Efficacy of an online intervention to reduce alcohol-related risks among community college students

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Abstract

Problems associated with alcohol use are well-documented among traditional 4-year college students, but less is known about community college students' alcohol use. The few published articles that have investigated alcohol consumption among community college students suggest that risky alcohol consumption is a concern. Online alcohol-related risk reduction programs may be well-suited to community college campuses, due to reduced cost and labour effort, as well as increased accessibility for students. The aim of the current study was to test the efficacy of an online intervention designed to reduce risks associated with alcohol use among community college students. Three hundred and nineteen community college students were randomised to one of two treatment conditions: reviewing the online alcohol-related risk reduction program or reviewing online educational newsletters. Generalised linear mixed models were conducted, testing for mean differences between conditions over time on each outcome (primary analyses: alcohol and other drug use, protective behaviours and consequences of substance use). Exploratory analyses for moderating effects of covariates and user engagement were also conducted. Twelve months after the intervention, students who reviewed the online intervention reported a reduction in the maximum number of drinks consumed on one occasion within the past week and a greater reduction in total drinks consumed within the past week, as compared to students who received educational e-newsletters. Online alcohol-related risk reduction programs for students beginning community college may offer a practical and effective way to reduce alcohol consumption, and may have the potential to increase the wellbeing of a largely underserved population.

Introduction

Problems associated with alcohol use are well-documented among traditional 4-year college students (Hingson & Zha, 2009; National Institute on Alcohol Abuse & Alcoholism [NIAAA], 2002). Forty percent of male college students and 27% of female college students report engaging in heavy episodic drinking (American College Health Association [ACHA], 2014), typically defined as consuming five or more drinks in a row for men, and four or more drinks in a row for women (Wechsler & Austin, 1998; Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994; Wechsler, Dowdall, Davenport, & Rimm, 1995). Heavy episodic drinking is associated with numerous negative consequences (Hingson, Zha, & Weitzman, 2009).

Drinking and drug use are also problems on community college campuses; however, little work has targeted this population, despite the fact that 46% of college students attend community colleges (American Association of Community Colleges [AACC], 2014). The few published articles that address the issue suggest that risky alcohol consumption is a concern (Blowers, 2009; Sheffield, Darkes, Del Boca, & Goldman, 2005; Velazquez et al., 2011; Wall, Bailey-Shea, & McIntosh, 2012) with recent estimates of heavy episodic drinking ranging from 32% to 35% of females and 39% to 50% of males (Velazquez et al., 2011; Wall et al., 2012) ages 18–25. Even less is known about drug use among community college students. Among 18–25 year olds in general, the most commonly used drug is marijuana (19% in the past year), followed by non-medical use of prescription-type drugs (5% in the past year [Substance Abuse and Mental Health Services Administration, 2013]). 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 driving under the influence of alcohol, being assaulted by another student who has been drinking or being the victim of an alcohol-related sexual assault or date rape (Hingson et al., 2009).

Community college students differ from traditional 4-year students in a number of ways that may have implications for alcohol risk reduction programming. On average, community college students are older than their 4-year counterparts and are more likely to be working (62% of full-time community

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college students work at least part-time [AACC, 2014]). Moreover, 17% are single parents (AACC, 2014). The majority of students (75%) live off campus (Epstein, 2007), and 36% are first-generation college students (AACC, 2014).

Alcohol consumption may vary among different groups of community college students (Velasquez et al., 2011; Wall et al., 2012). In a study that included 7965 students at 19 community colleges in a Midwestern state, Wall et al. (2012) found that men (50%) were more likely to be heavy consumers of alcohol than women (35%) and African Americans were the least likely of the racial groups to be heavy consumers (22%). Traditional-aged students (ages 17–24) were the most likely to binge drink (47%). In addition, students who worked reported consuming more than students who did not work, as did full-time students compared to part-time students.

Certain behavioural strategies seem to serve as a protective factor against the experience of alcohol-related problems among 4-year college students and, therefore, may be an important aspect of programming for community college students as well. Examples of strategies include ''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). Students who naturally utilise protective behavioural strategies (PBS) drink less and experience fewer consequences than students who use fewer PBS (Benton et al., 2004; Haines, Barker, & Rice, 2006; Martens et al., 2004; Park & Grant, 2005). Skill-building exercises to increase the use of PBS are often incorporated into alcohol interventions (Scott-Sheldon, Carey, Elliott, Garey, & Carey, 2014) and have been shown to effectively reduce risky drinking among college students.

To the best of our knowledge, there are no widely available, individualised, alcohol risk reduction interventions specifically tailored to community college students; however, a number of individual-level interventions have been found to reduce 4-year college student drinking (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Larimer & Cronce, 2007). Content is typically tailored to the participants, most often at the level of the individual. Interventions are delivered face-to-face by a facilitator to an individual or a group, or via computer and/or printed materials (Carey et al., 2007). In general, there is a lack of such programs on community college campuses, primarily due to low staffing (American College Counseling Association [ACCA], 2013) and limited reach to the large number of students who live off campus (Ottenritter, 2002). Existing online programs often target 4-year college students deemed to be ''at high risk'', such as fraternity and sorority members and athletes (Croom et al., 2009; Walters, Vader, & Harris, 2007). These programs may be perceived as irrelevant to community college students and may in turn decrease the possibility of behaviour change (Krebs, Prochaska, & Rossi, 2010; Lustria et al., 2013).

