

This clinical trial evaluates The Drinker's Check-Up,
a CheckUp & Choices' digital intervention now named "CheckUp—Alcohol."

Evaluation of Two Web-Based Alcohol Interventions in the U.S. Military*

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ABSTRACT. Objective: The U.S. military has traditionally had high rates of alcohol misuse and alcohol-related problems, necessitating effective treatment programs that minimize participant burden. Web-based interventions have shown promise as efficient treatment options for college students and adults but have not been widely evaluated in the military. This study evaluated the efficacy of two web-based alcohol interventions originally created for civilians and then adapted for U.S. military personnel. **Method:** Two web-based alcohol interventions, Alcohol Savvy and Drinker's Check-Up, were adapted for use among military populations. The interventions were evaluated using a convenience sample of 3,070 active-duty military personnel at eight installations. Following a baseline survey, participants were assigned to one of three treatment conditions: (a) Alcohol Savvy, (b) Drinker's Check-Up, or (c) control (no program participation). Follow-up surveys were completed by 1,072 participants

1 month following baseline and by 532 participants 6 months following baseline. **Results:** At 1-month follow-up, participants who completed the Drinker's Check-Up intervention had significant reductions in multiple measures of alcohol use relative to controls. Positive outcomes were found for average number of drinks consumed per occasion, frequent heavy episodic drinker status, and estimated peak blood alcohol concentration. These reductions in alcohol use at the 1-month follow-up were maintained at the 6-month follow-up. There were no statistically significant changes in alcohol use for participants who completed Alcohol Savvy. **Conclusions:** This study expands the literature on the effectiveness of web-based treatment for alcohol misuse. Findings indicate that web-based programs (Drinker's Check-Up in particular) can significantly decrease several indicators of alcohol use in U.S. military personnel. (*J. Stud. Alcohol Drugs*, 72, 480–489, 2011)

ALCOHOL MISUSE AND ITS CONSEQUENCES are recognized problems among military personnel. Rates of frequent heavy episodic drinking (defined as drinking five or more [men] or four or more [women] drinks on one occasion [at the same time or within a couple of hours of each other] in the past month) are consistently higher among military personnel than among demographically similar civilians (Bray et al., 1991, 2009). This is particularly true of young male personnel (ages 18–25), who are significantly more likely than their civilian counterparts to engage in such drinking behavior (26% vs. 16%; Bray et al., 2009). According to the 2008 Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel (DoD HRB Survey), there were reductions in the number

of personnel classified as frequent heavy episodic drinkers in the military from 1980 to 1998 (21%–15%), followed by an increase from 1998 to 2002 (15%–18%). This increase was sustained in 2005 (19%) and 2008 (20%) (Bray and Hourani, 2007; Bray et al., 2009). Alcohol misuse in the military has been linked to negative consequences, such as blackouts, fighting, drunken driving, domestic violence, and other negative social and/or health outcomes (Taylor et al., 2007). Furthermore, military personnel who drink heavily are at increased risk for incidence of stress fractures (Lappe et al., 2001), other injury risk (Henderson et al., 2000), work productivity loss (Fisher et al., 2000), and motor vehicle injury (Bell et al., 2000).

Much recent attention has been given to the potential of web-based programs to encourage changes in health-related behaviors, such as alcohol use. Web-based approaches for health interventions can engage users in a creative, interactive manner that helps to foster user interest and helps to stimulate self-exploration of salient health and therapeutic topics. These anonymous interventions can circumvent the problem of provider reluctance to initiate discussion about alcohol use (Kypri et al., 2004), which may be especially important in military populations, where disclosure of alcohol problems could have negative career effects. The absence of a personal encounter may also increase honesty and openness of responses (Van Sickle and Sokolow, 2006) and reduce defensiveness when confronted with feedback about drinking behavior (Kypri et al., 2004). In their review of an anonymous alcohol screening

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website that provided assessment and individualized feedback, Saitz et al. (2004) found greater proportions of problem and hazardous drinkers than are typically found in face-to-face screenings (e.g., Greenfield et al., 2003). Web-based programs also can be an effective way to offer low-cost interventions to a large number of individuals.

Evaluations of web-based alcohol programs, conducted primarily with college students, have shown that these brief interventions can be effective in curbing alcohol misuse. Decreases relative to control participants have been shown for estimated peak blood alcohol concentration (BAC; Hester et al., 2005; Walters et al., 2007), number of drinks consumed per drinking occasion or per week (Hester et al., 2005; Walters et al., 2007), frequent heavy episodic drinking (Kypri et al., 2004), total consumption (Kypri et al., 2004), and alcohol-related consequences (Hester et al., 2005; Kypri et al., 2004). Neighbors et al. (2004) demonstrated intervention effects on factor scores for an aggregate measure of alcohol use that included drinks per week, alcohol-related consequences, peak BAC, and pattern of alcohol use.

