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Randomized controlled trial of computerized alcohol intervention for college students: role of class level

Ashleigh Sweet Strohman, PhD¹, Sopagna Eap Braje, PhD², Omar M. Alhassoon, PhD³, Sylvie Shuttleworth, PhD⁴, Jenna Van Slyke, MS⁵, and Sharareh Gandy, PhD⁶

¹Clinical Psychology PhD Program, California School of Professional Psychology, San Diego, CA, USA; ²Counseling & Health Psychology Department, Bastyr University California, San Diego, CA, USA

ABSTRACT
Background: Because of their ability to reach a much wider audience than face-to-face counseling or psychoeducation, computer-delivered interventions for risky or potentially problematic behaviors have been increasing on college campuses. However, there are very few studies that examine who benefits most from such interventions. Objectives: The purpose of this study was to determine if participation in Alcohol-Wise, a computerized intervention, is associated with changes in alcohol drinking behavior and its consequences, perceptions of college drinking norms, and expectancies. It was hypothesized that class level (i.e., freshman/sophomore versus junior/senior) would moderate the effectiveness of Alcohol-Wise. Method: College students (n = 58) were randomly assigned to one of two conditions: (i) the computer-delivered intervention or (ii) wait-list control. Measures were completed at baseline and approximately 30 days later. Results: At follow-up, freshman and sophomore students in the intervention group showed significant reduction in peak number of standard drinks and blood alcohol concentration, but the effect was not observed for juniors and seniors. The intervention group reported more accurate estimates of drinking norms at follow-up relative to controls. There were no significant changes over time in alcohol expectancies in either group. Conclusion: This study provides support for the potential usefulness of Alcohol-Wise intervention at reducing short-term drinking among underclassmen but not upperclassmen in a 4-year college setting. These findings suggest that computerized interventions may be more effective when provided early, but not later, in a student’s college career.

Introduction
Excessive drinking in college can lead to consequences such as academic difficulties, engagement in risky sexual behavior, blackouts, alcohol poisoning, and even death from driving under the influence or being a passenger accompanying an intoxicated driver (1). According to the Centers for Disease Control and Prevention (2), excessive alcohol use is a leading cause of preventable death among college students. Additionally, alcohol-related physical and sexual assaults are a major problem on college campuses (3). In response to these public health concerns, the US Department of Education has awarded over $3.5 million to alcohol and drug prevention programs on college campuses since 1998 (4). Many of these programs are in the form of computer-delivered interventions, also known as electronic or web-based online interventions. These programs are cost-effective and easily disseminated. Students have reported that they prefer computer-delivered interventions over face-to-face interventions (5). Given potential differences in treatment-seeking behavior among college students (6), this intervention modality may increase the likelihood that students who need services will utilize them.

Cost-efficiency and ease of dissemination notwithstanding, the efficacy of computer-delivered interventions is equivocal. A recent meta-analyses found that these type of interventions produce similar treatment outcomes as face-to-face ones at short-term follow-up but not at long-term follow-up, with face-to-face outperforming computer-delivered interventions (7). However, not all computer-delivered interventions perform the same and the lack of benefit over other modalities must be considered in light of the fact that such interventions can reach a greater number of people since many may prefer the privacy and flexibility that they offer. To date, there are eight commercial computer-delivered interventions targeting alcohol use among college students: (1) Alcohol 101, (2) Under the Influence, (3) Alcohol Response-Ability, (4) myStudentBody, (5) Alcohol Response-Ability, (6) Under the Influence, (7) myStudentBody.
College Alc, (6) AlcoholEdu, (7) The Alcohol eCHECKUP TO GO (e-ChUG), and (8) Alcohol-Wise. Programs vary in content and length, but all of these available interventions provide normative drinking information, harm reduction strategies (e.g., tips for safer drinking), and alcohol education. The body of research supporting the efficacy of computer-delivered interventions for alcohol and other drug use is growing (7–10). However, some programs are being developed and implemented without being evaluated on their ability to reduce alcohol consumption and related problems among college students. In addition, further research is needed to identify specific characteristics of responders versus non-responders (11).

