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Effects of an Online Alcohol Education Course Among College Freshmen: An Investigation of Potential Mediators

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Abstract

This study investigated possible mediating effects of psychosocial variables (perceived drinking norms, positive and negative alcohol expectancies, personal approval of alcohol use, protective behavioral strategies) targeted by an online alcohol education course (AlcoholEdu for College) as part of a 30-campus randomized trial with 2,400 first-year students. Previous multi-level analyses found significant effects of the AlcoholEdu course on the frequency of past-30-day alcohol use and binge drinking during the fall semester, and the most common types of alcohol related problems. Exposure to the online AlcoholEdu course was inversely related to perceived drinking norms, but was not related to any of the other psychosocial variables. Multi-level analyses indicated at least partial mediating effects of perceived drinking norms on the behavioral outcomes. Findings of this study suggest that AlcoholEdu for College affects alcohol use and related consequences indirectly through its effect on student perceptions of drinking norms. Further research is needed to better understand why this online course did not appear to affect other targeted psychosocial variables.

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Introduction

Despite rising public awareness and concern, the misuse of alcohol by college students remains a major public health issue. Approximately 40 to 45% of college students report that they have engaged in heavy drinking within the previous two weeks, a rate that has remained stable over the past two decades (Hingson, Zha & Weitzman, 2009; Johnston et al., 2009). In response, many colleges now administer prevention programs that capitalize on the advent of interactive online learning technologies, among them AlcoholEdu for College (Hustad et al., 2010; Lovecchio, Wyatt & DeJong, 2010; Wall, 2007); College Alc (Paschall et al., 2006); e-CHUG (Doumas & Anderson, 2009; Hustad et al., 2010; Steiner et al., 2005; Walters et al., 2005; 2007); and My Student Body (Chiauzzi et al., 2005). Evaluations of these multi-component programs have generally yielded immediate but short-term effects (Neighbors et al., 2010).

Two decades of research have linked students' beliefs, attitudes, and perceived social norms to alcohol misuse and its related consequences, and these online prevention programs have sought to reduce student drinking by addressing those variables. It is surprising, therefore, that evaluations of these programs have generally not examined the possible mediating pathways through which changes in those variables lead to reduced alcohol consumption. A systematic investigation into these intervening processes would clarify the theoretical basis for these web-based interventions and thereby facilitate their further development and refinement (Neighbors et al., 2007).

In this study, we investigated five potential mediators of AlcoholEdu, which as of 2011 is being administered by over 250 colleges and universities nationwide. Several controlled evaluations have demonstrated the short-term effects of this web-based course on the frequency of students' recent alcohol use and heavy episodic drinking (Hustad, 2010; Lovecchio, Wyatt & DeJong, 2010; Paschall et al., 2011a; Wall, 2007). The course is grounded in several social behavioral theories, including social cognitive theory (Bandura, 1986), the theory of planned behavior (Azjen, 1991), social norms theory (Berkowitz, 2004), problem behavior theory (Jessor & Jessor, 1977), and expectancy theory (Darkes & Goldman, 1993, 1998). Collectively, these theories suggest several key constructs as potential program mediators, namely descriptive drinking norms, personal attitudes toward drinking, alcohol expectancies, and the adoption of protective behavioral strategies.

Normative beliefs can be thought of as internalized instructions concerning appropriate behavior, which are shaped by a relevant referent group (Solomon & Harford, 1984). The theory of planned behavior specifies that such beliefs are a key determinant of behavior. Descriptive norms are largely determined by the referent group's behavior – specifically, what the group is perceived as doing (Borsari & Carey, 2003). In this regard, AlcoholEdu presents accurate *descriptive drinking norms* by means of graphical displays of information concerning college students' alcohol use. This information helps students compare their drinking to that of their peers and corrects any exaggerated misperceptions they may have concerning their peers' alcohol use. College students tend to overestimate levels of alcohol use and heavy drinking among their peers, which may negatively influence their own drinking behavior (Baer, 2002; Neighbors, Lewis & Larimer, 2004; Perkins, Haines & Rice,

2005; Perkins, & Wechsler, 1996) and the consequences they experience (Borsari & Carey, 2003; Neighbors et al., 2006). Indeed, perceptions of peer drinking norms may constitute the most powerful single mediator of alcohol use (Neighbors et al., 2007). Many investigators (e.g., Baer, Stacy & Larimer, 1991; DeJong et al., 2006; LaBrie et al., 2008; Larimer & Cronce, 2002; Lewis & Neighbors, 2007; Sher, Bartholow & Nanda., 2001; Thombs et al., 2004: Walters, Vader & Harris, 2007; Walters et al., 2009), but not all (Clapp et al., 2003) all, have demonstrated that providing accurate normative or personalized feedback that reveals the true extent of peers' alcohol consumption can reduce students' own use.

AlcoholEdu is also designed to affect college students' *personal attitudes* towards drinking, specifically their approval or disapproval of student alcohol use. As suggested by the theory of planned behavior, attitudes are a function of pertinent beliefs, and changes in attitudes have been repeatedly linked to changes in health-related behaviors in computer-delivered interventions (see a meta-analysis of 75 pertinent randomized controlled trials, conducted by Portnoy et al., 2008). Attitudes towards alcohol have also been frequently (e.g., Collins & Carey, 2007; Mallett et al., 2009), but not consistently (Turrisi et al., 2009), linked to alcohol consumption. To reduce students' positive attitudes towards alcohol use, AlcoholEdu provides information that addresses their beliefs concerning the adverse physical, psychological, behavioral, and legal consequences of misuse, as well as commercial efforts to promote consumption (Wall, 2007).