Web-based alcohol interventions developed for the military have also shown promise. Hurtado et al. (2003) developed an alcohol intervention for the Marine Corps that included a web-based component that provided personalized feedback and tailored educational information. Participant ratings indicated that the format was well received, with 85% reporting that the web format was preferable over other methods of alcohol training (e.g., classroom training), and 80% believed that the personalized feedback they received was appropriate (Simon-Arndt et al., 2006). The efficacy of this web-based program in reduction of alcohol use was not evaluated, and we are not aware of any other study that directly tested the efficacy of a web-based alcohol intervention in active-duty military personnel.

The Program for Alcohol Training, Research, and Online Learning (PATROL) was a pilot program designed to assess the effectiveness of web-based interventions in the military. PATROL consisted of an adaptation of existing civilian programs for use with military personnel and a subsequent evaluation of the impact of these programs. Two interventions were selected because the diverse drinking experience of military personnel suggested that a single program may not fully meet the needs of this population. The first program was Alcohol Savvy (AS), a universal, primary prevention program aimed at adults in the workplace. The second was the Drinker's Check-Up (DCU), a brief motivational intervention designed to reduce alcohol misuse among adult high-risk drinkers. Both programs were developed for adults, which is appropriate for programs aimed at military personnel of all ages. The purpose of this study was to detail the two web-based interventions and to evaluate their effectiveness in reducing alcohol outcomes. Personnel who completed either program were predicted to show a reduction in alcohol use at follow-up relative to controls.

Method

Sample

Study participants were active-duty personnel at eight military installations, with two installations from each military branch (Army, Navy, Air Force, Marine Corps). Participation was voluntary and was open to all active-duty personnel assigned to the selected installations. Participants were recruited through recruitment tables manned by study staff placed in high pedestrian traffic areas, as well as through posters, fliers, installation-wide email solicitations, and (at some installations) print and television advertisements. The participants were not paid; but at the discretion of the installations, some were offered incentives such as time off work or participation in a raffle for noncash prizes. A total of 4,218 individuals registered for the study, and 3,889 (92.2%) completed the baseline survey. Of those, 1,369 completed the 1-month follow-up (35.2%), and 913 completed the 6-month follow-up (23.5%). The low response rate for the follow-up surveys is not atypical of either web-based or voluntary military surveys (Linke et al., 2007; Ryan et al., 2007; Verheijden et al., 2007) and likely reflects the realities of wartime deployment, as well as factors such as the lack of incentives offered by the installations for participation in the follow-ups. Attrition and its potential impact are discussed more fully below.

Sample size of the analysis sample was 3,070 (1,470 DCU, 686 AS, 914 control) at baseline, 1,072 (430 DCU, 251 AS, 391 control) at 1-month follow-up, and 702 (256 DCU, 175 AS, 101 controls, 170 delayed treatment accepters, described below) at 6-month follow-up. This sample omits a mixed-treatment program group (baseline $n = 819$) in which respondents received either AS or DCU based on their drinking risk level as determined by the Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 1992). This group was omitted from analyses because it confounded program efficacy with severity of alcohol use and did not permit a clear evaluation of either DCU or AS.

Sample characteristics are presented in Table 1 and are very similar to those for the overall active-duty population at the time of this study. The baseline sample was predominantly men (83% in PATROL vs. 85% in the total active-duty population; Bray et al., 2006), ages 21–34 (69% vs. 63%, respectively), non-Hispanic White (65% vs. 64%, respectively), and with some education beyond high school (67% vs. 66%, respectively). The sample was primarily Air Force (36%) and Navy (44%), with smaller numbers of Marine Corps (16%) and Army (5%) personnel. Alcohol use in the PATROL sample closely paralleled alcohol use in the overall active-duty population, with the percentage of high-risk drinkers (AUDIT of 8 or more) being nearly identical (24.3% in PATROL vs. 24.0% for the total active-duty population) and heavy episodic and frequent heavy

TABLE 1. Demographic characteristics of baseline, 1-month follow-up, and 6-month follow-up participants

Sociodemographic characteristic	Baseline (n = 3,070) %	1-month follow-up (n = 1,072) %	6-month follow-up (n = 702) %
Service			
Army	4.5	4.4	5.0
Navy	44.0	33.9	30.0
Marine Corps	16.0	12.7	13.3
Air Force	35.5	49.1	52.1
Gender			
Male	83.1	79.2	77.9
Female	16.9	20.8	22.1
Age, in years			
≤20	10.2	5.7	5.0
21–25	35.3	26.3	22.7
26–34	33.4	36.0	35.5
≥35	21.1	32.0	36.9
Race/ethnicity			
White, non-Hispanic	64.9	71.8	74.0
African American, non-Hispanic	16.7	12.5	10.7
Hispanic	11.9	8.6	9.3
Other	6.7	7.1	6.0
Education			
High school or less	33.2	23.0	20.2
Some college	52.0	58.0	58.0
College graduate or higher	14.7	19.0	21.8
Marital status			
Married or living as married	59.4	66.5	67.8
Divorced, separated, or widowed	9.8	9.2	9.5
Single, never married	30.8	24.3	22.7

episodic drinking being of similar, but slightly lower, prevalence (heavy episodic drinking: 39.7% vs. 44.5%, respectively; frequent heavy episodic drinking: 15.5% vs. 18.5%, respectively).

