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A behavioral economic supplement to brief motivational interventions for college drinking

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Abstract

Basic behavioral and neurobiological research has demonstrated that deficiencies in naturally occurring substance-free rewards are both a cause and a consequence of substance abuse that are due in part to the systematic discounting of delayed substance-free rewards. Existing brief motivational interventions (BMIs) for alcohol abuse do not target this mechanism of change. The goal of this uncontrolled pilot study was to evaluate a behavioral economic Substance-Free Activity Session (SFAS) to traditional alcohol BMIs. Participants were 13 college freshmen who reported two or more heavy drinking episodes (>5/4 drinks in an occasion for men/ women) in the past month. All participants completed a baseline assessment and a BMI that addressed alcohol use. In addition, participants received the SFAS, a 50-min individual session that attempts to increase engagement in constructive alternatives to drinking by enhancing the salience of delayed rewards (academic and career success) and the patterns of behavior (academic and extracurricular engagement) leading to these outcomes. At the 1-month follow-up assessment, participants reported significant reductions in heavy drinking, and moderate to large effect size reductions in weekly drinking and peak blood alcohol levels. The results of this pilot study provide preliminary support for the efficacy of this behavioral economic intervention session as a supplement to traditional alcohol BMIs.

Keywords

Alcohol; behavioral economics; binge drinking; college; motivational interventions; substance-free reinforcement

Heavy drinking peaks during late adolescence and early adulthood and is especially common among young adults who attend college (Johnston, O'Malley, Bachman, & Schulenberg, 2007). There are over 9 million US college students, approximately 45% of whom report engaging in heavy episodic drinking (45/4 drinks in one sitting for men/

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women) at least once in the preceding 2 weeks (Hingson, 2010). Although relatively few college students show the patterns of daily heavy drinking characteristic of alcohol dependence (Dawson, Grant, Stinson, & Chou, 2004), when college students drink they often consume large quantities of alcohol (> 5 drinks) over relatively brief time periods, which can result in significant intoxication, impaired judgment and decision making, and dangerously high blood alcohol concentrations (Fournier, Ehrhart, Glindemann, & Geller, 2004). Heavy drinking can also impede critical developmental tasks such as educational attainment and career development (Gotham, Sher, & Wood, 2003), which may in turn increase risk for substance abuse and other problematic outcomes during adulthood (Bennette, McGrady, Johnson, & Pandina, 1999). Heavy drinkers are also less engaged in academic activities during college, and finish with lower grades than other students (McCabe, 2002; Singleton, 2007).

Growing recognition of these social and health problems has made the prevention and treatment of college student alcohol abuse a significant research and public health priority (Hingson, 2010). The most promising interventions for college student drinkers include personalized feedback about factors such as current drinking patterns in relation to normative drinking, blood alcohol content (BAC), alcohol-related risks, and harm reduction strategies (Larimer & Counce, 2007). Often, the personalized drinking feedback is delivered using motivational interviewing (MI), a supportive and nonjudgmental therapeutic approach that focuses on increasing motivation to change (Miller & Rollnick, 2002). These brief motivational interventions (BMIs) result in drinking reductions that exceed various control conditions (Larimer & Counce, 2007; Murphy, Dennhardt, Skidmore, Martens, & McDevitt-Murphy, 2010). That said, recent reviews indicate that effect sizes of these interventions relative to control conditions are generally small to moderate (d 's = 0.11–0.40), and at least 33% of students who receive a BMI continue to drink heavily and experience alcohol-related problems (K.B. Carey, Scott-Sheldon, M.P. Carey, & DeMartini, 2007; Moreira, Smith, & Foxcroft, 2009).

Thus, there is a need to improve the efficacy of BMIs while maintaining the brief format, but there has been little theoretically based research that has addressed this goal (see Turrissi et al., 2009; Wood et al., 2010 for exceptions). Therefore, we recently developed a Substance-Free Activity Session (SFAS) to supplement existing BMIs that is grounded in basic behavioral economic research on reinforcement and decision making.