Students' expectancies about the effects of alcohol are another important set of beliefs. Expectancies can be *positive* or *negative*, and thus either facilitate or inhibit alcohol consumption (Goldman, del Boca & Darkes, 1999; Goldman, del Boca & Darkes, 1999; Jones, Corbin & Fromme, 2001). While negative consequences such as hangovers and socially inappropriate behavior have been linked by many investigators to reductions in alcohol consumption (e.g., Baer, 2002; Baer & Carney, 1993; Labbe & Maisto, 2011; Sher et al., 1996; Stacy, Widaman & Marlatt, 1990), alcohol use may also be positively associated with anticipated desirable or pleasurable outcomes such as reductions in stress, social anxiety, and sexual inhibitions (Ham, 2009). There is evidence that positive expectancies are more consistently associated than negative ones with alcohol consumption (e.g., Brown, 1993; Carey, 1995; Osberg et al., 2011; Patrick et al., 2010; Stacy et al., 1990; Validivia & Stewart, 2005; Zamboanga et al., 2010), but these findings may be a function of the relative lack of attention paid to negative expectancies in the literature (Patrick et al., 2010), or the degree to which some apparently negative outcomes, such as cognitive impairment, may be positively valued (Zamboanga et al., 2010). AlcoholEdu provides information on alcohol-related health and social risks, and presents reality-based case studies to illustrate these risks, in order to increase students' negative expectancies and reduce their positive expectancies.

AlcoholEdu is also designed to affect students' use of *protective behavioral strategies*, which are self-regulatory skills designed to limit or mitigate the risks associated with alcohol use (Araas & Adams, 2008; Larimer et al., 2007; Usdan et al., 2008). Protective behavioral strategies, which are inspired by problem behavior theory (Jessor & Jessor, 1977), are hypothesized to attenuate the likelihood that individuals will express problem behaviors (Sugarman & Carey, 2007). These strategies include designating sober peers as drivers,

maintaining hydration, eating food in drinking contexts, setting limits on the amount of alcohol consumed, pacing alcohol consumption, and avoiding games that promote drinking. The use of such strategies has been linked empirically with reductions in both alcohol consumption and related consequences (Clapp & Shillington, 2001; Delva et al., 2004; Haines, Barker, & Rice, 2006). AlcoholEdu also teaches students how to avoid or respond to potential alcohol-related problems such as alcohol poisoning, driving while impaired, or riding with a driver who is impaired.

The purpose of this study was to determine whether the effects of AlcoholEdu on several key program outcomes related to alcohol consumption are mediated by perceived drinking norms, personal approval of alcohol use, positive and negative alcohol expectancies, and protective behavioral strategies. Of these constructs, the effects of the online course have only been examined in regards to expectancies and protective behavioral strategies, and then only as discrete outcome measures. Lovecchio, Wyatt & DeJong (2010) reported that an earlier version of the AlcoholEdu course had a desired effect on positive, but not negative, expectancies. Wall (2007) reported positive program effects on the reduction of positive expectancies, but negative expectancies were not measured. He also found a decrease in what he called “intentional risky behaviors,” which are analogous, but inversely related, to protective behavioral strategies. No published evaluation of AlcoholEdu has formally tested any of these constructs as mediators.

We hypothesized that AlcoholEdu would demonstrate a direct effect on all five mediators, and that each would in turn mediate the relationship between the course and past 30-day frequency of alcohol use, heavy episodic drinking, and alcohol-related problems. We note here that two recently published articles based on this multi-campus randomized controlled trial have already demonstrated AlcoholEdu’s beneficial short-term effects on the behavioral outcomes examined in the present study (Paschall et al., 2011a,b).

Methods

AlcoholEdu for College

AlcoholEdu is an online course designed for first-year college students to prevent alcohol abuse and related harms. Students take the two- to three-hour course in two parts. The first part, which most incoming students complete the summer before they matriculate, begins with an introductory module that provides a course overview and a flash animation with detailed information about the standard drink size for various types of alcoholic beverages.

Students then complete a pre-intervention alcohol survey. Those identified as frequent heavy drinkers—for men, five or more drinks in one setting at least three occasions per week, and for women, four or more drinks—receive a pre-course brief intervention that provides personalized normative feedback that contrasts their drinking and experienced consequences against national norms. All students are shown these national norms in main part of the course.

The course also provides information about alcohol’s effects on the brain and body at different levels of blood alcohol concentration. Students review information about alcohol

laws and policies, including the consequences of infractions, and then explore the policies that are specific to the state in which they attend college. The final module encourages students to set personal goals for themselves and develop strategies to help them meet those goals. Students also select from a number of protective behavioral strategies to develop a plan for moderating their alcohol consumption and reducing potential harms.

Students complete the second part of the course 30 to 45 days later, during their fall semester. This component begins with a post-intervention alcohol survey. Next, students are given the opportunity to review and revise the plan they had developed earlier. Finally, students review information on how to manage stress and recognize problems related to alcohol abuse.

