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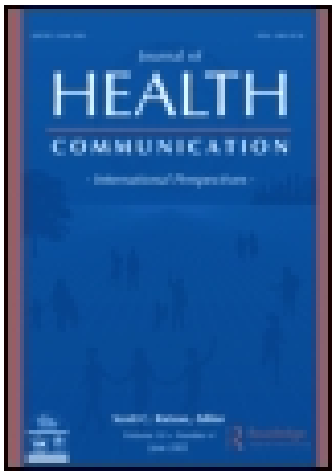

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The Glass Is Half Full: Evidence for Efficacy of Alcohol-Wise at One University But Not the Other

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The Glass Is Half Full: Evidence for Efficacy of Alcohol-Wise at One University But Not the Other

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This research extends the growing literature about online alcohol prevention programs for first-year college students. Two independent randomized control studies, conducted at separate universities, evaluated the short-term effectiveness of Alcohol-Wise, an online alcohol prevention program not previously studied. It was hypothesized the prevention program would increase alcohol knowledge and reduce alcohol consumption, including high-risk alcohol-related behaviors, among first-year college students. At both universities, the intervention significantly increased alcohol-related knowledge. At one university, the prevention program also significantly reduced alcohol consumption and high-risk drinking behaviors, such as playing drinking games, heavy drinking, and extreme ritualistic alcohol consumption. Implications for the use of online alcohol prevention programs and student affairs are discussed.

Alcohol use and abuse among adolescents and college-age students is alarmingly high (Johnston, O'Malley, Bachman, & Schulenberg, 2012a, 2012b). Academic leaders and administrators deal with the tragic consequences of excessive and risky consumption of alcohol on a daily basis. From poor academic performance to accidental injury or death, the harmful effects of high-risk drinking pervade higher education (Hingson, Heeren, Winter, & Wechsler, 2005; Murphy, Hoyme, Colby, & Borsari, 2006; Wechsler et al., 2000). More than 90,000 sexual assaults and as many as 1,800 deaths are associated annually with alcohol consumption among college students (Hingson et al., 2005; Hingson, Zha, & Weitzman, 2009).

First-year college students are particularly susceptible to abusing alcohol as they are in new academic and social settings, less subject to the control of parents, and may have incorrect perceptions about the extent and frequency of alcohol use among their peers (Berkowitz, 2005; Perkins, Haines, & Rice, 2005). In a study of more than 10,000 students from 14 colleges and universities approximately 55% of first-year students reported drinking, with 41% of men and 34% of women engaging in high-risk drinking at least once in the past 2 weeks (White, Courtney, & Swartzwelder, 2006).

This heavy drinking comes with significant consequences. The brain undergoes substantial neuronal remodeling during adolescence, which is affected by exposure to alcohol (Brown et al., 2008; Oscar-Berman & Marinkovic, 2003). This pivotal period of brain development also occurs at a time when decision-making capabilities are still in the formative stage (Mills, Reyna, & Estrada, 2008; Reyna & Farley, 2006). Adolescents perceive risk differently than adults and engage in risky behavior to a much greater extent than later in life (Mills, Reyna, & Estrada, 2008; Reyna & Farley, 2006; Reyna et al., 2011; Spear, 2000; Steinberg, 2008).

Ichiyama and Kruse (1998) found that high-risk drinking first-year students experienced more alcohol-related problems than first-year students who did not engage in such drinking. Of greater concern, Grekin and Sher (2006) reported the rate of alcohol dependence among first-year students to be 15%, more than twice as high as the rate (6%) for dependence among all college students (Knight et al., 2002). First-year students who fail to endorse a personal responsibility to obey drinking laws are significantly more likely to consume greater amounts of alcohol, engage in high-risk drinking behaviors, and experience alcohol-related harms,

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than first-year students who endorse a personal responsibility to wait until they are of legal age to drink (Reyna et al., 2013). This transition from high school to college in high-risk drinking, with the potential for the development of alcohol dependence, occurs during a relatively short period of time and speaks to the need for specific interventions targeted to college-bound students the summer before or early in the first semester of college.

Commercially available web-based prevention programs are widely used by institutions of higher education with the intent of decreasing drinking among first-year college students. The extant evidence suggests these programs vary in their effectiveness. Some research has demonstrated positive behavioral effects of these programs for first-year students who are heavy drinkers, at-risk students, or students who drink before coming to college (Bersamin, Paschall, Fearnow-Kenny, & Wyrick, 2007; Chiauzzi, Green, Thum, & Goldstein, 2005; Walters, Vader, & Harris, 2007).

However, the results of randomized controlled studies for the use of these programs as a universal alcohol prevention program for all incoming first-year students has been mixed. For example, Paschall, Bersamin, Fearnow-Kenney, Wyrick, and Currey (2006) evaluated the efficacy of College Alc, an online education-focused program, and found improvements in alcohol knowledge, intentions, and attitudes, but no changes in drinking-related behavior or alcohol-related problems, such as vomiting or hangovers. By comparison, Bersamin and colleagues (2007) found College Alc to have beneficial effects on alcohol behavior and consequences, but only for those students who reported drinking in the 30 days before entering college.

The most widely used online alcohol course is AlcoholEdu, which has undergone multiple revisions. The first randomized controlled trial of the program (4.0 edition) with incoming first-year students found little short-term impact on alcohol consumption or associated harms, and a modest decrease in playing of drinking games (Croom et al., 2009). A subsequent study examined the effectiveness of two different online alcohol programs simultaneously. A subset of incoming first-year students was randomly assigned to take AlcoholEdu for College (Fall 2008 version), eCHECKUP TO GO, or a control condition (Hustad, Barnett, Borsari, & Jackson, 2010). At the 1-month follow-up (into the fall semester), compared with the control condition, students in both the AlcoholEdu for College and eCHECKUP TO GO groups reported lower use on seven alcohol-related behaviors in the past month, including the average number of drinks, number of negative alcohol consequences, and the number of heavy drinking episodes. In a series of planned comparisons, the AlcoholEdu for College group had significantly fewer alcohol-related consequences compared with the control group, whereas the eCHECKUP TO GO study group did not. In addition, a direct comparison between the AlcoholEdu for College and the eCHECKUP TO GO study groups revealed no differences on alcohol-related consequences.