RATIONALE FOR THE SFAS

The SFAS uses common MI and brief intervention treatment elements (e.g., personalized feedback, reflective listening, open-ended questions, values clarification, and goal setting) to target the behavioral economic mechanisms of substance-free reinforcement and delayed reward discounting (DRD; Murphy, Correia, & Barnett, 2007). These mechanisms originated in theoretical and laboratory work within the areas of behavioral economics and operant psychology, but have more recently been “translated” into several variables that can be measured in naturalistic or clinical contexts (MacKillop et al., 2010; Murphy, MacKillop, Skidmore, & Pederson, 2009; Tucker, Roth, Vignolo, & Westfall, 2009).

Substance-free reinforcement

Numerous experimental studies have shown that high rates of substance use are most likely in contexts devoid of substance-free sources of reinforcement and that substance use will generally decrease if access to alternative reinforcers is increased (Higgins, Heil, & Lussier, 2004). These basic research findings have led to efficacious interventions such as contingency management and coping skills training that attempt to increase substance-free sources of reinforcement (e.g., Petry, Martin, Cooney, & Kranzler, 2000). However,

providing additional sources or reinforcement requires substantial resources on the part of the treatment provider (counselors, money for vouchers) and the participant (attending numerous counseling sessions) and would be difficult to implement with young adult drinkers, who generally show little interest in formal alcohol treatment (e.g., Buscemi et al., 2010).

Applied research with college students has identified specific classes of activities that are inversely related to alcohol use, including studying, volunteering, and the arts (Fenzel, 2005; Vaughan, Corbin, & Fromme, 2009). A study from our laboratory suggests that even among heavy drinkers, enjoyment ratings for substance-free recreational activities are positively related to motivation to change drinking (Murphy et al., 2007). Murphy, Correia, Colby, and Vuchinich (2005) found that participants in a BMI trial who derived a smaller proportion of their total reinforcement from substance use relative to substance-free activities at baseline reported lower levels of follow-up drinking, even after controlling for their baseline drinking level. Thus, heavy drinkers who have a number of enjoyable alternatives to drinking may have an easier time reducing their consumption following an intervention, a finding that mirrors research with adult problem drinkers who change without formal treatment (Tucker et al., 2009). Furthermore, Murphy et al. (2005) found that students who reduced their drinking by at least five drinks per week showed increased proportional reinforcement from substance-free activities at follow-up, and specifically increased academic activity.

It appears that providing explicit guidance to increase substance-free behaviors can also impact drinking. In another study, young adult drinkers were asked to self-monitor their drinking and assigned to one of three substance-free reinforcement conditions for a 4-week period: increased exercise participation, increased creative activities, or control (Correia, Benson, & Carey, 2005). A 1-month follow-up assessment showed that students who were instructed to increase these substance-free behaviors reported doing so, and also reported a statistically significant reduction in drinking. Control participants did not report changes in substance-free activities or drinking at follow-up. Together, these findings highlight the need for a formal intervention approach that attempts to increase alternative activities in non-dependent problem drinkers.

Behavioral economic theory uses the term “reinforcing efficacy” to describe the relative level of preference for a reinforcer such as alcohol (Hursh & Silberberg, 2008). In laboratory settings, reinforcing efficacy is quantified by the amount of behavior (e.g., lever presses and time) allocated to gain access to the reinforcer (Bickel, Marsch, & Carroll, 2000). In naturalistic studies with human participants reinforcing efficacy is measured by the relative level of resource allocation (time and money) allocated toward alcohol (Murphy et al., 2009; Tucker et al., 2009). The reinforcing efficacy of a given drug is a dynamic and contextually determined product of the direct reinforcing effects of the drug, individual difference factors related to decision making (e.g., delay discounting), and the availability of alternative reinforcers (Bickel et al., 2000). In the study described above (Murphy et al., 2005), a matching law (Herrnstein, 1970) based measure of the reinforcing efficacy of alcohol predicted BMI outcome; participants who reported a smaller proportion of their total activity participation and enjoyment (reinforcement) from substance use at baseline reported lower levels of follow-up drinking, even after controlling for their baseline drinking level (Murphy et al., 2005). Thus, even among heavy drinking students, those who report greater levels of participation in enjoyable substance-free activities are more likely to reduce their drinking following a BMI. These results are consistent with research with adult samples of by Tucker and other researchers indicating that behavioral economic measures that quantify the relative value of alcohol *versus* alternatives provide unique measures of problem severity that predict long-term drinking outcomes (Tucker, Vuchinich, Black, & Rippins, 2006; Tucker,

Vuchinich, & Rippins, 2002; Tucker et al., 2009), and suggest that traditional alcohol-focused BMIs may be inadequate for individuals with high alcohol reinforcing efficacy.