Web-based alcohol interventions

Alcohol Savvy. AS is an alcohol-misuse-prevention program initially developed for adults in the workplace. It is a fully narrated, multimedia program incorporating rich video and audio, as well as interactive components. AS draws heavily on social learning theory (Bandura, 1977) and incorporates central elements of the Health Belief Model (Rosenstock et al., 1988) and the Stages of Change Model (Prochaska and DiClemente, 1986). The program is based on the assumption that an individual's level of awareness, motivation, and knowledge about the risks and benefits of specific health-related behaviors combine in a multiplicative fashion (i.e., if any component is missing or below some minimal level, the individual will not engage in the healthful behavior). For example, one must be sufficiently aware of the benefits of light or moderate drinking compared with alcohol misuse to be motivated to drink at low or moderate levels. The first of three modules in AS provides an assessment of the user's personal level of alcohol use and related negative consequences. The second module conveys information

designed to encourage smart decisions regarding alcohol use, including video testimonials from real people who discuss their alcohol use and consequences. The final module provides skills and processes for making changes in alcohol use toward moderate drinking, including a healthful alternative to drinking, an interactive exercise to illustrate BAC levels resulting from particular levels of drinking, and video vignettes depicting real-life situations related to drinking that a person might face. The overarching workplace health program encompassing AS and other health-promoting programs has been shown to significantly decrease the number of drinking days and number of heavy episodic drinking days among adults (Cook et al., 2003).

For the military adaptation of the AS, all multimedia elements were redesigned to include military personnel, and all content was modified to address problems of alcohol misuse in a military environment. Consequences of alcohol misuse and benefits of responsible alcohol use were tailored to those that might be experienced by military personnel, and experts from health and legal backgrounds were replaced by military counterparts. Modifications were developed by the original AS creators, with input from researchers from the Naval Health Research Center in San Diego, CA, as well as members of TRICARE Management Activity from the U.S. Department of Defense.

Drinker's Check-Up. The DCU is a brief motivational intervention for high-risk drinkers. Brief motivational interventions evolved from research on brief interventions by emergency department physicians (e.g., Chafetz, 1968) and other research in the area of addictions that found that minimal interventions, sometimes as brief as 5 minutes, were often as effective as more intensive treatments (cf. Edwards et al., 1977; see Miller et al., 2003, for review). Brief motivational interventions evolved concurrently with and incorporate motivational interviewing techniques (Miller and Rollnick, 2002). These methods provide a client-centered but directive counseling style designed to help problem drinkers resolve their ambivalence about changing their drinking. The online version of DCU has been shown to reduce drinking, alcohol-related problems, and symptoms of dependency by 50% in a randomized clinical trial of adult heavy alcohol users (Hester et al., 2005).

DCU was modified in two significant ways for the military. First, because DCU was originally designed for older adults, content related to norms and consequences was revised to reflect the generally younger population of the military. Second, because the PATROL study focused on a general population rather than just high-risk drinkers, a second version of DCU was developed. Respondents assigned to DCU and with AUDIT scores of 8 or higher were offered the standard, or "high-risk," DCU. Respondents assigned to DCU who had AUDIT scores less than 8 were offered the new "low-risk" DCU. All revisions and the creation of the low-risk DCU content were performed by the original DCU

developers, with input from the same advisors who participated in the modification of AS.

The high-risk version of DCU began with a decisional balance exercise in which users consider the “pros and cons” of drinking, as well as questions about the user’s family history of alcohol problems and any negative consequences from their own drinking. The second module included (a) personalized feedback about how their drinking and level of negative consequences compared with civilian and military peers, (b) their estimated peak BAC in a regular week of drinking and on a heavier day of drinking, and (c) information on alcohol tolerance. This feedback was presented in a nonthreatening manner designed to reduce resistance to potentially upsetting feedback. The third module helped resolve any ambivalence about changing their drinking behavior, assisted in choosing specific goals related to change, and set up a plan of action if they decide to change their drinking.

The first module of the low-risk DCU addressed commonly held myths about drinking and attempted to correct them. The second module explained BAC levels, described how BAC levels affect behavior, provided the user with a personalized BAC table, and discussed risk factors for developing alcohol problems. The third module described how the user can help others who may have a drinking problem.

Procedure and design

Potential participants were directed by promotional materials to the study web page, which was accessible using any computer connected to the Internet. The participants registered for the study and completed an online informed consent form before beginning the baseline survey. Following the baseline survey, participants were assigned to the control group ($n = 914$) or to one of the program conditions (AS [$n = 686$] or DCU [$n = 1,470$]). Our original intention was to randomly assign participants at each installation to these conditions, but this was not done at some installations. At the request of installation leadership, one of the Air Force installations was restricted to program conditions only (all participants were randomly assigned to one of the two program conditions), and one Air Force installation and one Army installation were restricted to the control group. In addition, all personnel who were not assigned to the control group and who indicated that they did not have access to a high-speed Internet connection (18.4% of participants) were reassigned to DCU because AS is a Flash application that requires a high-speed connection to be fully functional. Outside of these exceptions, all other participants were randomly assigned to study conditions. Participants assigned to one of the program conditions began the program immediately following the baseline survey. Of those who began one of the programs, 91% of those assigned to AS completed the entire program, as did 73% of those assigned to DCU. Participants spent an average of 45 minutes on AS and 56 minutes on DCU.