A separate study found that, at 30-day follow-up, compared with a control group, students who completed AlcoholEdu for College (8.0 edition) consumed fewer drinks over a 2-week period, had a lower proportion of students engaging in heavy episodic drinking, and—on some measures of drinking-related harms—fewer negative consequences (Lovecchio, Wyatt, & DeJong, 2010). However, the AlcoholEdu for College group also had significantly fewer responsible alcohol behaviors compared with the control group.

The National Institute on Alcohol Abuse and Alcoholism sponsored the largest prospective randomized evaluation conducted to date on internet based alcohol education for college students. The study included 30 universities that were randomly assigned to either implement a campuswide online alcohol program (AlcoholEdu, version 8.0), or serve as a control group. This was the first randomized controlled trial of AlcoholEdu that extended the follow-up period beyond the first semester.

This large, multi-site study has yielded two sets of results; one on the effectiveness of AlcoholEdu for reducing alcohol use (Paschall, Antin, Ringwalt, & Saltz, 2011b) and another for additional alcohol-related problems (Paschall, Antin, Ringwalt, & Saltz, 2011a). Response rates from the participating colleges and universities, ranged from 44% to 48%; with approximately 90 study participants from each school per semester. The first follow-up occurred during the fall semester, during the months of October and November. The second follow-up took place in the spring semester during the months of March and April.

The intervention significantly lowered reported alcohol frequency and reduced binge drinking during the fall semester (Paschall et al., 2011b). In addition, the intervention group reported a short-term decrease in general alcohol problems, as well as physiological and social problems, and victimizations (Paschall et al., 2011a). None of the observed benefits of the course persisted beyond the fall semester.

The present study is the first to examine the efficacy of Alcohol-Wise, a commonly used online alcohol prevention program, which combines alcohol education with the eCHECKUP TO GO program. Embedded within Alcohol-Wise, the eCHECKUP TO GO program has been shown to have a positive impact on short-term high-risk drinking behavior among college first-year students (e.g., Doumas & Anderson, 2009). Conducted separately at two universities and using a randomized controlled design, first-year students were assigned to either an Alcohol-Wise or control group. We hypothesized that students who successfully completed the Alcohol-Wise program would demonstrate an increase in alcohol-related knowledge, less alcohol consumption, and report fewer high-risk drinking behaviors during their first semester, compared with a control group that did not complete the program.

Method

Institutional Review Board Approval

All research activities were carried out with the approval of the institutional review board for human participants at each university, respectively.

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Participants

The participants at both universities were incoming first-year students. University A is a large, urban, public research university. The undergraduate student body was comprised of approximately 55% women and 42% minority students (Temple University, 2012). University B is a mid-sized, rural, highly competitive, private university, with an undergraduate student body composed of 49% women and 28% minority students (Cornell University, 2012). At both universities, participation in first-semester online alcohol education is voluntary.

Sampling Procedure

In July of 2007, all domestic, non-transfer incoming first-year students at each university were randomly assigned to either an Alcohol-Wise or control group. The Alcohol-Wise group was asked to complete the full Alcohol-Wise course and pass the final course exam during the summer before arriving to campus, while the control group was asked to complete only the baseline survey.

In mid-July, letters were sent to participants' homes inviting them to log onto the Alcohol-Wise program (Version 3). The program was customized so that Alcohol-Wise and control group participants entered different course codes upon login. Participants in both groups were assured their responses would be confidential. The Alcohol-Wise group proceeded through the Alcohol-Wise program until passing the final exam. The control group stopped after the baseline survey. Also for control group participants, the eCHECKUP TO GO survey component was altered so as to not provide its usual personalized feedback. Both the control and Alcohol-Wise group participants were informed they would be invited back to finish the Alcohol-Wise program approximately 4 weeks into the fall semester. To increase participant responses to the pre-semester portion of the program, a reminder postcard was sent approximately 2 weeks after the study invitation was mailed, and then three email reminders were sent to those who had not logged in or completed the summer portion of the program. All pre-course data were collected before the students' arrival on campus.

Not all students who were enrolled during randomization decided to attend the universities and thus were no longer eligible for the study. This decrease in sample size was anticipated as the result of having to randomize and initiate the start of the study during a time when students are still making final decisions about where and whether they will attend college in the fall. Only those students who started their fall semester at one of the two universities partnering in this research were eligible for the study.

One month after arrival on campus, participants in study groups who had completed the summer portion of the study were sent an email to return to the Alcohol-Wise program and complete the follow-up survey. Over a 2-week period, four email reminders encouraged participants to complete the follow-up survey. To enhance response rates, participants who completed the follow-up surveys by a specified date were entered into a raffle for free tickets to a popular local sporting event (worth approximately US$50). Data collection finished once the follow-up surveys were complete. After data collection ended, control group participants were invited to complete the full Alcohol-Wise program.

An Overview of Alcohol-Wise

Alcohol-Wise is an interactive, online alcohol prevention course that contains the following components: a pretest of alcohol knowledge, a baseline survey which includes eCHECKUP TO GO (personalized feedback on drinking behavior and risks), educational lessons on alcohol, and a final examination of alcohol knowledge. The full course, including the survey, takes approximately 1 to 2 hours to complete. To pass the course, students must complete a post-course knowledge final exam with a grade of $\geq$70% correct answers. Approximately 30 to 45 days after the course is completed, students are asked to complete a follow-up survey which is identical to the baseline survey and takes approximately 15 to 20 minutes to complete.