Computer-based interventions tailored to the needs of community college students may be well-suited to deliver alcohol risk reduction programming to this group of students. Clinician contact is not a necessary component of effective interventions. Mailed feedback and tips have resulted in reduced alcohol consumption among college students (Larimer et al., 2007), as have interventions delivered via computer,

although rarely if the comparison condition included alcohol-relevant content (Carey, Scott-Sheldon, Elliott, Bolles, & Carey, 2009). Moreover, online interventions are less costly than individual- and group-prevention sessions, as they require considerably less staff effort to deliver and can be accessed by students off campus at any time. In addition, widespread Internet access and faster Internet connections (Brenner, 2013) have resulted in more advanced and interactive delivery vehicles (e.g. streaming video and flash memory technology), which may help to increase student engagement. Computer interventions can also be tailored to the individual user; providing personalised information and feedback has been shown to change health-related behaviours more effectively than non-tailored interventions (Krebs et al., 2010; Lustria et al., 2013).

The aim of the current study was to test the efficacy of Wellness & Success, an online intervention designed to reduce risks associated with alcohol and other drug (AOD) use among community college students. The intervention is a component of MyStudentBody (http://www.mystudentbody.com), a suite of online courses that collectively target college student health. Previous studies suggest that MyStudentBody is effective at reducing alcohol-related risks in 4-year college students (Chiauzzi, Green, Lord, Thum, & Goldstein, 2005; Donovan, Wood, Frayjo, Black, & Surette, 2012). We hypothesised that, when compared with a comparison group that received only educational e-newsletters, community college students who received the Wellness & Success online intervention would be more likely to report: (1) decreased AOD use, (2) increased use of PBS while drinking alcohol and (3) decreased negative consequences associated with AOD.

Method

Design

Participants were randomised equally to one of two conditions: the Wellness & Success online intervention or online newsletters. Data were collected at five time points: baseline, the day after the intervention period ended, 3 months post-baseline, 6 months post-baseline and 12 months post-baseline.

Recruitment

Students were recruited using a convenience sample of 10 community colleges in the US. All geographical regions, sizes and settings (urban/rural/suburban) were represented. Number of students recruited from each site ranged from 4 to 102, with 28 being the median. An email invitation to the study was sent from the college to incoming freshman students. Other recruitment efforts included posting the study on the institutions' intranet webpages and distributing study flyers around campus. Potential participants were directed to an online consent form, and students who agreed to participate were directed to an online screening form to determine their eligibility. Inclusion criteria for the study were as follows: (a) intent to complete a degree or certificate program, (b) aged 18–25 years, (c) enrolled as incoming freshmen and (d) reported alcohol use in the past 2 weeks. ''Intent to complete a degree or certificate program'' was included to

target students taking classes for credit (the intervention's target group), versus those taking non-credit classes (e.g. to learn a new hobby or for professional development).

Experimental and comparison conditions

The experimental group viewed the Wellness & Success online intervention. (This intervention is also part of the MyStudentBody suite of college health programs, but differs from the alcohol risk reduction intervention for 4-year college students described and tested by Chiauzzi et al. in 2005.) The intervention took approximately 120 min to complete. Content was tailored to 18- to 25-year-old students, who are at the highest risk for substance use (SAMHSA, 2013) and also comprise the largest group of community college students (AACC, 2014). The intervention addressed factors that specifically reflect the life circumstances of the average community college student (e.g. the increased likelihood, as compared to 4-year students, of working while in college, being a single parent or being a first-generation college student). The intervention also focused on campus-related factors (e.g. the increased likelihood, as compared to 4-year colleges, of being a commuter campus and of having fewer health and wellness resources on campus).

Students began by answering approximately 20 questions that tapped into their knowledge and beliefs and were then presented with personalised feedback. Personalised feedback was created by two psychologists (authors E.D. and E.C.) and was similar to Neighbors, Larimer, & Lewis (2004), a feedback intervention modelled after the normative feedback component of the BASICS intervention (Dimeff, Baer, Kivlahan, & Marlatt, 1999). However, the new feedback scheme was more detailed and included eight of the 11 components identified in Miller et al.'s (2013) review of personalised feedback interventions: (1) a drinking profile (typical quantity and frequency of alcohol use); (2) normative comparison of personal data (descriptive norms, percentile comparison and explanation of percentile, with an age-specific – but not gender-specific – reference group. Normative data provided for comparison were drinking quantity and frequency); (3) educational information about alcohol and its effects; (4) risk factors for future consequences (using data on past consequences); (5) estimated levels of intoxication associated with a peak drinking occasion (including estimated peak blood alcohol content); (6) strategies to limit risk (including behavioural strategies to limit consumption and protective strategies to limit risk exposure); (7) negative consequences of alcohol use reported by the individual; and (8) contact information for local referral or information sources (provided by the participating colleges).

Feedback also addressed marijuana use and prescription drug (opioid and stimulant) misuse, but was limited to a personalised profile (frequency of use), normative feedback (frequency of use using an age-based referent) and skills and tips for changing one's use.

