then presented to the student as part of the counseling session. In other contexts, feedback is used as a stand-alone intervention. In practice, colleges may utilize feedback as an adjunct to interventions targeted to groups of high-risk students (e.g., freshman, athletes, Greek-affiliated) or provide mailed or electronic feedback to other large groups. In a recent review of computerized prevention programs, every commercially available program used feedback as one aspect of the intervention (Walters, Miller, & Chiauzzi, 2004). These results alone mean that potentially tens of thousands of students are receiving drinking feedback each year.

2. Rationale for the present review

While it is encouraging to see an evidence-based intervention being adopted in practice, the popularity of this approach has, in some cases, outstripped available evidence and theory. For instance, there appears to be no systematic review of feedback approaches used to intervene with college drinking. Likewise, we have very little understanding of the mechanisms and conditions under which feedback might work. There has been relatively little discussion of how it might be used more strategically, or what the potential risks might be. Indeed, there are published studies that have found feedback to be no better than control, and even some preliminary evidence from unpublished studies that feedback may be harmful in certain contexts. Therefore, the present study was undertaken to review the literature on feedback-based approaches for college students, to examine the evidence for different feedback formats, and to make recommendations for future research.

3. Methods

This article focuses on published outcome studies that have utilized feedback as a major component of an alcohol intervention for college students. For purposes of this review, we define "feedback" as information about one or more aspects of personal drinking, such as consumption, risk factors, and/or normative comparisons. Most often, feedback has been allied with the counseling approach of motivational interviewing (e.g., Miller & Rollnick, 2002) in terms of the specific items included in the feedback, accompanying text, and/or interactions with a counselor. In July 2004, we conducted a search of the PsychInfo and Medline databases, using key terms (feedback)+(alcohol or drinking)+(college students)+(intervention or prevention or treatment). After eliminating duplicate and non-English references, 28 studies were identified. In cases where a single intervention trial resulted in multiple publications, we included only the most recent publication. Only studies that included a control/comparison group and assessed drinking behavior at one or more follow-up points were included. After examining study abstracts for relevance, 13 studies were retained. Table 1 summarizes the resulting studies.

4. Results

The studies varied widely in terms of population characteristics, control/comparison group, and follow-up period. Seven studies utilized feedback as an adjunct to an individual or group meeting, three studies tested feedback as a stand-alone intervention delivered through the mail or Internet, and three studies examined some combination of these two formats. Most studies used undergraduate volunteers screened out of psychology testing pools, though a few studies used students identified as "high risk" through other means. Most studies were limited to self-report and had relatively short-term follow-up periods.

Table 1
Results of college alcohol feedback interventions

Study	N	Feedback format	Drinking at follow-up
Agostinelli et al. (1995)	26	mailed feedback	▼ 6 weeks
Baer et al. (1992)	132	1 h individual+feedback	▼ 24 months
Borsari and Carey (2000)	60	1 h individual+feedback	▼ 6 weeks
Collins et al. (2002)	100	mailed feedback	▼ 6 weeks, n/s 6 months
Dimeff and McNeely (2000)	41	brief interaction+feedback	▼ 6 weeks
Larimer et al. (2001)	120	1 h individual+1 h group+feedback	▼ 12 months (males)
Marlatt et al. (1998)	456	1 h individual+mailed	▼ 6 months, ▼ 24 months
Murphy et al. (2004)	54	1 h individual+feedback	▼ 6 months
Murphy et al. (2001)	99	1 h individual+feedback	▼ 3 months (heavier drinkers), n/s 9 months
Neighbors et al. (2004)	252	computer feedback	▼ 3 months, ▼ 6 months
Neal and Carey (2004)	92	30 min individual+feedback	n/s 1 week
Walters (2000)	46	2 h group+mailed feedback, or mailed feedback only	n/s 6 weeks
Walters et al. (2000)	37	2 h group+feedback, or mailed feedback only	▼ 6 weeks

4.1. In-person feedback applications

Seven studies used feedback as part of a group or individual motivational interview with heavy drinking college students. Motivational interviewing (MI) is a "client-centered, directive method for…exploring and resolving ambivalence" (Miller & Rollnick, 2002, p. 25). MI has good support in the alcohol treatment literature, including among adolescents (McCambridge & Strang, 2004), pregnant problem drinkers (Handmaker, Miller, & Manicke, 1999), persons with severe mental illness and co-morbid substance use disorders (Daley, Salloum, Zuckoff, Kirisci, & Thase 1998; Swanson, Pantalon, & Cohen, 1999), and patients specifically hospitalized for alcohol-related accidents (Gentilello et al., 1999). In a typical motivational interview, feedback is presented to the client to help clarify ambivalence, build discrepancy, and increase motivation for change.