Research Design

A randomized controlled design was used to evaluate AlcoholEdu as a campus-level prevention strategy (Paschall et al., 2011a,b). We recruited colleges that had never implemented the course or any other online prevention program designed for all incoming freshmen. All participating colleges agreed to be randomly assigned to either an intervention or control group in the study's first year, and to implement the course if assigned to the intervention group. For each of the two semesters, the participating colleges also agreed to provide contact information for random samples of 200 freshmen. A total of 32 colleges were initially enrolled in the study over a two-year period, with 22 enrolled in the fall of 2007 and eight a year later. A random sample of entering first-year students from each institution was then asked to complete the intervention, the first cohort during the fall of 2008, and the second cohort during the fall of 2009.

Of the 16 colleges assigned to the intervention condition, one did not fully implement AlcoholEdu due to the loss of its campus coordinator, but was kept in the study for an intent-to-treat analysis. Another intervention school was lost to follow-up due to an insufficient number of usable surveys. Of the 16 schools assigned to the control condition, one dropped out of the study prior to baseline data collection.

Independent surveys, described below, were conducted with students at 30 colleges, with 15 sites in each condition. Note that the two alcohol surveys students completed when taking AlcoholEdu were not part of this investigation.

All study procedures were approved by the Institutional Review Board (IRB) of the Pacific Institute for Research and Evaluation and by IRBs at all 32 participating colleges.

Student Surveys

The participating colleges provided contact information for random cross-sectional samples of approximately 200 freshmen at the beginning of each semester. The fall survey was conducted in November, after students had completed AlcoholEdu, and the spring survey was conducted in April–May. To introduce the study, students received an invitation letter via regular U.S. mail with a $10 cashable check enclosed. The letter provided an overview of the study and a unique personal identification number with which to log in to the survey website. Up to three e-mail reminders with similar information were sent to those students

who had not logged into the website within the following three weeks. The survey took an average of 15 minutes to complete.

Measures

Potential mediating variables—Questions concerning *alcohol expectancies* were based on the Alcohol Expectancy Questionnaire (Brown et al., 1987). Respondents were asked, "How likely is it that each of the following things would happen to you personally if you were to drink 3 or 4 alcoholic beverages?" There were nine possible positive consequences (e.g., "feel relaxed," "feel happy," "feel more confident or sure of yourself") and an equal number of possible negative consequences (e.g., "get a hangover," "get into trouble with police," "do something you'd later regret"). Response options ranged from "very likely" (1) to "very unlikely" (4). After reverse coding some items, mean scores were computed separately for positive and negative expectancies (Cronbach alphas = .94 and .89, respectively).

To measure *perceived drinking norms*, respondents were asked, "How many alcoholic drinks, on average, do you think students in the following categories typically consume when they drink at a party?" Categories included "yourself," "your friends," "male students," and "female students," with 10 response options that ranged from "none" (0) to "21 or more" (21). A mean response score was computed for each student (Cronbach alpha = .80).

To assess *personal approval of drinking*, students were asked, "How would you feel about close friends having one or two drinks of an alcoholic beverage (beer, wine, liquor) nearly every day?" and "How would you feel about close friends having five or more drinks in one sitting?" These two questions were repeated with a different stem: "How would you feel about people 18 and over …" The five response options ranged from "strongly approve" (1) to "strongly disapprove" (5). After reverse coding students' responses to these four items, a mean response score was computed for each respondent, for which a higher score indicated greater personal approval of drinking (Cronbach alpha = .83).

Twelve questions concerning *protective behavioral strategies* (PBS) were adapted from a set included in the National College Health Association survey of college students (American College Health Association, 2007). Respondents were asked, "When you drank alcohol in the past 30 days, how often did you… set limits on the number of drinks you consumed, discourage a date or friend who was under the influence of alcohol from driving, make plans to avoid driving after drinking, alternate drinking alcoholic and nonalcoholic beverages, eat before and/or during drinking, keep track of how many drinks you are consuming, drink plenty of water to avoid dehydration, pace drinks to one or fewer per hour, have a friend let you know you've had enough to drink, avoid drinking games, anticipate and prepare yourself for unplanned sex, and anticipate unwanted sexual advances from someone else who was drinking?" The five response options ranged from "never" (1) to "always" (5). Because the internal consistency of these 12 items was fairly high (Cronbach alpha=0.88), we computed for each respondent an overall mean PBS score, for which a higher value represented more frequent use of PBS in the past 30 days.

Dependent variables—*Frequency of alcohol consumption* was assessed by the following question: "In the past 30 days, on how many days would you say that you had at least one drink of beer, wine, or liquor?"

Average number of drinks was assessed with the question, "Of those last 30 days when you did drink an alcoholic beverage, on average, how many drinks did you usually have?"

Frequency of binge drinking (NIAAA, 2004) was assessed by the following question: "During the past 30 days, how many times have you had 5 (or 4) or more drinks in a row within a two-hour period?" The number of drinks was automatically filled in on the web-based survey as either a 5 or a 4, depending on whether the respondent was male or female, respectively.

Alcohol-related problems were assessed with a question with the following stem: "During the past 30 days, how often has your drinking caused you to…." The question continued with a list of 28 problems (e.g., "have a hangover," "miss a class," "do something you later regretted," "argue with friends," "forget where you were or what you did"). Response options ranged from "never" (0) to 10+ times (6), and the items were summed to create an overall alcohol problem index. For response options with a range (e.g., 3–5 times, 6–9 times), the midrange value was used; for the final option (10+), 10 was used. Hence, the full index could potentially range from 0 to 280 (28 problems × 10 or more times in the past month).