Delayed reward discounting

Young adults who drink heavily may under-engage in the constructive alternatives to drinking identified above because the benefits of these activities are generally delayed. DRD refers to the level of decrease in value associated with reward delay. Although the value of all rewards decreases as their receipt is delayed, there are substantial individual differences in the degree that delayed rewards are discounted, and this discounting phenomenon may be a core feature of substance abuse (MacKillop et al., 2010; Madden & Bickel, 2010; Vuchinich & Heather, 2003). Whereas alcohol generally provides immediate reinforcement (e.g., anxiety reduction, euphoria, and social facilitation), many of the substance-free academic and career-related activities (e.g., attending class and studying) that would presumably compete with drinking are associated with extremely delayed outcomes (e.g., graduation, admission to graduate school, and career success) and are generally not enjoyable in the moment (Murphy, Barnett, & Colby, 2006). Students who sharply discount the value of delayed academic and career outcomes may be less likely to engage in the behaviors necessary for success in these domains (e.g., studying, completing internships, or extracurricular activities), and may instead allocate their behavior toward more immediately reinforcing activities such as consuming alcohol. Indeed, numerous studies have demonstrated that substance abusers discount the value of delayed rewards more steeply than control participants (Madden & Bickel, 2010; Reynolds, 2006; Vuchinich & Simpson, 1998).

Behavioral economic laboratory research suggests that increasing the salience of delayed outcomes and the extent to which the behavior leading to those rewards or punishers is viewed as part of a coherent pattern can reduce impulsive response patterns (Hofmeyr, Ainslie, Charlton, & Ross, 2011; Monterosso & Ainslie, 1999; Simpson & Vuchinich, 2000). Loewenstein and Prelec (1992) demonstrated that if future events were perceived as part of a temporally extended sequence or pattern, then their value was discounted less steeply than if the same events were perceived as independent events requiring separate, discrete choices.

One clinical implication of this research is that, short of creating immediate and powerful alternatives to substance use through intensive contingency management approaches (Higgins et al., 2004), or intensive cognitive rehabilitation to reduce discounting (Bickel, Landes, Hill, & Baxter, 2011), interventions should attempt to encourage substance abusers to view their day-to-day behavior as comprising patterns leading toward long-term outcomes (Logue, 2000; Murphy et al., 2007). Personalized alcohol feedback may help to accomplish this perspective shift. Specifically, feedback can aggregate discrete drinking decisions into meaningful patterns like drinks per week, money spent on individual drinking occasions can be totaled by month or year, personal drinking rates can be made relative to that of peers, and individual consequences of drinking can be amalgamated into diagnoses of alcohol abuse or dependence. Furthermore, a key and unique implication of behavioral economic theory is that interventions should attempt to aggregate more global day-to-day decisions and activities (both substance-related and substance-free) into cohesive patterns that have implications for long-term substance-free rewards. For example, an intervention could provide personalized feedback on time spent engaging in academic activities compared to time spent drinking and the specific implications of these patterns on outcomes such as grades and other academic outcomes that are, in turn, associated with future career and financial outcomes (Logue, 2000). Despite the fact that delay discounting has been associated with poor treatment response (MacKillop et al., 2009; Yoon, Higgins, & Heil,

2007), existing brief interventions do not make delayed rewards salient and frame patterns of behavior allocation in terms of their impact on obtaining those rewards.

This study

Given that BMIs for alcohol abuse are among the most cost-effective preventive care measures (Maciosek, Coffield, Edwards, Flottenmesch, & Solberg, 2009), the development and evaluation of innovative and theoretically based methods for improving BMIs is an important research and public health priority. The studies reviewed above suggest that alcohol abuse is often associated with under-engagement in substance-free activities, especially academic and career-related activities that are associated with delayed reinforcement. Individuals with few rewarding alternatives to drinking are less likely to respond to existing BMIs, and individuals who reduce their drinking following a BMI tend to increase their engagement in constructive activities. Yet existing interventions do not facilitate this reallocation of behavior, nor do they attempt to increase the salience of important but delayed rewards (academic and career outcomes).