After receiving the feedback, students were directed to a table of contents. Students could not proceed beyond the page until each piece of content (text and/or video based) had been opened. To encourage engagement with the program, students were notified that they would be given a knowledge test after reviewing the content. Articles and videos focused on the following: the definition of a ''standard drink'' and ''binge drinking'', factors affecting alcohol absorption, the biphasic effect, drug interactions, common expectancies associated with alcohol use, the use of PBS, misperceptions about alcohol use, recognising alcohol poisoning, refusal strategies, cognitive-behavioural skills training (e.g. planning out how much to drink before attending social events) and the impact of alcohol on academic success. Supplementary material was presented in two other modules. Alternative strategies for coping with stress were presented in the Balance module, with text and video focusing on stress management, e.g. recognising signs of stress, balancing work and college, finding social support and making time for sleep and physical activity. In the College Community module, educational information was presented to increase awareness about typically available campus support services, e.g. the counselling office, disability services and services for veterans (Center for Community College Student Engagement, 2005). In an attempt to maintain any behaviour change brought about by the intervention, monthly booster emails were sent to participants in the experimental condition. Each email included one new college health article (focusing on either AOD, coping or campus resources) along with a recommendation to visit the intervention website.

The comparison condition also received an active intervention: three educational newsletters. The newsletter content matched the content of each respective intervention module (AOD, alternative coping strategies and campus resources). Each newsletter was emailed sequentially over the course of the intervention period in an order that matched how the intervention modules were presented. The newsletter content was gathered from publicly available websites, including the Centers for Disease Control and Prevention, the US Department of Education and the National Institute on Alcohol Abuse and Alcoholism. In addition, the comparison group received monthly booster emails with links to relevant health information.

Procedure

Students were randomised to the experimental or comparison group using stratified block randomisation (Kernan, Viscoli, Makuch, Brass, & Horwitz, 1999), where gender and race were the strata. Approximately 2 weeks into the fall semester, students were instructed via email to complete the baseline assessment within a 2-week period. All data were collected using online software (Vovici Corporation, 2012), and were stored in a secure database. The intervention began immediately after baseline. Students in the experimental group were instructed via email to review the three modules that comprise the Wellness & Success intervention. The time commitment was approximately 40 min per content module, and students were given 2 weeks to complete the entire intervention. Students in the comparison group were instructed via email to view three e-newsletters over a period of 2 weeks. Students were contacted up to three times to encourage assessment completion, and were paid up to $150 for completing all the assessments. The study was approved by New England Institutional Review Board.

Measures

Demographic characteristics assessed at baseline included age, race, ethnicity, gender, marital status, number of children, employment status, college enrolment status (full-time versus part-time) and living arrangement (e.g. with parents, on campus, off-campus with own children).

Alcohol and other drug use was assessed by asking participants to report (1) the number of days they consumed alcohol within the last 30 days, and (2) the number of standard drinks they consumed each day within the past week. Heavy episodic drinking was assessed by asking participants to report how many days in the last 2 weeks they had consumed at least four (for women) or five (for men) standard drinks in a row (NIAAA, 2013). Participants were also asked to report the number of days within the last 30 days in which they had used an illicit drug or engaged in non-medical use of a prescription opioid or stimulant.

Rutgers Alcohol Problem Index ([RAPI]; White & Labouvie, 1989) is a 23-item, self-administered screening tool for assessing problem drinking, appropriate for college students. Responses are measured on a Likert scale ranging from 0 ''None'' to 3 ''More than five times'', and require students to indicate whether and how often they have experienced consequences impacting their personal, social or academic functioning. The RAPI has been shown to have strong internal consistency; Bosari and Carey (2000) reported an internal consistency of 0.85 in their study of brief motivational interventions among college students. Correlations between RAPI and alcohol-use intensity have been found to be moderately strong for all age groups, ranging from 0.20 to 0.57 (White & Labouvie, 1989).

Short Index of Problems – Drugs (SIP-D; Alterman, Cacciola, Habing, Ivey, & Lynch, 2009) is a 15-item measure designed to assess the adverse consequences of drug use. Responses are measured on a Likert scale ranging from 0 ''Never'' to 3 ''Daily or almost daily''. Factor analyses revealed that one main factor accounts for the majority of variance. Internal consistency reliability estimates for the SIP-D total scores have been found to be 0.97 in a study with substance use-disordered outpatients. Concurrent validity was demonstrated by examining the correlation between the SIP-D score and the Addiction Severity Index (ASI-Version 6) drug problem summary score of 0.61 (Alterman et al., 2009).

The Protective Behavioral Strategies Scale ([PBSS]; Martens, Pedersen, LaBrie, Ferrier, & Cimini, 2007) consists of 15 self-report items to measure the frequency of using protective behaviours while consuming alcohol. It has three subscales: limiting/stopping drinking, manner of drinking and serious harm reduction. Responses are measured on a 6-point scale which range from ''Never'' to ''Always''. In a study involving undergraduates, Martens et al. (2007) demonstrated strong psychometric properties for the PBSS. Internal consistency values for the three subscales were found to be 0.81, 0.73 and 0.63 for limiting/stopping drinking, manner of drinking and serious harm reduction, respectively. The PBSS subscales demonstrated negative correlations with all alcohol consumption variables and RAPI scores, thereby supporting the convergent validity of the measure (Martens et al., 2007).

