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Abstract

Objective: The purpose of this randomized controlled study was to examine sex as a moderator of the efficacy of a brief, web-based personalized feedback intervention (eCHECKUP TO GO) on decreasing cognitive risk factors for alcohol use, increasing protective behavioral strategies, and reducing alcohol use among high school seniors. **Method:** Participants (N = 311) were high school seniors randomized by class period to the eCHECKUP TO GO intervention or assessment-only control group. Participants completed online surveys at baseline and 30-day follow-up (91.0%; n = 283). **Results:** Students in the intervention group reported a significant reduction in normative perceptions of peer drinking, positive alcohol expectancies, and alcohol use relative to those in the control group. Intervention effects for perceptions of frequency of peer drunkenness and frequency of alcohol use were moderated by sex, with results favoring females. In contrast, we did not find evidence for sex as a moderator of intervention effects for normative perceptions of peer drinking frequency, sex-specific perceptions of peer heavy episodic drinking, positive alcohol expectancies, or peak drinking quantity. Further, we did not find significant intervention or moderator effects for protective behavioral strategies. **Conclusions:** Results of this study extend the literature by demonstrating the efficacy of the eCHECKUP TO GO for both males

and females on reducing cognitive risk factors and alcohol use, although results were significant for a broader range of variables for females. Results also indicate program content regarding normative feedback and protective behavioral strategies may need modification to be more effective for this age group.

Keywords: alcohol risk factors; protective behavioral strategies; alcohol use; web-based intervention; high school seniors

Adolescent alcohol use is a serious public health concern in the United States, posing significant health risks among youth (National Institute on Alcohol Abuse [NIAAA], 2017). Among high school students, seniors have the highest rates of alcohol use, with 58.5% of seniors reporting alcohol use and 42.9% reporting being drunk at least once in their lifetime (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2019). Further, binge drinking, defined as 4/5 (female/male) or more drinks in a row, escalates through high school, with 20.9% of seniors reporting binge drinking in the past 30 days (Center for Disease Control and Prevention [CDC], 2017). Among high school students, binge drinking is associated with multiple negative consequences including impaired neurocognitive functioning (Nguyen-Louie et al., 2015), academic problems (Patte, Qian, & Leatherdale, 2017), unwanted sexual activity (Arata, Stafford, & Tims, 2003), being a dating violence victim, attempting suicide, using illicit drugs, and riding with a driver who had been drinking (Miller, Naimi, Brewer, & Jones, 2007). Additionally, hazardous drinking (e.g., drinking games), which more prevalent among older high school students (Borsari et al., 2013), peaking at ages 17-19 (Zamboanga et al., 2016), is associated with a wide range of negative consequences including having a hangover, passing out, engaging in regretted sexual activities, and drinking and driving (Borsari et al., 2013).

Despite the need for alcohol interventions for high school seniors, a seminal review of alcohol preventive interventions concluded that the majority of research targets youth ages 10- 15, with limited research conducted with high school students aged 16 and older (Spoth, Greenberg, & Turrisi, 2008). More recent reviews echo these findings, indicating the majority of alcohol intervention research targets students in their first two years of high school (Champion, Newton, Barrett, & Teesson, 2013) or junior high school students (Strøm, Adolfsen, Fossum, Kaiser, & Martinussen, 2014). These findings, coupled with the high rates of alcohol use and associated consequences, highlight the importance of identifying effective alcohol interventions for high school seniors.

The eCHECKUP TO GO (San Diego State University Research Foundation, n.d.) is a web-based personalized feedback intervention categorized in the NIAAA *CollegeAIM* as a highly effective, low cost intervention (NIAAA, 2015). Because the eCHECKUP TO GO is brief, can be disseminated to large groups of students within one class period, and inexpensive, the program is well-suited for use as a school-based intervention. Although originally developed for college students, preliminary research provides some support for the efficacy of the eCHECKUP TO GO in reducing alcohol use among high school students (Doumas, Esp, Flay, & Bond, 2017; Doumas, Esp, Turrisi, Hausheer, & Cuffee, 2014). However, in a high school study comparing the eCHECKUP TO GO to traditional alcohol education, results indicated the eCHECKUP TO GO was effective in reducing rates of alcohol use for females only (Hausheer, Doumas, & Esp, 2018). Thus, the research suggests that although the eCHECKUP TO GO is a promising strategy for high school students, the intervention may need modification to increase program efficacy for males in this age group.

The eCHECKUP TO GO was designed to reduce alcohol use by targeting cognitive risk factors (e.g. normative perceptions of peer alcohol use and alcohol expectancies) and protective behavioral strategies (e.g., behaviors used to minimize risk associated with alcohol use). Results from an initial study conducted with high school seniors, however, demonstrated that when comparing outcomes between student receiving eCHECKUP TO GO and those in an assessment-only control group, intervention effects for cognitive risk factors, including normative perceptions of peer alcohol use and positive alcohol expectancies, were significant for females only (Doumas, Esp, Johnson, Trull, & Shearer, 2017). Further, the authors found no significant effects for protective behavioral strategies, although it is possible that the lack of significant findings was due to examining protective behavioral strategies changes for the whole sample, including non-drinkers. Overall, findings suggest the content of the intervention may not be optimal for addressing cognitive risk factors for males or protective behavioral strategies for high school seniors.

