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Personalized Feedback as a Universal Prevention Approach for College Drinking: A Randomized Trial of an e-Mail Linked Universal Web-Based Alcohol Intervention

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Abstract

Alcohol use among first-year university students continues to be a central health concern. Efforts to address drinking in this population have increasingly relied on web-based interventions, which have the capacity to reach large numbers of students through a convenient and highly utilized medium. Despite evidence for the utility of this approach for reducing hazardous drinking, recent studies that have examined the effectiveness of this approach as a universal prevention strategy in campus-wide studies have produced mixed results. We sought to test the effectiveness of a web-based alcohol intervention as a universal prevention strategy for first-year students. An e-mail invitation linked to a brief, web-based survey on health behaviors was sent to all first-year students during the fall semester. Those who completed the baseline assessment were randomized to receive either a feedback-based alcohol intervention (intervention condition) or feedback about other health-related behaviors such as sleep and nutrition (control condition). A second web-based survey was used to collect follow-up drinking data 5 months later. The number of heavy drinking episodes in the previous month and alcohol-related consequences in the previous 3 months served as the primary dependent variables. Negative binomial regression analyses did not indicate a significant effect of the intervention at follow-up on either heavy drinking episodes or alcohol-related consequences. Analyses of additional drinking outcomes among the subsample of students who reported that they did not drink at baseline showed that those who received the alcohol intervention were subsequently less likely to drink alcohol. These results suggest that web-based alcohol interventions may be a potentially useful method of maintaining abstinence among

underage, non-drinking students. Overall, however, results indicate that an e-mail-linked, campus-wide, web-intervention approach to address alcohol use among first-year students may have limited effectiveness as an approach to minimize hazardous drinking over the course of the year.

Keywords

Alcohol; University; Computer; Freshmen; Intervention; Internet; e-Mail

Introduction

Hazardous drinking continues to be one of the major health risk behaviors of university students (Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002; Wechsler, Lee, Kuo, & Lee, 2000). Extensive research has documented negative consequences for students such as drunk driving, risky sexual behavior, and poor academic/work performance that are associated with heavy episodic drinking (Vik, Carello, Tate, & Field, 2000). Hazardous drinking is of particular concern for first-year college students (Borsari, Murphy, & Barnett, 2007) who exhibit high levels of consumption as they are attempting to manage a number of developmental transitions in new social and physical environments (Schulenberg & Maggs, 2002).

Recognition of heightened risks associated with drinking among first-year students has led to the implementation of alcohol prevention programs for incoming students at a number of universities. Among these approaches, brief interventions that include personalized feedback about drinking (Carey, Scott-Sheldon, Carey & DeMartini, 2007) are particularly successful methods of reducing alcohol use. Indeed, a number of studies have now been conducted that suggest that personalized alcohol-specific feedback alone may be an efficacious approach to promote change in hazardous drinking in this population (see Carey et al., 2007; Walters & Neighbors, 2005). Interventions use feedback to provide students with corrective norms about drinking among fellow students (e.g., Larimer et al., 2007; Neighbors, Larimer, & Lewis, 2004), as well as information regarding costs, calories and consequences, in order to influence their standards about how much alcohol to consume and to increase motivation to reduce drinking (Hustad, Barnett, Borsari, & Jackson, 2010; Walters, Vader, & Harris, 2007).

Prevention approaches that are based on personalized feedback may have a number of advantages for addressing college drinking, including low participant burden, low training and supervision requirements, low cost and ease of dissemination, the potential for tailoring intervention content, and the ability to deliver content without face-to-face contact with an intervention specialist (Kypri et al., 2004; Larimer et al., 2007; Neighbors et al., 2004; Saitz et al., 2007; Walters et al., 2007; Zisserson, Palfai, & Saitz, 2007). Research that has examined the value of computerized feedback-based approaches for reducing hazardous drinking has yielded promising evidence of the efficacy of web-based interventions in health care settings (Kypri et al., 2004), judicial affairs (Barnett, Murphy, Colby, & Monti, 2007; Carey, Henson, Carey, & Maisto, 2009) and campus-wide interventions (Hustad et al., 2010; Neighbors et al., 2004).