Four studies employed feedback as a component of the Brief Alcohol Screening and Intervention for College Students (BASICS) approach (Dimeff, Baer, Kivlahan, & Marlatt, 1999). BASICS feedback contains information about personal consumption, perceived norms, alcohol related problems, and other risk factors. In addition, the in-person BASICS meeting contains components of moderation training (Hester, 2003), such as identifying what the student wants from drinking, setting limits, monitoring drinking behavior, and managing the drinking situation. In one early study, Baer et al. (1992) compared a 6-week didactic classroom format to a 1-hour intervention comprised of feedback and skills-based components. Throughout a 2-year follow-up, the classroom and brief intervention conditions yielded statistically similar reductions over baseline (from 24.4 to 15.0 and 27.2 to 22.0 drinks per week (DPW), respectively). In a second study, Marlatt et al. (1998) randomized a group of at-risk freshmen to receive an individual

BASICS session or assessment only. After 1 year, BASICS students were mailed additional feedback on their current drinking patterns and, if deemed at high risk, were contacted by phone for a brief motivational session. At a 2-year follow-up, students in the BASICS group showed greater reductions in use, fewer alcohol-related problems, and fewer symptoms of alcohol dependence, as compared to control (e.g., 3.6 vs. 4.0 drinks per drinking occasion for BASICS and control, respectively). Murphy et al. (2001) replicated this study using participants who reported being above the 66th percentile in terms of their drinking. At 3 months, they found a reduction in drinking for the heaviest 50% of the sample who received BASICS, as compared to those assigned to an educational intervention or control. Finally, Larimer et al. (2001) randomized fraternity and sorority pledges to a BASICS intervention with individual and housewide feedback components or control. This study used both professionals and undergraduate peers to deliver the intervention. Fraternity men who received the intervention significantly reduced their alcohol consumption and peak BAC, relative to those in the control group. Women in both groups reduced their drinking, with no differences between the groups. At a 1-year follow-up, intervention participants reduced their average DPW from 15.42 to 12.27, while control participants increased from 15.56 to 17.51. Importantly, peer interviewers were as effective as professionals across all outcome variables for men (Larimer et al., 2001).

Borsari and Carey (2000) randomized heavy drinking students to either a single MI session with feedback, or a no-treatment control condition. Unlike the BASICS studies, this intervention was modeled more strictly along the lines of a motivational interview, with little skills-based content. At a 6-week follow-up, the MI group significantly reduced their alcohol use, relative to control. Participants who had received the MI intervention reduced their drinking from 17.57 to 11.40 DPW, while participants in the control group reduced their drinking from 18.45 to 15.78 DPW. In this study, changes in consumption were mediated by changes in estimates of typical student drinking.

Dimeff and McNeely (2000) randomly assigned heavy drinking students presenting at a student health center to receive a brief feedback intervention or control. Intervention subjects completed a computerized assessment and received a feedback report, which they then discussed with a primary care practitioner. At a 30-day follow-up, intervention participants reduced their number of binge drinking episodes and alcohol problems, relative to control, though the authors do not report means or effect sizes. In addition, the longer the time spent with the practitioner and the more carefully the participant reported reading the feedback, the larger the decrease.

Finally, Neal and Carey (2004) compared two types of feedback with different content. Heavy drinking college students were randomized to one of three conditions delivered in a small group format: (1) personalized normative feedback that highlighted a discrepancy between behaviors of self and others; (2) personalized "strivings assessment" that highlighted a discrepancy between current and ideal self; or (3) an attention-only control. Results indicated that the personalized normative feedback increased discrepancy and intent to reduce alcohol use immediately following the intervention. However, at a 1-week follow-up, there were no between-group differences in terms of actual consumption.

4.2. Stand-alone feedback applications

Whereas some studies have used feedback as an adjunct to an individual or group interview, other studies have relied on feedback itself as the primary intervention. Two studies examined feedback delivered through the mail, while one examined feedback delivered online. Three additional studies (discussed in the next section) compared feedback with or without contact from a provider.