The purpose of the present study was to replicate and extend prior research examining sex differences in the efficacy of the eCHECKUP TO GO among high school seniors. We selected seniors because they have the highest rates of alcohol use and high-risk drinking among high school students, yet alcohol intervention research for this age group is limited (Spoth et al., 2008; Champion et al., 2013; Strøm et al., 2014). Our first objective was to assess sex differences in intervention effects on cognitive risk factors and protective behavioral strategies to identify areas of program content that may need to be revised for this age group. To achieve this aim, we built upon initial findings reported by Doumas Esp, Johnson et al. (2017). First, we included additional measures of normative beliefs to gain a better understanding of sex differences in this area. Peer drinking norms have been identified as the most consistent mediator of normative feedback interventions (Reid & Carey, 2015) and gender-specific norms are more strongly associated with problematic drinking than gender-nonspecific norms (Lewis & Neighbors, 2004). Second, we used a revised measure of protective behavioral strategies (PBSS-20; Treloar, Martens, & McCarthy, 2015) that includes additional items and has higher reliability than the original PBSS measure. We also examined changes on the PBSS-20 for a subsample of students who reported alcohol use. Our second objective was to extend the literature by assessing sex differences in intervention effects on alcohol use among high school seniors, as only one study (Hausheer et al., 2018) has examined sex as a moderator of intervention effects among high school students. Based on the findings reported by Doumas Esp, Johnson et al. (2017) and Hausheer et al. (2018), we hypothesized that relative to students in the control group, students in the eCHECKUP TO GO group would report 1) a decrease in cognitive risk factors for alcohol use with intervention effects favoring for females, 2) no difference in use of protective behavioral strategies, and 3) a decrease in alcohol use with intervention effects with results favoring for females.

Method

Design

This study evaluated the efficacy of the eCHECKUP TO GO for high school seniors using a randomized controlled design. Classroom periods were randomized to the eCHECKUP TO GO or control condition. Participants completed baseline and 30-day follow-up assessments online. All study procedures were approved by the University Institutional Review Board and the School District Research Board.

Participants

Participants were high school seniors recruited from two urban high schools in the Northwest. Because the School District Research Board required parental consent for students regardless of age, consent forms were sent to parents of all students (N = 867). A total of 39.4% (n = 342) provided consent and of these, 91% students (n = 311; 44.4% male, 55.6% female) agreed to study participation. See Figure 1 for the participant flow diagram. Table 1 presents demographic information by study group.

Procedures

Data were collected in fall 2018. At the beginning of the fall semester, parents of all seniors were contacted by the school principal via letter by mail that included a parental consent form and a project-addressed, stamped envelope. Parents were asked to return signed consent forms indicating permission (yes or no) for their adolescent's study participation. Reminder letters were sent to the student's home address and sent home with the student. Students who received active parental consent were recruited during a common core class period and were asked to assent prior to participating in the baseline survey. Because research indicates on family-oriented holidays such as Thanksgiving, drinking patterns change such that the number of youth who drink increases but the number of drinks consumed decreases (Goldman, Greenbaum, Darkes, Brandon, & Del Boca, 2011), we selected early October for baseline assessment to allow time for recruitment and so that the 30-day follow-up would occur prior to Thanksgiving break.

Students with parental consent met at the school's computer lab. A member of the research team described the study. Students were given a unique personal identification number (PIN) and URL to access the survey. Students logged onto the website where they read a welcome screen explaining the research. Once students gave assent by clicking "Agree," they were taken to a screen that asked them to enter their PIN and were directed to begin the survey. Students without parental consent or who did not provide assent remained in their classroom. After survey completion, students in the intervention group completed the eCHECKUP TO GO and students in the control group

returned to their classroom. All participants who completed the baseline survey were invited to participate in a 30-day follow-up survey. Incentives included $100 deposited to the teacher's school account for supplies and a bagel or pizza party for classrooms with a parental consent form (yes or no) return rate of at least 60%.

Measures

Demographics. A brief demographic questionnaire designed for this study included basic participant characteristics (e.g., sex, race/ethnicity, age).

Normative Beliefs About Peer Alcohol Use. A modified version of the Quantity/Frequency/Peak questionnaire (QFP; Dimeff et al., 1999; Marlatt et al., 1998) was used to assess perceptions of frequency of peer alcohol use. Participants were asked to indicate the frequency of drinking of a typical high school senior on an 8-point scale with options ranging from 1 (*every day*) to 8 (*do not drink alcohol at all*). Items were reverse scored so that high scores represent high frequency of use. Participants were also asked to indicate the frequency of peer drunkenness with the following question "During the past *30 days (about 1 month)*, how many times do you believe a typical 12th grade student has gotten drunk, or very high from alcohol?" This item was rated on a 6-point scale with options ranging from 1 (*never*) to 6 (*9 or more*). We also asked participants to report on sex-specific perceptions of the frequency of peer heavy episodic drinking in the past two weeks defined as having 5/3 (males/females) or more drinks in a row on a single occasion (Donovan, 2009).

Positive Alcohol Expectancies. The Brief Comprehensive Effects of Alcohol questionnaire (B-CEOA; Addictive Behaviors Research Center, University of Washington, 1997) is a 15-item measure used to assess expectancies concerning alcohol. The B-CEOA includes 11 items that assess the positive expectancy factors sociability, tension reduction, liquid courage, and sexuality. Individuals responded to each of the items on a 4-point Likert-type scale ranging from 1 (*disagree*) to 4 (*agree*). A total score was created by summing the items ($\alpha = .85$).

