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## A randomized, controlled trial to test the efficacy of an online, parent-based intervention for reducing the risks associated with college-student alcohol use

Elizabeth Donovan<sup>a</sup>, Mollie Wood<sup>a</sup>, Kezia Frayjo<sup>a</sup>, Ryan A. Black<sup>a</sup>, and Daniel A. Surette<sup>a</sup>

### Abstract

Alcohol consumption among college students remains a major public health concern. Universal, Web-based interventions to reduce risks associated with student alcohol consumption have been found to be effective in changing their alcohol-related behavior. Recent studies also indicate that parent-based interventions, delivered in booklet form, are effective. A parent-based intervention that is also Web-based may be well suited to a dispersed parent population; however, no such tool is currently available. The purpose of this study was to test the efficacy of an online parent-based intervention designed to (1) increase communication between parents and students about alcohol and (2) reduce risks associated with alcohol use to students. A total of 558 participants, comprising 279 parent-teen dyads, were enrolled in the study. The findings suggested that parents who participated in the online intervention were more likely to discuss protective behavioral strategies, particularly those related to manner of drinking and stopping/limiting drinking, with their teens, as compared with parents in an e-newsletter control group. Moreover, students whose parents received the intervention were more likely to use a range of protective behavioral strategies, particularly those related to manner of drinking and stopping/limiting drinking, as compared with students whose parents did not receive the intervention. A universal, online, parent-based intervention to reduce risks associated with student alcohol consumption may be an efficient and effective component of a college's overall prevention strategy.

### Keywords

alcohol; college students; intervention; parents; prevention

### 1. Introduction

Alcohol consumption among college students is a major public health concern (Hingson & Zha, 2009; Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism, 2002a). On average, approximately 66% of all college students drink alcohol over the period of a month, and approximately 37% engage in binge drinking, defined as consumption of five or more drinks in a row within a two-week period (Johnston, O'Malley, Bachman, & Schulenberg, 2010). Unfortunately, the situation does not seem to be improving: alcohol use by college students has changed little over the past decade (Johnston et al., 2010).

Arguably, the negative consequences that students experience as a result of consuming large amounts of alcohol are of more concern than the alcohol consumption itself. Heavy, episodic alcohol consumption among college students is associated with numerous negative consequences, including risky sexual activity, blackouts, and physical injury to oneself or

<sup>a</sup>Inflexion, Inc., 320 Needham Street, Suite 100, Newton, MA 02464. Phone: 617-614-0444. Fax: 617-332-1820 Please address all correspondence to Elizabeth Donovan at donovanelizabeth@gmail.com. .

another person (American College Health Association [ACHA], 2011). Recent research has focused on specific strategies that individuals can use to help reduce their alcohol use and the negative consequences resulting from such use; for example, “determine not to exceed a set number of drinks,” “avoid drinking games,” and “use a designated driver” (Benton et al., 2004; Martens et al., 2004); however, students’ tendency to use such strategies is mixed (ACHA, 2011).

Campus administrators have increased their efforts to implement interventions to minimize high-risk drinking and protect against associated negative consequences (Wechsler et al., 2002). One approach that is gaining popularity on college campuses is universal, Web-based interventions designed to reduce the risks associated with alcohol consumption. In general, online interventions have been found to be successful at changing a range of health-related behaviors (Ritterband et al., 2003). An advantage of these programs is that they are less costly than individual- and group-prevention sessions, as they require considerably less staff effort to deliver. Another advantage is that recent technological advances, including increased access to the Internet and faster Internet connections, have resulted in delivery vehicles such as streaming video and Flash technology, which may increase engagement and persuasion (Walters, Wright, & Shegog, 2006). Web-based interventions to minimize high-risk drinking and its consequences vary in scope and length, but they are likely to include a combination of educational and evidence-based components, such as cognitive-behavioral skills training and motivational information (Larimer & Crouse, 2007). An important content area is protective behavioral strategies—specific strategies that students can use to reduce alcohol use and associated negative consequences.

Web-based interventions to minimize high-risk drinking and its consequences have been found to be effective. Compared with control groups, this approach has resulted in a steeper reduction in alcohol use after one month (Chiauzzi, Green, Lord, Thum, & Goldstein, 2005), decreased overall alcohol consumption and alcohol-related consequences (Hustad, Barnett, Borsari, & Jackson, 2010; Lovecchio, Wyatt, & DeJong, 2010), and reduced alcohol consumption and alcohol-related consequences in high-risk drinkers specifically (Doumas & Andersen, 2009).

Another approach being taken by campus administrators to minimize high-risk drinking and protect against negative consequences is to involve the parents of college students. Contrary to the prevailing belief that parents’ influence declines at this stage of development (Harris, 1998), numerous studies have reported relationships between parental attitudes and beliefs and college-student drinking (see Ryan, Jorm, & Lubman, 2010). This has led to the development of a small number of interventions that aim to increase and guide parent-teen communication about alcohol-related issues (Ichiyama et al., 2009; Turrisi, Jaccard, Taki, Dunnam, & Grimes, 2001) with the goal of reducing high-risk drinking. These interventions typically involve using a booklet to educate parents about high-risk drinking and ways to share the information with their college-bound teens (Ichiyama et al., 2009; Turrisi et al., 2001). The results indicate that parent-based interventions are associated with a decreased likelihood of students transitioning from nondrinkers to drinkers (Ichiyama et al., 2009) and with decreased drinking and fewer negative consequences (Turrisi et al., 2001).

To our knowledge, no parent interventions have specifically been developed to be delivered to parents entirely online. There are a number of reasons to believe that this would be a promising approach. First, parents do not live on campus; they are distributed all over the country, even the world. A Web-based intervention may provide an efficient way to reach large numbers of parents. Second, particularly with a widely dispersed group such as parents, online interventions could provide substantial cost savings. Third, as with students, technological advances, such as streaming video and Flash technology, which can be

incorporated into Web-based interventions, may increase engagement and persuasion (Walters et al., 2006). Fourth, Web-based materials can be easily updated, which may offer parents an incentive to return to the program.

### 1.1 Study Aims and Hypotheses

The aim of the current study was to test the efficacy of an online, parent-based intervention, designed to increase parent-teen communication about alcohol and other drugs (AOD) and to reduce student risks associated with alcohol use in the weeks before and after the beginning of freshman year in college. The intervention was driven by cognitive-behavioral and harm-reduction theories and included cognitive-behavioral skills training and norms clarification. Much of the content was interactive and video-based.