Contextual variables—Additional questions concerned students' age, gender, race/ethnicity, whether they were living in a dormitory, and their grade-point average. College-level data included as covariates were the region of the country in which the college was located; whether it was it an urban, suburban, or rural area; whether it was a religious institution; the size, gender, and racial composition of its student body; and the proportions of students who lived on campus and were members of a Greek organization.

A copy of the study's instrument is available from the first author upon request.

Data Analysis

Descriptive analyses examined the degree of equivalency between schools and students in the intervention and control groups at baseline. All subsequent analyses were based on baseline survey data collected during the spring semester prior to implementation of AlcoholEdu, and during the fall semester after course implementation when AlcoholEdu effects on alcohol-related behaviors and problems were observed (Paschall et al., 2011a,b).

The analysis tested the direct effects of AlcoholEdu on the course's five mediators, with the primary independent variable of interest being the interaction between time (baseline vs. post-intervention) and study condition (AlcoholEdu or control). These and all other analyses controlled for the full complement of student- and college-level covariates, including survey response rate. Because effects were found effects for only one of the course's mediating variables, subsequent tests of mediation were limited to that variable. Two models were created for each of the study's dependent variables, first excluding and then including the

mediator. The beta coefficients or event rate ratios associated with the Time × Experimental Condition variable were examined to see if they decreased in magnitude or statistical significance from the first to the second model; a reduction was interpreted as an indicator of mediation (MacKinnon et al., 2007). Note that binge drinking was also examined as a potential mediator in models with alcohol-related problems as the dependent variable, as those problems were likely to be strongly associated with binge drinking.

SUDAAN version 10.0.1 software (Research Triangle Institute, 2002) was used for initial descriptive analyses, and HLM version 6.06 software (Raudenbush et al., 2004) was used for multi-level regression analyses. Both SUDAAN and HLM software adjust for clustering of observations within campuses and employ sample weighting to obtain unbiased standard errors and tests of statistical significance.

Results

Survey Response Rate

The overall survey response rates ranged from 44% to 48%, with an average of 90 respondents per school each semester. To correct for potential bias due to over- or under-representation of demographic subgroups, non-response weights were computed as ratios based on gender and ethnic breakdowns for the entire freshman classes at the participating colleges, relative to analogous breakdowns from the samples of survey respondents. Non-response weights were used in descriptive and multi-level regression analyses.

College and Student Sample Characteristics

There were no statistically significant differences between colleges in the intervention and control groups with respect to either geographic or demographic characteristics. As displayed in Table 1, participating colleges were evenly distributed across the four regions of the U.S., with the majority of schools in the Midwest and South. A somewhat larger number of control than intervention schools were located in urban and suburban, relative to rural, settings. Other characteristics were approximately equivalent across groups. The average survey response rate in Fall 2008/09 was somewhat higher at control than intervention schools, but this difference was not statistically significant. Table 2 displays baseline (Spring 2008/09) survey sample characteristics. Schools in the intervention condition did not differ from those in the control group on any of these characteristics.

Effects of AlcoholEdu on Mediators

The effects of AlcoholEdu on putative mediators during the post-intervention fall semester are shown in Table 3. As can be seen, the course affected perceived drinking norms in the expected direction, and the relationship between the interaction term representing Time × Experimental Condition and this mediator, controlling for all study covariates, was relatively strong ($p<.01$). The AlcoholEdu course had no effect on any of the other potential mediators.

Mediating Effects of Perceived Drinking Norms

The results of regression analyses to assess mediation by perceived drinking norms may be found in Tables 4 and 5. As noted earlier, these mediation tests were limited to this single

variable, as it was the only potential mediator on which the course had a significant direct effect. Adding this variable to models of the effects of AlcoholEdu on the frequency of both alcohol use and binge drinking reduced the betas associated with these two variables from −.64 to −.45 and from −.26 to −.18, respectively. These reductions represented approximately a 30% decrease for both variables, and in both models the mediating variable was highly (p<.01) significant.

Tests of the mediating effects of perceived drinking norms on alcohol-related problems revealed that the event rate ratios associated with these problems, when considered collectively and with each type of problem considered discretely, increased towards 1 when the mediator was added to the model. Event rate ratios may be interpreted in a manner analogous to odds ratios, with ratios closer to 1.0 representing smaller differences between the compared groups. The event rate ratio corresponding to the Time × Experimental Condition variable for total alcohol-related problems increased from .67 to .83, and the corresponding event rate ratios increased from .73 to .93 and from .55 to .69 for problems related to physiological and social problems, respectively, each representing a reduction of about 20%. The change in the AlcoholEdu effect associated with victimization, from .38 to .58 (about 35%), was more striking. Note that heavy episodic drinking also contributed to these changes and therefore another mediating variable for alcohol-related problems.