Measures

For the present study, the baseline and follow-up surveys comprised three sections. Section I contained a questionnaire about alcohol-related attitudes, and behaviors (developed by 3rd Millennium Classrooms, creator of Alcohol-Wise). Section II was a questionnaire designed by the authors of this article, which is based on a previously validated instrument and included theoretically based questions related to how adolescents make decisions and evaluate risk. Section III elicited responses to the eCHECKUP TO GO survey, which asks demographic and alcohol use questions to provide personalized feedback on drinking and risk factors.

The primary follow-up outcomes are alcohol knowledge, alcohol consumption, and high-risk drinking measures. Alcohol consumption and high-risk drinking measures, (detailed in Table 1), include the following:

1. Alcohol consumption
   a. The total number of drinks in the past 2 weeks (Total Drinks).
   b. The total number of drinks in a typical drinking week in the past month (Typical Week).
   c. The total number of drinks during the occasion drank the most alcohol in the past month (Drank Most).
   d. Estimated blood alcohol concentration during the occasion drank the most alcohol in the past month (BAC; calculated on the basis of the number of drinks, gender, weight, and hours drinking [Matthews & Miller, 1979]).
2. High-risk behaviors
   a. Played drinking games at least once in the past 30 days (Drinking Games).
   b. Skipped a meal before drinking at least once to get drunk faster in the past 30 days (Skip Meal).
   c. Heavy drinking at least once in the past 2 weeks (Heavy-1; defined as five or more drinks in a day for men, four or more drinks for women).

Table 1. Outcome measures

Outcome measure by type	Response format	Abbreviation
Alcohol consumption		
On the calendar below, please indicate the total number of alcoholic drinks you drank each day for the past 2 weeks. One standard drink = 10–12 oz beer = 5 oz wine = 1 shot or mixed drink. [Below these instructions appeared two rows, each with seven response boxes labeled with the days of the week. The numbers of each day's drinks were summed.]	Continuous	Total Drinks
For the past month, please describe a typical drinking week. For each day, fill in the number of standard drinks of each type of alcohol you consumed and the number of hours you drank on that day. [Below these instructions appeared four rows, each row contained seven response boxes labeled with the days of the week. The rows were marked "beer," "wine," liquor," and "hours." The numbers of beer, wine, and liquor drinks were summed.]	Continuous	Typical Week
Think of the one occasion during the past month where you drank the most. Fill in the number of standard drinks of each type you consumed and the number of hours you drank that day. [Below these instructions appeared four response boxes marked "beer," "wine," "liquor," and "hours." The numbers of beer, wine, and liquor drinks were summed.]	Continuous	Drank Most
Blood alcohol content was calculated from the number of drinks and the number of hours reported in the drank most question, in addition to self-reported weight and gender using the Matthews and Miller's (1979) formula.	Continuous	BAC
High-risk behaviors		
Drinking games was calculated from the following survey question: Within the past 30 days, if you drank, how often did you play drinking games? [Below the question five responses choices marked "always," "usually," "sometimes," "rarely," and "never".] Responses of "never" were coded "no," and all other responses categories were coded as "yes."	Yes/No	Drinking Games
Skip meal was calculated from the following survey question: Within the past 30 days, if you drank, how often did you skip a meal to get drunk faster? [Below the question, five responses choices marked "always," "usually," "sometimes," "rarely," and "never"] Responses of "never" were coded "no," and all other responses categories were coded as "yes."	Yes/No	Skip Meal
Heavy-1 was calculated as "yes" if a male reported 5+ drinks or a female reported 4+ drinks on at least one day of the 2-week drink calendar (Total Drinks).	Yes/No	Heavy-1
Heavy-3 was calculated as "yes" if a male reported 5+ drinks or a female reported 4+ drinks on at least three days of the 2-week drink calendar (Total Drinks).	Yes/No	Heavy-3
Extreme ritualistic alcohol consumption (ERAC) was calculated as "yes" if a male reported 11+ drinks or a female reported 8+ drinks on at least one day of the 2-week drink calendar (Total Drinks).	Yes/No	ERAC

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d. Heavy drinking three or more times in the past 2 weeks (Heavy-3; defined as five or more drinks in a day for men, four or more drinks for women).
e. Extreme ritualistic alcohol consumption at least once in the past 2 weeks (ERAC; 11 + drinks in a day for men, 8 + drinks for women; Glassman, Dodd, Sheu, Rienzo, & Wagenaar, 2010).

Results

Statistics and Data Analysis

Each university was considered a separate trial and they were not compared with one another. Although the randomization process ensured there was no bias in how students were assigned to treatment groups, we nevertheless performed conventional baseline study group comparisons (see Table 2). All Alcohol-Wise and control group baseline comparisons were made using Pearson chi-square tests for categorical data and the Student's two-sample t tests for continuous data.

Due to the number of zeros on continuous measures related to alcohol consumption (because a large number of students reported not drinking; i.e., zero drinks), the distribution of the data violated assumptions of traditional analytic approaches. Instead, a method proposed by Lachenbruch (2002) was used. In brief, to determine whether the distribution of drinking frequency differed between two groups, the usual Pearson chi-square statistic, χ^2, was computed for the 2×2 table of "non-drinker" versus "drinker" (i.e., number of drinks = 0 vs. number of drinks > 0) compared across the two groups. Then, the usual two-sample

Table 2. Baseline demographics and baseline alcohol characteristics by study group

Baseline variable	University A ($N = 2{,}007$)		University B ($N = 2{,}027$)	
	Control group ($n = 982$)	Alcohol-Wise group ($n = 1{,}025$)	Control group ($n = 952$)	Alcohol-Wise group ($n = 1{,}075$)
Gender				
Male (%)	37.1	38.9	49.0	51.1
Female (%)	62.9	61.1	51.1	48.9
Race/ethnicity				
White (%)	67.5	65.4	59.8	60.0
Asian (%)	10.2	12.1	23.3	22.6
Hispanic (%)	3.1	4.6	6.6	6.4
Black (%)	13.6	12.0	3.3	4.7
Other (%)	3.7	3.2	3.7	2.9
Refused (%)	2.0	2.6	3.4	3.4
Age (years)				
17 and younger (%)	15.8	16.7	22.1	21.3
18 (%)	78.3	77.1	72.0	73.1
19+ (%)	5.9	6.2	6.0	5.6
Baseline alcohol use and severity	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Total drinks in past 2 weeks	4.9 (11.3)	4.3 (10.0)	3.6 (9.0)	3.6 (9.6)
Drinks when drank the most in one sitting in past month	3.3 (4.9)	3.0 (4.6)	2.7 (4.1)	2.6 (4.1)
AUDIT score (0–40)	3.6 (5.0)	3.1 (4.6)	2.7 (3.9)	2.7 (4.2)

Note. AUDIT = Alcohol Use Disorders Identification Test; SD = standard deviation.