The hypotheses were that, compared with an e-newsletter control group, parents who participated in the online intervention would be more likely to report (1) increased confidence about discussing AOD with their college-bound teens, (2) increased discussion of specific protective behavioral strategies, and (3) greater likelihood of having read the college's policy on alcohol and other drugs. We hypothesized similar outcomes for the teens—specifically, that compared with children of parents in the e-newsletter control group, children of parents in the online intervention group would be more likely to report (1) increased confidence about discussing AOD with their parents; (2) increased use of protective behavioral strategies, and (3) greater likelihood of having read the college's policy on AOD. The secondary hypothesis was that, compared with children of parents in the e-newsletter control group, children of parents who participated in the online intervention would be more likely to report decreased high-risk drinking.

## 2. Method

### 2.1 Design

Given the sensitive nature of the outcomes of interest, that is, drinking behaviors and expectations related to parent-teen communication, we elected to use a randomized, controlled study design that would allow us to assess both the effect of the treatment and the potential effects of reactivity to the baseline assessment. Such reactivity may confound the results of a typical pre- and post-assessment controlled study; for instance, exposing parents, on the baseline assessment, to ideas about communicating with their children with regard to drinking behaviors may have an effect on how they respond to the parent-teen communication outcome measured post-intervention. To address this concern, we chose to use the Solomon four-group design on data collected from the baseline assessment and from the first follow-up assessment, conducted 30 days post-baseline (Campbell & Stanley, 1963; Solomon, 1949). This design explicitly addresses the issue of assessment/expectation reactivity and provides “immunity from most threats of internal validity” as well as “a higher degree of external validity in addition to the internal validity ... than other basic experimental designs” (Braver & Braver, 1988). The design calls for two groups to receive the experimental intervention, with one group administered the baseline assessment and the other group not given it. Similarly, there are two control groups, with one receiving the baseline assessment and the other not receiving it. Use of the four-group design allowed us to examine (1) the effect of the MyStudentBody-Parent intervention, (2) the effect of the assessment/expectation of benefit, and (3) the interaction effect of the assessment/expectation with the MyStudentBody-Parent intervention (Campbell and Stanley, 1963).

### 2.2 Participants

A total of 558 participants comprising 279 parent-teen dyads were enrolled in the study. Of the parents, 85% were women; the average age was 48 years old. Of the teens, 62% were

female; the average age was 18 years old. Of the teens who completed the baseline assessment (Groups 1 and 3), 49% reported having consumed alcohol in the past 30 days. The average reported consumption was 2.73 drinks (standard deviation, 5.02) in the past week. The number of drinks consumed per week ranged from 0 to 26 in the past 30 days, with 19.6% of teens reporting having consumed five drinks or more (four, for female participants) at a sitting in the two preceding weeks. Table 1 presents additional demographic information for the study sample.

Parents were recruited from 11 colleges and universities in the United States. The research team, in concert with each participating school, emailed an invitation to participate in the study to the parents of all incoming freshmen. Parents who indicated that they were interested in participating were screened online and, if accepted, were asked to provide their teen's e-mail address to the research team. Screening criteria for parents were as follows: (1) they had to be the parent of a high-school senior who would be entering college for the first time in the fall, (2) they had to have regular access to the Internet and e-mail, and (3) they would need to be able to contact their child regularly during July and August, before the beginning of the fall semester. A research coordinator then e-mailed separate invitations to participate to the parent and the teen. The invitation included a link to the online screening and consent/assent forms. The screening criterion for students was that they were high-school seniors who would be entering college for the first time in the fall. If the teen and the parent both agreed to participate, the dyad was enrolled in the study. If the teen did not want to participate, the parent was told only that the dyad was ineligible.

Participants (teens and parents) were paid \$25 each for completing the baseline assessment, \$25 for completing the post-test, \$40 for completing the three-month assessment, and \$50 for completing the six-month assessment, for a possible total of \$140 per person. Participants who were not given the baseline assessments were instead administered a set of demographic questions; they were paid the same amount as participants who received the baseline assessments.

### 2.3 Materials

The experimental-group material, referred to as MyStudentBody-Parent (<http://www.mystudentbody.com>), is one component of a suite of online college health programs, which, as a whole, target administrators and students as well as parents. Parent participants were exposed only to MyStudentBody-Parent, which consists of seven sections covering topics related to the transition to college life, with a focus on communicating about AOD. The content is driven by a cognitive-behavioral and harm-reduction approach. While most of the content focuses on alcohol use, as this is the most widely used substance among this age group (Johnston, O'Malley, Bachman, & Schulenberg, 2010) and the main focus of this study, some content focuses on other substances, such as marijuana, which are often used in combination with alcohol.

The seven sections of MyStudentBody-Parent are as follows: (1) College Trends, focusing on AOD education, with an emphasis on correcting misperceptions about student AOD use; (2) Share the Facts with Your Child, discussing higher-risk issues, such as alcohol use and its association with sexual assault; (3) Communicating About the Transition, focusing on the transition to college, including a discussion about the importance of setting expectations pertaining to alcohol use; (4) Prevention Strategies, emphasizing ways to stay safe, including how to share a family history of alcohol problems and protective behavioral strategies to use if one chooses to drink alcohol; (5) Warning Signs, covering issues associated with alcohol abuse; (6) Support for Students, dealing with different types of support, such as becoming involved in activities with peers and campus safety resources; and (7) Rules and Regulations, centering on college policies such as those related to

amnesty, as well as state and federal laws pertaining to AOD. Each content area also spotlights an issue identified in the literature as being central to communication about AOD—for example, the importance of clarifying expectations concerning student AOD use, how to address questions about a parent’s own past use, and how to respond to an alcohol-poisoning emergency.

The content was delivered with use of four methods. First, some information was delivered through text-based articles. Second, each of the seven sections of MyStudentBody-Parent contained one video-based “click-through” lesson, which focused on an issue identified in the literature as being central to communication about AOD—for example, the importance of clarifying expectations about student AOD use. Each lesson comprised an average of ten screens of text and photographs and included illustrative videos of teens and parents discussing the central issue. Third, there were “campus perspectives,” consisting of an audio recording of a college staff person or student discussing an AOD experience. Fourth, each MyStudentBody-Parent section included an interactive, Web-based tool, which participants could manipulate; the “orientation questions tool,” for instance, allowed participants to view a list of recommended questions related to AOD to ask at orientation, with the option of creating a customizable, printable list.

Control-group material consisted of seven electronic newsletters sent to parent participants via e-mail. The content also focused on college-student AOD use and associated risks, but it was purely educational and did not strongly emphasize communication skill-building. The information was gathered from publicly available, government-sponsored websites, such as [www.collegedrinkingprevention.org](http://www.collegedrinkingprevention.org), which represent the most widely available information about AOD for parents of college students.