The SFAS session is grounded in behavioral economic theory and uses MI along with personalized feedback to increase the salience of delayed academic and career activities. Furthermore, the feedback also highlights the current patterns of behavior that lead to those rewards (attending class, studying, participating in extracurricular activities) or may impede progress toward those rewards (missing class, poor grades, lack of involvement in constructive college/community activities, and heavy drinking). Thus, the overall goal of the session is to further reduce drinking by increasing reinforcement from substance-free activities. This study evaluated the initial feasibility and drinking outcomes of the SFAS when combined with a standard alcohol BMI in a sample of heavy drinking college students. We hypothesized that this two-session intervention would be associated with reductions in alcohol use and the reinforcing efficacy of alcohol relative to alternatives.

METHODS

Participants

Participants in this pilot study were 13 first-year undergraduate students at a large metropolitan university in the southern United States. Students were recruited from a mass screening in university-wide introductory classes. Four of the participants were female and nine were male. The mean age of the sample was 18.38 (SD, standard deviation = 0.65). According to self-reported ethnicity/race, 2 of the participants were Black, 10 were White, and 1 did not report a race/ethnicity. Participants reported drinking an average of 19.92 (SD = 18.22) drinks during a typical drinking week and 8.00 (SD = 8.83) heavy drinking episodes in the past month.

Measures

Alcohol consumption—Alcohol consumption was assessed using the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985). The DDQ asks participants to report the total number of standard drinks that they consumed on each day during a typical week in the past month. Days are summed to generate an estimate of typical weekly drinking. The DDQ has been used frequently with college students and is a reliable measure that is highly correlated with self-monitored drinking reports (Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990). In addition, participants were asked how many heavy drinking episodes (5/4 or more drinks in one occasion for a man/woman) they had in the past month, and to report their maximum alcohol consumption for the past month (used to estimate peak BAC).

Reinforcing efficacy of alcohol—Participants completed the Adolescent Reinforcement Survey Schedule – Substance Use Version (ARSS-SUV; Murphy et al., 2005) to measure past-month reinforcement from substance-related and substance-free activities. Past-month activity frequency and enjoyment ratings are made with five-point Likert scales (0–4). Frequency ratings range from 0 (*zero times per week*) to 4 (*more than once per day*), and enjoyment ratings range from 0 (*unpleasant or neutral*) to 4 (*extremely pleasant*). The frequency and enjoyment ratings are multiplied to obtain a cross-product score that reflects reinforcement derived from the activity (Correia, Carey, Simons, & Borsari, 2003). These item scores are then averaged to create three total scores: the average reinforcement from all substance-free activities (substance-free total), the average reinforcement from all substance-related activities (substance-related total), and the total reinforcement ratio, i.e., substance-related total/(substance-free total + substance-related total), which measures the reinforcing efficacy of substance use.

Importance of grades—Participants completed a single item that asked “Overall, how important is it for you to get good grades in college” at baseline and immediately after each of the intervention sessions. Responses options were “not at all important,” “slightly important,” “moderately importantly,” and “very important.” This item reflects the current valuation of a key delayed reward that is targeted in the SFAS session.

Procedure

All procedures were approved by the University Institutional Review Board. Students were screened in university-wide introductory classes. Students who reported one or more heavy drinking episode (5/4 or more drinks in one occasion for a man/woman) in the past month were invited to participate in the trial. Participants completed the study measures during their initial appointment. During this same appointment, all participants completed an individual, 50-min brief alcohol intervention session that included MI and personalized alcohol feedback. This session was modeled after the BASICS program (Dimeff, Baer, Kivlahan, & Marlatt, 1999; Marlatt et al., 1998; Murphy et al., 2010). After 1 week, all participants returned to complete the SFAS with the same clinician. Participants completed a follow-up assessment battery 1 month following the intervention (prior to the start of final exams).