Protective Behavioral Strategies. The Protective Behavioral Strategy Scale-20 (PBSS-20; Treloar et al., 2015) is a 20-item measure that assesses three types of protective behaviors: stopping/limiting drinking, manner of drinking, and serious harm reduction. Respondents rate the degree to which they engage in protective behaviors when using alcohol on a scale ranging from 1 (*never*) to 5 (*always*). A total score was created by summing the items ($\alpha = .98$).

Alcohol Use. Past 30-day alcohol use was assessed with the following question: "During the past 30 days, how many days did you drink alcohol (Beer, wine, liquor)?"(Bachman, Johnston, & O'Malley, 1996). Peak drinking was assessed by the question "What is the most number of drinks that you have consumed on any given night in the past month?" (QFP; Dimeff et al., 1999; Marlatt et al., 1998).

The eCHECKUP TO GO

The eCHECKUP TO GO (http://www.echeckuptogo.com/) is a brief, web-based personalized feedback intervention. The online assessment consists of demographic information and information on alcohol consumption and drinking behavior assessed through standard alcohol measures. Individualized feedback is provided in the following domains: quantity and frequency of drinking, estimated risk-status for negative consequences associated with drinking, genetic risk, tolerance, approximate financial cost of drinking in the past year, and normative feedback comparing one's own drinking to national survey data for sex-specific adult normative data, sex-specific college student normative data, and sex-nonspecific youth ages 12-17 normative data, as well as comparisons of perceptions of peer drinking to local high school data. The program assesses student willingness to utilize several protective behavioral strategies (e.g. avoid drinking games, space my drinks out over time, spend time with friends who don't drink alcohol, identify alternative social activities instead of partying). The program then provides resources for services in the local community. To ensure standardized intervention delivery, a member of the research team read a script to the participants. Research team members were present to assist participants and serve as monitors, ensuring participants completed the program, kept their eyes on their own screens, were engaged in the program, and that there was no discussion among participants.

Statistical Analyses

All outcome variables were examined for outliers at baseline and follow-up and were adjusted to 3.3 SD above the mean before conducting analyses (Tabachnik & Fidell, 2007). We examined differences on demographic and outcome variables between the two study conditions at baseline. Students in the intervention group reported a significantly higher level of frequency of drinking, $t(281) = 3.46$, $p < .001$, and peak drinking, $t(281) = 3.23$, $p < .001$, than student in the control group. Thus, we included these variables as control variables in the analyses of risk factors and protective behavioral strategies. Because students were recruited from two schools and class periods were randomized to treatment, we assessed the importance of incorporating random effects (i.e., participants nested within school and within period) using AIC_C (Burnham & Anderson, 2002) under the restricted maximum likelihood algorithm (REML). We examined the intraclass correlations (ICCs) to evaluate the degree of non-independence among students within school and within period. Because the ICCs for both within school and within period ranged from .01 - .09 and .04 - .06, respectively, compared to a within student ICCs ranging from .91 – .93, and the change in AIC_C was negligible, we did not consider these random effects further. We fit study outcomes with a repeated measures analysis of variance with group (intervention; control) and sex (male; female) as grouping factors and time (baseline; follow-up) as the within factor. The analysis for protective behavioral strategies was conducted with a subsample of students who reported alcohol use in the past 30-days use (49.9%). Analyses were considered significant at $p < .05$ and were conducted in SPSS version 24.0.

Results

Overall, 91.0% ($n = 283$) of the 311 participants completed the 30-day follow-up assessment. Chi-square and one-way analyses of variance revealed no differences on demographic or outcome variables between 30-day survey completers and non-completers. Additionally, there was no difference in the rate of attrition across the two groups. Means and standard deviations for outcome variables by group and sex at baseline and follow-up are reported in Tables 2 - 4.

Cognitive Risk Factors

Perceptions of Frequency of Peer Drinking. Results revealed a significant interaction effect for Time x Group, Wilks' Lambda = .99, $F(1, 277) = 3.01$, $MSE = .62$, $p = .05$, $\eta^2_p = .01$. The interaction effect for the Time x Group x Sex, Wilks' Lambda = 1.00, $F(1, 277) = 0.99$, $MSE = .62$, $p = .32$, $\eta^2_p = .00$, was not significant. Students in the intervention group reported a reduction in perceptions of frequency of peer drinking compared to no change in the control group.

Perceptions of Frequency of Peer Drunkenness. Results revealed a significant interaction effect for Time x Group, Wilks' Lambda = .95, $F(1, 277) = 14.61$, $MSE = .78$, $p = .001$, $\eta^2_p = .05$, and for Time x Group x Sex, Wilks' Lambda = .99, $F(1, 277) = 3.82$, $MSE = .78$, $p = .05$, $\eta^2_p = .01$. Post-hoc analyses indicated a significant Time x Group interaction for females, Wilks' Lambda = .91, $F(1, 151) = 15.08$, $MSE = 0.88$, $p = .001$ $\eta^2_p = .09$, but not for males, Wilks' Lambda =.98, $F(1, 124) = 2.01$, $MSE = 0.68$, $p = .16$, $\eta^2_p = .02$. Females in the intervention group reported a decrease in perceptions of frequency of peer drunkenness, compared to an increase in the control group.