One month after completion of the baseline survey, participants were contacted through personally addressed emails and invited to participate in the 1-month follow-up survey. If needed, three email reminders (one per week) were sent for the follow-up. Participants in the control condition were offered one of the programs following completion of the 1-month follow-up survey, with the assignment following the same specifications as the assignment to conditions following the baseline survey. The final follow-up was conducted 6 months after baseline, following the same procedure as the 1-month follow-up. All data collection and program implementation occurred via a secure website.

Measures

Multiple outcomes were used to reflect a variety of behaviors related to problematic drinking. Given the presence of two distinct programs, multiple outcome measures permit for greater texture in understanding programs effects. Outcomes were measured at baseline, 1 month, and 6 months. The measures of alcohol use, with the exception of estimated peak BAC, were taken from the 2005 DoD HRB Survey (Bray et al., 2006) to provide estimates that are comparable with the most widely cited assessment of alcohol use among active-duty military personnel. Questions used to assess estimated peak BAC were adapted from the assessment module of the DCU and used the formula described by Matthews and Miller (1979) adjusted for slightly larger common drink sizes in the United States (e.g., 12-oz. beers rather than 10-oz. beers), using a metabolism rate of 16 mg% per hour. The formula for men was

$$\frac{[\text{number of standard drinks} \times (7,530 \times 0.5 \times 1.2)]}{\text{weight (in pounds)} - 16} / \text{hours spent drinking},$$

and the formula for women was

$$\frac{[\text{number of standard drinks} \times (9,000 \times 0.5 \times 1.2)]}{\text{weight (in pounds)} - 16} / \text{hours spent drinking}.$$

The timeframe for all outcomes was in the past 30 days and included the following:

Average number of days that alcohol was used. Respondents indicated how often they had consumed alcohol in the past month, with seven response options ranging from “Didn’t drink any alcohol in the past 30 days” to “28–30 days (about every day).”

Average number of drinks consumed per drinking occasion. A single item measured drink quantity, ranging from 0 to 22 drinks.

Number of days perceived drunk. This outcome was a single item measuring the number of days per week in the past month that respondents perceived themselves to be drunk.

Heavy episodic drinker status. Respondents were classified as a heavy episodic drinker if they reported drinking five or more (men) or four or more (women) drinks on one occasion (at the same time or within a couple of hours of each other) in the past month.

Heavy episodic drinking episodes. This item measured the frequency of heavy episodic drinking in the past month and ranged from 0 to 30 (or every day).

Frequent heavy episodic drinker status. Participants were classified as a frequent heavy episodic drinker if they reported four or more heavy episodic drinking episodes in the past month (or an average of one or more episodes a week).

Estimated peak BAC. Estimated peak BAC was a self-reported measure based on the respondents' weight and ounces of ethanol consumed during their heaviest drinking episode over a stated amount of time drinking.

Control measures. Measures assessed at baseline and included as controls were service branch (Army, Navy, Air Force, Marine Corps), age, gender, minority status, rank (enlisted personnel/officers), and family status (married with spouse present or living as married with partner present vs. single, divorced, separated, widowed, or married with nonpresent spouse). Education was not included as a control item because it was highly correlated with the indicator of enlisted versus officer, and this latter item was more central to an evaluation of a military sample.

Analyses

To evaluate the impact of AS and DCU on alcohol outcomes, a piecewise longitudinal growth model was used to estimate two unique segments of change. The first segment captured change in use from the baseline assessment to 1-month follow-up, whereas the second segment captured changes between the 1-month and 6-month follow-ups. Indicators of treatment condition (AS or DCU) were added to the model, and interactions of each treatment indicator and each time segment were estimated. These interaction parameters indicated the deviation from control group slopes in each of the treatment conditions and were the principal estimates of significant program effects. Models were estimated in the mixed-model (multilevel regression) framework using SAS (SAS Institute Inc., Cary, NC) PROC MIXED and PROC GLIMMIX. All models controlled for service branch, pay grade (military categories for pay that act as a proxy measure for socioeconomic status), gender, age, racial/ethnic minority membership, and marital status. All cases with outcome data at one or more measurement occasions were retained in program effects models through the use of maximum likelihood estimation (Little and Rubin, 2002; Schafer and Graham, 2002). All analyses followed an intent-to-treat design, and intercepts of the models were estimated as baseline values to estimate and control for any initial differences in alcohol use across treatment groups. Both AS and DCU were evalu-

ated in relation to the control group because they were both hypothesized to decrease alcohol use. AS and DCU were not directly compared with each other because there were no a priori hypotheses about how these two programs might differ.

The web-based alcohol programs were implemented immediately following baseline, and no additional program content or any information that might influence respondents' alcohol use was presented after the initial program completion. For this reason, we did not hypothesize decreases in alcohol use in the program conditions between the 1-month and 6-month follow-up surveys. Maintenance of program effects through 6 months was assessed using Group \times Time interaction effects between the 1-month and 6-month follow-ups.