Agostinelli, Brown, and Miller (1995) found reductions when feedback was mailed to participants and no face-to-face meeting occurred. Heavy drinking students were randomized to receive, or not receive, mailed feedback on their drinking relative to population norms. At 6 weeks, students who received the feedback significantly reduced their alcohol use (mean decrease of 7.9 DPW), as compared to control students (mean decrease of 0.5 DPW). Using a similar design, Collins, Carey, and Sliwinski (2002) reported that, at 6 weeks, participants who received mailed feedback reported consuming significantly fewer drinks per heaviest drinking week and engaging in drinking less frequently than control participants. However, these between-group differences were no longer evident at 6 months.

Neighbors, Larimer, and Lewis (2004) tested the efficacy of computerized normative feedback among heavy drinking college students. Intervention participants received information summarizing their drinking in relation to what they thought the average student drank, and what the average student actually drank. At a 6-month follow-up, feedback participants reduced their drinking (3.41 DPW reduction) relative to control participants (0.90 DPW reduction). Moreover, changes in drinking were accompanied by changes in perceptions of drinking norms, suggesting that the correction of normative misperceptions was operating as a mediator.

4.3. Comparison of in-person and stand-alone formats

Three studies compared feedback with or without the addition of a group or individual meeting. Two of the studies looked at feedback with or without the addition of a group interaction, while the third examined feedback with or without an individual motivational interview.

In one study, Walters, Bennett, and Miller (2000) examined the incremental effectiveness of adding a psychoeducational class to mailed feedback. Heavy drinking college students were randomized to (1) a 2-h psychoeducational class plus mailed personal feedback, (2) mailed feedback only, or (3) assessment only. At a 6-week follow-up, feedback participants reduced their drinking (13.8 DPW reduction), relative to control (6.35 DPW reduction). Changes among those in the classroom condition were not different from the other two conditions. This study highlighted the effectiveness of mailed feedback over control and suggested that the addition of a psychoeducational group did not increase (and may have actually detracted from) the effectiveness of the feedback.

Walters (2000) compared mailed feedback to feedback discussed in a group setting. Heavy drinking college students were randomized to (1) a 2-h group session that integrated personal feedback on drinking, (2) mailed feedback only, or (3) assessment only. Feedback was

identical to that used in Walters et al. (2000), while the group was structured along the lines of an individual motivational interview, consisting of values clarification, discussion of feedback, and non-confrontational advice. At a 6-week follow-up, changes between groups were nonsignificant, though mailed feedback did show a mean decrease over the other conditions.

Finally, Murphy et al. (2004) randomized students to receive personalized feedback with or without an individual motivational interview. At a 6-month follow-up, participants in both groups showed mean reductions in drinking, with no differences between the groups. In contrast to a previous study (Collins et al., 2002), women showed larger reductions than men.

Overall, we conclude that feedback has modest support in literature, particularly among heavier drinkers. Eleven of the 13 reviewed studies (77%) reported some significant reduction in drinking as compared to baseline drinking or (when available) a control or comparison group. Among these, one study reported a significant effect only on heavier drinkers, while another found an effect at 6 weeks, but not at 6 months.

5. Discussion

The numerous differences among this relatively small number of studies combined with methodological limitations make any inferences tentative. However, for the moment, existing data seem to suggest a number of conclusions.

First, it appears that personalized feedback can be effective whether delivered via an individual interview, mail, or computer. Effect sizes were similar across the various feedback-delivery formats. For example, Collins et al. (2000) and Borsari and Carey (2000) report similar 6-week between-group effect sizes (ES) for feedback, whether delivered through the mail (Collins et al., drinks per heaviest drinking week, ES=.28) or via a motivational interview (Borsari and Carey, drinks per week, ES=.21). Duration of effect has yet to be determined, but existing studies suggest that feedback delivered as part of an individual counseling session can be effective for up to 2 years (Baer et al., 1992). The duration of effect for mailed feedback may be somewhat shorter; There are clear effects for mailed feedback at 6 weeks, but the only study to evaluate a longer follow-up found that effects were no longer present at 6 months (Collins et al., 2002). One computer-delivered feedback study found reductions at 3- and 6-month follow-ups (Neighbors et al., 2004). In one study (Murphy et al., 2004) where feedback was directly tested with or without the presence of an individual motivational interview, there was no significant difference between the two formats in terms of drinking outcome. At 6 months, Murphy et al. (2004) reported composite effect sizes of .48 and .42 for feedback with and without a motivational interview, respectively. Thus, at this point, there is little or no evidence that an in-person meeting increases the short-term impact of feedback. However, since no stand-alone feedback studies have followed students past 6 months, it is difficult to say whether the two formats would have a comparable long-term effect.