Discussion

The primary aim of this study was to investigate whether a number of key constructs, which were derived from behavioral theories and informed the development of AlcoholEdu, mediated the course's effects on alcohol use, binge drinking, and alcohol-related problems among college freshmen. There are a growing number of evaluations of web-based alcohol use prevention programs designed for college student populations, but most studies have focused exclusively on their effects on behavior and not the role of supposed mediators. As hypothesized, perceived drinking norms partially mediated the relationship between AlcoholEdu and all three of the specified outcomes. While these mediating effects were generally modest (reductions in the range of 20–35%), they do demonstrate a clear pathway by which the effects of the course on these outcomes may be traced.

Support for the robustness of this finding is provided by an evaluation of e-CHUG that targeted a population of college freshmen who reported heavy episodic drinking, in which changes in perceived drinking norms mediated the intervention's effects (Walters, Vader & Harris, 2007). Another study, which compared web-based personalized normative feedback to web-based education for a population of college students who had been mandated to receive counseling services for violating their college's alcohol and drug policies, yielded the same finding (Doumas, McKinley, & Book, 2009). A third study of a web-based intervention that also targeted college students who drank heavily reported a similar finding (Neighbors, Larimer, & Lewis, 2004). It should be noted that all three of these studies targeted indicated populations of college students. To our knowledge, the present study is the first to confirm the mediating role played by perceptions of others' drinking in a universal population, a finding that supports the implementation of AlcoholEdu with all incoming freshmen.

One of the assets of AlcoholEdu as a web-based course is its ability to offer selected students immediate personalized feedback, in the form of both text and graphical displays, comparing their drinking behavior and alcohol-related problems with those of other students who have participated in the course. Future versions of AlcoholEdu could be designed to tailor such feedback still further, by offering personalized feedback to all students participating in the course.

There is both theoretical and evidentiary support to suggest that students are more responsive to the perceived drinking norms of their proximal referent groups than those of the general study body. The emerging literature on this topic suggests that potential referent groups may include gender, age, ethnicity, group affiliation (e.g., fraternities and athletes), and place of residence (e.g., dormitory). It does not appear that information concerning drinking behaviors of close or best friends is helpful, as students' misperceptions of these behaviors are minimal (Baer & Carney, 1993; Larimer et al., 2009; Lewis & Neighbors, 2006). While it would be premature for AlcoholEdu to tailor the personalized feedback it provides to include comparative data for these more specific reference groups, future versions of this online course could randomly vary the reference groups to determine which group or combination of groups being cited might produce the greatest positive effect.

In this study, perceived drinking norms were the only mediating pathway with respect to drinking behaviors and alcohol-related problems, with heavy episodic drinking also serving as a mediator for the latter. This resulted from the fact that the course had no effect on any of AlcoholEdu's other putative mediators, namely positive or negative expectancies, personal approval of alcohol use, or protective behavioral strategies. There is no ready explanation for this set of findings, particularly given that two prior evaluations of AlcoholEdu did demonstrate effects on positive expectancies (Lovecchio, Wyatt & DeJong, 2010; Wall, 2007) and mixed effects on protective behavioral strategies (Wall, 2007). It would be premature for AlcoholEdu to be revised to strengthen the content that addresses these mediators, but future course evaluations should routinely include tests of mediation to determine if any clear patterns in effects emerge.

Study findings should be interpreted in light of three limitations. First, the conservative intent-to-treat analysis may have underestimated the actual effects of AlcoholEdu on potential mediators because of relatively low completion rates at some of the intervention schools. Note, however, that results of additional multi-level regression analyses (not reported here) did not provide evidence for dosage effects with respect to campus-level course completion rate. Second, this study lost two of its original sample of 32 randomized colleges (one in each condition), which may have had a small adverse effect on the integrity of the sample. Third, the survey response rates, which were in the range of 44 to 48%, were sufficiently low that the sample may have been compromised. Even so, tests of inter-group equivalency pertinent to all key variables at baseline yielded no statistically significant differences.

The study also had several strengths. Among these were the number of colleges enrolled, the universal nature of the population of freshmen targeted (whereas other tests of mediation within the context of web-based interventions have assessed effects only on high-risk

drinkers), the use of an intent-to-treat approach to analysis, and the number of potential mediators examined.

In conclusion, this large, multi-campus randomized controlled trial represents the first test of the theory-derived mediators thought to constitute the pathways by which AlcoholEdu affects students' alcohol use, binge drinking, and related negative consequences. While we found support for the meditational effects of perceived drinking norms, we found none for the program's other putative mediators, despite some prior evidence of the meditational effects of positive expectancies and protective behavioral strategies. Future evaluations of AlcoholEdu and other web-based alcohol-prevention curricula should routinely include measures of their full complement of potential mediators to clarify the pathways by which these curricula demonstrate effects and to learn which content-specific components may be in need of modification or omission. While the majority of the effects of these curricula attenuate quickly after initial follow-up, their brevity, low cost, acceptability, and the ease with which they can be accessed and completed suggests that they should be widely disseminated to incoming freshmen populations who are at elevated risk for alcohol abuse and related problems, especially during their first semester on campus.