As noted previously, control participants who returned for the 1-month follow-up were offered the opportunity to complete one of the web-based programs. Of the 391 control participants who completed the 1-month follow-up, 170 chose to receive a program and were randomly assigned (with the aforementioned restrictions) to either the AS or DCU program. These participants formed a delayed treatment group, and their responses were removed from the control group for analyses of treatment effects at the 6-month follow-up. The remaining 101 control participants continued to serve as the control group for the 6-month follow-up. Analyses of program effects from baseline to the 1-month follow-up included comparisons of the program group versus the full control group. Analyses of program effects from the 1-month follow-up to the 6-month follow-up include separate comparisons of the immediate program group versus the 6-month control group, as well as comparisons of the delayed program group versus the 6-month control group (i.e., evaluation of program effects for the delayed treatment group).

Results

Sample validity

Although not atypical of web-based or military-related research, the considerable attrition at each follow-up raises the possibility of response bias in estimates of program effects. Models of program effects typically assume that data are missing at random. Estimates are subject to bias and may be incorrect when responses are missing in a nonrandom fashion, such as when they attrite from the study based on their levels of the outcome measure. We tested for this possibility with two exploratory analyses. First, point biserial or tetrachoric correlations for baseline outcome values and indicators of missingness at each follow-up were examined. A high correlation would indicate that there was differential attrition based on alcohol use at baseline. Correlations indicated that missingness at follow-up was only very modestly

related to baseline drinking (correlations were all less than .15) in the overall sample, as well as individually in the combined treatment and control samples. A more stringent test of problematic missingness was examined with a computer simulation conducted in Mplus Version 4.2 (Muthén and Muthén, 1998–2006). This simulation modeled the observed parameters from program effects model (baseline to 1-month follow-up) for the outcome with the most prevalent missing data: estimated peak BAC. Missing data points were determined according to the results of a logistic regression that predicted missingness from gender, program/control exposure, and minority status (other demographics were not significantly related to missingness and were dropped for simplicity). Simulation results indicated that, compared to models without missing data at follow-up, models with missing data according to that observed in the actual PATROL data did not yield biased estimates.

A second potential issue of particular concern for estimates of change from the 1-month to 6-month follow-up assessments is whether personnel decided to take the delayed program administration. Similar to differential attrition, dif-

ferential dropout of the control condition to participate in a delayed treatment group could bias estimates of change in alcohol behaviors if such behaviors predicted continuation as a control participant or participation in delayed treatment. Exploratory analyses examined whether continuing controls differed from delayed treatment takes on all alcohol measures at the 1-month assessment. There was no significant difference in alcohol use between the two groups, which indicates that the continuing controls could still validly be used as a comparison group at the 6-month assessment for both the original AS and DCU conditions, and that the delayed treatment groups could feasibly be compared with the continuing controls to estimate program effects for delayed treatment.

Program effects

Model-based means and standard errors (or percentages and standard errors) for each outcome at each time point are presented in Table 2, and the relevant parameter estimates for evaluation of the effectiveness of AS and DCU are pre-

TABLE 2. Model-based estimates of alcohol outcomes at baseline, 1-month, and 6-month follow-up

Alcohol outcome	DCU		AS		Control ^a	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
No. of drinking days						
Baseline	4.2	0.3	4.8	0.3	4.8	0.3
1-month follow-up	3.9	0.3	4.7	0.4	4.6	0.3
6-month follow-up	3.7	0.4	4.4	0.4	4.7	0.5
Average drinks per drinking occasion						
Baseline	3.0	0.2	3.2	0.2	3.1	0.2
1-month follow-up	2.1 ^b	0.2	2.4	0.3	2.7	0.2
6-month follow-up	2.1	0.2	2.4	0.3	2.8	0.3
No. of heavy episodic drinking days						
Baseline	1.5	0.2	1.7	0.2	1.8	0.2
1-month follow-up	1.1	0.2	1.5	0.3	1.7	0.2
6-month follow-up	1.2	0.2	1.4	0.3	1.5	0.3
No. of days perceived drunk per week						
Baseline	0.42	0.05	0.45	0.06	0.52	0.05
1-month follow-up	0.36	0.06	0.41	0.07	0.50	0.06
6-month follow-up	0.37	0.25	0.43	0.30	0.38	0.39
Estimated peak BAC						
Baseline	.078	.005	.077	.006	.079	.006
1-month follow-up	.061 ^b	.006	.066	.007	.080	.006
6-month follow-up	.065	.007	.070	.007	.075	.009
	%	<i>SE</i>	%	<i>SE</i>	%	<i>SE</i>
Heavy episodic drinker						
Baseline	33.6	2.7	37.9	3.2	37.2	2.9
1-month follow-up	23.6 [§]	3.1	29.2	4.1	34.8	3.7
6-month follow-up	25.9	3.9	31.2	4.8	34.5	6.2
Frequent heavy episodic drinker						
Baseline	8.2	1.4	10.5	1.9	9.6	1.7
1-month follow-up	4.2 ^b	1.2	5.9 [§]	1.8	9.4	2.1
6-month follow-up	3.4	1.3	4.9	1.9	8.7	3.3

Notes: DCU = Drinker's Check-Up; AS = Alcohol Savvy; BAC = blood alcohol concentration. ^aThe control group at 1-month follow-up includes all respondents assigned to the control group at baseline who completed the 1-month follow-up ($n = 391$); the control group at 6-month follow-up includes all control respondents who did not complete one of the programs following the 1-month follow-up and who completed the 6-month follow-up ($n = 101$). ^bSignificant program effect (Group \times Time interaction) from baseline to the 1-month follow-up ($p < .05$). [§]Borderline significance.