Clinician training and supervision—Clinicians were two graduate students in clinical psychology (Ashley Dennhardt and Jessica Skidmore) and two PhD-level study investigators (James Murphy and Matthew Martens). All clinicians had experience conducting brief alcohol interventions with college students and had completed over 20 h of training in MI that included directed readings, MI training DVDs, and supervised role-plays. Clinicians also completed training in the SFAS, including reading the manual and completing supervised role plays. The graduate students received training and supervision (including review of session tapes) by study investigators James Murphy and Matthew Martens.

Brief alcohol intervention session—This session consisted of four major parts: (a) an introductory discussion that emphasized confidentiality, harm reduction, and the student’s autonomy/ responsibility to make decisions about the information provided in the session, (b) a decisional balance exercise, (c) personalized alcohol-related feedback, and (d) summary, goal setting, and, if the student was interested, reviewing protective behavioral strategies. Personalized feedback elements included: (a) a comparison of the student’s perception of how much college students drink and actual student norms, (b) a comparison of the student’s alcohol use *versus* gender-based national norms, (c) an estimated BAC chart depicting the student’s past month estimated peak BAC and the BAC associated with a more

moderate drinking episode (i.e., a DDQ entry in which the participant drank under the binge threshold and/or spaced their drinking such that their estimated BAC was less than 0.08¹), (d) alcohol-related consequences and risk behavior, including drinking and driving and alcohol-related risky sexual behavior, (e) money spent on alcohol, and (f) calories consumed from alcoholic drinks. Clinicians used MI principles and methods to encourage the student to engage in discussion about the feedback. Students who were interested in changing their drinking were encouraged to set specific goals (see Murphy et al., 2010 for a controlled evaluation of the alcohol MI session). Although personalized feedback is not an essential element of MI (Miller & Rollnick, 2009), they have often been combined in effective brief interventions (Lundahl, Kunz, Brownell, Tollefson, & Burke, 2010), and one study with college students found that the combination of MI and personalized feedback was more effective than either MI or personalized feedback presented in isolation (Walters, Vader, Harris, Field, & Jouriles, 2009).

The SFAS session—The SFAS is a 50 min individual counseling session with the primary aims of increasing the salience of academic and career goals, highlighting the relationship between substance use and goal accomplishment, and increasing engagement in and reinforcement from substance-free alternative activities. This session was developed by the study investigators using a sequential treatment development approach (Rounsaville, Carroll, & Onken, 2001) that included drafting an initial manual and modifying it based on feedback from expert consultants in college drinking and behavioral economics, and from six focus groups with heavy drinking college students. Because this study included only first year students, it was described to participants as the “College Adjustment Session.” The session is similar in structure to a BASICS intervention in that it is conducted in a MI style and students received personalized feedback based on their assessment data.

The session begins by following up with the student about their alcohol and drug use following the previous week’s intervention. Students are also provided with a brief overview of the purposes and format of the SFAS before beginning. The first section of the SFAS is an open-ended discussion of the student’s college and career goals. Prompt questions include:

I’m curious to hear about some of the reasons why you decided to go to college?

What are your goals for college?

What would you like to accomplish over the next 4 years?

What do you hope to do after you graduate?

What do you think you will need to accomplish during college to become a success in that profession?

Do you have any goals related to involvement with campus or community activities?

What are some possible benefits of getting involved with campus or community activities such as volunteering or doing an internship?

Students are encouraged to discuss the values they hold which may keep them motivated to pursue these goals. The purpose of this section is to reduce the discounting of delayed academic and career rewards by making those rewards more salient and personally

¹BAC estimates were generated with the DUI Professional Blood Alcohol Analysis Program (www.duipro.com). The program plots estimated blood alcohol curves over time so that participants could see both their peak BAC and the duration of their elevated alcohol level on both a heavy and a more moderate drinking night. If a participant did not report any moderate drinking nights on the DDQ we generated a hypothetical moderate night (e.g., three drinks over 3 h for a woman, four drinks over 4 h for a man) to use as a contrast to their heavy drinking night.

meaningful. Following this discussion, students are asked to talk about the extent to which they believe that their alcohol and drug use has impacted their ability to accomplish the goals they discussed. The purpose of this activity is to increase the salience of the delayed negative consequences of alcohol and drug use, in particular with respect to the student's ability to accomplish important college and career goals. Prompt questions include:

How does your alcohol use fit in with your ability to accomplish your college goals?