Statistical analysis

Data analyses were carried out in the following steps: (1) computing descriptive statistics for baseline student characteristics; (2) testing for differences in demographics between conditions; (3) testing for mean differences between conditions over time on each outcome (primary analyses); and (4) conducting exploratory analyses for moderating effects of covariates and user engagement. A generalised linear mixed model (GLMM) approach was used in steps 3 and 4 because of its ability to handle missing data and to model co-variation (using flexible covariance structures among repeated measures). An unstructured residual variance covariance structure was used for all analyses.

Models for the primary analyses included the following fixed effects: (1) condition (experimental vs. comparison), (2) time (baseline, post-intervention, 3 months post-baseline, 6 months post-baseline and 12 months post-baseline) and (3) condition-by-time interaction. The primary analyses focused on the condition-by-time interaction, as this effect tests differences between conditions over time.

Moderation analyses (step 4) examined whether or not the magnitude of intervention effects differed by gender (male versus female), race (White versus non-White), enrolment status (full-time versus part-time) or employment (full-time versus part-time). The analyses also considered the potential differential effects of user engagement on the outcomes; participants who completed the AOD module were considered to be ''engaged'' in the study and those who did not complete the module were classified as ''not engaged''.

Exploratory models were constructed to test for moderating effects, with condition, time, the moderating variable and the higher order interactions as the fixed effects; *post hoc* tests with multiplicity adjustments (LSMESTIMATE statement in SAS) were performed if the three-way interaction effect (condition × time × moderator) was significant. *p* Values reported for *post hoc* comparisons were thus corrected for Type I error; the level of significance was set at $\alpha = 0.05$ for each analysis. All analyses were performed using SAS, version 9.3 (SAS Institute, Inc., 2011). The GLIMMIX procedure was used for GLMM with the DIST and LINK option to specify the distribution of the data and the appropriate user-defined link function. For the AOD outcomes, a Poisson distribution with a log link (maximum drinks), or a binomial distribution with a logit link (drinks per week), was employed; regressions for all other outcomes fit a normal distribution.

Results

Participant selection

Over a third (35%) of students did not meet eligibility criteria (80% due to alcohol consumption, 17% due to age and 3% did not plan to obtain a degree or certificate). Overall, 415 subjects were randomly allocated to either the experimental ($n = 207$) or comparison ($n = 208$) condition. The final study sample was limited to the 319 participants who completed the baseline assessment (159 in the experimental group and 160 in the comparison group). A total of 244 participants (118 in the experimental group and 126 in the comparison group) completed the 1-month follow-up assessment. Two hundred

and sixty-one participants (121 experimental group and 140 comparison group) completed the 3-month follow-up assessment, 247 participants (112 experimental group and 135 comparison group) completed the 6-month follow-up assessment, and 244 participants (118 experimental group and 126 comparison group) completed the 12-month follow-up assessment. Complete participant enrolment and follow-up details are documented in Figure 1.

Of students who took the baseline assessment, 73% were female, 77% were White and 14% were Hispanic (as compared to demographics of students enrolled for credit nationally: 57% female, 50% White and 21% Hispanic [AACC, 2014]). The participants' average age was 21.4 years (SD = 2.2). Due to a time gap between initial recruitment and baseline assessment, most, but not all, participants (89%) reported consuming alcohol in the past 30 days. Analyses included all participants.

As for heavy episodic drinking, 53% reported consuming five or more drinks (four or more for women) at a sitting in the past 2 weeks. Baseline and demographic characteristics were not statistically different between study conditions. Refer to Table 1 for details about the study sample.