Sex-Specific Perceptions of Peer Heavy Episodic Drinking. Results indicated a significant interaction effect for Time x Group, Wilks' Lambda = .98, $F(1, 277) = 5.91$, $MSE = 4.13$, $p = .02$, $\eta^2_p = .02$. The interaction effect for the Time x Group x Sex, Wilks' Lambda = 1.00, $F(1, 277) = 0.03$, $MSE = 4.13$, $p = .86$, $\eta^2_p = .00$, was not significant. Students in the intervention group reported a reduction in perceptions of frequency of sex-specific peer heavy episodic drinking compared to an increase in the control group.

Positive Alcohol Expectancies. Results revealed a significant interaction effect for Time x Group, Wilks' Lambda = .98, $F(1, 277) = 4.42$, $MSE = 16.01$, $p = .04$, $\eta^2_p = .02$. The interaction effect for the Time x Group x Sex, Wilks' Lambda = 1.00, $F(1, 277) = 0.01$, $MSE = 16.01$, $p = .94$, $\eta^2_p = .00$, however, was not significant. Students in the intervention group reported a greater reduction in positive alcohol expectancies compared to students in the control group.

Protective Behavioral Strategies

Neither the interaction effect for Time x Group, Wilks' Lambda = .99, $F(1, 133) = 1.36$, $MSE = 56.66$, $p = .25$, $\eta^2_p = .01$, or for Time x Group x Sex, Wilks' Lambda = 1.00, $F(1, 133) = 0.70$, $MSE = 56.66$, $p = .41$, $\eta^2_p = .01$, were significant, indicating no differences between study conditions.

Alcohol Use

Frequency of Alcohol Use. Results revealed a significant interaction effect for Time x Group x Sex, Wilks' Lambda = .99, $F(1, 279) = 4.12$, $MSE = 0.31$, $p = .04$, $\eta^2_p = .02$. Post-hoc analyses indicated a significant Time x Group interaction for females, Wilks' Lambda = .97, $F(1, 153) = 4.21$, $MSE = 0.28$, $p = .04$, $\eta^2_p = .03$, but not for males, Wilks' Lambda =.99, $F(1, 126) = 0.86$, $MSE = 0.36$, $p = .36$, $\eta^2_p = .01$. Females in the intervention group reported a greater reduction in frequency of alcohol use than females in the control group.

Peak Drinking. Results indicated a significant interaction effect for Time x Group, Wilks' Lambda = .98, $F(1, 279) = 6.29$, $MSE = 6.29$, $p = .01$, $\eta^2_p = .02$. The interaction effect for the Time x Group x Sex, Wilks' Lambda = 1.00, $F(1, 279) = 1.09$, $MSE = 6.29$, $p = .30$, $\eta^2_p = .00$, was not significant. Students in the intervention group reported a greater reduction in peak drinking compared to students in the control group.

Discussion

The purpose of this study was to extend the literature by examining sex differences in the efficacy of the eCHECKUP among high schools seniors. Our findings suggest the eCHECKUP TO go was effective in reducing perceptions of peer alcohol use, perceptions of sex-specific peer heavy episodic drinking, positive expectancies, and peak drinking for both males and females. However, consistent with prior research (Doumas, Esp, Johnson et al., 2017; Hausheer et al., 2018), intervention effects for perception of peer drunkenness and frequency of alcohol use were significant for females only and we found no significant effects for protective behavioral strategies.

Understanding sex differences in normative perceptions of peer drinking is important as changing normative perceptions is the most consistently identified mediator of intervention effects for personalized feedback interventions (Reid & Casey, 2015). Because females typically report less alcohol consumption than males, when using sex-neutral normative data, females are presented with normative feedback that provides higher average alcohol consumption norms relative to their own drinking (Lewis & Neighbors, 2006). Thus, sex-neutral (e.g., typical student) normative feedback may be less effective for females. Our results, however, suggest the opposite pattern. One explanation is that at baseline, female students reported higher normative perceptions of frequency of peer drunkenness ($M = 3.68$, $SD = 1.30$) than male students ($M = 3.03$, $SD = 1.10$), $t(281) = 4.51$, $p < .001$. The discrepancy between perceptions and normative data may have been greater for females, potentially resulting in greater shifts in perceptions of peer drunkenness and frequency of alcohol use among females. In contrast, results for sex-specific heavy episodic drinking did not favor females. It is possible that our use of the 3/5 definition for heavy episodic drinking, rather than the 4/5 definition, may have resulted in lower normative estimates of female drinking. Also of note, the sex-specific normative data presented in the eCHECKUP TO GO are from adult and college student national surveys. Replacing this data with sex-specific local normative data from high school seniors may provide a more relevant normative comparison for both males and females.

In contrast to prior research, we did not find moderation effects for positive alcohol expectancies. It is not clear why this study did not replicate the sex differences reported by Doumas, Esp, Johnson et al. (2017) as both samples were comprised of high schools seniors and had a similar demographic characteristics, including distribution of males and females. The finding, however, that positive expectancies were reduced for both male and females is particularly important as positive alcohol expectancies have been identified as primary risk factors for adolescent alcohol use (Jester et al., 2014; Newton, Barrett, Swaffield, & Teesson, 2014; Patrick, Wray-Lake, Finlay, & Maggs, 2010) and are associated with high-risk drinking among high school students (Zamboanga et al., 2016). Similarly, we did not find sex differences in intervention effects for peak drinking. This parallel finding may in part, be explained by the relationship between positive expectancies and high-risk drinking among high school students.