Despite evidence from a number of randomized controlled trials that supports the efficacy of personalized feedback interventions for students identified as hazardous drinkers, there are several unanswered questions that are pertinent to university administrators who wish to incorporate these strategies into large scale universal screening approaches for their incoming students. In addition to choosing the specific type of intervention, administrators must make decisions about how to distribute interventions to entire incoming classes and how to encourage students to complete screening processes. A variety of approaches have been utilized ranging from increasing awareness of the availability of alcohol screening programs to making completion of screening and assessment mandatory (e.g., as part of registration or as a requirement for athletic involvement). Choices among these various strategies rest on the relative values that a given university may place on issues such as participation, program effectiveness, and student autonomy.

A related issue concerns how to deliver alcohol intervention approaches that may be of use to an entire incoming class (i.e., both drinkers and non-drinkers) as a universal prevention strategy. The utility of electronic screening and brief intervention (eSBI) as a universal prevention strategy has not been well explored. With a few exceptions (e.g., Larimer et al., 2007; Neighbors et al., 2011), there is relatively little evidence that supports feedback-based approaches as a prevention strategy for those who are light or non-drinkers (Elliot, Carey, & Bolles, 2008). Moreover, there is concern that the use of screening and personalized normative feedback as a universal prevention strategy may be irrelevant for non-drinking students or, given some evidence of the potential for iatrogenic effects of these alcohol prevention programs (Werch & Owen, 2002), may even have negative consequences. Although recent studies have not indicated increased alcohol involvement following feedback-based interventions (Walters et al., 2007), the absence of prevention effects for either non-drinking or lighter drinking students may be a limitation to personalized feedback-based approaches that seek to limit alcohol use among all incoming first-year students.

Another pertinent issue is how to determine whether a web-based intervention that has been empirically supported in well-controlled research settings will be effective when implemented at a population level. Recent large scale effectiveness trials of empirically established brief interventions (e.g., single-session motivational or feedback interventions) have shown relatively little effect on campus-wide heavy drinking over time (Neighbors et al., 2010; Wood et al., 2010). This may be of particular concern for web-based alcohol interventions for college students given that the effects of computerized interventions appear to be shorter-lived than in-person approaches (Carey, Scott-Sheldon, Elliott, Garey, & Carey, 2012). Indeed, recent work suggests that computerized interventions for college drinking may have short duration effects (e.g., Hustad et al., 2010), however, additional approaches may be required to extend effects past the first semester (Neighbors et al., 2010; Paschall, Antin, Ringwalt, & Saltz, 2011; Walters et al., 2007). Given the costs of screening, it is uncertain whether brief intervention effects may be observed over longer term outcomes.

Finally, the evaluation of any given approach at the university level is also a challenge. Randomized controlled trials in the literature typically include incentives that are sufficient

to ensure to high rates of participation at baseline and follow-up timepoints. Typically, these incentives are not available for university administrators which reduces participation, follow-up and consequently hinders program evaluation (Ekman et al., 2011).

In the current study, we sought to evaluate the effectiveness of a web-based screening and brief intervention approach as a universal prevention strategy in the context of a university-wide effort to limit alcohol use among first-year students. The purpose of this study was to examine the effectiveness of an e-mail invitation linked to a screening and prevention strategy to minimize alcohol use. Our primary goals were to examine whether: (1) this e-mail-linked, web-based universal prevention approach could engage a substantial proportion of the student population (over 50 %); (2) the alcohol intervention was associated with less hazardous drinking over the course of the first academic year for the population as a whole; and (3) the intervention was an effective strategy to maintain abstinence among students who were non-drinkers when they began university. We hypothesized that those exposed to the alcohol intervention would exhibit less frequent heavy episodic drinking and fewer alcohol-related consequences than those exposed to the control intervention. Moreover, we explored the hypothesis that students exposed to the intervention who did not drink alcohol at baseline would be more likely to maintain abstinence at follow-up.