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t statistic was computed for the comparison of number of drinks, restricted to those students who reported at least one drink consumed (i.e., number of drinks >0). Because of the large sample size, t^2 behaves like z^2, the square of a standard normal deviate, which has a χ^2 distribution with 1 degree of freedom (*df*). Because χ^2 and t^2 are independent (see Lachenbruch, 2002), $W = \chi^2 + t^2$ has a χ^2 distribution with 2 degrees of freedom (*df*). Accordingly, the drinking distributions for the two groups were declared significantly different if $W > 5.991$, the upper 5% critical point of χ^2 with 2 *df*.

On finding a significant difference, we "separated" the W statistic into its chi-square and t components to determine whether the significance of W was due to the difference of the proportion of non-drinkers or due to the difference in mean number of drinks among the drinkers (or both). Thus, these respective chi-square and t tests were evaluated, but at the Bonferroni-adjusted significance level of 0.025.

It is noteworthy that a traditional regression analysis was performed on these zero-inflated outcome variables to compare the two study groups, adjusting for gender, ethnicity, and pre-course baseline measurements of outcome measures. Although these models did not satisfy the necessary regression statistical assumptions, particularly due to the skewed distribution of excess zeros, they nevertheless yielded identical results to the Lachenbruch method.

In addition, the high-risk outcome measures Played Games and Skipped Meal were reduced from five response choices ("Never," "Rarely," "Sometimes," "Usually," and "Always"), to dichotomous variables. Similar to the continuous measures, these two outcomes contained a high proportion of zeros (i.e., "Never" responses). However, unlike the continuous measures, there was very little variation among the non-zero categories (70%–90% of the responses were captured by two or fewer response choices). We therefore created two dichotomous variables, recoding the response choices of "Rarely," "Sometimes," "Usually," and "Always" to "Yes," and the response of "Never" to "No." A regression analysis using the original scale of these two variables yielded identical results.

All analyses were performed with SAS 9.2.

Recruitment

At both campuses the Alcohol-Wise group and the control group had similar response rates to the invitation to log into the Alcohol-Wise website. University A students logged in at rates of 88.82% for the Alcohol-Wise group and 85.63% for the control group. University B students logged in at rates of 95.54% for the Alcohol-Wise group and 94.48% for the control group. The rates of students completing the baseline, summer portion of the study were also similar across study groups. At University A, the summer portion completion rates were 65.22% and 64.73% for Alcohol-Wise and control groups, respectively. At University B, these rates were 90.41% and 88.44%, respectively.

Attrition

When participants dropped out of the study before the baseline survey, there was no way to ascertain their drinking behaviors, and so they were naturally omitted from the

study, even though the authors understand the "intention to treat" principle. To be in the study, participants had to complete both the baseline and follow-up surveys.

University A

Figure 1 contains the progress of study participants using the Consolidated Standards of Reporting Trials (CONSORT) flow diagram. Initially 4,651 students were randomized to the control and Alcohol-Wise groups. Approximately 65% of participants in each group completed the baseline portion of the study. Reasons for not completing the baseline included: did not respond to the study invitation (control group 14.4%, Alcohol-Wise group 11.2%), started but did not finish the baseline portion (control group 9.5%, Alcohol-Wise 11.0%), and withdrew college enrollment (control group 11.4%, Alcohol-Wise group 12.6%). Approximately one-third of baseline participants did not complete the follow-up. Of those initially randomized, 40.9% of the control group and 44.1% of the Alcohol-Wise group completed both the baseline and follow-up surveys resulting in an analytic sample of 2,007.

University B

The CONSORT flow diagram of University B attrition is presented in Figure 2. Initially 3,045 students were randomized to the control and Alcohol-Wise groups. Almost 90% of participants in each group completed the baseline portion of the study. Reasons for not completing the baseline included did not respond to the study invitation (control group 5.5%, Alcohol-Wise group 4.5%), started but did not finish the baseline portion (control group 4.3%, Alcohol-Wise group 4.0%), and withdrew college enrollment (control group 1.8%, Alcohol-Wise group 1.1%). Approximately 28% of the control group baseline participants did not complete the follow-up, compared with almost 19% of the Alcohol-Wise group. Of those initially randomized, 62.5% of the control group and 70.7% of the Alcohol-Wise group completed both the baseline and follow-up surveys resulting in an analytic sample of 2,027.

Thus overall, study enrollment rates and attrition were similar across study groups at both Universities, suggesting that bias may be an unlikely explanation for any observed group differences.