Although the eCHECKUP TO GO program is designed to increase protective behavioral strategies, we found no significant intervention effects. This finding has now been demonstrated across two samples, with both the original PBSS measure and the PBSS-20 measure, as well as with a sample including all seniors and a subsample of seniors

reporting alcohol use. As suggested by Doumas, Esp, Johnson et al. (2017), how information regarding protective behaviors is presented in the eCHECKUP TO GO program may need to be modified for this age group. Alternatively, the lack of significant findings may be due to measurement issues. With the exception of a few items (i.e., alternate alcoholic and non-alcoholic drinks, avoid drinking games, drink slowly), the eCHECKUP TO GO items do not map on exactly to the PBSS items, although the items do reflect strategies consistent with the PBSS domains. However, the eCHECKUP TO GO intervention includes strategies consistent with alcohol avoidance and identification of alternative activities that are not assessed by the PBSS (e.g., have a plan to say no when I am offered alcohol, spend time with friends who don't drink alcohol, avoid situations where alcohol is present or I am likely to drink, and identify alternative social activities instead of partying). Thus, non-significant findings for protective behavioral strategies in both studies may be related to measurement issues and may not reflect actual changes in participant behavior.

Limitations of the study include a primarily Caucasian sample recruited from two high schools in the Northwest region. Further, although the response rate in this study was low (35.9%), it is consistent with response rates of 30%-60% reported in school-based alcohol intervention research using active parental consent procedures (Smith, Boel-Studt, & Cleeland, 2009). Further, although response bias should be considered, both the demographic make-up of our sample and alcohol use were similar to the data reported by the target school district. Additionally, the duration of the follow-up was short. Future research should examine if intervention effects are sustained across the academic year and post-graduation. Finally, this study did not examine how to increase program effectiveness for protective behavioral strategies or for males. Qualitative data collection may be an effective way to gather information needed to inform program modifications.

Findings from this study have important implications for developing intervention programs for high school seniors. First, this study suggests that the eCHECKUP TO GO is effective in reducing cognitive risk factors and alcohol use for both female and male students. Although we did find that females reported positive effects across a wider range of measures, data from this study demonstrate that male students also reported reductions in the majority of cognitive risk factors examined in this study, as well as reductions in peak drinking. Thus, even in the absence of intervention effects for protective behavioral strategies, this study adds to the literature supporting the use of the eCHECKUP TO GO with high school seniors.

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References

Addictive Behaviors Research Center. (1997). *The Alcohol Skills Training Program Facilitators Manual*. Unpublished manual. Psychology Department; University of Washington.

Arata, C. M., Stafford, J., & Tims, M. S. (2003, Fall). High school drinking and its consequences. Adolescence, *38*(151), 567–579. doi:10.1037/adb0000041 Medline.

Bachman, J. G., Johnston, L. D., & O'Malley, P. M. (1996). *The Monitoring the Future project after twenty-two years: Design and procedures* (Monitoring the Future Occasional Paper No. 38.) Ann Arbor, MI: Institute for Social Research.

Borsari, B., Zamboanga, B. L., Correia, C., Olthuis, J. V., Van Tyne, K., Zadworny, Z., et al. (2013). Characterizing high school students who play drinking games using latent class analysis. Addictive Behaviors, *38*(10), 2532–2540. doi: 10.1016/j.addbeh.2013.04.009. Medline

Burnham, K. P., & Anderson, D. R. (2002). *Model selection and multimodel inference: A practical information-theoretic approach.* (2nd Ed.). New York: Springer Verlag.

Centers for Disease Control and Prevention. (2017). Youth Risk Behavior Surveillance System (YRBSS) retrieved from https://www.cdc.gov/healthyyouth/data/yrbs/index.htm

Champion, K. E., Newton, N. C., Barrett, E. L., & Teesson, M. (2013). A systematic review of school-based alcohol and other drug prevention programs facilitated by computers or the internet. Drug and Alcohol Review, *32*(2), 115–123. doi: 10.1111/j.1465-3362.2012.00517.x. Medline

Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). *Brief Alcohol Screening and Intervention for College Students (BASICS): A harm reduction approach.* New York: Guilford Press.

D'Amico, E. J., & McCarthy, D. M. (2006). Escalation and initiation of younger adolescents' substance use: the impact of perceived peer use. The Journal of Adolescent Health, *39*(4), 481–487. doi: 10.1016/j.jadohealth.2006.02.010. Medline

Donovan, J. E. (2009). Estimated blood alcohol concentrations for child and adolescent drinking and their implications for screening instruments. Pediatrics, *123*(6), e975–e981. doi: 10.1542/peds.2008-0027. Medline

Doumas, D. M., Esp, S., Flay, B., & Bond, L. (2017). A randomized controlled trial testing the efficacy of a brief online alcohol intervention for high school seniors. Journal of Studies on Alcohol and Drugs, *78*(5), 706–715. doi: 10.15288/jsad.2017.78.706. Medline

Doumas, D. M., Esp, S., & Hausheer, R. (2015). Parental consent procedures: Impact on response rates and nonresponse bias. Journal of Substance Abuse and Alcoholism, *3*, 1031–1034.