Methods

Participants

Participants were first-year students at a private urban university in the United States who were 18 years of age or older. In the fall semester of their first year, we invited all of these students ($n = 3,746$) by e-mail to participate in a study of college health behaviors that was characterized as a brief (15 min) web-based study on health behaviors at the university. A link to the study assessment was included within the e-mail. We offered students who completed the survey the opportunity to participate in a lottery that involved a series of \$100 and \$500 gift certificates from a major on-line retailer. Prior to the study e-mail, the Dean of Students sent an official e-mail to all first-year students announcing the upcoming study and encouraging participation. Figure 1 presents the randomization process and flow of participants through the study. Following the example of Kypri et al. (2004), we used a two-stage consent procedure. We initially provided students with a description of the study as a survey of college health behaviors and informed them that they would be receiving personalized feedback on their responses. Altogether, 1,398 students logged on to the survey (37 % of those eligible for the study) and 1,336 completed the baseline assessment questions. We then randomized students to either an intervention or control condition. We divided students into four groups as defined by their gender and hazardous drinking status, and then randomized them within each stratum. Hazardous drinking status was indexed by scores on the Alcohol Use Disorders Identification Test (AUDIT; Babor, De La Fuente, Saunders, & Grant, 1992) and frequency of heavy drinking episodes (i.e., AUDIT score ≥ 8 or two or more heavy drinking episodes in the past month). Within each of these four strata, we randomized students to conditions based on a 2–1 ratio, using a randomly permuted blocks size of 6 and 9. This ratio was chosen to maximize the number of students exposed to the web-based alcohol intervention (which contained content shown to be efficacious in

previous smaller-scale studies). Following randomization, students viewed either the alcohol-related feedback (intervention condition) or general health feedback (control condition). At the end of the baseline procedures, students indicated whether they would permit the study team to contact them by e-mail in the next semester and invite them to complete a subsequent survey. Eighty-five percent of those who completed the baseline procedures ($n = 1,137$; 87 % control, 84 % intervention) agreed to be recontacted.

Five months after the initial survey, we sent these students a second e-mail announcing the follow-up study. A second consent form that described the nature of the follow-up study questions preceded the second survey. A total of 705 students completed the follow-up procedures, which represented 62 % of those who agreed to be contacted. Those who completed the brief on-line assessment received a \$10 on-line gift certificate and were enrolled in an additional drawing for a larger gift certificate (10 at \$50 and two at \$500).

Independent Variable

Students in the control condition received standard feedback about their sleep and dietary behavior based on their responses to screening questions. The feedback form included individualized reports of each student's sleep, exercise, and consumption of fruit, vegetables, and high fat foods. This was accompanied by standard feedback on guidelines for nutrition, exercise and sleep patterns. Students in this condition did not receive alcohol-related feedback.

The alcohol intervention sought to correct misperceptions of peer drinking norms, provide personalized feedback that would support student choices to abstain from drinking, and offer harm reduction tips regarding alcohol use. Students in the intervention condition were given feedback based on their responses to the alcohol screening questions. Those who underestimated the relevant norm for a particular alcohol indicator (only 3 % of the sample underestimated both quantity and heavy episodic drinking) did not receive feedback about their perceived norms concerning quantity of alcoholic drinks or heavy episodic drinking. All non-drinking students in the intervention condition received personalized feedback about how their drinking behavior compared to a gender matched student (Lewis & Neighbors, 2007) who engaged in hazardous drinking behavior (e.g., a hypothetical student with three heavy drinking episodes per week) in terms of monetary savings, calories, and avoidance of risk. For example, female students who did not drink received information about the costs and calories related to a female peer who consumed four drinks three times per week. One of the advantages of a computerized intervention approach is that students may receive feedback about their own drinking (e.g., costs and calories) as compared to heavy drinking students in order to make the benefits of their decisions to abstain more salient. A peak blood alcohol level (BAL) was calculated based on an algorithm for a hypothetical hazardous drinking student who was the same gender and weight as the student completing the intervention. Typical cognitive and physiological effects at that BAL were presented as part of the alcohol-related feedback. Students then received information concerning a series of alcohol harm reduction strategies (e.g., alternate non-alcoholic beverages when drinking alcohol). To promote greater depth of information processing, students rated the value of each strategy as a means to reduce alcohol-related harms. Finally, students had the option of

selecting information about the effects of alcohol as related to various topics of interest (e.g., weight, sleep, and duration of effects). The intervention ended with university specific web-resources for wellness, nutrition, and health services. The intervention took approximately 15 minutes to complete.

Dependent Measures

Health Behaviors Survey—Students completed eight questions regarding various aspects of health behavior including exercise frequency, smoking, and dietary habits (e.g., fruit and vegetable consumption). These items were administered to all participants and were used to generate feedback content for individuals in the control condition.