Third Millennium Classroom’s program, Alcohol-Wise, was created in 2007 and is used on over 300 college campuses. Despite the wide-spread usage (3rd Millennium Classrooms, 2007), there are currently no published studies on its effectiveness. Alcohol-Wise includes elements of several existing alcohol computer-delivered interventions, such as: alcohol education, personalized feedback, expectancy challenge, and skills based activities. Additionally, Alcohol-Wise utilizes motivation enhancement strategies to reduce students’ likelihood of engaging in risky drinking behaviors in the future. The eCHECKUP TO GO (e-Chug), which is incorporated into Alcohol-Wise, has garnered extensive empirical support as a stand-alone treatment for alcohol treatment and prevention (9,10,12–15). However, there are currently no published studies that have examined the effectiveness of the e-Chug when used in conjunction with other alcohol-related programs. Moreover, the majority of the studies on the e-Chug have focused on mandated populations or incoming freshman. Therefore, it would be useful to examine how upperclassmen respond to the intervention.

In addition to the eCHECKUP TO GO brief intervention, Alcohol-Wise is an alcohol education course that is designed as a tool for prevention as well as intervention. Alcohol-Wise includes: social norms information, audio narration, student interviews, interactive journaling reflections, lesson quizzes, and a final exam to check for attention and retention of information.

The current study is the first randomized control trial to examine Alcohol-Wise’s effectiveness at reducing drinking behavior and to include class level (i.e. freshman/sophomore versus junior/senior) as a moderating variable. Alcohol-Wise specifies that the program should be used as a prevention tool for incoming students as well as an intervention tool. It is not clear, however, how effective Alcohol-Wise is with older students. The specific purpose of this pilot study is to examine how upperclassmen (juniors and seniors) versus underclassmen (freshmen and sophomores) participating in Alcohol-Wise reduced their drinking frequency, quantity, and alcohol-related negative consequences 30-days later relative to a control group. The first hypothesis was that the effect of Alcohol-Wise on reducing drinking behavior would be moderated by class level. The second hypothesis examined whether Alcohol-Wise would result in a reduction in positive alcohol-related expectancies and an increase in accurate perceptions of drinking norms (normative perceptions) among students. Finally, the third hypothesis was that such cognitive changes would also be moderated by class level.

Method

Participants

Participants in the study were students enrolled at a public university in Southern California. Participants were treated according to the established ethical standards of the American Psychological Association. The methods and procedures used in this study were approved by the Institutional Review Board. Participants in the Alcohol-Wise experimental condition and wait-list control condition were compensated equally. Each participant was given $15 after completing the initial phase of the study and $30 after completing the follow-up surveys. In response to campus advertising, 106 participants contacted the researcher by email expressing interest in the study. The researcher matched potential participants on sex, class level, and Greek affiliation and randomly assigned each participant to one of two conditions: (i) the Alcohol-Wise experimental condition or (ii) the wait-list control condition. The researcher sent different links directing the potential participants to the appropriate condition. However, 29 students did not enroll in the study for unknown reasons. A total of 77 participants enrolled in the study. Seventy-six participants started the study with 40 randomly assigned to the experimental condition and 36 to the control condition. Fifty-eight participants completed pre and post measures, 29 in the control condition and 29 in the experimental condition. Only participants who completed both the baseline and follow-up self-report measures were included in statistical analyses (See Figure 1). Comparisons using t-tests and Chi-squares showed no statistically significant differences on demographic variables (i.e. sex, age, class level, ethnicity, housing, Greek affiliation, athletic
affiliation, and GPA) between participants who did not complete self-report measures and those who completed all self-report measures.