Aside from individual-level deliveries, three studies combined feedback with group interventions (Larimer et al., 2001; Walters, 2000; Walters et al., 2000). One study

([Larimer et al., 2001](#)) found that the combination of an in-person and group meeting with feedback was better than control, but in another ([Walters et al., 2000](#)), a group session appeared to detract from the effect of mailed feedback. These results, compared with other studies that did not include a group component, suggest that a group meeting may add little or nothing to the feedback effect and may, in some cases, detract from the effect. Indeed, in one unpublished study, fraternity and sorority members who received a group feedback intervention did not fare as well as control ([Martin, Noto, & Walters, 2000](#)). As some have already suggested, in group interactions, concerns about the impressions of other group members may interfere with otherwise effective intervention strategies ([Walters et al., 2000; Walters, Ogle, & Martin, 2002](#)). In addition, for groups of adjudicated or high-risk students, there is the possibility of having multiple instances of extreme feedback scores, which may create a new "deviant" high-risk norm, and reduce the discrepancy that is targeted through normative feedback.

[Table 2](#) lists eight categories of feedback information that were included in the various studies: (1) personal alcohol consumption, such as drinks per week and peak blood alcohol level; (2) alcohol-related consequences, such as injuries, academic performance, time spent drinking, calories consumed, and money spent on alcohol; (3) national, campus-specific, or other drinking norms; (4) risk factors, such as tolerance and genetic risk of alcoholism; (5) alcohol-related expectancies; (6) didactic information; (7) suggestions for moderating drinking; and (8) BAC diary cards. All studies included basic information about personal alcohol consumption and a comparison to gender-specific adult or college student norms. Most but not all studies also included feedback about consequences that participants had experienced as a result of their alcohol use, potential risk factors, and didactic information regarding the effects and dangers of alcohol.

Determining which feedback components are necessary and sufficient for behavior change presents a considerable challenge. Although existing research is insufficient to draw firm conclusions, several possibilities are worth considering. First, some components may be more interesting or motivating to college students than others. One study found an effect when consumption and social norms information was presented alone ([Neighbors et al., 2004](#)), which suggests that these common components of all the reviewed interventions may be sufficient in and of themselves to produce behavior change. It is unclear whether other components, such as risk factors or alcohol-related consequences, have a supplemental effect. Second, the effects of individual components may be additive, such that more information is better. Under this scenario, feedback that offers a variety of information would be expected to have a greater effect. However, no studies have been specifically designed to answer this question, and in this review, no clear patterns emerged. At this point, it appears that normative information may be as effective as feedback that includes other variables. Third, the overall effect may depend on the combination of components. For example, the largest effects may be observed when combining components 1, 2, 6, and 8 without including 3, 4, 5, and 7. It is also possible that some components become less effective in the presence of others (interference), or that components are differentially effective for different kinds of students. For instance, feedback on consumption might be more salient for men, while normative comparisons or caloric intake might be more relevant for women. Although intuitive, at this

Table 2
Feedback content across interventions

Study	Drinking summary	Consequences	US norms	Campus norms	Other norms	Risk factors	Expectancies	Didactics	Moderation strategies	BAC card
Agostinelli et al. (1995)	×	×	×			×		×		
Baer et al. (1992)	×	×	×	×		×	×	×	×	×
Borsari and Carey (2000)	×	×	×	×		×	×	×	×	
Collins et al. (2002)	×	×	×	×		×		×		
Dimeff and McNeely (2000)	×	×		×	×	×			×	×
Larimer et al. (2001)	×	×			×	×	×	×	×	×
Marlatt et al. (1998)	×	×		×		×	×	×	×	×
Murphy et al. (2004)	×	×		×		×		×	×	
Murphy et al. (2001)	×	×		×		×	×	×	×	
Neighbors et al. (2004)	×			×						
Neal and Carey (2004)	×	×	×							
Walters (2000)	×	×	×		×	×		×		
Walters et al. (2000)	×	×		×	×	×		×		

point, we have little information on which to base recommendations about optimal factor combinations.