Drinking Status—Hazardous drinking status was defined as two or more heavy drinking episodes in the past month or an AUDIT score of ≥ 8 (Babor et al., 1992). Drinking status (yes/no) was determined by the question, “How often did you have a drink containing alcohol?” from the AUDIT. Students completed these measures at baseline and follow-up.

Indices of Risky Alcohol Use—To examine the effect of the intervention on hazardous drinking, students completed measures of alcohol use and alcohol-related consequences (Dimeff, Baer, Kivlahan, & Marlatt, 1999; Wood et al., 2010). The primary dependent variable for this study was the frequency of heavy episodic drinking (i.e., four or more drinks per occasion for females and five or more for males) in the past month (Wechsler et al., 2000). In addition, two items (i.e., “typical quantity per occasion in the past month” and “typical quantity per week in the past month”) were employed to calculate the index of typical quantity per week. We used this measure to calculate a dichotomous measure of risky drinking based on National Institute on Alcohol Abuse and Alcoholism (NIAAA) guidelines for men (>14 per week) and women (>7 per week) (National Institute of Alcohol Abuse and Alcoholism, 2007). Students also completed an eight-item subset of alcohol-related consequence items from the Young Adult Alcohol Consequences Questionnaire (YA-ACQ; Read, Kahler, Strong, & Colder, 2006) at baseline and follow-up, to provide additional information about alcohol-related consequences within the past 3 months. This subset of common young adult alcohol-related consequences was highly correlated ($r = .91$) with the full YAACQ in a replication sample of 120 first-year students.

Statistical Analyses

The primary aim of this study was to examine whether students exposed to the universal web-based alcohol intervention were less likely to drink in a hazardous manner than those in a control group. To address this question, we examined two continuous outcomes (i.e., number of heavy drinking episodes in the past month and number of negative alcohol-related consequences in the past 3 months) and one dichotomous outcome (i.e., whether the student engaged in risky drinking over the outcome period as defined by NIAAA guidelines of either more than 3 or 4 drinks on any one occasion or 7 or 14 drinks per week for females and males, respectively), controlling for the corresponding baseline drinking variable. We also examined the influence of the intervention on “typical drinks per week” and on abstinence. In particular, we were interested in addressing the question of whether students who were non-drinkers at baseline were more likely to report non-drinking at follow-up if

they were exposed to the alcohol intervention. Because these count data were heavily skewed, we used negative binomial regression approaches for each of these analyses. For the dichotomous outcomes (i.e., NIAAA [2007] guideline for risky drinking and non-drinking), logistic regression analyses were used.

Results

Baseline Characteristics

Of those who completed the initial survey, female students constituted 67 % of the sample and the majority of the students identified themselves as White (72.7 % White, 18.8 % Asian American, 3.2 % African American, and 5 % other; 9 % of these students identified themselves as Hispanic). This distribution is consistent with university reports of demographic characteristics of the undergraduate population (i.e., 62 % female, 59 % White, 19 % Asian, 3.2 % African American, and 8.6 % Hispanic). The mean age of students was 18.21 ($SD = .46$). The mean AUDIT score was 4.73 ($SD = 4.98$), mean number of heavy drinking episodes was 1.83 ($SD = 2.96$) and the mean number of alcohol-related consequences was 1.35 ($SD = 1.68$). These characteristics did not differ by intervention group. Of the students who completed the baseline survey, 486 (36 %) were hazardous drinkers and 398 (30 %) were non-drinkers. Consistent with previous work (Larimer et al., 2007), female ($\chi^2 = 10.82, p < .01$) and non-hazardous drinkers ($\chi^2 = 7.14, p < .05$) were more likely to complete both baseline and follow-up surveys. Table 1 shows the baseline characteristics of those who completed the study by intervention condition. Follow-up did not significantly differ by intervention condition ($\chi^2 = 2.51, ns$).