A series of t-tests showed no statistically significant differences between the experimental and control condition on research variables at baseline. Additional t-tests showed no statistically significant differences between upperclassmen and underclassmen on research variables at baseline. There were no statistically significant differences between the control and experimental conditions on demographic variables including: sex, age, ethnicity, class level, GPA, housing, or Greek and athletic affiliation. The demographic information described in this section is reported for the entire sample (n = 58). Participants ranged in age from 18–22 years (M = 20; SD = 1.22). Most participants were female (n = 43, 79.3%) and white (n = 40, 69%) (See Table 1).

Figure 1. Participant attrition flow chart.

to complete, making the total intervention time approximately 90 min.

Participants in the experimental condition were asked to complete the eCHECKUP TO GO assessment followed by six modules of Alcohol-Wise. Approximately 30 days after completing the intervention, participants received an email and were asked to complete the eCHECKUP TO GO assessment. Each module of Alcohol-Wise ended with a quiz regarding the information covered in the module. Participants in the wait-list control condition completed the same assessments as participants in the experimental group but did not complete the Alcohol-Wise program. Participants in the wait-list control condition were given access to voluntarily complete the intervention after the completion of the study.

Measures

Demographics information
Demographic information was collected including: race/ethnicity, sex, age in years, weight in pounds, Greek affiliation (i.e. membership in a fraternity or sorority), membership in a college athletic team, grade point average (GPA), and class level. Participants were also asked whether or not they were taking any medications and whether or not they lived on-campus or in a residence hall.

eCHECKUP TO GO
The eCHECKUP TO GO assessment is comprised of several different questionnaires, some of which have
been modified from originals to better serve a college student population. The questionnaires incorporated are well established for use in alcohol research. The following section will describe the different topics addressed by the survey that were examined in the present study.

Alcohol use
The first 13 questions of the eCHECKUP TO GO assessment include questions about demographic information and alcohol use. Participants were asked at what age they first started drinking alcohol and to provide the frequency and quantity of their alcohol use in a typical month. First, they were asked how many weeks out of the month they drink alcohol. Participants were then shown a week-long calendar (i.e. Sunday through Saturday) and asked to fill in how many standard drinks (i.e. 12 oz. of beer or wine cooler, 4.5 oz. of table wine, and 1.5 oz. of spirits) they would typically consume each day. The calendar format was based on the timeline follow-back method (16). Participants were also asked to provide the number of hours they drink to allow for BAC estimations. Additionally, they were also asked to recall the time they drank the most in the past month to allow for peak alcohol consumption and BAC estimations. The participants were provided both audio and visual descriptions of a standard drink.

Expectancies
Expectancies were measured utilizing an adapted version of the Alcohol Expectancy Questionnaire (AEQ) (17). The AEQ measures anticipated experiences associated with alcohol use. Participants were asked questions regarding positive expectancies about the effects of alcohol using a dichotomous scale (i.e. Yes or No). The revised version used in the current study is comprised of 18 statements that assess alcohol reinforcement expectancies relevant to college population. Higher scores indicate higher positive expectancies in the areas of general experience, sexual enhancement, social/physical pleasure, assertiveness, relaxation/tension reduction, and arousal/interpersonal power as a result of consuming alcohol. The AEQ scores are predictive of current and future drinking behaviors, participation in treatment, and relapse (17). In the current study, the Cronbach’s alpha coefficient was 0.88 for the adapted AEQ.

Perceptions of drinking norms
Perceptions of drinking norms were measured by asking participants what percent of university students do not drink at all in a typical week. This question is similar to questions asked on The Drinking Norms Rating Form (DNRF) (18). During the Alcohol-Wise intervention, participants are given the normative data in comparison to their estimations.
Negative consequences
The Alcohol Use Disorders Identification Test (AUDIT) (19) was developed as part of a six-nation World Health Organization (WHO) project. The AUDIT is a 10-item screening to identify excessive (i.e. hazardous) drinking by measuring consumption, behavior, and consequences associated with consumption measured on a 5-point Likert scale. In general, cut-off scores ranging from 6–11 may indicate hazardous drinking, but should be interpreted with caution among a college population (20,21). Lower specificity may result in over identification of hazardous drinkers; however, given the prevalence of at-risk drinkers in college, over identification (false-positives) may be of less concern than false-negatives; especially when evaluating the effectiveness of an intervention at reducing risky drinking behavior. The AUDIT assesses alcohol use over the past year and is incorporated in the eCHECKUP TO GO assessment. In the current study, the Cronbach’s alpha coefficient was 0.97 for the adapted AUDIT.