5.1. By what mechanism does feedback work?

Of the three studies that provided empirical tests of mediators, two found strong evidence for changes in perceived norms as a mediator for intervention efficacy (Borsari & Carey, 2000; Neighbors et al., 2004), which further highlights the role of social norms in the feedback recipe. Perceived norms include perceptions of how much others drink (i.e., descriptive norms), as well as information about what others consider to be acceptable drinking practices (i.e., "injunctive" norms; Reno, Cialdini, & Kallgren, 1993). In this area, research finds that college-aged drinkers tend to overestimate how much other students are drinking (Baer, Stacy, & Larimer, 1991; Borsari & Carey, 2001), and misjudge the prevailing attitudes toward alcohol use and drunkenness (Berkowitz & Perkins, 1986; O'Leary et al., 2002; Prentice & Miller, 1993). Social norms may be particularly relevant at the developmental stage of most college students, because they are exploring new roles, attitudes, and behaviors. Since students use peers to gauge the acceptability of their own drinking practices, it makes sense that discrepant norm information might motivate students to make changes. Interestingly, Collins et al. (2002) found no evidence for changes in the subjective discrepancy between self and others as a mediator. This suggests that changing students' perceptions of peers' drinking may be more important than reducing the perceived discrepancy of their own drinking in relation to peers.

In terms of other mechanisms of effect, Borsari and Carey (2000) found no evidence that drinking reductions were linked to changes in expectancies. These findings do not rule out expectancy feedback as a useful component, but they do suggest that behavioral changes are more strongly tied to perceptions of others' behavior as opposed to expected effects of one's own alcohol use. Additional research is needed to evaluate other potential mechanisms of intervention efficacy, such as attitude changes, risk perception, ability to estimate BAC, and adoption of moderation strategies.

5.2. For whom does feedback work?

A number of studies have tested moderators of effectiveness. However, relatively little information has been found to help identify individuals for whom feedback is more or less effective. The most consistently evaluated moderator has been gender. Across several studies, personalized feedback appears to be equally effective for men and women. Two studies found that gender was related to changes in drinking, but neither found differences as a function of group assignment (Collins et al., 2002; Murphy et al., 2004). For example, in Collins et al. (2002), men reduced their drinking more than women, irrespective of the group to which they were assigned. In contrast, Murphy et al. (2004) found greater overall reductions for women than men, but again, gender differences were independent of group assignment. Other studies have also failed to find outcome differences as a function of gender (Marlatt et al., 1998; Neighbors et al., 2004).

Aside from gender, a number of other moderators have been tested. With few exceptions, feedback seems to be effective irrespective of individual characteristics. Reductions in drinking have been similar across family history of alcohol problems, history of conduct disorder, Greek affiliation, motivation to change, and desire to avoid risks (Larimer, Irvine, Kilmer, & Marlatt, 1997; Marlatt et al., 1998). Only social reasons for drinking and drinking status have been found to differentiate better versus worse candidates for personalized feedback interventions. Neighbors et al. (2004) found that feedback was more effective among students who drank primarily for social reasons. The explanation provided for this finding was that individuals who drink for social reasons may be more interested in a social comparison. Murphy et al. (2001) found that personalized feedback was more effective among heavier drinkers. The authors speculate that, for heavier drinkers, the feedback information may have a larger impact, simply because the information regarding consequences, risk factors, and normative perceptions is more extreme. Related to this finding, some have questioned whether feedback may not be appropriate for abstainers and light drinkers and suggested that it might even be harmful to these low-risk groups. The logic is that receiving feedback indicating a low level of personal risk, as well as the fact that most students consume some alcohol, might actually increase the consumption of abstainers and light drinkers. Although none of the reviewed studies included light drinkers or abstainers, in other studies of mailed (Walters & Woodall, 2003) and in-person (Anderson & Larimer, 2002) feedback, this type of information does not appear to harm abstinent individuals. For instance, in one study (Walters & Woodall, 2003), mailed feedback reduced the drinking of moderate and light drinking adults, and did not change the drinking of abstinent individuals. In addition, there is preliminary evidence from one college study that feedback may delay the initiation of drinking among currently abstinent students (M. Larimer, January 15, 2004, personal communication).