Differential Attrition

We were able to examine students who had completed the baseline but not the follow-up survey, which was required for inclusion in the analysis. We compared these non-completers first by study groups, to discover if the groups were differentially affected by the attrition. Next, we compared this group of non-completers to all study participants,

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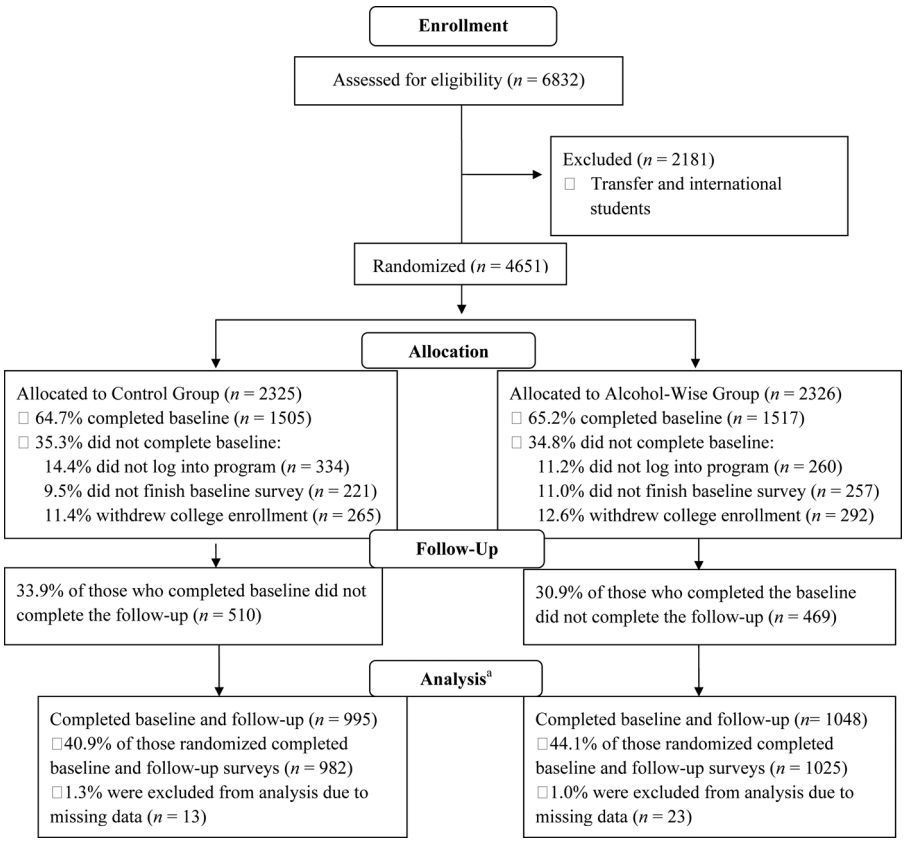

Fig. 1. University A CONSORT flow diagram. [a]To be in the study, participants had to complete both baseline and follow-up. No intent to treat analysis was performed.

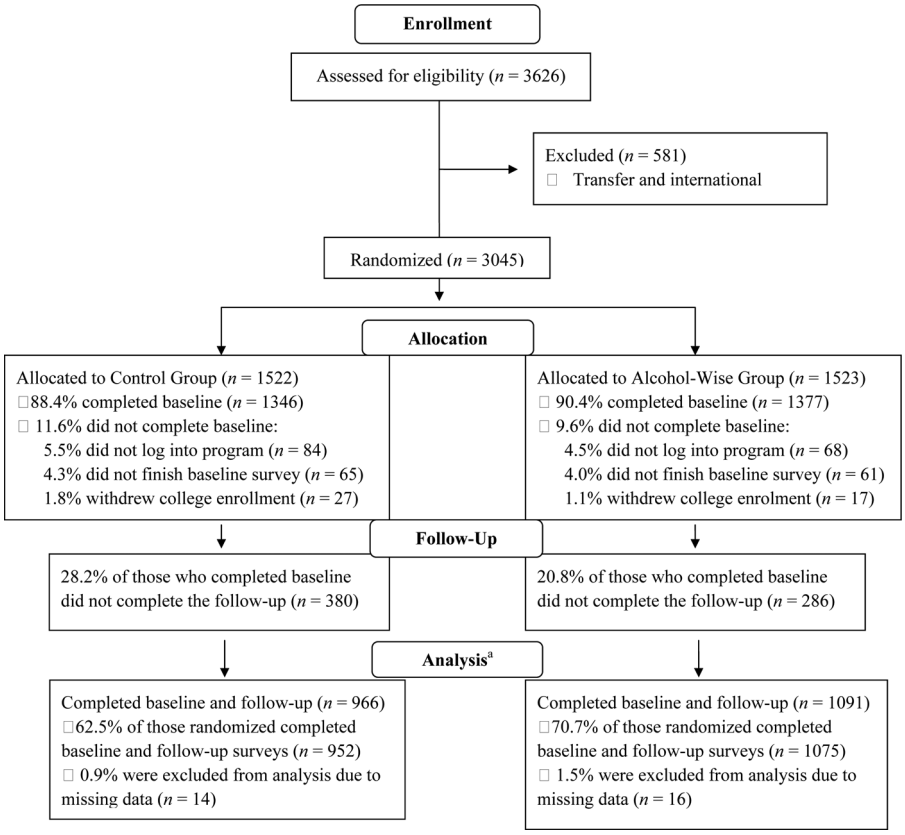

Fig. 2. University B CONSORT flow diagram. [a]To be in the study, participants had to complete both baseline and follow-up. No intent to treat analysis was performed.

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to discern if there were any differences between those who finished the study and those who did not. Comparisons were made on basic demographic variables, such as age, gender, and ethnicity, and on baseline measures of alcohol characteristics, including baseline Alcohol Use Disorders Identification Test (AUDIT) score, baseline total number of drinks in the past 2 weeks, and baseline total number of drinks during the occasion drank the most alcohol in the past month.

Between the study groups, there was only one difference among students who dropped out of the study. At University A, men in the Alcohol-Wise group (55.22%) were significantly more likely to drop out of the study than men in the control group (48.43%), but Alcohol-Wise group women (48.23%) were less likely to drop out of the study than their control group counterparts (51.57%, $p = .0336$). There were no differences between study groups among those who dropped out of the study at University A on baseline measures of alcohol characteristics (total number of drinks in the past 2 weeks, total number of drinks during occasion drank the most, and AUDIT scores), or other basic demographics such as age and ethnicity. At University B, there were no differences among students who did not complete the follow-up survey between the Alcohol-Wise and control study groups on basic demographics or baseline alcohol characteristics.