## 2.4 Procedure

Using SPSS® software, parent-teen dyads were categorized as one of eight combinations on the basis of parent/teen gender and presence/absence of past teen substance use. Alcohol use in high school has consistently been found to predict its use in college (Bosari, Murphy, & Barnett, 2007). Examples of dyad combinations included father/son-substance use and mother/daughter-absence of substance use. To ensure a balance of dyad gender and teen AOD within each combination, dyads were randomly assigned to one of four groups: Group 1 (experimental group, with baseline assessment), Group 2 (experimental group, no baseline assessment), Group 3 (control group, with baseline assessment), and Group 4 (control group, no baseline assessment).

The intervention began four weeks prior to the start of freshman year, in preparation for the first six weeks of college, which have been identified as a particularly high-risk time for student alcohol use (Borsari, Murphy, & Barnett, 2007). Participants in Groups 1 and 3 completed baseline assessments in the week before the intervention, the week immediately post-intervention, three months post-baseline, and six months post-baseline. Participants in Groups 2 and 4 completed all assessments other than the baseline assessment; instead of the full battery of baseline assessments, they were administered demographic questions only. For all participants, instructions were delivered through e-mail.

At the beginning of Week 1, parents in the MyStudentBody-Parent intervention group were instructed, in an e-mail, to review two sections of the website per week over a four-week period. (The exception was Week 1, when parent participants completed assessments and reviewed only one section of the website.) The review of each website section comprised one Web-based, interactive tool; one audio-based “campus perspective”; four articles; and one video-based lesson. The video-based lesson also encouraged parents to discuss the topic of the lesson—for example, how to prepare for an alcohol emergency—with their teen. At

the beginning of each subsequent week, parent participants were sent an e-mail reminder of which two sections to review that week. The time commitment for both the intervention and the control condition was approximately 20 minutes per session; there were two sessions a week for four weeks, for a total of 160 minutes. The weekly instructions were also posted on the website.

Parents in the control group were instructed, via e-mail, to review two e-newsletters a week for four weeks. Newsletters were e-mailed to participants twice a week. As in the MyStudentBody-Parent experimental group, Week 1 consisted of assessments and review of one e-newsletter.

All participants received booster sessions consisting of one e-newsletter a month, delivered via e-mail, for the six months post-intervention. Figure 1 presents a CONORT diagram.

## 2.5 Measures

### 2.5.1 Parents

**2.5.1.1. The Parent-Teen Communication Scale (PTCS):** (Jaccard, Dittus, & Gordon, 2000) consists of a 22-item parent measure and a 15-item teen measure of self-efficacy for communication about sex. The measures were modified for this study by changing the target of conversation from “sex” to “alcohol and other drugs” (AOD). An example of a parent item is, “I really don’t know enough about alcohol and other drugs to talk about it with my son.” Responses were measured on a 7-point Likert scale. Similar to the validation study of the original instrument, an exploratory factor analysis on both the modified-parent and modified-teen scales (using baseline data) did not yield clearly defined multidimensional constructs; that is, several items loaded highly on more than one factor. However, internal consistency was adequate for both the modified-teen and modified-parent versions ( $\alpha = 0.93$  and  $0.89$ , respectively). Test-retest reliability over a 30-day period starting from baseline was also conducted on a subsample of 61 participants from the experimental and control conditions, who were assessed at baseline. Results revealed adequate stability coefficients for the summed scores of the modified-teen and modified-parent scales ( $r = 0.83$  and  $0.88$ , respectively). Therefore, summed scores for each modified scale were used as clinical outcomes in this study.

**2.5.1.2. The Communication about Protective Behavioral Strategies Scale:** (derived from Martens, Pedersen, LaBrie, Ferrier, & Cimini, 2007) measures the perspective of parents on the extent to which they discussed alcohol-related protective behavioral strategies with their teen. Each of the 15 PBSS items was modified to capture communication, from parents’ perspective, on the areas covered in the PBSS. The new scale will be referred to as the C-PBSS to reflect these changes. The items are measured on a 6-point rating scale, with responses ranging from “never” to “always,” and are intended for parents to complete. Parents are asked, for example, to indicate the degree to which they have talked with their teen about “determine not to exceed a set number of drinks,” “avoid drinking games,” and “use a designated driver” when using alcohol or “partying.”

A confirmatory factor analysis (CFA) was conducted on baseline data ( $N = 133$ ) to determine if the original model structure for the PBSS (Martens et al., 2007) could be extended to the parent population with slightly modified wording.<sup>1</sup> Results from the CFA yielded support for the factor-model structure similar to that for the original scale,  $\chi^2(71) = 127.96$ ,  $p < 0.001$ , comparative fit index (CFI) =  $0.96$ , and root mean square error of

<sup>1</sup>The item measuring the extent to which parents reported speaking with their teens about “taking shots” was removed from all analyses due to poor wording that led to inconsistent responses.

approximation (RMSEA) = 0.08. All factor loadings were above 0.60. Three pairs of error terms were permitted to be correlated to improve model fit. All modification indices were less than 10 in the final model (Byrne, 2001). The C-PBSS factorial model consisted of three first-order factors and one second-order factor.<sup>2</sup> The three first-order factors were named Limiting/Stopping Drinking Communication, Manner of Drinking Communication, and Serious Harm Reduction Communication; the overarching, second-order factor was named Protective Behavioral Strategies Communication. The names for the first-order factors are identical to those in the PBSS, with the exception of each name ending in “Communication.” That term was added because the C-PBSS items measure parents’ perception of the extent to which they communicated with their teen about the same alcohol-related behaviors measured on the PBSS.

Test-retest reliability, calculated with use of data from the 66 participants in the control group who were assessed at baseline and post-intervention (one month post-baseline), yielded a stability coefficient of  $r = 0.62$  for the C-PBSS total scale scores and coefficients of  $r = 0.58, 0.63,$  and  $0.63$  for the Stop Drinking (C-PBSS-S/L), Drinking Manner (C-PBSS-M), and Harm Reduction (C-PBSS-SHR) subscale scores, respectively.

Given the adequate fit of the second-order-factor model, with three first-order factors, along with test-retest reliability over a relatively long period (one month), the scores on the three subscales of the C-PBSS as well as the C-PBSS total score were used as clinical outcomes in this study. (The C-PBSS validation manuscript is being prepared for publication.)

**2.5.1.3. Reading of the college alcohol and other drug policy:** was assessed by asking participants whether they had ever read it.

## 2.5.2. Teens

**2.5.2.1. The Parent-Teen Communication Scale (PTCS):** Jaccard et al., 2000). An example of a teen item is, “I would be embarrassed talking to my mother about alcohol and other drugs.” (For a full description, see **2.5.1 Parents**, above.)