Doumas, D. M., Esp, S., Johnson, J., Trull, R., & Shearer, K. (2017). The eCHECKUP TO GO for High School: Impact on risk factors and protective behavioral strategies for alcohol use. Addictive Behaviors, *64*, 93–100. doi: 10.1016/j.addbeh.2016.08.030. Medline

Doumas, D. M., Esp, S., Turrisi, R., Hausheer, R., & Cuffee, C. (2014). A test of the efficacy of a brief, web-based personalized feedback intervention to reduce drinking among 9th grade students. Addictive Behaviors, *39*(1), 231–238. doi: 10.1016/j.addbeh.2013.10.011. Medline

Goldman, M. S., Greenbaum, P. E., Darkes, J., Brandon, K. O., & Del Boca, F. K. (2011). How many versus how much: 52 weeks of alcohol consumption in emerging adults. Psychology of Addictive Behaviors, *25*(1), 16–27. doi: 10.1037/a0021744. Medline

Grazioli, V. S., Lewis, M. A., Garberson, L. A., Fossos-Wong, N., Lee, C. M., & Larimer, M. E. (2015). Alcohol expectancies and alcohol outcomes: Effects of the use of protective behavioral strategies. *Journal of Studies on Alcohol and Drugs, 76*, 452-458. doi: 10.15288/jsad.2015.76.452

Hausheer, R., Doumas, D. M., & Esp, S. (2018). Evaluation of a web-based alcohol program alone and in combination with a parent-based intervention for 9th grade students. *Journal of Addiction and Offender Counseling, 39*, 15-30. doi: https://doi.org/10.1002/jaoc.12038

Jester, J. M., Wong, M. M., Cranford, J. A., Buu, A., Fitzgerald, H. E., & Zucker, R. A. (2015). Alcohol expectancies in childhood: change with the onset of drinking and ability to predict adolescent drunkenness and binge drinking. *Addiction, 110,* 71-79. doi:10.1111/add.12704

Johnston, L. D., Miech, R. A., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E., & Patrick, M. E. (2019). Monitoring the Future national survey results on drug use 1975-2018: Overview, key findings on adolescent drug use. *Ann Arbor: Institute for Social Research, The University of Michigan*. Retrieved from: http://www.monitoringthefuture.org/pubs/monographs/mtf-overview2018.pdf

Kelly, A. B., Evans-Whipp, T. J., Smith, R., Chan, G. C., Toumbourou, J. W., Patton, G. C., ... & Catalano, R. F. (2015). A longitudinal study of the association of adolescent polydrug use, alcohol use and high school non-completion. *Addiction*, *110*, 627-635. doi: 10.1111/add.12829

Lewis, M. A., & Neighbors, C. (2004). Gender-specific misperceptions of college student drinking norms. *Psychology of Addictive Behaviors*, *18*, 334 - 339. doi: 10.1037/0893-164X.18.4.334

Lewis, M. A., & Neighbors, C. (2006). Social norms approaches using descriptive drinking norms education: A review of the research on personalized normative feedback. *Journal of American College Health, 54*, 213-218. doi: 10.3200/JACH.54.4.213-218

Litt, D. M., & Stock, M. L. (2011). Adolescent alcohol-related risk cognitions: the roles of social norms and social networking sites. *Psychology of Addictive Behaviors, 25,* 708-713. doi: 10.1037/a0024226

Marlatt, G. A., Baer, J. S., Kivlahan, D. R., Dimeff, L. A., Larimer, M. E., Quigley, L. A., et al. (1998). Screening and brief intervention for high-risk college student drinkers: Results from a 2-year follow-up assessment. *Journal of Consulting and Clinical Psychology, 66*, 604-615. doi: 10.1037/0022-006X.66.4.604

Martens, M. P., Ferrier, A. G., Sheehy, M. J., Corbett, K., Anderson, D. A., & Simmons, A. (2005). Development of the protective behavioral strategies survey. *Journal of Studies on Alcohol and Drugs, 66*, 698–705. doi: http://dx.doi.org/10.15288/jsa.2005.66.698

Miller, J. W., Naimi, T. S., Brewer, R. D., & Jones, S. E. (2007). Binge drinking and associated health risk behaviors among high school students. *Pediatrics, 119*, 76-85. doi: 10.1542/peds.2006-1517

National Institute on Alcohol Abuse and Alcoholism. (2015). *Planning alcohol interventions using NIAAA's college aim alcohol intervention matrix*. Retrieved from http://www.collegedrinkingprevention.gov/CollegeAIM/Resources/NIAAA_College_Matrix_Booklet.pdf

National Institute on Alcohol Abuse and Alcoholism. (2017). *Underage drinking*. Retrieved from https://www.niaaa.nih.gov/sites/default/files/publications/Underage_Fact.pdf

Newton, N. C., Barrett, E. L., Swaffield, L., & Teesson, M. (2014). Risky cognitions associated with adolescent alcohol misuse: Moral disengagement, alcohol expectancies and perceived self-regulatory efficacy. *Addictive Behaviors, 39*, 165-172. doi: 10.1016/j.addbeh.2013.09.030

Nguyen-Louie, T., Castro, N., Matt., G., Squegelia, L., Brumback, T., & Tapert, S. (2015). Effects of emerging alcohol and marijuana use behaviors on adolescents' neuropsychological functioning over four years. *Journal of Studies on Alcohol and Drugs, 76, 738-748.* doi:10.15288/jsad.2015.76.738

Patrick, M. E., Wray-Lake, L., Finlay, A. K., & Maggs, J. L. (2010). The long arm of expectancies: Adolescent alcohol expectancies predict adult alcohol use. *Alcohol and Alcoholism, 45*, 17-24. doi: 10.1093/alcalc/agp066