With study groups combined, students who started the study but did not complete the follow-up survey were different on several characteristics when compared overall to study participants. At University A, compared with study participants, the non-completers were more likely to be male (51.69% vs. 38.02%, $p < .0001$) and self-identified as Black (18.30% vs. 12.77%, $p = .0009$), than study participants. Non-completers were also significantly more likely to have both higher AUDIT scores (mean of 3.80 vs. 3.34, $p = .0129$) and total number of drinks in the past 2 weeks (mean of 5.72 vs. 4.57, $p = .0189$), than study participants. At University B, there were two differences between non-completers and study participants. Those who did not complete the follow-up survey were significantly more likely to be over the age of 19 (10.83% vs. 5.77%, $p < .0001$) and self-identified as Black (9.02% vs. 4.04%, $p < .0001$) than study participants.

Sample Background and Demographics

Baseline demographics and alcohol characteristics are presented by study group for each university in Table 2.

University A

Overall, the majority of University A participants were female (61.98%) and white (66.42%). People of color

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self-identified as Black (12.77%), Asian (11.18%), and Hispanic (3.84%). The majority of participants were 18 years old (77.68%). At the beginning of the study, respondents drank an average of 4.57 drinks ($SD = 10.67$) in the past 2 weeks and an average of 3.13 drinks ($SD = 4.76$) at the sitting in which they drank the most over the past month. Baseline scores on the AUDIT scale, which can range from 0 to 40, averaged 3.34 ($SD = 4.80$). AUDIT values of 8 and higher are associated with harmful alcohol use (Saunders, Aasland, Bobor, De La Fuente, & Grant, 1993).

University B

Approximately half of the participants at University B were female (49.93%) and the other half were male (50.07%). Almost 60% chose White to describe their ethnicity, and people of color self-identified as Black (4.00%), Asian (22.94%), and Hispanic (6.51%). The majority of participants were 18 years old (72.57%). At the beginning of the study, respondents drank an average of 3.58 drinks ($SD = 9.31$) in the past 2 weeks and an average of 2.63 drinks ($SD = 4.10$) at the sitting in which they drank the most over the past month. Baseline scores on the AUDIT scale averaged 2.70 ($SD = 4.08$).

Post-Study Knowledge

At both universities, students in the Alcohol-Wise group's knowledge scores significantly improved after taking the course. At University A, pre-course knowledge scores in the Alcohol-Wise group increased from an average of 54.0 ($SD = 13.4$) to 81.5 ($SD = 7.8$) after completing the course (t test, $p < .0001$). At University B, average knowledge scores improved from an average of 59.2 ($SD = 12.7$) pre-course to 87.0 ($SD = 7.9$) post-course (t test, $p < .0001$).

Alcohol Consumption

Alcohol consumption results of both universities are presented in Table 3.

University A

Relative to the control group, the Alcohol-Wise group reported consuming significantly fewer drinks in terms of total drinks in typical week in the past month (Typical Week, $p = .0181$) and total drinks in a sitting when subjects drank the most in the past month (Drank Most, $p = .0300$). In addition, the estimated BAC in the sitting when subject drank the most in the past month was significantly lower in the Alcohol-Wise group ($p = .0110$).

Upon these significant findings, we separated the W statistic into the chi-square and t test components, to determine whether the significance results among these alcohol consumption outcomes were due to differences in the proportion of zeros (chi-square), non-zero values (t test), or both (using a Bonferroni-adjusted significance criteria of $p < .025$).

Table 3. Study group results for alcohol consumption using the Lachenbruch method

	University A ($N = 2{,}007$)					
	Drinking status		Alcohol consumption among drinkers			
Outcome measure	Control group ($n = 982$) Drinkers (%)	Alcohol-Wise group ($n = 1{,}025$) Drinkers (%)	Control group ($n = 441$)[a] Mean (SD) of non-zero values	Alcohol-Wise group ($n = 441$)[a] Mean (SD) of non-zero values	Lachenbruch method W	p
Alcohol consumption						
Total number of drinks	44.9	43.2	18.30 (19.13)	16.37 (18.87)	2.97	.2262
Typical Week	43.7	41.4	14.23 (12.82)	11.96 (12.44)	8.02	.0181
Drank Most	48.3	45.5	7.71 (4.83)	6.97 (4.96)	7.01	.0300
BAC[b]	46.1	41.7	0.16 (0.10)	0.15 (0.10)	9.02	.0110
	University B ($N = 2{,}027$)					
	Drinking status		Alcohol consumption among drinkers			
Outcome measure	Control group ($n = 952$) Drinkers (%)	Alcohol-Wise group ($n = 1{,}075$) Drinkers (%)	Control group ($n = 467$)[a] Mean (SD) of non-zero values	Alcohol-Wise group ($n = 562$)[a] Mean (SD) of non-zero values	Lachenbruch method W	p
Alcohol consumption						
Total number of drinks	49.1	52.2	15.59 (16.09)	14.73 (16.10)	2.70	.2588
Typical Week	48.7	50.7	10.55 (9.94)	9.71 (8.86)	2.73	.2548
Drank Most	53.1	55.3	6.80 (4.26)	6.36 (4.36)	3.86	.1449
BAC[b]	50.7	53.1	0.15 (0.09)	0.14 (0.09)	4.28	.1172

Note. W refers to the W statistic (the null hypothesis of W is a distributed as a χ^2 with 2 df; see Lachenbruch, 2002). SD = standard deviation; BAC = blood alcohol content.

[a]These are approximate ns because the number of cases varies slightly across outcome measures.

[b]The proportion of BAC is less than Drank Most (the event from which BAC is derived) because of missing data: University A = 1.6%, University B = 0.9%.