To what extent will your current drinking pattern be compatible with your future academic or professional demands?

After these discussions, the personalized feedback is introduced. As in the BMI session, the feedback is delivered in a non-confrontational, non-judgmental style and interactive style. The feedback includes information on: (a) income differences based on a high school diploma *versus* graduating from college, (b) college graduation rates, (c) income differences based on grade point average (GPA), (d) the requirements for the student's major and/or intended career (students who have not chosen a major or career are provided with general information about academic requirements for graduate school, and advice on how to choose a major), (e) a personalized list of extracurricular activities tailored to the student's major and career goals, (f) a graph of the amount of time the student allocates to several key activity categories (class, studying, extra-curricular activities, exercise, and drinking/drug use), (g) a normative graph that depicts average college GPA as a function of time spent drinking, attending class, and studying (Figure 1), (h) for students struggling with stress or depressive symptoms, information on these symptoms and coping with them (Geisner, Neighbors, & Larimer, 2006), and (i) a list of substance-free recreational or leisure activities that the student reported engaging in recently or reported potentially enjoying.

Again, the feedback is delivered in a non-confrontational, non-judgmental, and interactive style. The overall goal of the feedback is to enhance the value of delayed academic and career goals (e.g., college graduation and grades) in part by specifying the specific financial benefits associated with these outcomes. Another goal is to make a more clear connection between current patterns of behavior (e.g., drinking, studying, and attending class) and the attainment of those delayed rewards. The feedback might also increase the salience of possible delayed costs associated with drinking, namely poor academic performance and lower income. Basic behavioral economic research suggests that individuals may exhibit lower delay discounting when future outcomes are framed in terms of costs instead of rewards (Murphy, Vuchinich, & Simpson, 2001). The clinician uses the feedback material to provide information as well as to develop discrepancy between current behavior and future goals. For example, after presenting the feedback on the student's recent time allocation, the clinician asks: "To what extent is this graph consistent with your priorities for college?" Another goal of the feedback is to increase engagement in currently available substance-free leisure activities. Finally, the material on depression and coping skills is presented because negative affect can interfere with productive goal-directed behavior and also increase the reinforcing value of alcohol (Lewis et al., 2008; Rousseau, Irons, & Correia, 2011).

Following the delivery of the feedback, students are asked to complete a goal setting worksheet. Based on the information they have learned in the session they are asked to set three academic or career goals and one personal goal. These goals are relatively short-term in nature and students are encouraged to be as specific as possible (i.e., "Get a 3.5 GPA this semester" *versus* "Get good grades") and write down the ways in which they will accomplish these goals (e.g., attending class each week, taking advantage of tutoring services on campus). Finally, students received a day planner to assist with time

management, and a list of tips from upperclassman for succeeding in college. A sample feedback report and treatment manual is available from the first author upon request.

Data analysis

All variables were checked for outliers and deviations from normality prior to analysis. Outliers greater than 3.29 SDs above the mean ($p < 0.001$) were re-coded following the recommendations of Tabachnick and Fidell (2006). Square root transformations were used to correct for significant skewness to the drinking variables. Untransformed variables are presented in the tables for interpretational clarity. Paired samples t -tests were used to assess change in baseline to 1-month drinks per week, heavy drinking episodes, peak estimated BAC, and reinforcement. A chi-squared test was used to assess for changes in the subjective importance of getting good grades in college from baseline to post-alcohol MI, and from baseline to post-SFAS. In light of the small sample size, we were primarily interested in determining the effect sizes associated with this new intervention.