5.3. Recommendations for future research

Overall, results from these studies support the conclusion that feedback can reduce drinking among college students when used as an adjunct to an individual motivational intervention, or in some cases, delivered through the mail or internet. Feedback has less support when used in a group format. Aside from this general support, many questions remain about what kinds of feedback are most effective, under what circumstances, and for what populations. One important finding is that, in short-term follow-up, in-person and stand-alone feedback interventions have been roughly comparable in effect. While a cost-effectiveness study has not been conducted, this finding is intuitively important because of the larger expense associated with the in-person component. Although at least one recent study attempted to minimize costs by using trained college undergraduates to deliver the counseling intervention, this component is still undoubtedly associated with the greater expense. As previously mentioned, though a motivational interview does not appear to increase the short-term impact of feedback, it may increase the duration of the effect. If this finding holds true in future studies, one explanation might be that the counseling session increases the depth of processing of the information. Indeed, Dimeff and McNeely (2000) reported that the more carefully the participant reported reading the feedback, the larger the decrease. Unfortunately,

depth of processing in this study appeared to be confounded with length of time spent with the practitioner. An alternative explanation is that the in-person interview increases verbal commitments to change, which have been predictive of outcome in other populations (Amrhein, Miller, Yahne, Palmer, & Fulcher, 2003). This questions might be answered through a study or series of studies that directly compares the various formats of feedback delivery. The simplest test might involve a dismantling study of motivational interviewing and feedback (i.e., motivational interviewing with feedback, motivational interviewing without feedback, mailed feedback only, assessment only). To examine the impact of verbal commitments, drinking outcomes might be examined as a function of commitment statements expressed during the counseling session. In terms of depth of processing, students might complete an "exit survey" after viewing their feedback, which could then be covaried with outcome. In an experimental design, students might complete a self-guided journal or writing exercise to increase depth of processing or actually calculate their own feedback.

Another important finding that emerged in mediator and moderator analyses was the connection between feedback and social norms, particularly with regard to students' overestimates of peers' drinking. As previously mentioned, these findings are consistent with the large body of literature emphasizing the effects of social context and modeling on college drinking (Borsari & Carey, 2001; Graham, Marks, & Hansen, 1991; Larimer et al., 1997; Wood, Read, Palfai, & Stevenson, 2001). However, at this point, we know less about what information (e.g., quantity/frequency, peak BAC, consequences) or reference group (e.g., year in school, gender, athletic, Greek status) might be most motivating to students. Most studies have given information on rates of moderate drinking or abstinence (e.g., "What percent of students don't drink at all in a typical week?" "What percent of students have two drinks or less in a typical week?") or presented a student's drinking in relation to a reference group. However, the reference groups have varied considerably—from US adults, to US college students, to local college students. One study among fraternity and sorority pledges (Larimer et al., 2001) included a more proximal comparison to Greek house norms.

Because of the important role that drinking norms appear to serve, the choice of a reference group would seem to be critical. A number of social psychological perspectives suggest that individuals may better attend to information from a referent group with whom they perceive themselves as being more similar. These include Social Comparison Theory (Festinger, 1954), Social Identity Theory (Tajfel & Turner, 1986), Social Impact Theory (Latane, 1981), and Social Learning Theory (Bandura, 1977). For instance, a fraternity member might be more interested in a comparison to other fraternity members. However, at the same time, it also seems important to balance the proximity of the reference group with the potential discrepancy of the comparison. For a Greek-affiliated student, a comparison to other Greek students might be more relevant, but might ultimately be less effective because of the elevated drinking norms in this subgroup. This dilemma becomes more apparent when one considers that heavy drinking students tend "cluster" with other heavy drinkers. As another example, preliminary evidence suggests that gender specific normative feedback may have a greater impact on women because female norms are lower and because gender-specific normative beliefs are more closely tied to drinking among women (Lewis & Neighbors, in press). Further research would help to clarify which norms and reference groups make the most

effective comparison. At some point, it might be possible to create an algorithm that weighs the difference between a students' drinking and group norms, against measures of perceived relevance or identification with the group.

Aside from these questions about what feedback components are effective for whom, questions remain about whether feedback differentially impacts aspects of drinking demography (e.g., quantity, frequency, peak episodes, consequences). Most studies have used a quantity-frequency method, such as a weekly calendar, to examine changes in drinking. However, this method may mask more subtle changes, such as a reduction in heavy episodes. There are also questions about feedback formatting, that is, whether some types of layouts, presentation styles, or graphics are most effective. Finally, future studies might also examine ways to more efficiently distribute feedback. The evolution of feedback has largely followed technology—from in-person, to mailed, to computer and Internet applications. One delivery method that has shown promise in the smoking treatment literature is phone counseling (Lichtenstein, Glasgow, Lando, Ossip-Klein, & Boles, 1996), and it may be possible to deliver feedback over the phone, or provide phone counseling as an adjunct to feedback delivered via other means. With the advent of technology, there seem to be many more possibilities for delivering customized and effective information in a timely manner.

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