**2.5.2.2. The Protective Behavioral Strategies Scale (PBSS):** (Martens et al., 2007) consists of 15 self-report items measuring the frequency of use of protective behaviors while consuming alcohol. Examples of items are “determine not to exceed a set number of drinks,” “avoid drinking games,” and “use a designated driver.” Responses, which range from “never” to “always,” are measured on a 6-point scale. Martens and colleagues (2007) demonstrated strong psychometric properties for the PBSS. A first-order CFA revealed a clearly defined three-factor structure: (1) Limiting/Stopping Drinking, (2) Manner of Drinking, and (3) Serious Harm Reduction:  $\chi^2(86) = 318.73, p < 0.001,$  CFI = 0.91, and RMSEA = 0.07. Other psychometric tests also supported the model (Martens et al., 2007).

**2.5.2.3. Reading of the college alcohol and other drug policy:** was assessed by asking all participants whether they had ever read it.

**2.5.2.4. Binge drinking:** was measured by asking teen participants how many times in the past 30 days they had consumed five drinks or more (four, for female participants) in about a two-hour period.

<sup>2</sup>In addition to the three first-order factors, we incorporated a second-order factor to reflect an overarching factor that accounted for these three types of communication.

## 2.6 Data Analysis

Data analysis was carried out in the following steps: (1) calculating descriptive statistics and testing for differences among conditions at baseline on relevant demographic variables and outcomes, (2) testing for reactivity to baseline-assessment and treatment effects immediately post-intervention with use of Braver and Braver's recommended steps to analyze a Solomon four-group design (1988), and (3) testing for effects of treatment over the entire trial with use of traditional longitudinal analyses.

With respect to Braver and Braver's recommended steps, we started by testing for the presence of baseline reactivity by performing a 2×2 ANOVA with outcome scores on the post-intervention assessment as the dependent variable and condition (MyStudentBody-Parent vs. e-newsletter control) and baseline assessment (assessed vs. not assessed) and their interaction as the independent variables; categorical outcomes were analyzed similarly, using logistic regression. If baseline reactivity ( $p_{interaction} < 0.05$ ) was observed, simple main-effects tests were conducted separately for groups that were assessed at baseline and groups that were not. If no baseline reactivity was observed, we performed (1) a main-effects test for the MyStudentBody-Parent versus the e-newsletter control group at post-intervention; (2) a multiple regression (linear for continuous variables and logistic for categorical variables) for both groups that were assessed at baseline, controlling for baseline mean score; (3) a *t* test or logistic regression on post-intervention scores for groups that were not assessed at baseline; and (4) a combination of the results from Steps 2 and 3 into a meta *z* statistic with use of Stouffer's method (Mosteller & Bush, 1954). Stouffer's method allows the results of multiple tests to be combined into a single *z* statistic without statistical power being compromised. The *z* statistics from the individual independent tests are summed, and the sum is divided by its standard deviation. This statistic can then be compared with critical values in the standard normal table.

A significant result for any of Steps 1 through 4 is sufficient to conclude that there is a treatment effect. In addition, in the presence of baseline reactivity, a significant effect in either the groups that were assessed at baseline, or in those that were not, is interpreted to mean that the treatment had an effect, but only for those groups; for example, a treatment effect was observed, but only among participants not assessed at baseline.

With respect to longitudinal analyses, we used linear mixed models (LMM) for continuous outcomes and generalized linear mixed models (GLMM) for categorical outcomes to assess differences between treatments over time (treatment-BY-time); only data from participants who were assessed at baseline were used. Two mixed-model analyses were run on each outcome: the first tested for differences between treatment groups at each assessment point relative to baseline, with time treated as a categorical variable, and the second, a linear trend analysis (LTA), tested for differences in linear trends across all time points, with time treated as a continuous covariate. In the presence of a significant treatment-BY-time interaction effect for the mixed models where time was treated as a categorical variable, post hoc contrasts were conducted to determine at which post-baseline time points (relative to baseline) the conditions (MyStudentBody-Parent vs. e-newsletter control) differed.

Level of significance was set at  $\alpha = 0.05$  for all analyses. Post hoc contrasts were Bonferroni-corrected to maintain a family-wise Type-I error rate of  $\alpha = 0.05$ . All analyses were carried out with use of SAS® 9.2.

### 3. Results

#### 3.1 Descriptive Statistics

Demographic characteristics of the four treatment groups were compared. In the control group that was assessed at baseline, both parents and teens identified more often as Hispanic/Latino than did parents or teens in the treatment groups ( $p = 0.0296$  and  $0.0187$ , respectively); no other significantly different characteristics were noted. Additional information about the demographic characteristics of the sample can be found in Table 1.

#### 3.2 Statistical Analysis

As discussed previously, data were analyzed with use of two approaches: (1) Solomon four-group analysis, to assess reactivity to baseline assessment and treatment effects immediately post-intervention, and (2) traditional longitudinal (condition-BY-time) analyses, to assess differences between treatment conditions at all post-intervention assessments relative to baseline as well as differences between treatment conditions in linear trends across all time points. For each outcome, we begin by reporting results from the Solomon four-group analysis, followed by results from the condition-BY-time analyses. Table 2 presents least-squares means and standard errors for MyStudentBody-Parent and e-newsletter control groups who underwent a baseline assessment, at all time points, for each primary and secondary outcome. Table 3 provides a detailed outline of the Solomon four-group analytical procedure for each primary and secondary outcome.

#### 3.3 Solomon Four-Group Analysis

**3.3.1 Communication about Protective Behavioral Strategies and Use of Protective Behavioral Strategies**—For parents, we began by examining baseline reactivity for each of the three C-PBSS subscales (Stopping/Limiting Drinking, Manner of Drinking, and Serious Harm Reduction), as well as the C-PBSS sum score. Baseline reactivity was noted for the Manner of Drinking subscale ( $p_{\text{interaction}} = 0.0255$ ).

In support of our hypothesis, subsequent analysis revealed that, among participants who were assessed at baseline, parents who participated in the MyStudentBody-Parent intervention had higher scores than did e-newsletter controls immediately post-intervention for the overall C-PBSS sum score ( $p = 0.0108$ ); that is, parents who received the MyStudentBody-Parent intervention were more likely to discuss with their teens ways to stay safe while drinking alcohol. In addition, the MyStudentBody-Parent group had higher scores than did e-newsletter controls immediately post-intervention for the Manner of Drinking subscale ( $p_{\text{unpretested}} = 0.0047$ ); no effect of treatment was noted for participants who did not undergo baseline assessment (Table 3). A significant difference between the MyStudentBody-Parent and e-newsletter control groups was also noted for the Stopping/Limiting subscale ( $p = 0.0378$ ). Neither baseline reactivity nor treatment effects immediately post-intervention were noted for the Harm Reduction scale of the C-PBSS.