Patte, K. A., Qian, W., & Leatherdale, S. T. (2017). Marijuana and alcohol use as predictors of academic achievement: a longitudinal analysis among youth in the COMPASS study. *Journal of School Health, 87*, 310-318. doi: 10.1111/josh.12498

Reid, A. E., & Carey, K. B. (2015). Interventions to reduce college student drinking: State of the evidence for mechanisms of behavior change. *Clinical Psychology Review*, *40*, 213-224. doi: 10.1016/j.cpr.2015.06.006

San Diego State University Research Foundation (n.d.). http://www.echeckuptogo.com/

Shaw, T., Cross, D., Thomas, L. T., & Zubrick, S. R. (2015). Bias in student survey findings for active parental consent procedures. *British Educational Research Journal, 41*, 229–243. doi: http://dx.doi.org/10.1002/berj.3137

Smith, D. C., Boel-Studt, S., & Cleeland, L. (2009). Parental consent in adolescent substance abuse treatment outcome studies. *Journal of Substance Abuse Treatment, 37*, 298-306. doi:10.1016/j.sat.2009.03.007

Spoth, R., Greenberg, M., & Turrisi, R. (2008). Preventive interventions addressing underage drinking: State of the evidence and steps toward public health impact. *Pediatrics, 121*, 311-336. doi: 10.1542/peds.2007-2243E

Strøm, H. K., Adolfsen, F., Fossum, S., Kaiser, S., & Martinussen, M. (2014). Effectiveness of school-based preventive interventions on adolescent alcohol use: a meta-analysis of randomized controlled trials. *Substance abuse treatment, prevention, and policy*, *9*(1), 48. doi: 10.1186/1747-597X-9-48

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Allyn and Bacon.

Treloar, H., Martens, M. P., & McCarthy, D. M. (2015). The Protective Behavioral Strategies Scale-20: Improved content validity of the Serious Harm Reduction subscale. *Psychological Assessment, 27*, 340-346.doi: http://dx.doi.org/10.1037/pas0000071

Wang, M. T., & Fredricks, J. A. (2014). The reciprocal links between school engagement, youth problem behaviors, and school dropout during adolescence. *Child Development*, *85*, 722-737. doi: 10.1111/cdev.12138

Zamboanga, B. L., Tomaso, C. C., Cloutier, R. M., Blumenthal, H., Kenney, S. R., & Borsari, B. (2016). Drinking game participation among high school and incoming college students. *Journal of Addictions Nursing*, *24*(1), E1. doi: 10.1097/01.JAN.0000481966.33116.a5

Table 1

Demographics by Study Group

Demographics	Control Group (n = 137)	Intervention Group (n = 174)	Total Sample (n = 311)
Age in years, *M* (*SD*)	17.13 (0.45)	17.14 (0.46)	17.15 (0.47)
Sex			
Male	46.7%	42.5%	44.4%
Female	53.3%	57.5%	55.6%
Race/Ethnicity			
White	81.8%	87.9%	85.2%
Hispanic	6.6%	3.5%	4.8%
Asian	5.1%	4.0%	4.5%
African-American	2.9%	0.6%	1.6%
American Indian/Alaska Native	1.5%	1.2%	1.3%
Hawaiian/Other Pacific Islander	0.0%	1.2%	0.7%
Other	2.2%	1.7%	1.9%

Table 2

Means and Standard Deviations for Cognitive Risk Factors at Baseline and Follow-Up Assessments by Study Condition and Sex

		Sex		
		Male[a]	Female[b]	Total Sample[c]
Outcomes		*M (SD)*	*M (SD)*	*M(SD)*
		Perception of Frequency of Peer Drinking		
Control	Baseline	5.47 (1.31)	5.49 (1.02)	5.48 (1.16)
	Follow-Up	5.37 (1.47)	5.57 (0.89)	5.48 (1.19)
Intervention	Baseline	5.37 (1.09)	5.74 (0.88)	5.57 (0.99)
	Follow-Up	5.11 (1.15)	5.35 (1.05)	5.24 (1.10)
		Perception of Frequency of Peer Drunkenness		
Control	Baseline	2.93 (1.15)	3.40 (1.40)	3.19 (1.31)
	Follow-Up	2.97 (1.16)	3.57 (118)	3.29 (1.21)
Intervention	Baseline	3.11 (1.06)	3.90 (1.18)	3.55 (1.19)
	Follow-Up	2.83 (1.08)	3.09 (1.18)	2.98 (1.14)
		Sex-Specific Perception of Heavy Episodic Drinking		
Control	Baseline	2.61 (2.93)	2.69 (2.19)	2.65 (2.55)
	Follow-Up	2.95 (2.81)	3.45 (3.23)	3.22 (3.04)
Intervention	Baseline	2.87 (2.46)	3.03 (2.45)	2.96 (2.44)-
	Follow-Up	2.20 (1.82)	2.59 (2.47)	2.42 (2.21)-

		Positive Alcohol Expectancies		
Control	Baseline	27.73 (7.42)	27.73 (7.11)	27.73 (7.23)
	Follow-Up	27.46 (8.53)	27.49 (6.70)	27.48 (7.57)
Intervention	Baseline	30.52 (6.34)	30.40 (5.38)	30.45 (5.81)
	Follow-Up	28.76 (6.20)	28.77 (7.57)	28.77 (6.97)

[a] Control Group *n* = 57; Intervention Group *n* = 71.
[b] Control Group *n* = 67; Intervention Group *n* = 88.
[c] Control Group *n* = 124; Intervention *n* = 159.