Primary outcomes

Significant condition-BY-time effect was noted for the following alcohol use outcomes: (1) total drinks (in the past week) and (2) maximum number of drinks on one occasion (in the past week). Specifically, a significant overall effect of condition-BY-time was noted for total drinks ($F_{4,317} = 3.39$, $p = 0.010$, $d = 0.21$) and maximum drinks ($F_{3,317} = 3.29$, $p = 0.012$, $d = 0.20$). *Post hoc* analysis with adjustments for multiple comparisons indicated that the participants in the
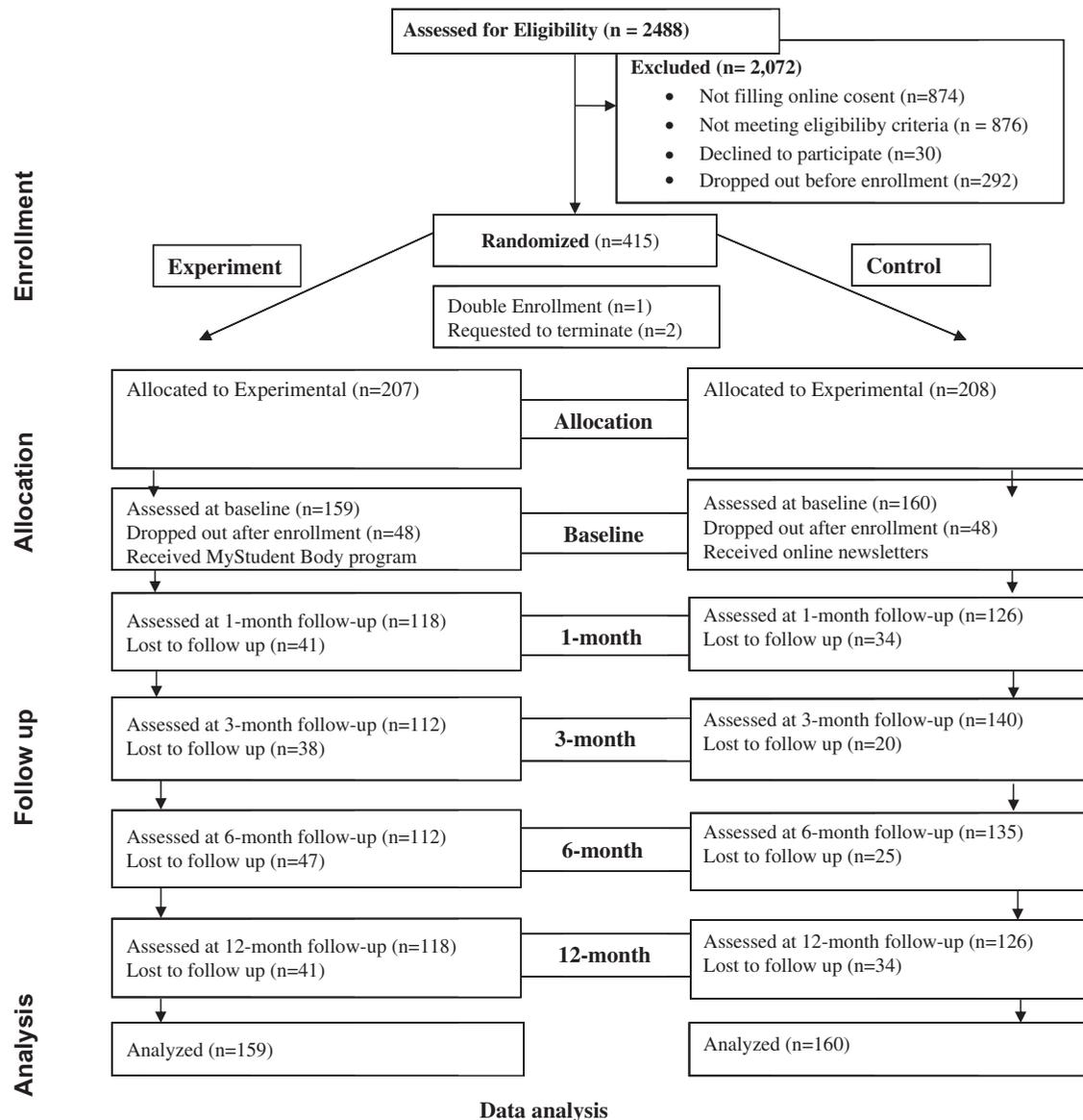
The study was designed with an intent-to-treat approach and the goal was to follow as many participants as possible, regardless of their completion of intervention. It should be noted that participants who did not take the baseline assessments were nonetheless invited to participate in the follow up assessments. However, these subjects (n=25) were not included in the study sample due to missing demographic information. Further, due to technical issues with data collection, 25 participants could not be identified at 1 month post-intervention assessment.

Figure 1. Participant flow diagram.

experimental condition reported a greater reduction in total drinks consumed within the past week from baseline to 6-month follow-up ($t = -2.44$, $p = 0.050$, $d = 0.27$), and from baseline to 12-month follow-up ($t = -2.41$, $p = 0.055$, $d = 0.27$; Figure 2). Participants in the experimental condition also reported greater reductions in the maximum number of drinks consumed on one occasion within the past week from baseline to 3-month follow-up ($t = -2.58$, $p = 0.038$, $d = 0.29$), and from baseline to 12-month follow-up ($t = -2.61$, $p = 0.035$, $d = 0.29$), as compared to the comparison participants (Figure 3).

After adjusting for baseline scores, there were no statistically significant condition-BY-time effects for heavy episodic drinking, drinking days, other drug use or use of PBS (total score or subscales), and no observed intervention effects on negative consequences associated with AOD use over the follow-up period. Refer Table 2 for least squares means and standard errors for outcome measures.

Table 1. Baseline characteristics of community college students.

	Experimental ($n = 159$)	Control ($n = 160$)	Total ($n = 319$)	Test statistic	p Value
Age (years, Mean ± SD)	21.4 (2.2)	21.5 (2.2)	21.4 (2.2)	0.71	0.48
Gender – Female	114 (71.7)	119 (74.4)	233 (73.0)	0.29	0.59
Race				4.17	0.53
White/Caucasian	120 (75.5)	127 (79.4)	247 (77.4)		
Black/African American	13 (8.2)	10 (6.3)	23 (7.2)		
Native American/Alaskan Native	1 (0.6)	2 (1.3)	3 (0.9)		
Asian	1 (0.6)	4 (2.5)	5 (1.6)		
Multi-racial	8 (5.0)	7 (4.3)	15 (4.7)		
Other	16 (10.1)	10 (6.2)	26 (8.2)		
Ethnicity – Hispanic	26 (16.4)	21 (13.1)	47 (14.7)	0.66	0.42
Marital Status				1.16	0.76
Single	145 (91.2)	143 (89.4)	288 (90.3)		
Married	12 (7.5)	14 (8.8)	26 (8.2)		
Separated	0 (0.0)	1 (0.6)	1 (0.3)		
Divorced	2 (1.3)	2 (1.2)	4 (1.2)		
Have Children	35 (22.0)	30 (18.8)	65 (20.4)	0.52	0.47
Employed	116 (73.0)	113 (70.6)	229 (71.8)	0.21	0.64
Hours[a] (Mean ± SD)	26.6 (10.5)	23.6 (9.9)	25.1 (10.3)		
Living off campus	154 (96.9)	155 (97.5)	309 (97.2)	1.41	0.99
Full-time students	120 (75.5)	113 (71.1)	233 (73.3)	1.97	0.37
Educational goal				3.30	0.19
Transfer to 4-year college	101 (63.5)	91 (57.2)	192 (60.4)		
Associates degree	48 (30.2)	62 (39.0)	110 (34.6)		
Certificate	10 (6.3)	6 (3.8)	16 (5.0)		
Heavy episodic drinking	83 (52.2)	87 (54.4)	170 (53.3)	0.15	0.70
Nonmedical use of Rx drugs					
Opioids	10 (6.3)	5 (3.1)	15 (4.7)	1.78	0.18
Stimulants	6 (3.8)	11 (6.9)	17 (5.3)	1.52	0.22