For teens, the Solomon four-group analytic approach showed no evidence of baseline reactivity or treatment immediately post-intervention with the PBSS.

**3.3.2 Parent-Teen Communication**—Neither baseline reactivity nor treatment effects immediately post-intervention were noted for the sum score for the PTCS (Jaccard et al., 2000).

For teens, the Solomon four-group analytic approach showed no evidence of baseline reactivity or treatment immediately post-intervention with the PTCS (Jaccard, et al., 2000).

**3.3.3 Reading the College Alcohol/Drug Policy**—For parents, neither baseline reactivity nor treatment effects immediately post-intervention were noted in association with having read the institutional alcohol/drug policy.

For teens, the Solomon four-group analytic approach showed no evidence of baseline reactivity or treatment effects immediately post-intervention in association with having read the alcohol/drug policy.

**3.3.4 Secondary Outcome**—The Solomon four-group analytic approach showed no evidence of baseline reactivity or treatment effects immediately post-intervention for binge drinking.

The remainder of the results will focus on the traditional longitudinal (condition-BY-time) analyses to assess differences among treatment conditions at all post-intervention assessments relative to baseline, as well as differences among treatment conditions in linear trends across all time points.

### 3.4 Longitudinal (Condition-BY-Time) Analyses

**3.4.1 Communication about Protective Behavioral Strategies and Use of Protective Behavioral Strategies**—For parents, we used LMM to compare MyStudentBody-Parent and e-newsletter control participants with regard to differences in change scores for communicating about protective behavioral strategies with their children. This analysis was conducted over all time points and was done only for participants who had had baseline assessment. Again partially supporting our hypotheses, LTA revealed that, over the course of the study, parents in the MyStudentBody-Parent group reported a greater increase in discussing protective behavioral strategies from the Manner of Drinking subscale with their children than did parents in the e-newsletter group ( $F_{(1,353)} = 4.43, p = 0.0360$ ).

For teens, an LMM analytic approach, treating time as a categorical variable, did not reveal a significant treatment effect over time for the PBSS sum score or PBSS subscales. However, LTA, treating time as a continuous covariate, revealed that teens in the MyStudentBody-Parent group increased their use of protective behavioral strategies; that is, despite no direct intervention, these teens showed an overall increase in their PBSS sum scores, whereas participants who received the e-newsletter showed a decrease ( $F_{(1,214)} = 5.42, p = 0.0209$ ). They also showed a greater increase in the Stopping/Limiting and Manner subscales ( $F_{(1,214)} = 4.48, p = 0.0354$  and  $F_{(1,214)} = 7.42, p = 0.0070$ ) as compared with e-newsletter controls. (See Figure 2 for a graphical depiction of condition-specific linear trends on protective behavioral strategies.)

**3.4.2 Parent-Teen Communication**—For parents, separate LMMs treating time as (1) a categorical predictor and (2) a continuous covariate did not reveal a significant difference in change over time for the PTCS sum scores between parents in the MyStudentBody-Parent group and those in the e-newsletter group.

Similarly, among teens, an LMM approach treating time as (1) a categorical variable and (2) a continuous covariate revealed no significant treatment-BY-time effect for the PTCS sum score.

**3.4.3 Alcohol/Drug Policy**—For parents, a GLMM approach did not reveal any significantly different changes with regard to having read the institutional drug policy, whether time was considered a categorical variable or a continuous covariate.

For teens, a GLMM approach did not reveal a significant treatment-BY-time effect in the proportion who reported having read the alcohol/drug policy, whether time was treated as a categorical predictor or a continuous covariate.

**3.4.4 Secondary Outcome**—A GLMM approach did not reveal a significant treatment-BY-time effect in the proportion of teens who reported having engaged in binge drinking over the past two weeks, whether time was treated as a categorical predictor or a continuous covariate.

## 4. Discussion

The focus of this study was to examine the effect of a parent-based intervention, administered in the weeks before the beginning of freshman year in college, that targeted students' alcohol-related behavior. Recent studies (Ichiyama et al., 2009; Turrisi et al., 2001) have suggested that parents may be an effective delivery mechanism for alcohol education. However, few empirically based programs are available to colleges, and to our knowledge no online parent-based interventions are available. Thus, this study extends the current literature on college-student drinking by examining the effect of an online program that aims to encourage the reduction of risks associated with alcohol by means of parents.

There were two findings of primary interest in the current study. First, the results suggest that parents who visited the MyStudentBody-Parent website were more likely to talk with their college-bound teens about specific and effective ways to protect themselves, particularly with regard to stopping/limiting drinks (e.g., “determine not to exceed a set number of drinks”) and manner of drinking (e.g., “avoid drinking games” and “avoid mixing different types of alcohol”) than were parents who received educational e-newsletters. Second, recall that no teen received a direct intervention. Yet, teens whose parents reviewed the MyStudentBody-Parent website were more likely to report that they had used protective behavioral strategies over the course of the study period as compared to first-year students whose parents received educational e-newsletters. Consistent with the parent findings, this was especially true for behaviors related to stopping/limiting drinks and manner of drinking.

It is worth noting that the Solomon Four-Group analysis revealed an immediate post-intervention effect in parents, while the behavior change revealed by the LTA in teens was noted across the six-month study period. This seems to make sense intuitively, given that the teen intervention was indirect: while parents received a direct intervention, which may have motivated them to engage immediately in conversations with their children about ways to stay safe, teen drinking behavior was in turn influenced over a longer period of time. These results suggest that parents are willing to learn about harm-reduction strategies and ways to communicate them to their college-age children, even those who are under the legal age for drinking alcohol. It also confirms previous findings suggesting that parents influence their children's drinking, even after the children have left for college (Ryan et al., 2010).

Apparent ease of communication between this generation of parents and teens may help to account for the finding of no difference between the MyStudentBody-Parent and e-newsletter control groups with regard to confidence about communication. Parents of the current generation of college students communicate regularly with their college-age children. In a survey of over 1,700 of its members and subscribers and members of the Student Advantage database, College Parents of America (2008) found that, on average, 74% of parents with children currently in college communicate at least two to three times a week with their sons or daughters and 34% have such communication on at least a daily basis.

In terms of confidence about discussing AOD-related issues specifically, parents and teens in our sample were already very confident at the beginning of the study. At baseline, approximately 75% of parents had a score of 42 or lower on the PTCS scale. Possible scores on this scale range from 21 (excellent communication) to 105 (poor communication). The fact that most parents in the sample reported an average score of 2 points on each item of the PTCS scale suggests that there was little room for overall improvement in confidence with regard to communicating about AOD for these participants. However, as previously discussed, despite confidence in communicating about AOD in general, parents who participated in the intervention were better equipped to discuss with their children specific effective ways to stay safe while drinking alcohol.