Results
Statistical analyses
Prior to statistical analyses, the data was screened for outliers, skewness, kurtosis, and restriction of range. Review of skewness and kurtosis revealed that the data for the number of standard drinks at heaviest drinking occasion were positively skewed at the baseline and follow-up assessments. Additionally, the negative consequences variable was positively skewed at the follow-up assessment. Outliers that were two standard deviations above the mean were transformed using Winsorization, which is the process of replacing outliers with the next closest value. Winsorization has been shown to provide a more accurate representative view of the data when compared to more classical methods (e.g. trimming) and, as such, was selected as the method of choice when attending to outlier variance (22–24). After Winsorization, all research variables met normality assumptions (see Table 2).

The study broadly hypothesized that participants in the Alcohol-Wise experimental condition would report fewer drinking days, fewer standard drinks at peak drinking occasion, a smaller peak BAC, and fewer negative consequences in a typical week at the 30-day follow-up compared to participants in the wait-list control condition. More specifically, it was hypothesized that this effect will be stronger for underclassmen than upperclassmen. The study also hypothesized that participation in Alcohol-Wise would reduce alcohol-related expectancies that would be moderated by class level. The effect of the Alcohol-Wise on social norms was not expected to be moderated by class level. A mixed between-within subjects 2 (intervention vs. control) × 2 (under vs. upperclassmen) × 2 (Time 1 vs. Time 2) analyses of variance (ANOVA) was conducted separately for each dependent variable.

Drinking days
There was no significant three-way interaction between class level, experimental condition, and time on drinking days, F(1, 54) = 0.00, p = 0.98, η²p = 0.00. There was

### Table 2. Mean and standard deviation of drinking behavior, expectancies, and perception of drinking norms.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experimental group n = 29</th>
<th>Control group n = 29</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Underclassmen n = 15</td>
<td>Upperclassmen n = 14</td>
</tr>
<tr>
<td>Typical drinking Days</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Time 1</td>
<td>2.47 (0.92)</td>
<td>3.36 (1.65)</td>
</tr>
<tr>
<td>Time 2</td>
<td>2.20 (0.56)</td>
<td>3.36 (2.02)</td>
</tr>
<tr>
<td>Heaviest drinking occasion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>9.80 (4.62)</td>
<td>10.50 (10.22)</td>
</tr>
<tr>
<td>Time 2</td>
<td>6.87 (2.67)</td>
<td>12.07 (11.29)</td>
</tr>
<tr>
<td>Peak BAC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>0.22 (0.12)</td>
<td>0.19 (0.18)</td>
</tr>
<tr>
<td>Time 2</td>
<td>0.14 (0.08)</td>
<td>0.23 (0.20)</td>
</tr>
<tr>
<td>Total negative consequences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>15.33 (9.13)</td>
<td>16.21 (10.86)</td>
</tr>
<tr>
<td>Time 2</td>
<td>10.93 (8.18)</td>
<td>16.79 (22.10)</td>
</tr>
<tr>
<td>Explicit alcohol expectancies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>10.47 (4.09)</td>
<td>9.71 (4.14)</td>
</tr>
<tr>
<td>Time 2</td>
<td>11.27 (3.04)</td>
<td>10.14 (5.64)</td>
</tr>
<tr>
<td>Implicit alcohol expectancies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>-0.05 (0.61)</td>
<td>-0.41 (0.42)</td>
</tr>
<tr>
<td>Time 2</td>
<td>-0.21 (0.56)</td>
<td>-0.20 (0.43)</td>
</tr>
<tr>
<td>Perception of abstinence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>-5.87 (21.26)</td>
<td>-19.29 (13.40)</td>
</tr>
<tr>
<td>Time 2</td>
<td>3.60 (19.61)</td>
<td>-6.71 (21.32)</td>
</tr>
</tbody>
</table>