Effects of the Intervention on Risky Drinking

To examine whether the intervention was associated with less hazardous alcohol use for the sample as a whole, we examined the outcomes of heavy drinking episodes, negative consequences, and risky drinking (based on NIAAA guidelines). These results are summarized in Table 2, in which the control condition serves as the reference group. Our primary analysis was conducted on frequency of heavy drinking episodes in the past month, controlling for heavy episodic drinking at baseline. Negative binomial regression analyses revealed that there was no significant effect of the alcohol intervention on past-month heavy drinking episodes [IRR = .91 (95 % confidence interval CI 0.73, 1.14, *ns*), as students in the two conditions exhibited similar rates of heavy drinking at follow-up. Similarly, there was no significant effect at 5 month follow-up on the number of negative consequences reported [IRR = 1.10 (95 % CI 0.86, 1.39), *ns*]. Analyses conducted on typical weekly consumption, which deleted one subject who reported typical drinking 10 standard deviations above the mean, also showed no intervention effects [IRR = .90 (95 % CI 0.75, 1.08), $p = .27$. Finally, we examined the influence of the intervention on risky drinking as a dichotomous variable based on NIAAA-guidelines (See Table 3). We used logistic regression analyses to examine whether the intervention was associated with lower odds of risky drinking at follow-up, controlling for baseline risky drinking. As shown in Table 3, these analyses found little difference between groups as indicated by the adjusted odds ratio [$OR = .921$ (95 % CI 0.72, 1.40), *ns*], with 47 % of students in the intervention and 48 % of those in the control group meeting criteria at follow-up. Examination of gender as a moderator of this intervention

showed no evidence of any significant Intervention by Gender interactions on the above indicators. Thus, these analyses did not support the hypothesis that the intervention would reduce hazardous drinking among first-year students.

Effects of Intervention on Heavy Episodic Drinking and Alcohol Consequences Among Hazardous Drinkers

Although the primary goal of this intervention was to minimize hazardous drinking across the entire first-year class, we also examined the influence of the intervention for those students who were hazardous drinkers at baseline. Support for the use of computer-based interventions has largely come from studies that utilize students who are identified as at-risk given their drinking patterns (Carey et al., 2012). Parallel analyses conducted among students identified as hazardous drinkers did not show any effect of the intervention on alcohol involvement. Controlling for relevant baseline measure of alcohol involvement, the intervention had no effect on either heavy drinking episodes [IRR = .91 (95 % CI 0.73, 1.13), *ns*] or negative consequences [IRR = 1.10 (95 % CI 0.86, 1.39), *ns*]. We observed similar findings for the dichotomous risk drinking variable as shown in Table 3. Thus, the study did not provide support for the hypothesis that the web-based intervention would reduce risky drinking among students identified as hazardous drinkers at baseline.

Effects of Intervention on Non-drinking Students

We used logistic regression analysis to examine whether the intervention group predicted alcohol use (yes/no) among non-drinking students during the follow-up period. Results showed a significant difference in the odds of drinking alcohol between intervention and control groups, [OR = 0.50 (95 % CI 0.26, 0.98), $p < .05$]. Only 17 % of the students in the intervention group reported drinking in the past 3 months, relative to 30 % of those in the control condition. We also examined the influence of the intervention on the occurrence of heavy drinking in the past month. Because of the low frequency of heavy drinking episodes, we used logistic regression to examine whether students had one or more heavy drinking episodes in the past month (yes/no). Results from this analysis did not show any difference in the occurrence of heavy episodic drinking (yes/no) by intervention group [Intervention = 10 %, Control = 10 %, OR = 1.02 (95 % CI 0.40, 2.63), *ns*]. For students who did begin drinking, the mean number of drinks per occasion in the past month was 2.15 ($SD = 1.98$) and the mean number of heavy drinking episodes in the same period was .79 ($SD = 1.3$). Thus, consistent with previous work with college students (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001), initial alcohol use patterns tended to be relatively strong predictors of alcohol use over time.

Discussion

We conducted the current study to test the utility of a universal approach to address alcohol use among first-year university students. This e-mail-linked intervention was designed to provide alcohol-related feedback to students regarding drinking norms, increase the salience of benefits associated with personal decisions to abstain, and provide protective strategies related to alcohol use. Our goal was to test the effectiveness of an optional, single session, web-based screening and brief intervention approach to reduce hazardous drinking over the

course of students' first college year, a time of particular risk (Borsari et al., 2007). Although the efficacy of computer-based interventions has been empirically established in a number of studies with short-term outcomes (e.g., 6 weeks), decisions about implementation for university administrators rest on questions about whether these interventions can be broadly disseminated, whether they are readily utilized by students, whether they have enduring effects on hazardous drinking, whether they can be evaluated, and whether they are cost effective.