We also did not find a difference between the MyStudentBody-Parent and e-newsletter control groups with regard to having read the AOD policy. Our results suggest that there may have been some confusion associated with this question. Participants were not consistent in their reports of whether they had ever read the policy across study-assessment time points. For example, while 39% of participants in the MyStudentBody-Parent group said that they had read the policy post-intervention, this number dropped to 36% six months post-intervention. Similar results were found with the parent e-newsletter control group and also with the teen experimental and control groups. One interpretation may be that the policy may be read and quickly forgotten, as it is received along with a lot of other paperwork that parents and teens review leading up to the beginning of freshman year. The apparent failure of memory on the part of some participants may also suggest that parents and teens placed little significance on the AOD policy or that they did not find it useful.

Finally, the program was not associated with reduced binge drinking. First, the teens in this study reported lower binge drinking than the national average; thus, it may have been harder to detect change. Second, the result may not be surprising given that teens did not receive direct intervention. We take heart in the knowledge that teens whose parents received the intervention increased their use of measures to stay safe, even if their frequency of binge drinking did not decrease.

There were limitations to the current study related to its design. Specifically, teens who agree to participate in a study about AOD as part of a teen-parent dyad may represent a particularly low-risk group. First, as previously mentioned, teens in our study consumed less alcohol than the average college student. While 66% of all college students drank alcohol in a one-month period and approximately 37% engaged in heavy episodic drinking (Johnston et al., 2010), 49% of the teens in our sample reported drinking in the past month and nearly 20% reported binge drinking. However, infrequent episodes of heavy drinking by otherwise low-risk students carry the risk of severe consequences. The fact that teens in our study reported an increase in their use of protective behavioral strategies when drinking alcohol was encouraging. Second, we did not measure alcohol-related consequences. While we did not detect changes in binge drinking, we did detect a change in the use of protective behavioral strategies. It is possible, then, that decreased negative consequences may also have been detected had we measured this construct. Third, parents visited the website as part of their study participation, for which they were paid. Strategies are needed to encourage all parents to visit the website. Finally, teens and parents who self-select to participate in a study that focuses on communicating about AOD may already have a high level of confidence for communicating about AOD, which our results seem to confirm. The sample of parents and teens in our study may thus represent a group that is more confident about communicating with one another than the general population of teens and parents. Future research may seek a way to avoid this potential selection bias.

The results have implications for college AOD prevention efforts. First, while much attention in the literature has been devoted to high-risk students, recent research has focused on lower-risk students (Gruenewald, Johnson, Light, Lipton, & Saltz, 2003; Weitzman & Nelson, 2004), who account for the majority of college students (Johnston et al., 2010). This is a group that would benefit from intervention, as—distributed across a large number of drinkers and drinking occasions—problems reported by students occur most often at moderate drinking levels (two to three drinks) (Gruenewald et al., 2003). Increasing the likelihood that these students will use protective behavioral strategies on the occasions that they do drink alcohol is an important component of a college's overall prevention approach. Second, parents of college students are a relatively untapped channel for delivering AOD education to incoming freshmen. To our knowledge, there are very few parent-based interventions; however, preliminary evidence suggests that such interventions are an effective way to change student behavior (Ichiyama et al., 2009; Turrisi et al., 2001). Third, parents are willing and enthusiastic participants in AOD prevention. We found that parents not only were willing to participate but also were very likely to stick with the program. Attrition was quite low, with 89% and 80% of parents taking the three- and six-month post-tests. Finally, MyStudentBody-Parent has extensive reach. A universal, Web-based prevention program for parents of incoming freshmen may be a cost-effective way to reach a large number of parents, nationally and internationally, and to involve them in an effort to keep college students safe.

## 5. Conclusion

A universal, Web-based prevention program, which includes information for parents of incoming freshmen, may be an efficient way to reach large numbers of students. Given the positive results associated with parental communication about, and student use of, specific and effective protective behavioral strategies, an online, parent-based intervention may represent a valuable component of a college's comprehensive prevention effort.

## Acknowledgments

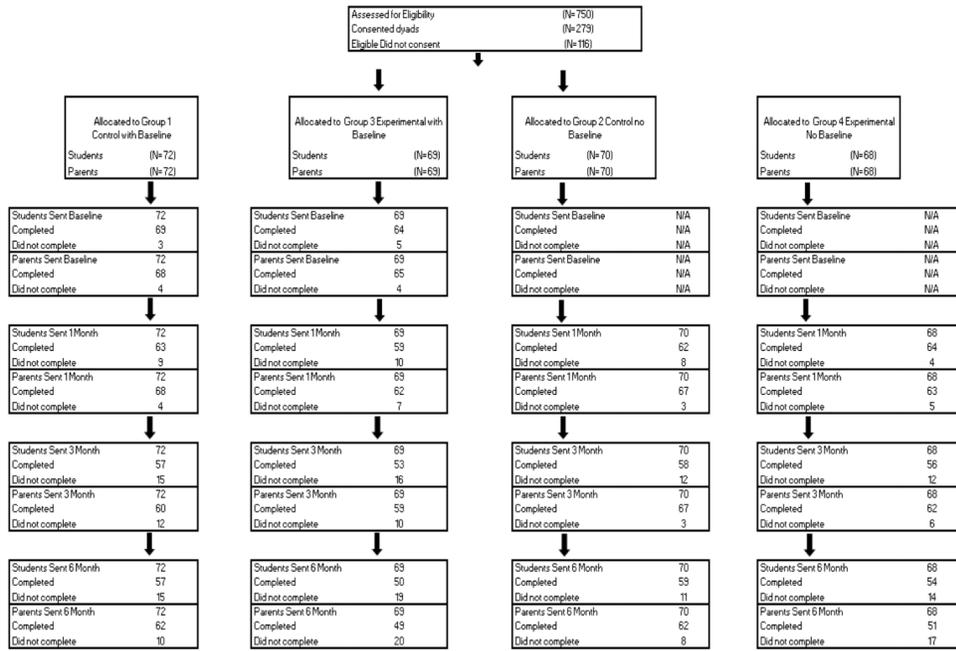
The authors wish to thank the students and parents as well as the colleges and universities who participated in the study.