TABLE 3. Estimates of program effects

Effect	No. of drinking days		Average drinks per drinking occasion		No. of heavy episodic drinking days		No. of days perceived drunk per week		Estimated peak BAC		Heavy episodic drinker		Frequent heavy episodic drinker	
	Estimate (SE)	Effect size, <i>d</i>	Estimate (SE)	Effect size, <i>d</i>	Estimate (SE)	Effect size, <i>d</i>	Estimate (SE)	Effect size, <i>d</i>	Estimate (SE)	Effect size, <i>d</i>	Estimate (SE)	Effect size, <i>d</i>	Estimate (SE)	Effect size, <i>d</i>
Intercept	5.599 (0.730)		2.643 (0.496)		1.607 (0.476)		0.467 (0.126)		0.058 (0.013)		-1.149 (0.308)		-3.322 (0.532)	
DCU	-0.604* (0.253)	0.087	-0.105 (0.200)	0.019	-0.356* (0.169)	0.076	-0.076 (0.041)	0.067	-0.002 (0.005)	0.015	-0.156 (0.105)	0.054	-0.173 (0.133)	0.047
AS	-0.011 (0.304)	0.001	0.104 (0.240)	0.016	-0.104 (0.203)	0.019	-0.046 (0.049)	0.034	-0.002 (0.006)	0.014	0.032 (0.125)	0.009	0.099 (0.156)	0.023
Time 1	-0.145 (0.220)	0.032	-0.435* (0.179)	0.116	-0.129 (0.158)	0.039	0.000 (0.034)	0.000	0.001 (0.004)	0.016	-0.105 (0.144)	0.093	-0.022 (0.186)	0.006
Time 2	0.011 (0.087)	0.006	0.022 (0.062)	0.017	-0.033 (0.058)	0.028	-0.024 (0.078)	0.015	-0.001 (0.002)	0.041	-0.002 (0.055)	0.002	-0.017 (0.073)	0.011
DCU × Time 1	-0.077 (0.301)	0.012	-0.510* (0.241)	0.102	-0.189 (0.216)	0.042	-0.062 (0.047)	0.063	-0.017** (0.006)	0.163	-0.392 (0.203)	0.093	-0.677* (0.289)	0.112
AS × Time 1	0.064 (0.349)	0.009	-0.393 (0.281)	0.067	-0.081 (0.251)	0.015	-0.040 (0.055)	0.035	-0.012 (0.007)	0.099	-0.286 (0.230)	0.060	-0.609 (0.320)	0.091
DCU × Time 2	-0.051 (0.104)	0.023	-0.008 (0.075)	0.005	0.044 (0.070)	0.030	0.025 (0.092)	0.014	0.002 (0.002)	0.055	0.027 (0.069)	0.019	-0.029 (0.103)	0.014
AS × Time 2	-0.068 (0.112)	0.029	-0.007 (0.081)	0.004	0.014 (0.076)	0.009	0.027 (0.098)	0.013	0.002 (0.002)	0.055	0.021 (0.073)	0.014	-0.020 (0.106)	0.009

Notes: BAC = blood alcohol concentration; DCU = Drinker's Check-Up; AS = Alcohol Savvy; Time 1 = Baseline to 1-month follow-up; Time 2 = 1-month follow-up to 6-month follow-up.

* $p < .05$; ** $p < .01$.

sented in Table 3. The model-based entries in Table 2 are adjusted for demographic controls in the models and are consequently lower than raw mean and prevalence estimates. For DCU, significant program effects ($p < .05$) from baseline to the 1-month follow-up were found for average drinks per drinking occasion, frequent heavy episodic drinking status, and estimated peak BAC. DCU also reduced heavy episodic drinking status relative to controls at the 1-month assessment, although this did not reach conventional statistical significance ($p = .053$). For AS, there were no significant program effects from baseline to 1-month follow-up, although frequent heavy episodic drinking did show a considerable decrease relative to control participants ($p = .057$). Although there were no statistically significant program effects for AS, the simple slopes (change from baseline to 1-month follow-up) of AS participants were generally similar to those in the DCU group. As an example of the pattern of simple slopes, Figure 1 displays the change from baseline to 1-month follow-up for all three groups for heavy episodic drinking status.

There were no significant program effects from the 1-month follow-up to the 6-month follow-up for any of the conditions, indicating that the program groups did not differ from the control group in change over the period. There were also no significant treatment effects found for either the delayed DCU or delayed AS groups, although it should be noted that power to detect effects was seriously attenuated for these tests. For clarity of presentation, delayed treat-

ment group program effect and descriptive estimates are not shown in Tables 2 and 3.