Results from students who completed the study revealed limited evidence of the value of this approach as a universal intervention strategy to minimize hazardous drinking across their first year. Among completers, there were no significant differences in heavy drinking episodes or negative consequences. Indeed, none of the alcohol-related outcomes in the entire sample showed differences at 5 months. This finding is consistent with similar previous evaluations of single web-based interventions during the first semester, which do not produce significant reductions in hazardous drinking over the course of the academic year (Cunningham, Hendershot, Murphy, & Neighbors, 2012; Neighbors et al., 2010). However, this study did not seek to examine the influence of the intervention on short-term (1–2 month) outcomes (Walters et al., 2007), which may be a sufficient goal for administrators who are seeking to minimize harm at the particularly high risk time when students first come to university.

Although there were no significant overall effects of the intervention, logistic regression analyses among the non-drinking sample provided suggestive evidence that this intervention may prevent the uptake of alcohol among students who do not drink. Consistent with previous universal prevention studies (e.g., Larimer et al., 2007; Wood et al., 2010), we found that this computerized alcohol intervention was associated with a lower likelihood of alcohol use among students who were non-drinkers at baseline. Such findings offer some promise that the same types of personalized feedback strategies that have been effective for hazardous drinking college students (Walters & Neighbors, 2005) may be modified to influence the drinking behavior of non-drinking students as well. The on-line tailoring capabilities afforded by computerized systems opens up the possibility of using tailored feedback approaches as a universal prevention strategy for college students. With the flexibility of a computerized intervention, we were able to tailor this approach for non-drinking students to correct misperceptions of peer drinking norms for students who overestimated gender-specific norms. Furthermore, we were able to provide personalized information about how their drinking behavior compared to a gender-matched student who engaged in hazardous drinking behavior in terms of estimated savings, calories, and risks. Finally, students were also provided with a series of protective strategies for minimizing alcohol-related harm.

There are several limitations to the current study that should be addressed in future studies. First, this e-mail-linked screening and brief intervention was completed by only 37 % of the students in the incoming class. This is a lower percentage than a previous study that used similar methods (Saitz et al., 2007), in which 50 % of the incoming class completed the eSBI. A number of factors may have reduced our completion rate. First, the use of e-mail surveys may be much more common today than at the time of Saitz et al. (2007) study,

leading to greater selectivity among students in their decisions to respond to them. Second, in an effort to increase recruitment and confirm the authenticity of the survey, the study included a preceding e-mail announcing the study from the Dean of Students. Although this may have increased the perceived legitimacy of the study itself, it may have decreased participation among students concerned about the confidentiality of their responses to a survey on alcohol use (an illegal behavior for most first-year students) that was supported by the university administration. Third, participation may also have been influenced by the size of the financial incentives. The incentives used in this study for participation in the initial survey were designed to be sufficiently modest to allow easy implementation within most university budgets. However, our approach may not have been sufficient to engage the majority of students in the survey itself. Fourth, the consent procedures and elements related to obtaining subject-specific follow-up data may have reduced participation. The two-stage recruitment procedure asked students to complete the initial survey and then participate in the outcome study. Although this procedure did not appear to differ by intervention group, there were differences in completion by gender and hazardous drinking status, and there may have been other important differences between students who did and did not complete the follow-up that we were unable to identify with our brief screening instrument. Moreover, even though data were kept separate from e-mail addresses and passwords, our requirement that students enter their e-mail address to enroll may have limited their participation. However, it should be noted that the percent of students who participated in the study is consistent with other college campus-wide surveys and established national surveys of alcohol and drug use (see Cunningham et al., 2012; Kypri, Samaranayaka, Connor, Langley, & MacLennan, 2011; Laguilles, Williams, & Saunders, 2011). However, university administrators who wished to utilize this approach as a primary strategy for addressing hazardous drinking among first-year students would likely require much higher participation rates. The question of whether and how this approach can be modified to increase engagement by students remains to be addressed. Strategies to increase engagement may depend on university settings (e.g., urban, university size). The study was conducted at a single, private, urban university in the US with over 15,000 undergraduate students. It will be important to examine the generalizability of these results by studying this approach in other university and college settings. Finally, the current study consisted of only one five month outcome time point and produced significant changes only for variables related to abstinence, not to quantity of alcohol use.