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Table 1

College characteristics, by study condition

Variable	Control Group (N=15)	AlcoholEdu (N=15)	p value
Region			
Northeast	4	2	0.65[a]
South	4	4	1.00[a]
Midwest	5	7	0.71[a]
West	2	2	1.00[a]
Urban/suburban location	11	7	0.26[a]
Public university	8	8	1.00[a]
Religious institution	4	4	1.00[a]
Total undergraduate population, mean (SD)	8491.47 (7685.8)	8489.9 (7269.1)	1.00[a]
Percent white, mean (SD)	71.6 (20.1)	76.8 (12.9)	0.40[b]
Percent male, mean (SD)	46.4 (5.8)	43.7 (5.8)	0.22[b]
Percent Greek students, mean (SD)	12.3 (11.2)	11.2 (7.9)	0.77[b]
Percent living on campus, mean (SD)	46.1 (26.5)	46.3 (24.8)	0.99[b]
Survey response rate, mean (SD)	51.4 (9.9)	45.2 (9.8)	0.10[b]

[a] Fisher's exact test.

[b] Student's *t*-test.

Table 2

Baseline student sample characteristics, by study condition

Variable	30 colleges (N=2400)	15 control schools (n=1298)	15 AlcoholEdu schools (n=1102)
Demographics			
Age, mean (SD)	18.7 (0.8)	18.6 (0.7)	18.8 (0.9)
Male, %	45.0	46.2	43.7
White, %	71.3	67.5	75.8
Hispanic, %	11.2	12.2	10.1
Asian, %	7.1	9.5	4.4
Black, %	5.3	4.7	6.0
Other race/ethnicity, %	4.1	4.7	3.3
Living in dormitory, %	80.3	80.5	80.0
Grade-point average, mean (SD)	3.2 (0.6)	3.2 (0.6)	3.2 (0.5)
Alcohol use, past 30 days			
Alcohol use frequency	3.8 (5.1)	3.6 (4.9)	4.0 (5.2)
Binge drinking frequency	1.3 (2.2)	1.2 (2.1)	1.3 (2.2)
Alcohol-related problems, past 30 days			
Total, %	49.0	47.3	50.9
Physiological, %	40.1	39.9	40.4
Social, %	32.7	31.4	34.2
Victimization, %	4.0	3.7	4.2
Mediating factors			
Perceived drinking norms	7.9 (3.4)	7.6 (3.5)	8.3 (3.3)
Positive alcohol expectancies[a]	3.2 (0.7)	3.2 (0.7)	3.2 (0.7)
Negative alcohol expectancies[a]	1.7 (0.6)	1.7 (0.6)	1.6 (0.6)
Personal approval of alcohol use	2.1 (0.9)	2.1 (0.9)	2.1 (0.9)
Protective behavioral strategies[b]	3.0 (1.0)	2.9 (1.0)	3.1 (1.0)

[a] N = 1,782 (control schools n = 935, AlcoholEdu schools n = 847).

[b] N = 1,697 (control schools n = 895, AlcoholEdu schools n = 802).

Table 3

Assessment of AlcoholEdu effects on targeted intermediate outcomes during post-intervention fall semester, beta (SE)

Variable	Perceived drinking norms	Positive expectancies	Negative expectancies	Personal approval of alcohol use	Protective behavioral strategies
Time × Condition	−.82 (.24)**	−.07 (.06)	.005 (.04)	−.06 (.06)	−.05 (.07)
Time (1=baseline, 2=post-intervention semester	−.03 (.17)	.005 (.02)	.08 (.03)*	−.03 (.04)	.04 (.06)
Intervention condition (0=control, 1=AlcEdu)	.69 (.43)	.06 (.08)	−.04 (.08)	.06 (.08)	0.18 (.11)
Student covariates					
Age	.03 (.10)	−.02 (.02)	.001 (.009)	.001 (.02)	−.007 (.02)
Male	−.34 (.12)**	−.06 (.03)*	−.23 (.03)**	.47 (.03)**	−.31 (.04)
White	−.07 (.26)	.06 (.06)	−.04 (.04)	.05 (.08)	.16 (.08)*
Black	−.65 (.39)	−.16 (.09)	.13 (.07)	−.14 (.09)	−.07 (.10)
Asian	−.32 (.36)	−.20 (.09)*	.08 (.07)	−.72 (.40)	.06 (.11)
Hispanic	.13 (.30)	.02 (.07)	. 005 (.05)	−.03 (.06)	.16 (.10)
Living in dormitory	.23 (.15)	.04 (.04)	−.04 (.04)	.07 (.04)	.11 (.07)
Grade-point average	−.45 (.10)**	−.02 (.02)	. 04 (.03)	−.16 (.02)**	.08 (.03)*
College covariates					
Midwest region	.76 (.28)*	.03 (.02)	−.05 (.02)*	.005 (.03)	−.07 (.04)
Urban/suburban	−.26 (.39)	−.03 (.03)	.01 (.02)	.03 (.04)	−.08 (.06)
Public institution	−.58 (.90)	.11 (.07)	−.004 (.05)	.01 (.10)	−.15 (.14)
Religious institution	−.18 (.59)	.08 (.05)	−.08 (.04)	.02 (.07)	−.08 (.13)
Student population size	−.0003 (.0002)	.0003 (.0003)	.0005 (.0002)*	−.0003 (.0004)	.0002 (.00006)*
% white	.02 (.01)*	.0001 (.0007)	.0006 (.0007)	.002 (.001)	−.0009 (.003)
% male	−.02 (.03)	−.003 (.002)	−.003 (.001)	.0008 (.004)	−.001 (.002)
% living on campus	−.02 (.01)	−.0003 (.001)	.002 (.001)	−.0007 (.002)	−.0003 (.003)
% in Greek organization	−.001 (.01)	.002 (.001)	−.004 (.001)*	−.003 (.002)	−.004 (.005)
Survey response rate	−.05 (.01)**	.002 (.002)	.001 (.001)	−.0005 (.002)	−.0008 (.004)