Data expressed as N (%), unless otherwise mentioned. Test-statistic and p value was calculated using t-test for continuous variables (age, hours) and chi-square test for categorical variables for comparison between experimental and control conditions. No adjustments were made for multiple comparisons. Baseline demographic data was incomplete for one participant.
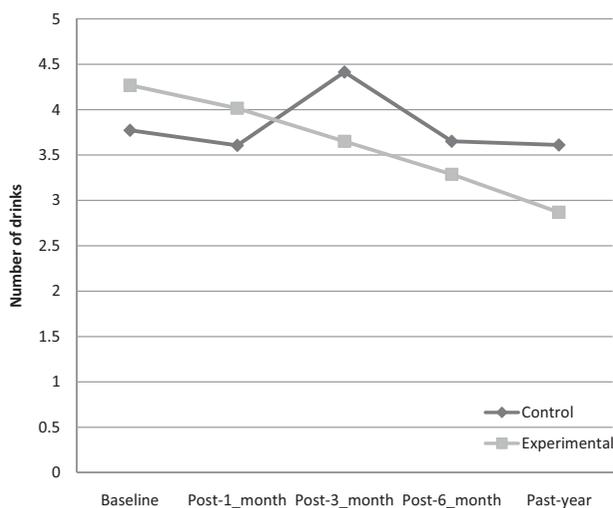[a]Limited to students who were employed ($N = 229$).

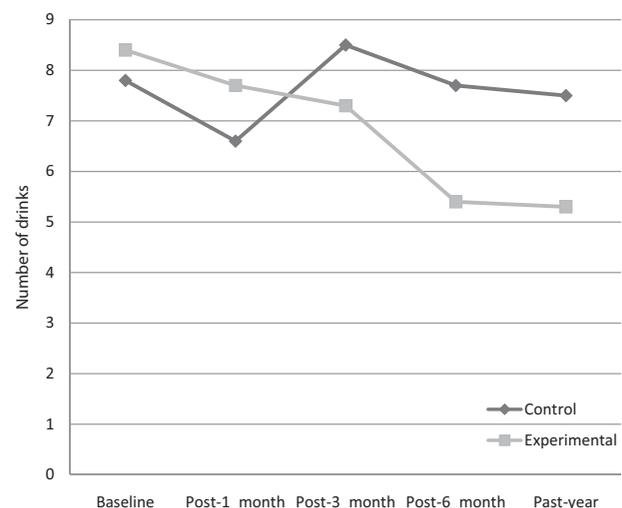Figure 2. Maximum number of drinks per drinking occasion in the past week.

Figure 3. Total number of drinks in the past week.

Table 2. Least square means and standard errors for all outcome measures.