RESULTS

A total of 11 of 13 participants (85%) completed the 1-month follow-up. The two remaining participants did not attend their scheduled follow-up appointments or respond to efforts to reschedule. Means, standard deviations, and Cohen's d effect sizes for all continuous variables are presented in Table I. There was a statistically significant reduction in heavy drinking episodes from baseline to 1-month follow-up, $t(9) = 2.34$, $p = 0.04$, $d = 0.61$. Analysis of individual level data indicated that 60% of participants reduced their number of past month heavy drinking episodes; the average percentage reduction from baseline was 78% (range = 50–100%). A total of 4 of the 11 participants did not change and one increased heavy drinking. We also found a non-significant trend level effect of the intervention on peak BAC level, $t(10) = 2.07$, $p = 0.07$, $d = 0.79$. Analysis of individual level data indicated that 64% of participants ($n = 7$) reduced their estimated peak BAC; the average percentage reduction from baseline was 71% (range = 33–100%). Two participants did not change and two increased their estimated peak BAC. Although we did not find a significant decrease in drinks per week from baseline to 1-month follow-up, there was a moderate effect size for this outcome ($t(10) = 1.69$, $p = 0.12$, $d = 0.59$). Analysis of individual level data indicated that 73% of participants reduced their weekly drinking; the average percentage reduction from baseline was 60% (range = 03–100%).

ARSS-SUV scores indicated a small effect size reduction ($d = 0.30$) in the proportion of reinforcement from substance-related activities, although this difference was not statistically significant. Finally, because all participants reported that grades were either “moderately important” or “very important,” we analyzed this outcome dichotomously. The percentage of participants who reported that grades were very important was 69% at baseline, 67% after the alcohol session, and 85% after the SFAS session. A chi-squared test that compared the baseline and post-SFAS values was significant, $\chi^2(1, N = 13) = 5.32$, $p = 0.02$.

DISCUSSION

This study provides a preliminary, uncontrolled evaluation of a novel supplement to standard BMIs. The SFAS session is based on basic behavioral research (Higgins et al., 2004; Hofmeyr et al., 2011; Madden & Bickel, 2010; Monterosso & Ainslie, 1999; Rachlin, 2000; Vuchinich & Heather, 2003) and clinical research indicating that individuals who do not respond to BMIs report high reinforcing efficacy from alcohol (MacKillop & Murphy, 2007; Murphy et al., 2005) compared to substance-free activities. We found that the combination of a standard alcohol-focused BMI session and a behavioral economic SFAS resulted in significant, moderate to large reductions in heavy drinking, and small effect size

reductions in the reinforcing efficacy of alcohol relative to alternatives. Consistent with the goals of the session, participants also increased the extent to which they believed college grades were important. Although our study design did not allow us isolate the effect of the supplemental session above and beyond the standard BMI, and indeed the SFAS is not intended to be a stand-alone intervention for alcohol abuse, the observed drinking reductions compare favorably to those obtained in most clinical trials evaluating standard alcohol BMIs (Carey et al., 2007; Larimer & Cronce, 2007).

Our findings are consistent with behavioral economic theory and suggest that the SFAS session may have enhanced the effect of the alcohol BMI session by increasing engagement in constructive alternatives to drinking (Murphy et al., 2007). The observed changes in the reinforcing efficacy variable indicated that, in addition to reducing drinking, participants reduced the relative role of alcohol within their overall pattern of behavior and enjoyment (Murphy et al., 2005; Rachlin, 2000; Vuchinich & Heather, 2003). Findings were not significant in this small sample but the effect size indicates there was an effect that would be significant in an appropriately powered trial. Participants also increased the extent to which they valued a key delayed reward, college grades. This change was not present after the alcohol session and only emerged after the SFAS. Previous research indicates that changes in drinking are more likely when alcohol accounts for a lower relative proportion of total reinforcement (Murphy et al., 2005; Tucker et al., 2002, 2006, 2009). Students may be more likely to maintain their drinking reductions when their motivation stems not only from increased awareness of the risks of drinking (a primary goal of alcohol BMIs) but also from an awareness of the conflict between heavy drinking and important college and life goals (a primary goal of the SFAS session).

Limitations and future directions

Future research should evaluate the incremental efficacy of the SFAS using a larger sample and a controlled design to more conclusively determine if: (a) the supplemental session improved outcomes beyond the standard alcohol BMI and (b) the improvement was due to the specific content of the intervention *versus* nonspecific additional clinical contact. Previous research suggests that neither MI session length (Kulesza, Apperson, Larimer, & Copeland, 2010) nor the presence of an MI booster session (Barnett, Murphy, Colby, & Monti, 2007) improves outcomes of standard alcohol BMIs with young adult drinkers, which suggests that novel intervention content may be required to improve outcomes (Turrissi et al., 2009; Wood et al., 2010).