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For all three significant results at University A, the observed differences between study groups were among the drinkers, or non-zero values; the Alcohol-Wise group drank approximately 2 drinks less than the control group in a typical week (mean 11.96 vs. 14.23, respectively, $p = .0086$). In the sitting when participants drank the most in the past month, those in the Alcohol-Wise group drank approximately three-quarters of a drink less than the control group (6.97 vs. 7.71, respectively, $p = .0207$). The Alcohol-Wise group had a lower BAC for the sitting they drank the most in, compared with the control group (.15 vs. .16, respectively, $p = .0232$).

University B

None of the follow-up alcohol consumption measures differed significantly between the control and Alcohol-Wise groups at University B (see Table 3).

High-Risk Behaviors

The high-risk alcohol-related behaviors for both universities are presented in Table 4.

University A

There was a significant difference between study groups on several high-risk drinking behaviors. The Alcohol-Wise group was significantly less likely than the control group to play drinking games (42.0% vs. 46.4%, respectively; Drinking Games, $p = .0431$). Approximately 12% of the Alcohol-Wise group engaged in heavy drinking three or more times in the past 2 weeks, compared with almost 17% of the control group (Heavy-3, $p = .0026$). The Alcohol-Wise group was also significantly less likely than the control group to participate in extreme ritualistic alcohol consumption over the past 2 weeks (4.6% vs. 6.6%, respectively; ERAC, $p = .0472$).

University B

None of the high-risk alcohol-related behaviors were significantly different among the study groups at University B (see Table 4).

Table 4. Study group results for binary high-risk behavioral outcomes

University A ($N = 2{,}007$)			
Outcome measure	Control group ($n = 982$)	Alcohol-Wise group ($n = 1{,}025$)	p^a
High-risk behavior			
Drinking Games (%)	46.4	42.0	.0431
Skip Meal (%)	11.5	10.4	.4439
Heavy-1 (%)	28.1	24.3	.0520
Heavy-3 (%)	16.6	11.9	.0026
ERAC (%)	6.6	4.6	.0472
University B ($N = 2{,}027$)			
Outcome measure	Control group ($n = 952$)	Alcohol-Wise group ($n = 1{,}075$)	p^a
High-risk behavior			
Drinking Games (%)	48.0	47.1	.6742
Skip Meal (%)	7.9	8.1	.8587
Heavy-1 (%)	30.3	29.3	.6406
Heavy-3 (%)	14.9	13.2	.2694
ERAC (%)	5.6	5.3	.7928

[a]*p* value for chi-square test.

Discussion

Despite routine use of online alcohol prevention programs at colleges and universities, there are limited independent, randomized controlled tests of their efficacy. The present study examined the effectiveness of Alcohol-Wise in two different cohorts of incoming first-year students. Whereas the intervention increased the alcohol-related knowledge at both institutions, it significantly affected alcohol consumption measures and high-risk drinking behaviors among first-year students only at the urban, public campus, University A. This effect at University A was obtained despite the fact that students in University B had higher post-course alcohol knowledge test scores compared with University A students, underscoring the argument that increased knowledge does not necessarily change behavior.

If improved knowledge is not the driving force behind behavior change, what then accounts for the different outcomes at the two universities? Although it is beyond the scope of this study to analyze comprehensively the environmental disparities between University A and University B, it is worth noting that the two universities differ in several important ways. Although both institutions are in the Northeast, University A is located in a large urban center, whereas University B is in a rural location. Furthermore, although each campus has a fraternity/sorority system, Greek life plays a much larger role at University B than at University A. Schools with large Greek systems have a greater likelihood of having a problematic drinking culture (Presley, Meilman, & Leichliter, 2002). University B has one of the largest fraternity and sorority systems in North America, with 66 chapters involving 28% of male and 22% of female undergraduates. In contrast, at University A, which has a larger overall student enrollment, there are 29 Greek letter organizations, with only 2.5% of students joining these groups.

Research suggests that an institution's environment such as regional location, density of alcohol outlets, and presence of a large Greek system can influence the rates of alcohol use among its students (Presley, Meilman, & Leichliter, 2002; Weitzman, Folkman, Folkman, & Wechsler, 2003). Institutions that address a large number of environmental factors (such as increased enforcement of alcohol policies on and off campus, increased penalties and sanctioning policies, substance-free residence halls, and parental notification) are more likely to achieve changes in alcohol consumption and related harms than schools that address

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a smaller number of these factors (Weitzman, Nelson, Lee, & Wechsler, 2004). These multifaceted environmental components may create specific campus cultures that are more or less conducive for interacting synergistically with online prevention programs.

We identified several study limitations and examined some of them with the available data. We considered how those who did not participate in the study may have affected the results. Non-study participants included both students who did not respond to the study invitation, and students who completed the baseline survey but not the follow-up. We do not have sufficient descriptive data on those who did not respond to the initial study invitation. Thus, there is the potential that those who did not respond to the study invitation were qualitatively different than those who participated in the study, creating a bias in the results. However, there is no evidence of overall differential enrollment or attrition by treatment group, suggesting that bias is unlikely to explain reported group differences.

We also looked for evidence of a self-selection bias in our samples. We did not find overall differences in attrition between the study groups, and our samples were representative of the first-year student body populations at each campus. We further compared those who dropped out by study group on basic demographics and baseline alcohol characteristics at each campus. Only one difference emerged: at University A, men were more likely to have dropped out of the Alcohol-Wise group than were women (who were more apt to drop out of the control group).

Because men are more likely than women are to be heavier drinkers (White, Courtney, & Swartzwelder, 2006), we examined the baseline alcohol characteristics among University A men who dropped out of the study by study group. There were no significant differences among men by study group on the total number of drinks in the past 2 weeks, the total number of drinks on occasion drank the most in the past month, nor on AUDIT scores.

With study groups combined, we reported that men were more likely to drop out of University A. Again, since men are more likely to be high-risk drinkers (White, Courtney, & Swartzwelder, 2006), it could be argued that the male attrition from University A may have contributed to finding the results observed at University A, given that the higher-risk drinkers were not in the study. Although this criticism could not account for the differences between study groups, it would limit the generalizability of the results. Thus we compared non-study men to their study counterparts on heavy drinking measures.