* p<.05,

** p<.01

Table 4

Mediation of AlcoholEdu effects on alcohol use and binge drinking during post-intervention fall semester, beta (SE)

	Alcohol use frequency		Binge drinking frequency	
Variable	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Time × Condition	−.64 (.29)*	−.45 (.29)	−.26 (.10)*	−.18 (.10)
Time (1=baseline, 2=post- intervention semester	.10 (.18)	.11 (.18)	.05 (.07)	.05 (.06)
Intervention condition (0=control, 1=AlcEdu)	.87 (.66)	.71 (.69)	.33 (.18)	.25 (.19)
Student covariates				
Age (years)	.29 (.13)*	.28 (.13)*	.01 (.04)	.005 (.04)
Male	1.04 (.15)**	1.11 (.14)**	.64 (.08)**	.68 (.08)**
White	−.02 (.37)	−.01 (.38)	.02 (.19)	.03 (.20)
Black	−1.76 (.63)**	−1.60 (.60)**	−.75 (.25)**	−.68 (.24)**
Asian	−1.64 (.47)**	−1.57 (.49)**	−.67 (.20)**	−.64 (.22)**
Hispanic	−.17 (.39)	−.19 (.40)	−.17 (.17)	−.19 (.18)
Living in dormitory	.64 (.29)*	.59 (.29)*	.43 (.09)**	.41 (.08)**
Grade-point average	−.97 (.19)**	−.86 (.18)**	−.31 (.06)**	−.27 (.05)**
Perceived drinking norms	---	.23 (.02)**	---	.11 (.008)**
College covariates				
Midwest region	−.45 (.32)	−.60 (.35)	−.11 (.10)	−.19 (.11)
Urban/suburban	.35 (.42)	.29 (.41)	.03 (.14)	.04 (.12)
Public institution	.21 (.97)	.11 (1.06)	.08 (.32)	.12 (.34)
Religious institution	.59 (.66)	.66 (.67)	.38 (.21)	.41 (.21)
Student population size	.0005 (.0004)	.0007 (.0004)	.0001 (.0001)	.0002 (.0001)
% white	.02 (.01)*	.01 (.01)	.007 (.004)	.005 (.003)
% male	.005 (.04)	.01 (.04)	.009 (.01)	.01 (.01)
% living on campus	.01 (.02)	.01 (.02)	.003 (.008)	.005 (.008)
% in Greek organization	.006 (.03)	.01 (.03)	−.003 (.009)	−.0009 (.01)
Survey response rate	−.002 (.02)	−.002 (.02)	−.007 (.006)	−.002 (.006)

* p<0.05,

** p<0.01

Table 5

Mediation of AlcoholEdu effects on alcohol-related problems during post-intervention fall semester, event rate ratio (95% C.I.)