Note. Time 1 = baseline and Time 2 = 30-day follow-up assessment. The Valence Alcohol Implicit Association Test (IAT) n ranges from 21–29, N = 50. The IAT is reported as a D score. Perception of Abstinence is reported as a difference score (the difference between participants’ estimates and the actual percentage [39%] of students who abstain from drinking alcohol) and negative scores reflect an overestimation of how many students abstain.
no difference between the control and experimental condition or upper and underclassmen on number of drinking days, across the two time periods.

**Peak number of drinks consumed in one sitting**

There was a statistically significant three-way interaction between class level, group condition, and time on standard drinks consumed on heaviest drinking occasion, $F(1, 54) = 8.05, p = 0.01, \eta^2_p = 0.13$. Follow-up analyses were conducted to parse out the interaction effect. Two mixed between-within subjects $2 \times 2$ ANOVAs were conducted first. There was a statistically significant interaction between time and group condition on standard drinks consumed on heaviest drinking occasion for underclassmen, $F(1, 29) = 7.15, p = 0.01, \eta^2_p = 0.20$. The same interaction was not statistically significant for upperclassmen, $F(1, 25) = 2.12, p = 0.16, \eta^2_p = 0.08$. There was a statistically significant interaction between class level and time on standard drinks consumed on heaviest drinking occasion for participants in the experimental condition, $F(1, 27) = 9.17, p = 0.01, \eta^2_p = 0.25$. The same interaction was not statistically significant for participants in the control condition, $F(1, 27) = 9.98, p = 0.28, \eta^2_p = 0.04$. Finally, a two-way ANOVA was conducted to determine if there were any differences on standard drinks consumed on heaviest drinking occasion between under and upperclassmen and participants in the experimental or control condition at Time 1. The interaction effect between group condition and class level was not statistically significant, $F(1, 54) = 0.12, p = 0.74, \eta^2_p = 0.00$. The simple main effects for group condition, $F(1, 54) = 0.05, p = 0.83, \eta^2_p = 0.00$, and class level, $F(1, 54) = 0.09, p = 0.77, \eta^2_p = 0.00$, did not reach statistical significance, suggesting the groups did not differ on standard drinks consumed on heaviest drinking occasion at Time 1. Overall, underclassmen in the experimental condition reported a statistically significant reduction of standard drinks consumed from Time 1 ($M = 9.8, SD = 4.62$) to Time 2 ($M = 6.87, SD = 2.67$), whereas underclassmen in the control condition reported a non-significant increase in standard drinks consumed from Time 1 to Time 2. There was no statistically significant difference between the control and experimental condition among upperclassmen, from Time 1 to Time 2 (see Figure 2).

**Average blood alcohol content**

There was a statistically significant three-way interaction between class level, experimental condition, and time on peak BAC, $F(1, 54) = 4.54, p = 0.04, \eta^2_p = 0.08$. Follow-up analyses were conducted to disentangle the interactions effect. Two mixed between-within subjects $2 \times 2$ ANOVAs were conducted first. There was no statistically significant two-way interaction between time and group condition on peak BAC for underclassmen, $F(1, 29) = 2.43, p = 0.13, \eta^2_p = 0.08$ or upperclassmen, $F(1, 25) = 2.11, p = 0.16, \eta^2_p = 0.08$. There was a significant main effect for time for underclassmen only, $F(1, 29) = 6.10, p = 0.02, \eta^2_p = 0.17$. There was a statistically significant two-way interaction between class level and time on peak BAC for participants in the experimental condition, $F(1, 27) = 11.75, p < 0.01, \eta^2_p = 0.30$, and a non-significant interaction for participants in the control condition, $F(1, 27) = 0.05, p = 0.83, \eta^2_p = 0.00$. Finally, a two-way ANOVA was conducted to determine if there were any differences on peak BAC between under and upperclassmen and participants in the experimental or control condition. The interaction effect between group condition and class level was not statistically significant, $F(1, 54) = 0.05, p = 0.83, \eta^2_p = 0.00$. The main effects for group condition, $F(1, 54) = 0.20, p = 0.66, \eta^2_p = 0.00$ and class level, $F(1, 54) = 0.69, p = 0.41, \eta^2_p = 0.01$, did not reach statistical significance, suggesting the groups did not differ on peak BAC at Time 1. Overall, underclassmen in the experimental condition reported a statistically significant reduction in peak BAC from Time 1 ($M = 0.22, SD = 0.12$) to Time 2 ($M = 0.14, SD = 0.08$), whereas underclassmen in the control condition reported a non-significant reduction in peak BAC from Time 1 to Time 2. There was no statistically significant difference between the control and experimental condition among upperclassmen, from Time 1 to Time 2. However, upperclassmen in the experimental condition reported a non-significant increase in peak BAC from Time 1 to Time 2 (see Figure 3).