Discussion

These results suggest that DCU was in general more successful than AS at reducing alcohol use in the military. Participants in the DCU condition had significant reductions from baseline to 1-month follow-up on three measures of alcohol use relative to participants in the control condition, whereas there were no conventionally significant program effects for AS. It is possible that the increased statistical power in the DCU condition was a contributing factor to the higher number of statistically significant effects for this condition. Because AS required a high-speed Internet connection, all personnel who did not have access to a high-speed Internet connections were assigned to the DCU condition, which resulted in a baseline sample size ($n = 1,470$) considerably larger than the AS condition ($n = 686$). Program effect sizes were small, with Cohen d s concentrated in the .05 to .15 range (Cohen, 1988), which supports the idea of power differences being an important factor in the tests of the different conditions. However, post hoc power analyses indicated that AS exhibited smaller effect sizes than DCU and as a result would require a larger group size than DCU to achieve comparable power. Although differences in power cannot be discounted, the effect size differences suggest that even with comparable sample sizes, AS may not have achieved

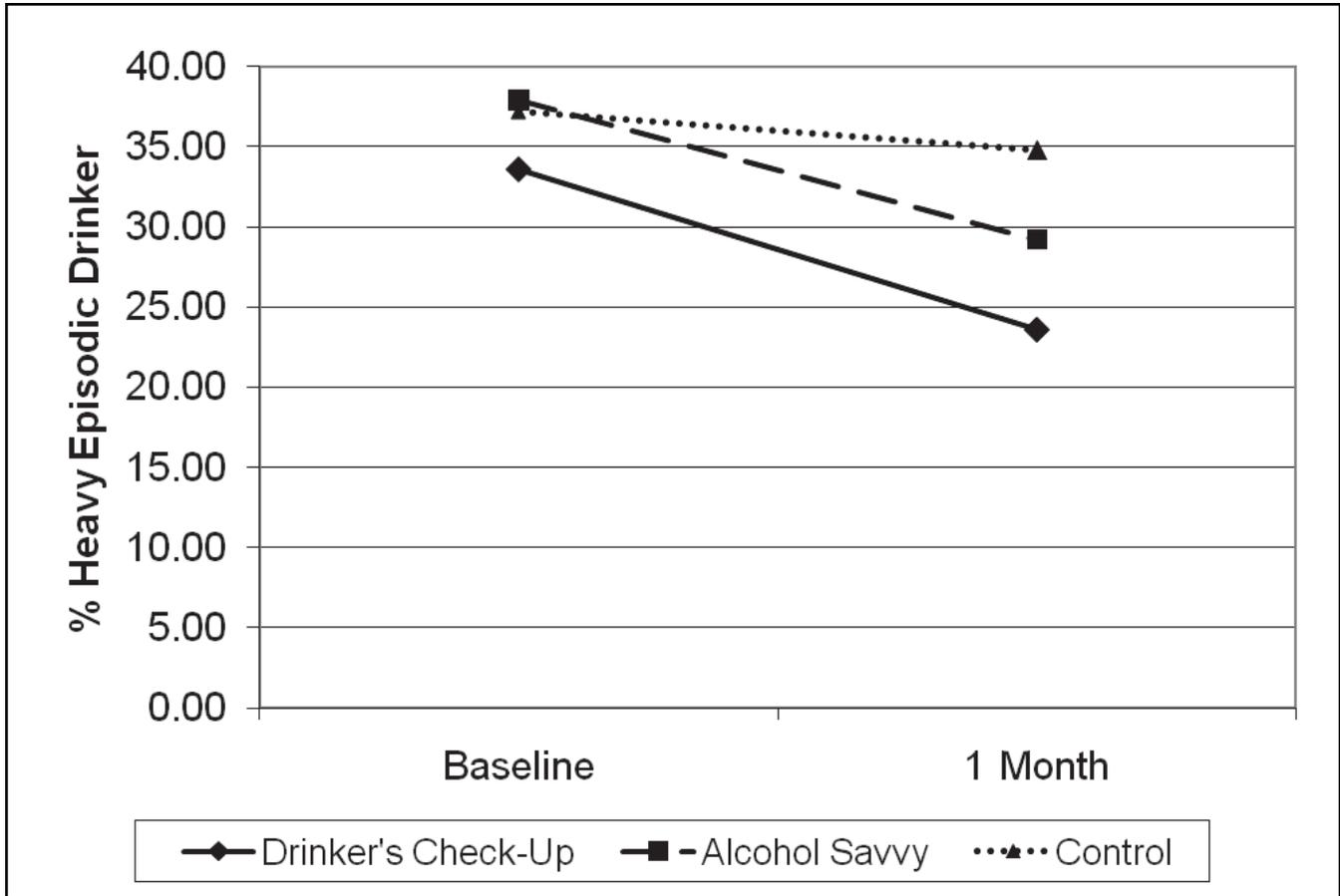


FIGURE 1. Change from baseline to 1-month follow-up in heavy episodic drinking by treatment condition

conventional statistical significance. An additional factor that strengthens the findings for DCU is that significant effects were found even though the program completion rate was lower for DCU (73%) than for AS (91%).