	Experimental					Control				
	Baseline	Post	3-Month	6-Month	12-Month	Baseline	Post	3-Month	6-Month	12-Month
Alcohol use										
Days used (past 30 days)	6.4 (0.07)	6.1 (0.08)	6.2 (0.08)	4.7 (0.10)	6.0 (0.08)	5.4 (0.08)	6.0 (0.08)	5.5 (0.08)	6.4 (0.07)	6.1 (0.08)
Total drinks (past week)	8.4 (0.95)	7.7 (0.81)	7.3 (0.90)	5.4 (0.79)[b]*	5.3 (0.73)	7.8 (0.92)	6.6 (0.73)	8.5 (0.92)	7.7 (0.89)[b]*	7.5 (0.83)
Max. drinks (past week)	4.3 (0.34)	4.0 (0.37)	3.7 (0.37)[a]*	3.3 (0.34)	2.9 (0.30)[c]*	3.8 (0.32)	3.6 (0.34)	4.4 (0.38)[a]*	3.7 (0.34)	3.6 (0.33)[c]*
Heavy episodic drinking (% endorsed)	52.2 (0.04)	54.2 (0.04)	56.0 (0.04)	47.1 (0.05)	44.6 (0.05)	54.4 (0.04)	47.2 (0.04)	56.0 (0.04)	50.7 (0.04)	49.4 (0.04)
Substance use (past 30 days)										
Tobacco	8.3 (0.11)	8.2 (0.12)	8.0 (0.12)	7.4 (0.13)	7.0 (0.13)	7.1 (0.13)	7.1 (0.13)	6.0 (0.14)	8.3 (0.11)	8.2 (0.12)
Marijuana	2.3 (0.23)	2.2 (0.24)	2.0 (0.25)	2.3 (0.25)	2.8 (0.20)	2.1 (0.23)	2.7 (0.21)	2.5 (0.23)	2.3 (0.23)	2.2 (0.24)
Other illegal drugs	3.7 (0.18)	3.2 (0.20)	2.9 (0.21)	3.3 (0.21)	3.5 (0.18)	3.1 (0.20)	3.6 (0.18)	3.4 (0.20)	3.7 (0.18)	3.2 (0.20)
Protective behaviour										
Sum score	51.1 (1.25)	50.8 (1.46)	50.4 (1.52)	52.6 (1.64)	53.2 (1.62)	52.3 (1.24)	51.7 (1.42)	50.1 (1.45)	50.1 (1.55)	50.1 (1.55)
Limiting	20.3 (0.69)	20.3 (0.82)	20.3 (0.80)	21.4 (0.91)	21.6 (0.89)	21.2 (0.69)	20.4 (0.80)	19.9 (0.76)	19.9 (0.86)	19.7 (0.84)
Manner	17.5 (0.47)	17.5 (0.53)	17.6 (0.56)	17.8 (0.59)	18.0 (0.58)	17.8 (0.47)	18.1 (0.52)	17.3 (0.54)	16.9 (0.55)	18.0 (0.56)
Harm reduction	13.4 (0.35)	13.0 (0.41)	12.6 (0.42)	13.5 (0.43)	13.7 (0.43)	13.3 (0.35)	13.2 (0.40)	13.0 (0.40)	13.4 (0.40)	13.3 (0.41)
Consequences†										
Alcohol related – sum score	–	–	–	–	3.4 (0.49)	–	–	–	–	3.4 (0.46)
Drug related										
Sum score	–	–	–	–	5.0 (1.18)	–	–	–	–	4.0 (1.13)
Personal	–	–	–	–	2.7 (0.62)	–	–	–	–	1.9 (0.59)
Physical, social and financial	–	–	–	–	2.2 (0.64)	–	–	–	–	2.0 (0.61)
DUI	–	–	–	–	0.02 (0.03)	–	–	–	–	0.002 (0.01)

Pairwise *post hoc* contrasts between experimental and control groups for the change in prevalence for heavy episodic drinking and mean change in differences for all other outcomes.

[a,b,c]Unique superscripts indicate significant pairwise *post hoc* tests (adjusted $p < 0.05$).

*Change by condition-BY-time compared to baseline.

†It should be noted that measures pertaining to consequences associated with alcohol and substance use differed in their assessment recall periods. As such, to test for an association between intervention and outcome (consequence at 12-month follow-up), we constructed linear regression models with the 6-month score as the dependent variable, controlling for condition and the baseline score as independent variables.

Moderation analyses

Race moderated the effect of the intervention on the primary outcomes. Statistically significant three way-interactions (condition by time by race) were detected for the total number of drinks consumed in the past week ($F_{4,315} = 2.89$, $p = 0.022$, $d = 0.19$). *Post hoc* analyses adjusted for multiple comparisons revealed that students in the experimental condition who were of White race showed a significant reduction in the total number of alcoholic drinks consumed in the past week from baseline to 6-month follow-up ($t = -3.16$, $p = 0.013$, $d = 0.40$), and from baseline to 12-month follow-up ($t = -2.84$, $p = 0.035$, $d = 0.36$), as compared to the comparison condition; no such change was noted for non-White students. There were no moderation effects found for gender, enrolment status (full-time versus part-time) or employment status (full-time versus part-time).

Engagement

Regarding potential moderation by engagement status, about half of participants in the experimental condition ($n = 102$) completed all of the modules, with an additional five completing only the AOD module and one person completing the AOD and the coping skills module. Notably, participants who completed the AOD module, versus those who did not, were less likely to require developmental courses (76% versus 93%, $p = 0.006$, $d = 0.45$). Developmental courses are pre-college courses designed to raise a student's skill level to college standards (Bailey, 2009). Level of engagement was not significantly associated with improved outcomes over the follow-up period.

Discussion

The purpose of this study was to examine the effect of an online, alcohol-related risk reduction program administered to community college students within the first 2 weeks of freshman year. Our hypotheses were partially supported. Alcohol consumption decreased among students who reviewed the Wellness & Success alcohol risk reduction program, relative to the comparison condition. However, no change was noted in the use of PBS or in the experience of negative consequences. A number of other computer-delivered interventions have been found to reduce alcohol use in 4-year college students (Carey et al., 2009). However, interventions are typically compared to assessment-only controls. In our study, the intervention group was compared to a group of students who received educational content matched to the Wellness & Success intervention. In addition, there are no other computer-based interventions that tailor content specifically to community college students. Our results extend the current literature by suggesting that an online alcohol risk reduction program is an effective way to change alcohol-related behaviours among community college students in the short term. Our study also indicates that a decrease in alcohol consumption is sustainable after 1 year.

There were two findings of primary interest that occurred at 12 months post-intervention. First, students who were asked to review the Wellness & Success online module reported a reduction in the maximum number of drinks consumed on one occasion within the past week, as compared to students who received educational e-newsletters only. Second, those who reviewed the module reported a greater reduction in total drinks consumed within the past week, as compared to students who received the educational e-newsletters only. Taken together, these results suggest that tailored online programs may be an effective way to reduce alcohol consumption among community college students. To the best of our knowledge, this is the first online alcohol risk reduction program designed specifically with community college students in mind, and the first study to demonstrate that such an intervention can reduce alcohol consumption among these students. Moreover, a reduction in alcohol consumption was maintained at 12 months post-intervention, making a compelling case for the value of online programming within this student population.