**Negative consequences**

The interaction effect between experimental condition and class level was not statistically significant for negative consequences, $F(1, 54) = 0.71, p = 0.40, \eta^2_p = 0.01$. The main effects for experimental condition, $F(1, 54) = 2.57, p = 0.12, \eta^2_p = 0.05$ and class level, $F(1, 54) = 2.58, p = 0.11, \eta^2_p = 0.05$, did not reach statistical significance.

**Alcohol expectancies**

There was no statistically significant three-way interaction between class level, experimental condition, and time on positive expectancies, when measured by the adapted AEQ, $F(1, 54) = 0.91, p = 0.34, \eta^2_p = 0.02$. There was no difference between the control and experimental condition or upperclassmen and
underclassmen on positive alcohol expectancies, across the two time periods.

**Drinking norms**

With regards to perceptions of abstinence (i.e. estimates of how many students do not drink alcohol), there was a statistically significant interaction between group and time, $F(1, 56) = 4.84, p = 0.03, \eta^2_p = 0.08$. Participants in the experimental condition reported more accurate estimates of abstinence at Time 2 (see Figure 4). The difference in estimates of abstinence was not moderated by class level.

**Discussion**

The present study sought to evaluate the efficacy of Alcohol-Wise; a widely used computer-delivered intervention for alcohol use among college students. Despite its extensive usage, this is the first randomized control trial to evaluate Alcohol-Wise. Research on computer delivery of alcohol prevention has been inconsistent, potentially due to heterogeneity of such interventions and the samples they are tested on. Given the use of Alcohol-wise as a prevention tool among students of all class levels, it was important to consider how junior and seniors, who are legally able to drink, respond to the intervention compared to freshmen and sophomores. This study adds to a growing body of literature on the efficacy of computer-delivered interventions for reducing the quantity of alcohol consumed by college students.

Consistent with the first hypothesis, underclassmen in the Alcohol-Wise experimental condition reported drinking fewer standard drinks on their heaviest drinking occasion at the 30-day follow-up, compared to underclassmen in the wait-list control condition. The lack of

![Figure 2](image-url)

**Figure 2.** Y-axis represents the estimated marginal means of standard alcoholic drinks reported for heaviest drinking occasion across Time 1 and Time 2 (X-axis), between underclassmen and upperclassmen. Figure is divided by group condition (i.e. experimental and control).

![Figure 3](image-url)

**Figure 3.** Y-axis represents the estimated marginal means of peak BAC across Time 1 and Time 2 (X-axis), between underclassmen and upperclassmen. Figure is divided by group condition (i.e. experimental and control).
change in drinking behavior among upperclassmen, suggests that intervening early in a student’s college career rather than later, when students have already established patterns of alcohol use, may be an effective strategy to combat alcohol misuse on campus. However, contrary to expectations, there was no difference between the experimental condition and the control for either upperclassmen or underclassmen on the number of drinking days they reported, with both groups reporting drinking less than three days on average. Previous research (25,26) found that college students tend to drink less frequently, but in greater quantities than non-college students. The lack of effect for number of drinking days might be due to the restriction of range on how many days students drink in a typical week.