Further investigation revealed that men at University A that did not complete the study ($n = 506$) were significantly more likely than study participant men ($n = 763$) to have drank in the past 2 weeks; 42.89% versus 35.39%, respectively (χ^2, $p = .0072$). However, for those who drank, there was no significant difference between non-completers and study participants on the number of drinks consumed. On average, drinking male non-completers drank 17.75 ($SD = 19.72$) drinks over the past 2 weeks, compared with 17.36 ($SD = 18.25$) for their study counterparts. Also, there was no significant difference between the number of drinks drank in the sitting they drank the most in the past month (non-completers averaged 9.16 [$SD = 5.70$]) vs. study participants at 8.93 [$SD = 5.51$], respectively). In addition, the non-completer men were not significantly different from their study participant counterparts on several other measures of heavy drinking; consumed five or more drinks in one day at least once in the past 2 weeks (24.11% vs. 22.41%, respectively), consumed five or more drinks in one day, three or more times in the past 2 weeks (11.86% vs. 9.17%, respectively), and extreme ritualistic alcohol consumption (5.34% vs. 4.06%, respectively). Thus, given the available data, there is no evidence that men who dropped out of the study at University A consumed greater quantities of alcohol or engaged in high-risk drinking more often than their study counterparts.

From a demographic perspective, University A has a higher percentage of women undergraduates (55% vs. 49%) and students of color (42% vs. 29%) than University B. Past research has documented that female college students and minority students tend to drink in less high-risk ways than male and White students (Grant et al., 2004). Higher proportions of students that are more likely to drink in moderation may support a more moderate drinking culture. In turn, even potentially high-risk drinkers, in this more moderate culture, may be better able to make use of the lessons learned in an online-program, such as Alcohol-Wise.

Another limitation in the present study is low response rates. A review of the response rates of existing online alcohol program research suggests mandating the program may improve response rates. In a mandated, randomized trial of AlcoholEdu, the overall response rate was 75% (Lovecchio et al., 2010). In the multi-site trial of AlcoholEdu, schools with a ''hard mandate'' were more likely to have greater course completion than schools with an implied mandate (50% vs. 36%; Paschall et al., 2011). However, another randomized trial that did not mandate participation had a general response rate of 60% (Croom et al., 2009). Thus, factors which affect response rates may extend beyond the issue of mandatory participation and vary by type of campus.

Campus variation factors may help to explain the differences in response rates in both the present and previous studies. For example, the online alcohol prevention studies with highest reported response rates (Lovecchio et al. [2010] and Croom et al. [2009], respectively), were both conducted at mid-sized, private campuses. In the present study, where both campuses had identical study procedures, the overall response rate of University B (67%), a private, mid-sized campus, was higher than that of the large, public campus of University A (43%); the latter's response rate was more similar to those reported in the multisite trial (44–48%), which included 16 public colleges (Paschall et al., 2011). These variations in response rates and campus factors may limit the generalizability of the present results.

In addition, the present study design included the randomization of students to study groups before students finalized their plans of when and where to attend college. Therefore, the number of students assigned to study groups was inflated, and those who chose not to attend were included in the attrition rates reported in Figures 1 and 2. This reduction in the number of available participants did

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not have a large effect at University B, where less than 2% of students randomized decided not to attend the university. However, at University A, 11.4% of the control group and 12.6% of the Alcohol-Wise group decided not to attend the university. If response rates are recalculated with those students removed, the response rates at University A increase to almost 50% (48.18% for the control group and 51.52% of the Alcohol-Wise group).

This study also lacks information as to whether the Alcohol-Wise course results in negative consequences for students (e.g., academic, social, emotional, or physical harms). Although questions regarding alcohol-related consequences were included on the baseline and follow-up surveys, the time frame of the questions (over "the past year") and binary response choices ("yes" or "no") of the questions, limited the ability to adequately determine harms which occurred during the study window.

The present study also relies solely upon self-report data. Despite assurances of confidentiality, we cannot rule out the possibility a social desirability bias was operating. However, self-reports of college student drinking have demonstrated to be both reliable and valid measure of alcohol consumption (Borsari & Muellerleile, 2009; Dowdall & Wechsler, 2002).

This study is unable to clearly differentiate the effects of Alcohol-Wise from the embedded prevention program it contains, eCHECK UP TO GO. Although the intent of this study was not to evaluate the individual effects of these programs, we are unable to reject claims that the program effectiveness was due to the subcomponent, eCHECK UP TO GO, and not a result of the Alcohol-Wise program.

Conclusion

Our study has several implications for college and university administrators who must decide how to invest scarce prevention dollars. Whereas past research has demonstrated that programs such as Alcohol-Edu and College Alc improve students' knowledge of alcohol (Croom et al., 2009; Paschall et al., 2006), the extant literature is less consistent regarding the effect of online prevention programs on behavioral measures including consumption, high-risk activities, protective actions, and harm. Research on AlcoholEdu for College and eCHECKUP TO GO suggests that online prevention programs can modify drinking behavior and general alcohol problems (Hustad et al., 2010; Lovecchio et al., 2010; Paschall et al., 2011a, 2011b). However, other studies have found little or no effect on behavioral measures (Croom et al., 2009; Paschall et al., 2006). In this context, the present finding of different behavioral effects of Alcohol-Wise in two different university settings suggests that the demographic make-up of a campus and other environmental components may influence the degree to which a program such as Alcohol-Wise alters behavior.

Student demographics and school context and culture may interact to affect the degree to which online alcohol prevention is effective. For some schools, it may be more prudent to address first-year student drinking by focusing on the environmental components contributing to risky drinking rather than invest in online alcohol prevention programs. For other schools, online alcohol prevention programs may reinforce campus expectations and potentially contribute to reductions in alcohol-related harm. Future research at a wide range of colleges and universities, using several different online alcohol prevention programs, exploring the moderating role of different environmental factors, may better identify which programs modify first-year student behavior at different kinds of institutions of higher education.

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