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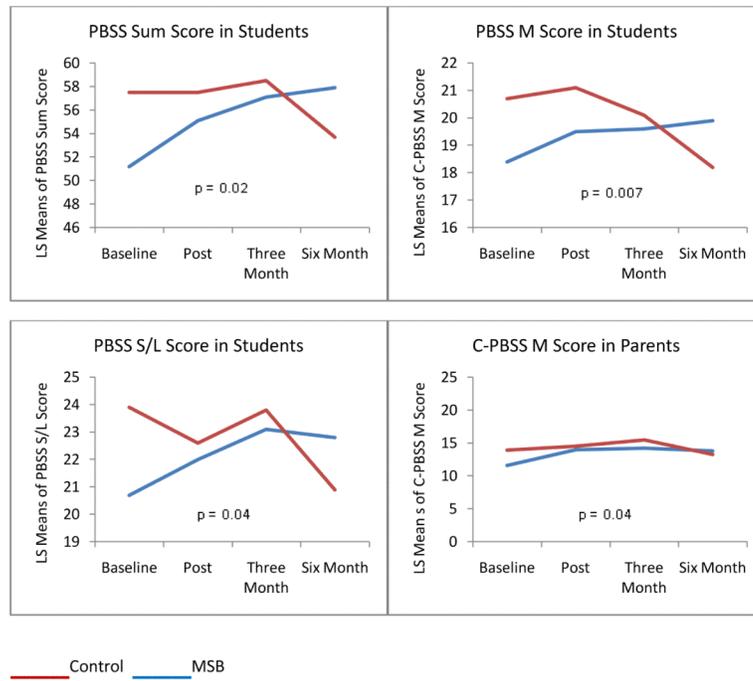
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**Figure 1.**  
Participant flow diagram



**Figure 2.** Linear trends across all four time points for pretested parents and students

Table 1

## Demographic Characteristics of Parent and Student Participants

	All (N = 279)	MSB-BL	MSB-NBL	Control-BL	Control-NBL
<i>Parent Characteristics</i> *					
<b>Age (yrs.)</b>	48.1 (6.4)	49.0 (4.8)	48.8 (5.2)	47.9 (4.4)	46.9 (9.7)
<b>Gender</b>					
Female	230 (85.2)	56 (84.9)	58 (85.3)	58 (85.3)	58 (85.3)
Male	40 (14.8)	10 (14.7)	10 (14.7)	10 (14.7)	10 (14.7)
<b>Marital Status</b>					
Single/never married	5 (1.9)	0 (0.0)	4 (5.9)	0 (0.0)	1 (1.5)
Married/domestic partnership	234 (87.0)	60 (92.3)	59 (86.8)	58 (85.3)	57 (83.8)
Separated/divorced	26 (9.7)	4 (6.2)	8 (11.8)	8 (11.8)	6 (8.8)
Widowed	4 (1.5)	1 (1.5)	0 (0.0)	2 (2.9)	1 (1.5)
<b>Race</b>					
White/Caucasian	253 (94.1)	63 (96.9)	63 (92.7)	62 (91.2)	65 (95.6)
Black/African American	9 (3.4)	0 (0.0)	4 (5.9)	3 (4.4)	2 (2.9)
Pacific Islander	1 (0.4)	1 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)
Asian	3 (1.1)	0 (0.0)	1 (1.5)	1 (1.5)	1 (1.5)
Multiracial	1 (0.4)	0 (0.0)	0 (0.0)	1 (1.5)	0 (0.0)
Other	2 (0.7)	1 (1.5)	0 (0.0)	1 (1.5)	0 (0.0)
<b>Ethnicity</b> ***					
Hispanic/Latino	5 (1.9)	0 (0.0)	1 (1.5)	4 (5.9)	0 (0.0)
Non-Hispanic	263 (97.8)	65 (100.0)	67 (98.5)	63 (92.7)	68 (100.0)
Not answered	1 (0.4)	0 (0.0)	0 (0.0)	1 (1.5)	0 (0.0)
<b>Education</b>					
High school or GED	64 (23.8)	17 (26.2)	11 (16.2)	17 (25.0)	19 (27.9)
Associate's degree	48 (17.8)	10 (15.4)	14 (20.6)	10 (14.7)	14 (20.6)
Bachelor's degree	101 (37.6)	27 (41.5)	30 (44.1)	22 (32.4)	22 (32.4)
Master's degree	45 (16.7)	11 (16.9)	9 (13.2)	13 (19.1)	12 (17.7)
Doctoral degree	11 (4.1)	0 (0.0)	4 (5.9)	6 (8.8)	1 (1.5)

	All (N = 279)	MSB-BL	MSB-NBL	Control-BL	Control-NBL
<i>Student Characteristics</i>					
<b>Age (yrs.)</b>	18.4 (2.4)	18.6 (3.6)	18.2 (0.5)	18.2 (0.4)	18.6 (3.1)
<b>Gender</b>					
Female	167 (62.1)	42 (63.6)	42 (61.8)	43 (62.3)	40 (60.6)
Male	102 (37.9)	24 (36.4)	26 (38.2)	26 (37.7)	26 (39.4)
<b>Race</b>					
White/Caucasian	247 (91.4)	59 (85.5)	62 (93.9)	63 (95.5)	61 (89.7)
Black/African American	12 (4.4)	0 (0.0)	4 (5.9)	5 (7.3)	3 (4.6)
Native American/Alaskan Native	1 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.5)
Pacific Islander	1 (0.4)	1 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)
Asian	1 (0.4)	0 (0.0)	0 (0.0)	1 (1.5)	0 (0.0)
Multiracial	4 (1.5)	2 (3.0)	0 (0.0)	2 (2.9)	0 (0.0)
Other	4 (1.5)	0 (0.0)	2 (2.9)	2 (2.9)	0 (0.0)
<b>Ethnicity</b> <sup>***</sup>					
Hispanic/Latino	7 (2.6)	0 (0.0)	2 (2.9)	5 (7.3)	0 (0.0)
Non-Hispanic	264 (97.4)	66 (100.0)	66 (97.1)	64 (92.8)	66 (100.0)
<b>Binge drinking (past 2 wks.)</b>	27 (19.6)	11 (15.7)	—	16 (23.5)	—

Note: MSB = MyStudentBody, BL = baseline assessment, NBL = no baseline assessment.

\* Age is presented as the mean and standard deviation; all other characteristics are given as N values, with percentage in parentheses.

\*\*\* Significant difference between groups,  $p < 0.05$ , tested by one-way ANOVA for continuous variables, and  $\chi^2$  tests or Fisher's exact test for categorical variables.