	Total		Physiological		Social		Victimization	
Variable	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Time × Condition	0.67 (0.51, 0.87)†	0.83 (0.69, 1.00)	0.73 (0.57, 0.93)*	0.93 (0.77, 1.12)	0.55 (0.37, 0.83)**	0.69 (0.49, 0.99)*	0.38 (0.16, 0.88)*	0.58 (0.29, 1.15)
Time (1=baseline, 2=post-intervention	1.11 (0.94, 1.31)	1.05 (0.93, 1.19)	1.01 (0.87, 1.17)	0.94 (0.84, 1.05)	1.30 (0.99, 1.70)	1.22 (0.98, 1.52)	2.08 (1.31, 3.32)**	1.92 (1.26, 2.94)**
Intervention condition (0=control, 1=AlcEdu)	1.56 (1.03, 2.36)*	1.27 (0.97, 1.65)	1.43 (0.99, 2.06)	1.14 (0.86, 1.52)	1.86 (0.94,3.66)	1.47 (0.84, 2.59)	2.39 (0.45, 12.58)	1.47 (0.39, 5.55)
Student covariates								
Age	1.04 (0.97, 1.11)	1.03 (0.95, 1.11)	1.07 (1.00, 1.14)	1.06 (0.99, 1.14)	0.99 (0.91, 1.08)	0.97 (0.88, 1.07)	0.90 (0.73, 1.10)	0.88 (0.71, 1.11)
Class	0.97 (0.64, 1.47)	1.09 (0.77, 1.56)	0.90 (0.64, 1.27)	1.05 (0.78, 1.42)	0.86(0.45, 1.64)	0.99 (0.55, 1.76)	0.82 (0.16, 4.21)	1.19 (0.28, 5.14)
Male	1.37 (1.18, 1.60)†	1.06 (0.93, 1.21)	1.26 (1.07, 1.49)†	0.95 (0.84, 1.09)	1.35 (1.10, 1.66)**	1.07 (0.87, 1.31)	1.93 (1.11, 3.33)*	1.47 (1.04, 2.09)*
White	0.86 (0.60, 1.22)	0.89 (0.65, 1.22)	1.08 (0.74, 1.57)	1.15 (0.81, 1.63)	0.81 (0.52, 1.26)	0.82 (0.56, 1.19)	0.34 (0.12, 0.93)*	0.44 (0.18, 1.09)
Black	0.60 (0.32, 1.12)	1.01 (0.59, 1.71)	0.52 (0.27, 1.02)	0.88 (0.53, 1.46)	0.59 (0.31, 1.11)	0.94 (0.52, 1.67)	0.46 (0.09, 2.30)	1.05 (0.21, 5.15)
Asian	0.54 (0.37, 0.78)**	0.77 (0.51, 1.15)	0.47 (0.32, 0.71)†	0.75 (0.47, 1.19)	0.49 (0.31, 0.77)**	0.69 (0.45, 1.06)	0.08 (0.02, 0.34)**	0.15 (0.03, 0.68)**
Hispanic	1.00 (0.67, 1.50)	1.14 (0.73, 1.79)	1.16 (0.78, 1.73)	1.35 (0.87, 2.11)	1.07 (0.69, 1.66)	1.19 (0.73, 1.95)	0.74 (0.23, 2.39)	0.91 (0.33, 2.55)
Living in dormitory	1.11 (0.87, 1.41)	0.87 (0.68, 1.11)	1.31 (1.04, 1.65)*	1.02 (0.82, 1.28)	1.25 (0.92, 1.70)	0.98 (0.70, 1.37)	1.08 (0.50, 2.34)	0.93 (0.44, 1.97)
Greek	1.05 (0.78, 1.43)	0.55 (0.36, 0.83)	1.52 (0.99, 2.33)	0.81 (0.49, 1.35)	0.98 (0.67, 1.44)	0.49 (0.29, 0.83)**	3.79 (0.60, 23.99)	1.70 (0.19, 14.69)
Grade point average	0.75 (0.67, 0.83)†	0.84 (0.76, 0.92)†	0.81(0.73, 0.90)†	0.92 (0.85, 1.01)	0.74 (0.64, 0.87)**	0.84 (0.72, 0.98)*	0.86 (0.55, 1.33)	0.87 (0.58, 1.32)
Perceived drinking norms	---	1.04 (1.02, 1.07)*	---	1.04 (1.03, 1.06)*	---	1.06 (1.03, 1.09)**	---	1.12 (1.03, 1.23)*
Binge drinking	---	1.31 (1.27, 1.35) †	---	1.33 (1.29, 1.37)†	---	1.31 (1.27, 1.35)**	---	1.34 (1.26, 1.42)**
College covariates								
Midwest region	0.96 (0.79, 1.18)	0.96 (0.82, 1.19)	0.91 (0.75, 1.10)	0.92 (0.82, 1.03)	0.98 (0.80, 1.22)	1.00 (0.85, 1.18)	0.87 (0.45, 1.674)	0.86 (0.49, 1.51)
Urban/suburban	1.04 (0.74, 1.45)	1.03 (0.80, 1.31)	0.96 (0.75, 1.22)	0.98 (0.84, 1.13)	1.13 (0.87,1.46)	1.09 (0.94, 1.28)	1.20 (0.52, 2.76)	1.10 (0.59, 2.06)
Public institution	0.92 (0.45, 1.90)	0.95 (0.56, 1.63)	0.80 (0.41, 1.56)	0.81 (0.55, 1.20)	1.02 (0.56, 1.89)	1.01 (0.67, 1.53)	0.72 (0.12, 4.45)	0.73 (0.19, 2.79)
Religious institution	1.02 (0.61, 1.74)	1.04 (0.71, 1.52)	1.10 (0.69, 1.74)	1.10 (0.83, 1.47)	1.10 (0.70, 1.73)	1.07 (0.80, 1.44)	0.51 (0.15, 1.67)	0.63 (0.25, 1.59)
Student population	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
% white	1.01 (1.00, 1.02)*	1.01 (1.00, 1.02)*	1.01 (1.00, 1.02)*	1.01 (1.00, 1.02)*	1.01 (1.00, 1.02)**	1.01 (1.00, 1.02)**	1.04 (1.02, 1.06)**	1.03 (1.01, 1.04)**
% male	1.00 (0.97, 1.02)	1.00 (0.98, 1.02)	0.99 (0.97, 1.02)	0.99 (0.98, 1.01)	0.99 (0.97, 1.02)	0.99 (0.98, 1.01)	0.98 (0.93, 1.03)	0.99 (0.95, 1.03)

	Total		Physiological		Social		Victimization	
Variable	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
% living on campus	1.00 (0.98, 1.01)	0.99 (0.98, 1.01)	1.00 (0.98, 1.01)	0.99 (0.98, 1.00)	1.01(0.99, 1.03)	1.01(0.99, 1.02)	1.01 (0.97, 1.05)	1.00 (0.97, 1.04)
% in Greek organization	0.99 (0.97, 1.01)	0.99 (0.98, 1.01)	1.00 (0.98, 1.02)	1.00 (0.99, 1.02)	0.99 (0.96, 1.01)	0.99 (0.98, 1.01)	0.97 (0.91, 1.03)	0.98 (0.94, 1.03)
Survey response rate	0.99 (0.98, 1.00)	1.00 (0.99, 1.01)	1.00 (0.98, 1.01)	1.00 (0.99, 1.01)	0.97 (0.94, 1.00)	0.99 (0.98, 1.01)	0.95 (0.91, 1.00)	0.97 (0.93, 1.01)

* p<.05,

** p<.01