Similar to the first finding, underclassmen in the experimental condition reported statistically significant reductions from Time 1 to Time 2 on peak BAC. This reduction reflects a change from BAC levels that potentially produce an alcohol-related blackout, to less harmful BAC levels. Both findings on the intervention’s effectiveness at reducing quantity but not frequency suggests that Alcohol-Wise may lead to lower rates of binge drinking, a particularly harmful drinking behavior. The reduction in BAC detected is both statistically and clinically significant, further supporting the potential of this intervention to reduce the harmful effects of heavy alcohol use.

Contrary to the second hypothesis, the intervention was not successful at changing self-reported expectancies regarding alcohol use. Alcohol-related positive expectancies may be resistant to change because they develop over time and are maintained by peers. Alcohol-related positive expectancies may require a more extensive intervention than that offered by Alcohol-Wise. It is possible, however, that college students can modify their drinking habits without concurrent change in expectancies.

Finally, the intervention appears to have increased accuracy of perceptions of normative drinking behavior among college students. Students in the experimental condition reported more accurate perceptions of abstinence after the intervention, compared to students in the control condition. Interestingly, contrary to the third hypothesis, this relationship was not moderated by class level. After participating in Alcohol-Wise, students had a more realistic view of how many students abstain from drinking alcohol during college. The majority of students underestimated the number of people who do not drink, suggesting they perceive alcohol consumption as a normal part of the college experience. The present study is consistent with findings that have found that college students consistently overestimate rates of alcohol consumption among their peers (27).

The present findings also provide valuable information about tracking/self-monitoring approaches. Participants in the wait-list control conditions completed assessment measures yet did not significantly reduce their alcohol consumption relative to the experimental group. Thus, it appears that including alcohol education components does bestow additional benefits beyond self-monitoring.

**Limitations and future research**

Although the study utilized a randomized control design, the gold standard in treatment outcome research, the pilot nature of the study limits its generalizability and its use as comprehensive evidence for clinical efficacy (28). Results from the current study should also be interpreted in light of participant attrition and sample size. In order to reduce attrition in future studies, in-person intervention might be used instead of online. Future studies should also consider a longitudinal design, with multiple assessments in fall and spring semesters. The present study included a short-term follow-up assessment, which prevented it from detecting the long-term impact of the intervention. Furthermore, a 30-day follow-up may not be long enough to detect
significant changes in alcohol-related negative consequences (e.g. GPA changes), regardless of the measure. Future studies should consider tracking negative consequences between baseline and follow-up assessments, extending the follow-up period to at least one semesters’ length and asking questions about more specific consequences related to alcohol use.

According to Baer (29), there are few observational or longitudinal studies of college student drinking. Instead most studies rely on self-report measures, which require insight and a willingness to truthfully disclose thoughts, feelings, and behaviors. Due to the sensitive nature of the topic some individuals may find this to be challenging. This study attempted to reduce such experimental effects by delivering both the intervention and the assessment electronically. In addition, this study used implicit, as well as explicit, measures to avoid total reliance on self-report.

Although not statistically significant, it might be possible that upperclassmen may increase their drinking as a result of participating in Alcohol-Wise. This possibility should be explored in future studies. This is especially important since some colleges mandated all students to participate in Alcohol-Wise, regardless of their class level.

Conclusion

This study provides evidence for the short-term usefulness of a computer-delivered intervention in reducing drinking among underclassmen. More interestingly, it provides insight into when preventive measures are most effective in a college setting. Since only freshmen and sophomores appeared to benefit from the intervention, the study suggests that prevention efforts should be concentrated in the first two years of college. Moreover, the intervention increased the accuracy of perceptions of drinking norms among college students, potentially ameliorating peer pressure to increase drinking. These results, however, should be interpreted with caution in light of the small sample size.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

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ORCID

Omar M. Alhassoon http://orcid.org/0000-0003-0596-6085

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