Future research should also carefully measure the intended mechanisms of change, increased engagement in constructive alternatives to drinking and lower relative reinforcing efficacy of alcohol, in order to test the theoretical underpinnings of the SFAS. Although the current trial did not have the sample size or follow-up length to evaluate long-term college outcomes, if successful, the SFAS might increase engagement in academics, career, and community-related activities, and possibly improve college performance and retention. Given that college dropout is a significant social problem in its own right (graduation rates from 4-year colleges are typically lower than 50%), this intervention has the potential for dissemination even outside the context of alcohol prevention. Although this study focused on young adults who attend college – an important high risk group that comprises approximately 50% of all young adults – the basic treatment mechanisms that are targeted in the SFAS could easily be translated into other populations of risky drinkers who might benefit from an intervention approach that attempts to increase engagement in constructive alternatives to drinking (non-student young adults, military veterans, the unemployed, or older adults transitioning to retirement). There may also be gender differences in response to the SFAS; college men are less likely to socialize without alcohol (Murphy et al., 2006) and may require an approach such as the SFAS to develop alternatives to drinking. Future

research should also investigate the ideal timing for the SFAS session, both with respect to the transition of interest and the alcohol session. For example, in applications with college students, the SFAS may be more effective with second year students who have identified a major and are starting to think about career options. In terms of session order, it is possible that the SFAS session might be an effective precursor to an alcohol BMI, particularly with individuals who are defensive about discussing their drinking but might be more receptive to discussing their future goals.

Future research should also attempt to dismantle the multiple intervention components or to use qualitative or process-based approaches to determine the key elements of the SFAS. Finally, future research should investigate the use of booster phone or web-based contact to provide additional feedback on time allocation, available substance-free activities, and progress toward college and career goals.

CONCLUSION

In sum, although advances have been made in identifying the key ingredients of BMIs and testing their efficacy with a variety of alcohol abusing samples (Lewis & Neighbors, 2006; Walters et al., 2009; Wood et al., 2010), there has been little development of novel intervention content, despite the fact that research on the development and natural course of substance abuse has identified a number of potentially modifiable risk factors (Carroll, Anker, & Perry, 2009). In particular, there is a need for interventions that are effective with heavy drinkers who do not respond to standard single-sessions BMIs, but who may lack the motivation or resources to engage in extended behavioral or pharmacological treatments (Buscemi et al., 2010). This study was the first to develop a theoretically based supplement to brief alcohol interventions that is based on a consistent body of basic behavioral economic research. Although internal and external validities were limited by our use of small sample and the lack of a control condition, our results suggest that brief alcohol interventions might be improved by adding intervention elements that attempt to shift behavior away from drinking and toward potentially reinforcing substance-free activities (academic, career-related activities, and hobbies).

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Figure 1.

SFAS feedback figure depicting average time allocation of college students as a function of college GPA. This figure is included in the SFAS intervention in order to enhance the salience of the relations between the student's current time use and future academic outcomes. The intervention also includes a figure depicting the positive relation between college GPA and subsequent post-college income, thereby making the connection between current behavioral allocation to drinking vs. academic engagement and the delayed rewards of GPA and income.

Table 1

Means and SDs of alcohol and reinforcement variables.

Variable	Baseline		1-month		Cohen's d
	Mean	SD	Mean	SD	
Drinks/week (<i>n</i> = 11)	20.91	19.78	11.45	10.84	0.59
No. of HDEs (<i>n</i> = 10)	8.20	9.74	3.70	3.71	0.61
Peak BAC (<i>n</i> = 11)	0.12	0.11	0.06	0.06	0.79
Reinforcement ratio (<i>n</i> = 9)	0.40	0.10	0.35	0.21	0.30

Notes: HDE = past month heavy drinking episodes (5/4 drinks per occasion for men/women); BAC = blood alcohol content; reinforcement ratio is the proportion of total reinforcement derived from substance-related activities and is computed from the ARSS-SUV; one participant did not complete the heavy drinking item at baseline and two participants did not complete the ARSS-SUV correctly and thus had missing reinforcement ratio data.