In conclusion, web-based screening and brief intervention approaches that are introduced by e-mail can reach a large proportion of students with relatively little cost and high flexibility as to time of delivery and content of information. Such approaches may provide an alternative mode of delivery that can ultimately be integrated with other secondary prevention efforts utilized on campus. Previous research has shown that even with minimal incentives, students are responsive to invitations to participate in such interventions regardless of whether they are presented as alcohol specific or general health surveys (Saltz et al., 2007). However, the question of whether a voluntary, universal alcohol prevention strategy based on personalized feedback can minimize hazardous drinking among first-year students remains unclear (Cunningham et al., 2012). Future efforts to examine the

effectiveness of web-based interventions in campus-wide studies will be critical to establishing the value of such approaches (Neighbors et al., 2010).

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Fig. 1.
Flow of participants through the randomized trial

Table 1

Baseline characteristics of study completers by condition ($N = 705$)

Variable	Control	Intervention
Gender, n (%) ^a		
Female	181 (72.7 %)	319 (70.0 %)
Male	68 (27.3 %)	137 (30.0 %)
Race, n (%)		
White	186 (74.7 %)	342 (75.0 %)
Asian/Asian American	49 (19.7 %)	74 (16.2 %)
African American	7 (2.8 %)	20 (4.4 %)
Hispanic	23 (9.2 %)	40 (8.8 %)
Age, mean (SD)	18.23 (.43)	18.18 (0.45)
Drinks per week	3.58 (5.58)	4.07 (7.18)
AUDIT ^b	4.35 (4.56)	4.21 (4.76)
Heavy episodic drinking ^c	1.56 (2.45)	1.60 (2.69)
Alcohol-related consequences ^d	1.23 (1.44)	1.22 (1.63)
Risky drinking ^e , n (%)	118 (47.4 %)	205 (45.0 %)
Alcohol use, n (%)	177 (71.1 %)	306 (67.1 %)

^aReflects percentage of within condition

^bAlcohol Use Disorders Identification Test (Babor et al., 1992)

^cNumber of heavy drinking episodes in the past month (Wechsler et al., 2000)

^dAlcohol-related consequences from the Young Adult Alcohol Consequences Questionnaire (Read et al., 2006)

^eRisky drinking according to NIAAA guidelines (NIAAA, 2007)

Table 2

The influence of intervention on alcohol involvement among first-year students: continuous outcomes ($N = 695$)

	Control (SE)	Intervention (SE)	IRR ^a (95 % CI)
Heavy drinking episodes			
Unadjusted	1.54 (.13)	1.46 (.09)	.95 (.78, 1.16)
Adjusted	1.11 (.10)	1.01 (.07)	.91 (.73, 1.14)
Alcohol consequences			
Unadjusted	1.02 (.09)	1.18 (.08)	1.16 (.93, 1.44)
Adjusted	.73 (.07)	.80 (.05)	1.09 (.86, 1.39)
Drinks per week			
Unadjusted	3.86 (.28)	3.85 (.20)	1.00 (.84, 1.19)
Adjusted	2.95 (.22)	2.66 (.15)	.90 (.75, 1.08)

Note Covariates are corresponding baseline alcohol use variable. Control is the reference group in all analyses. Controls make up 35 % of sample

^a IRR: Adjusted Incident Rate Ratio, controlling for baseline alcohol variable

Table 3

The influence of intervention on alcohol involvement among first-year students: dichotomous outcomes ($N = 695$)

	<i>B</i>	<i>SE</i>	<i>OR</i> (95 % CI)
Full sample			
Risky drinking	.02	.21	1.02 (.68, 1.54)
Any drinking	-.38	.25	.68 (.42, 1.13)
Hazardous drinkers ^a			
Risky drinking	-.28	.45	.76 (.31, 1.84)
Any drinking	.52	1.01	1.68 (.23, 12.11)
Non-drinkers ^b			
Risky drinking	.07	.48	1.07 (.41, 2.77)
Any drinking	-.69	.34	.50* (.26, .98)

Note Baseline alcohol use variable is used as a covariate for the full sample analyses only. Control is the reference group in all analyses. Controls make up 35 % of the sample

^aHazardous drinkers at baseline

^bNon-drinkers at baseline

* $p < 0.05$