**Table 2**  
Linear Trend Analysis Across All Time Points for Pretested Parents and Students

	Baseline		Post-Intervention		3-Mo. Assessment		6-Mo. Assessment	
	MSB	Control	MSB	Control	MSB	Control	MSB	Control
<i>Parents</i>								
<b>PTCS sum</b>	35.9	35.3	35.7	34.1	33.8	34.8	33.4	33.3
(M [SD])	(1.3)	(1.3)	(1.3)	(1.3)	(1.6)	(1.6)	(1.4)	(1.4)
<b>C-PBSS sum</b>	39.2	44.0	45.8	45.9	43.7	49.3	44.6	43.1
(M [SD])	(2.5)	(2.5)	(2.7)	(2.6)	(2.7)	(2.6)	(3.0)	(2.8)
<b>C-PBSS S/L</b>	18.1	20.9	23.2	22.5	21.4	24.6	22.4	21.5
(M [SD])	(1.4)	(1.4)	(1.5)	(1.4)	(1.5)	(1.5)	(1.6)	(1.5)
<b>C-PBSS M</b>	11.6	13.9	14.0	14.5	14.2	15.5	13.8	13.3
(M [SD])	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(1.0)	(1.0)
<b>C-PBSS SHR</b>	12.3	12.8	12.1	12.5	11.6	13.1	11.9	11.5
(M [SD])	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	(0.6)	(0.7)	(0.7)
<b>ADP (no. [%])</b>	32 (50.0)	42 (61.8)	39 (62.9)	54 (79.4)	41 (69.5)	50 (83.3)	36 (73.5)	53 (85.5)
<i>Students</i>								
<b>PTCS sum</b>	32.8	34.5	32.8	34.0	32.8	34.4	32.7	34.7
(M [SD])	(1.2)	(1.2)	(1.4)	(1.4)	(1.4)	(1.3)	(1.5)	(1.4)
<b>PBSS sum*</b>	51.2	57.5	55.1	57.5	57.1	58.5	57.9	53.7
(M [SD])	(3.0)	(2.9)	(2.9)	(2.8)	(3.3)	(3.3)	(2.9)	(2.9)
<b>PBSS S/L*</b>	20.7	23.9	22.0	22.6	23.1	23.8	22.8	20.9
(M [SD])	(1.5)	(1.5)	(1.6)	(1.5)	(1.8)	(1.7)	(1.7)	(1.6)
<b>PBSS M*</b>	18.4	20.7	19.5	21.1	19.6	20.1	19.9	18.2
(M [SD])	(0.9)	(0.9)	(1.0)	(0.9)	(1.1)	(1.1)	(1.0)	(1.0)
<b>PBSS SHR*</b>	12.1	12.9	13.5	13.6	14.1	14.5	15.1	14.5
(M [SD])	(0.7)	(0.7)	(0.7)	(0.7)	(0.8)	(0.8)	(0.7)	(0.7)
<b>ADP (no. [%])</b>	33 (51.6)	40 (58.0)	41 (69.5)	44 (69.8)	36 (67.9)	43 (76.8)	33 (66.0)	41 (71.9)
<b>Binge** (no. [%])</b>	16 (25.0)	11 (15.9)	14 (23.7)	13 (20.6)	17 (32.1)	21 (36.8)	18 (36.0)	22 (38.6)
								1.50 <sub>1,334</sub>

Note: MSB = MyStudentBody, PTCS = Parent Teen Communication Scale, M [SD] = mean and standard deviation, C-PBSS = Communication about Protective Behavioral Strategies Scale, S/L = Stopping/Limiting Subscale, M = Manner Subscale, SHR = Serious Harm Reduction Subscale, ADP = Alcohol Drug Policy, PBSS = Protective Behavioral Strategies Scale;

\* Limited to participants who reported any alcohol use (n = 138).

† p < 0.05;

<sup>‡</sup>  $p < 0.001$ .

\*\*\* Participants reported binge drinking within past two weeks.

Table 3

Results of Analysis of Solomon Four-Group Design for Parents and Students

	Test 1: Group x Treatment Interaction	Test 2: Simple Main: Effects for Pretested Groups	Test 3: Simple Main Effects for Unpretested Groups	Test 4: Main- Effects Test	Test 5: ANCOVA or Multiple Logistic Regression for Pretested Groups	Test 6: Independent-Samples t Test or Logistic Regression for Unpretested Group	Test 7: Meta- Analyzed z Statistic	Conclusion
<i>Parents</i>								
PTCS sum	0.1777*	***	***	0.7565*	0.4395***	0.4433***	1.09	No effect of treatment
C-PBSS sum	0.0700*	***	***	0.0885*	0.3025***	0.0108***,§	***	Treatment effect at post
C-PBSS S/L	0.0931*	***	***	0.0378*,§	***	***	***	Treatment effect at post
C-PBSS M	0.0255*	0.7107*	0.0047*,§	***	***	***	***	Treatment effect at post, only in groups who were assessed at baseline
C-PBSS SHR	0.1572*	***	***	0.4227*	0.9666***	0.1116***	1.15	No effect of treatment
ADP	0.2584¶	***	***	0.0803¶	0.3762***	0.5367¶	1.06	No effect of treatment
<i>Students</i>								
PTCS sum	0.7077*	***	***	0.1403*	0.4796***	0.1743***	1.46	No effect of treatment
PBSS sum**	0.9767*	***	***	0.5058*	0.9361***	0.6177***	0.41	No effect of treatment
PBSS S/L**	0.7837*	***	***	0.5248*	0.7681***	0.7754***	0.41	No effect of treatment
PBSS M**	0.9179*	***	***	0.2869*	0.5094***	0.4261***	1.03	No effect of treatment
PBSS SHR**	0.8154*	***	***	0.8929*	0.4305***	0.7074***	0.40	No effect of treatment
ADP	0.3906¶	***	***	0.0661¶	0.5860#	0.0567¶	1.72	No effect of treatment
Binge ***,***,***	0.8900¶	***	***	0.2205¶	0.7585#	0.3513¶	0.88	No effect of treatment

Note: PTCS = Parent Teen Communication Scale, C-PBSS = Communication about Protective Behavioral Strategies Scale, (S/L = Stopping/Limiting Subscale, M = Manner Subscale, SHR = Serious Harm Reduction Subscale, ADP = Alcohol Drug Policy, PBSS = Protective Behavioral Strategies Scale.

*Note:* For the Solomon Four-Group Design analysis: (1) baseline reactivity [Test 1] is tested; if reactivity is observed, then groups with and without baseline are assessed separately [Tests 2 and 3]. If no reactivity is observed, then (2) Tests 4\*\*\*6 are conducted. A significant finding on any of Tests 4\*\*\*6, or a significant meta-analyzed z statistic [Test 7], suggests an effect of treatment. (For further details, see the Analysis section.)

\* According to ANOVA (analysis of variance).

\*\*\* According to ANCOVA (analysis of covariance). \*\*\*According to *t* test.

§ Significant difference between experimental and control groups,  $p < 0.05$ .

¶ According to logistic regression analysis.

# According to multiple logistic regression analysis.

\*\* Analysis limited to students who reported any alcohol use ( $n = 150$ ).

\*\*\* \*\*\*  
Binge drinking reported in past two weeks.