Table 3

Means and Standard Deviations for Protective Behavioral Strategies at Baseline and Follow-Up Assessments by Study Condition and Sex

		Sex		
		Male[a]	Female[b]	Total Sample[c]
		M (SD)	*M (SD)*	*M(SD)*
Control	Baseline	65.81 (10.58)	70.06 (13.32)	68.08 (12.17)
	Follow-Up	63.43 (14.15)	70.63 (12.00)	67.27 (13.40)
Intervention	Baseline	64.19 (11.91)	68.31 (11.70)	68.60 (11.90)
	Follow-Up	65.92 (12.25)	69.36 (15.06)	67.94 (14.00)

[a] Control Group *n* = 21; Intervention Group *n* = 39.
[b] Control Group *n* = 39; Intervention Group *n* = 55.
[c] Control Group *n* = 60; Intervention Group *n* = 79.

Table 4

Means and Standard Deviations for Alcohol Use at Baseline and Follow-Up Assessments by Study Condition and Sex

		Sex		
		Male[a]	Female[b]	Total Sample[c]
Outcomes		*M (SD)*	*M (SD)*	*M(SD)*
		Frequency of Alcohol Use		
Control	Baseline	1.81 (1.26)	1.60 (0.97)	1.69 (1.11)
	Follow-Up	1.67 (0.97)	1.54 (0.94)	1.60 (0.95)
Intervention	Baseline	1.99 (1.08)	2.26 (1.25)	2.14 (1.78)
	Follow-Up	1.99 (1.15)	1.96 (1.09)	1.97 (1.12)
		Peak Drinking Quantity		
Control	Baseline	3.83 (6.74)	1.81 (2.99)	2.73 (5.15)
	Follow-Up	3.49 (6.03)	1.62 (2.98)	2.48 (4.71)
Intervention	Baseline	4.82 (5.52)	5.25 (6.26)	5.06 (5.93)
	Follow-Up	3.86 (4.56)	3.56 (4.40)	3.69 (4.46)

[a] Control Group $n = 57$; Intervention Group $n = 71$.
[b] Control Group $n = 67$; Intervention Group $n = 88$.
[c] Control Group $n = 124$; Intervention Group $n = 159$.

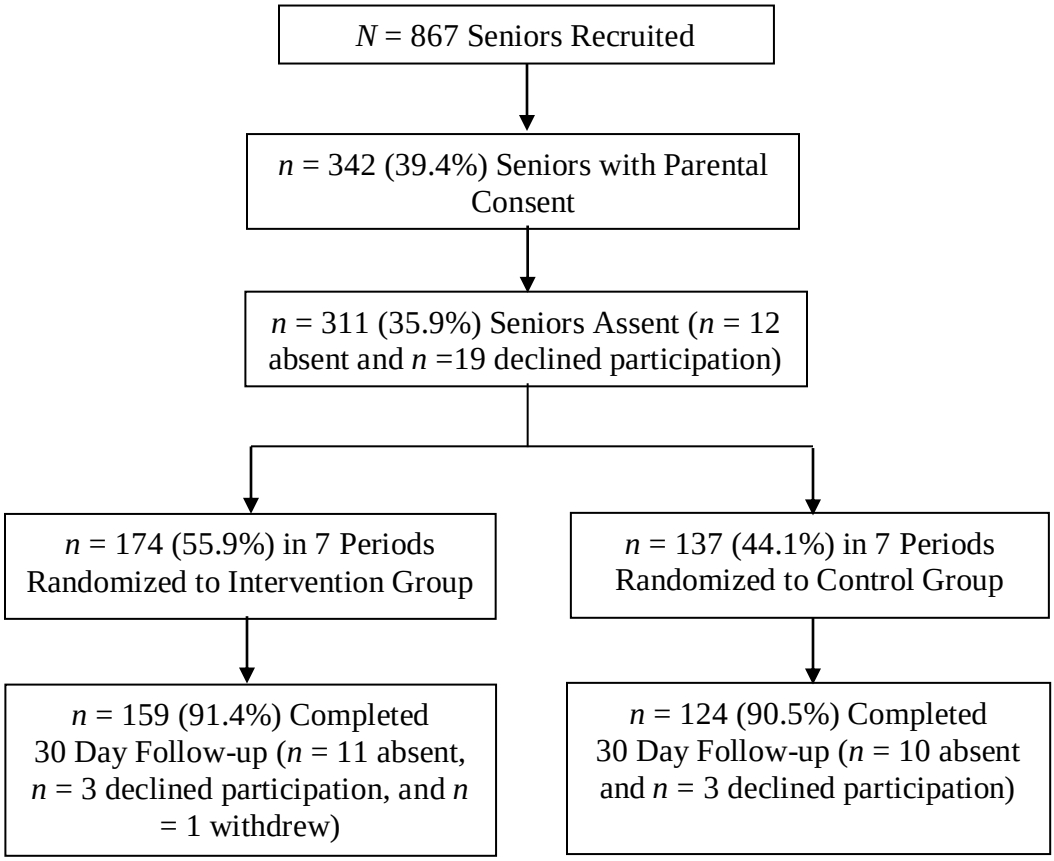

Figure 1. Participant flow diagram