We did not find any differences between the experimental and comparison groups with respect to PBS use or AOD-related negative consequences. In general, very few negative consequences were noted. Negative consequences are associated with heavy episodic drinking (Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002); however, given practical limitations around recruitment, we were only able to recruit around 50% heavy episodic drinkers. A higher proportion of heavy episodic drinkers in our sample may have resulted in a higher proportion of negative consequences, thus potentially increasing the likelihood of effecting change in this outcome. Similarly, drug use was reported by very few students, making it difficult to draw conclusions about any possible effect of the intervention on this behaviour.

White students showed a significant reduction in the total number of drinks consumed in the past week, whereas no such change was noted for non-White students. One possible explanation may be that the intervention itself was more relevant to White students (e.g. if non-White students were less likely to be working, much of the content geared towards balancing work and college life would not be relevant); however, no such difference was apparent based on the demographic information that we captured. Another possibility is that because of the relatively small numbers of non-White participants, we were unable to detect any change caused by the intervention.

Regarding engagement with the intervention, our data indicated that participants who did not complete the AOD module were more likely to require developmental courses, pre-college courses designed to raise a student's skill level to college standards (Bailey, 2009). One possible explanation for this finding is that the content of the intervention was more appealing to students who did not require developmental courses, perhaps as a result of literacy level.

Several limitations to the current study should be noted. First, the age range of our sample was restricted to ages 18–25. As such, our findings are not generalisable to the broader community college student population. Our decision to limit the target age group was based on evidence suggesting that tailoring programs increase relevance and the possibility of behaviour change (Strecher & McPheeters, 2006). Second, 73% of the students who participated in our study were female, which is higher than the proportion of females (57%)

within the US community college student population (AACC, 2014). A consequence of this gender imbalance might be a skew away from heavier drinkers who are more likely to be male (SAMHSA, 2013). Third, students in our study were recruited from a convenience sample of 10 colleges. These colleges represented the four major geographic regions in the US, but they did not allow for a representative sample of all community college students; thus, the findings may not be generalisable to the full range of community college students. In addition, while the sample size was appropriate for the goal of the efficacy study, community college students are extremely diverse and a larger sample size is required to examine differences within subgroups. For example, Wall et al. (2012) found that a number of student characteristics were associated with alcohol consumption, such as full-time work status and living in newly emerging community college residence halls.

Attrition in our study was also quite high, which can serve a source of bias. Attrition occurred despite a number of strategies that were included in the procedure to guard against it, including graduating participant payments, collecting more than one email address and contacting participants more than once to encourage participation in follow-up assessments. We did not collect information about why participants did not complete the study; however, community college students are more likely to be juggling multiple responsibilities, such as work and family life, as compared to 4-year students (AACC, 2014), and therefore may have been unable to dedicate time to completing the requirements of a study. The intervention also takes approximately 120 min to complete, but we do not have information on the average amount of time spent reviewing the content. Finally, we did not collect information about participant satisfaction with the study; such information may have given some insight into challenges such as attrition.

Despite these limitations, our findings have broad implications for college AOD prevention efforts. To begin, it is worth noting that the time needed to complete the intervention (~2 h) was on the longer side for an online intervention (Elliott, Carey, & Bolles, 2008). The benefit of a program with more content is that the program may be more engaging, as it allows for a range of delivery approaches such as video-based peer stories and online tools that can be easily manipulated. On the other hand, personalised, feedback-only interventions (Riper et al., 2009) require less of a time commitment on the part of students. Still, as noted earlier, it is difficult to implement AOD prevention programming on community college campuses due to low staffing and limited reach to students who reside off campus. The results of the current study suggest that an online alcohol risk reduction program may be a practical solution to these challenges by offering programming that can be accessed off-campus with little staff involvement.

Our results also suggest directions for future studies. We tailored the Wellness & Success course to community college students ages 18–25 only. Future studies may tailor interventions to various subgroups of community college students. Providing normative feedback to students is an effective and popular component of alcohol risk reduction interventions but, as others (Lewis & Neighbors, 2008) have suggested, careful consideration must be given to the reference group to increase chances of health behaviour change. The question of who should serve as a reference group for community college students is worth exploring. Community college students, who are typically working and spending little time on campus, are less integrated into college life. It is possible that they may identify more strongly as a worker, for example, than as a student. Future research might explore which group might serve as the most appropriate reference group for the normative feedback component of alcohol interventions.

Over the last several years, community college student enrolment has soared (AACC, 2014); however, retention is low compared to 4-year colleges (NCHEMS Information Center for Education Policymaking and Analysis, 2011). As a result, student success courses are increasingly being offered by colleges (Fain, 2012). Given the impact of alcohol on academic success (Pascarella et al., 2007; Porter & Pryor, 2007; Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Hang, 1998; Wolaver, 2002), a skill-focused alcohol risk reduction program may be a positive addition to these types of courses. Most community colleges now offer a range of online courses (AACC, 2014), suggesting that an online program would likely present few implementation challenges.

In conclusion, online alcohol related risk reduction programs for students beginning community college may offer a practical and effective way to reduce alcohol consumption, and may have the potential to improve the health and wellbeing of a largely underserved student population.

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