There were no statistically significant program effects from 1-month follow-up to 6-month follow-up for any of the alcohol use measures, which suggests that the program effects found from baseline to 1-month follow-up were maintained through the 6-month follow-up. Supplemental models that examined effects from baseline directly to 6-month follow-up indicated significant reductions relative to controls for DCU participants on frequent heavy episodic drinking and marginally significant reductions in the average number of drinks. The significant effect of DCU on peak estimated BAC was not maintained. However, the greatly reduced control group at 6 months had a deleterious impact on power; therefore, any support for maintenance of 1-month effects is notable.

Limitations

There were a number of limitations to the study related to the sample selection, study design, and response rates.

Regarding the sample selection, the primary concern is that this voluntary convenience sample of active-duty military personnel may not be representative of the overall active-duty population. Specifically, it could be that those who misuse alcohol may be less likely to volunteer to participate than those in less need of alcohol programs, and it could also be that the uneven level of participation from the four branches of the military may have resulted in a biased sample. Comparisons between the unadjusted prevalence of alcohol use in the baseline sample with the prevalence found in the total active-duty population (Bray et al, 2006) indicated that the baseline sample had a slightly lower prevalence of heavy episodic drinking and frequent heavy episodic drinking, and nearly identical levels of high-risk drinkers, compared with the total active-duty population. These data indicate that the convenience sample used may slightly underrepresent heavy episodic and heavy drinkers but was a reasonable approximation of the full military population who misuse alcohol.

The study design included several elements that were not optimal. The greatest concern is the lack of randomization to condition at three of the eight military installations, with

one limited to program conditions only and two limited to control conditions only. Given the geographical and other pre-existing differences between military installations, this lack of random assignment could lead to nonrandom differences between the program and control groups. A related concern was the lack of random assignment to condition for those who did not have access to a high-speed Internet connection, with all such individuals assigned to the DCU condition. The majority of respondents who did not have access to high-speed connections were in the Navy and the Marine Corps, although military service branch was controlled for in all analyses of program effects, which reduced the impact of service-level differences. The primary effect of this lack of randomization based on access to high-speed Internet connections is a larger sample size, and subsequently higher statistical power, in the DCU condition.

Potential biasing effects resulting from the lack of random assignment were tested in several ways. First, we assessed baseline differences between the program and control groups in demographic and alcohol use variables, finding that there were not statistically significant differences. Second, differences in program effect estimates were examined by adding an indicator of random versus nonrandom assignment as a moderator to the program evaluation model. Results indicated no significant differences in estimates of program effects as a result of assignment type. Adding service as a moderator also resulted in no significant differences in program effects by service type. These results suggest that the lack of random assignment for all participants did not significantly alter the make-up of program and control groups nor influence program efficacy. This is likely because the nonrandom element of assignment was based on external factors not related to a person's alcohol use, thus reducing or eliminating any selection effects that can result from nonrandom assignment. Despite this, the conclusions of this study would be strengthened considerably if replicated on a representative sample of active-duty military personnel with true random assignment to conditions.

Finally, there was considerable attrition at both the 1-month and 6-month follow-ups, which may have resulted in bias in the follow-up sample. Although follow-up attrition is always a concern, the concern is lessened if the missing cases are missing at random, as opposed to having differential attrition based on study condition or drinking status. Exploratory analyses and simulation models suggested that attrition in this study did not bias the results. The main impact of the high levels of attrition was on the power to detect statistically significant program effects rather than the interpretation of those program effects. Similarly, although not attrition in the strict sense, personnel electing to participate in a treatment program after the first follow-up further decreased the size of the control group, which also had a detrimental effect on power to detect program effects from the 1-month to 6-month assessments. Although such delayed

treatment was voluntary, we found no evidence of problematic selection effects for evaluation of 1-month to 6-month effects, and delayed treatment had no bearing on the primary evaluation of change in alcohol use from baseline to 1-month follow-up.

Conclusions

This study represents the first evaluation of the efficacy of two web-based alcohol interventions among active-duty military personnel. These data suggest that military versions of civilian web-based alcohol programs show promise in reducing alcohol misuse in active-duty military personnel. One program, a revised version of the DCU, reduced several indicators of problematic alcohol use relative to controls. A second program, a revised version of AS, also reduced several alcohol indicators relative to controls, although none of these differences reached statistical significance. Despite the differences in power and sample size, this discrepancy in the effectiveness of these two programs indicates future research should seek to identify the crucial elements or program components that are effective in reducing alcohol use. For example, it could be that the personalized normative feedback that was a major focus of DCU was effective in getting participants to understand how their drinking behavior compared with that of their peers, which in turn led to changes in alcohol use. Future analyses will also assess the impact of these web-based interventions on self-reported negative consequences from alcohol use, such as work productivity loss, accidental injury, or disciplinary action. Finally, replication of results presented herein, with a more representative sample of active-duty personnel, is needed to strengthen these conclusions.

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