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*Psychol Addict Behav*. Author manuscript; available in PMC 2013 September 01.

Published in final edited form as:
*Psychol Addict Behav*. 2012 September ; 26(3): 393–405. doi:10.1037/a0027565.

# Efficacy of Expectancy Challenge Interventions to Reduce College Student Drinking: A Meta-Analytic Review

**Lori A. J. Scott-Sheldon**, **Danielle L. Terry**, **Kate B. Carey**, **Lorra Garey**, and **Michael P. Carey**
Center for Health and Behavior, Syracuse University

## Abstract

Interventions challenging alcohol expectancies may lead to reductions in alcohol consumption. We conducted a meta-analysis to examine the efficacy of alcohol expectancy challenge (EC) interventions for college alcohol abuse prevention. Included were 14 studies (19 EC interventions) that measured alcohol expectancies and consumption, provided sufficient information to calculate effect sizes, and were available as of June 2010 ($N$ = 1,415; $M$ age = 20; 40% women; 88% White). Independent raters coded participant characteristics, design and methodological features, and intervention content, and calculated weighted mean effect sizes at first follow-up, using both fixed- and random-effects models. Compared to controls, EC participants reported lower positive alcohol expectancies, reduced their alcohol use, and reduced their frequency of heavy drinking ($d_+$s ranged from 0.23 to 0.28). Within-group improvements in alcohol expectancies and consumption emerged for the EC group only; relative to their own baseline, EC participants reported lower positive alcohol expectancies, reduced their alcohol use, and reduced their frequency of heavy drinking ($d_+$s range from 0.13 to 0.36). Supplemental analyses found improvements in specific alcohol expectancies (social, sexual, tension, and arousal) both between- and within-group. The short-term effects of EC interventions on college student drinking are not maintained at follow-ups greater than 4 weeks.

### Keywords

meta-analysis; college students; alcohol expectancies; alcohol consumption; intervention

Alcohol consumption is pervasive on most U.S. college campuses. Nearly 64% of full-time college students consumed alcohol in the last month compared to 53% of their non-college peers (SAMHSA, 2010). Two-thirds of full-time college students report current alcohol consumption with 43% reporting heavy episodic alcohol use, defined as consuming 5 or more alcoholic beverages per occasion at least once in the past month (SAMHSA, 2010). Heavy episodic alcohol use is associated with both short- and long-term consequences including academic problems, sexual assault, injuries and/or violence, college attrition, and alcohol abuse and dependence (Hingson, Zha, & Weitzman, 2009; Jennison, 2004; Knight et

Correspondence concerning this article should be addressed to Lori A. J. Scott-Sheldon, PhD, Centers for Behavioral and Preventive Medicine, Coro Building, Suite 314, One Hoppin Street, Providence, RI 02903. lori_scott-sheldon@brown.edu.
Drs. Scott-Sheldon and M. P. Carey are now with the Centers for Behavioral and Preventive Medicine, The Miriam Hospital and the Department of Psychiatry and Human Behavior, Brown University, Providence, RI; Dr. K. B. Carey and Ms. Garey are now at the Center for Alcohol and Addiction Studies, Brown University, Providence, RI.

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al., 2002; Martinez, Sher, & Wood, 2008). Given the adverse consequences associated with alcohol use, the prevention and reduction of alcohol consumption among college students has been declared a public health priority by the Surgeon General (U.S. Department of Health and Human Services, 2007) and reducing binge drinking in college students is a primary objective in Healthy People 2020 (U.S. Department of Health and Human Services, 2010).

To further understand the determinants of alcohol consumption among college students, researchers have investigated the role of alcohol expectancies. Early research on alcohol expectancies focused on identifying the causal role of alcohol-related expectancies on consumption. Alcohol expectancies, traditionally conceptualized as positive or negative beliefs associated with alcohol use, have been shown to predict current and future alcohol use (for reviews, see (B. T. Jones, Corbin, & Fromme, 2001; National Institute on Alcohol Abuse and Alcoholism, 2002; Stacy, Widaman, & Marlatt, 1990). Positive expectancies have been shown to predict *greater* alcohol consumption whereas negative expectancies predict *lower* alcohol consumption (B. T. Jones, 2004; Leigh & Stacy, 2004). Consistent with earlier motivational models of alcohol use (e.g.,(Cox & Klinger, 1988), college students' alcohol consumption is strongly influenced by the positive expectations associated with consuming alcohol. For example, Carey (1995) showed that heavy episodic alcohol use among college students is associated with explicit positive alcohol expectancies regarding alcohol's ability to enhance sexual situations. Past experiences with alcohol may also influence individuals' implicit alcohol-related expectancies (i.e., expectancies that are outside of conscious awareness that influence behaviors in automatically) (Cox, Fadardi, & Klinger, 2006).

Research has also shown longitudinal effects of alcohol-related expectancies; that is, adolescents with positive expectancies are more likely to consume alcohol during adolescence, increase their alcohol use between the ages of 16 and 35 years, and have higher rates of lifetime alcohol use (Patrick, Wray-Lake, Finlay, & Maggs, 2010). Among college students, Leeman, Toll, Taylor, and Volpicelli (2009) found positive expectancies of alcohol-induced social disinhibition measured during their freshman year were associated with heavy episodic drinking measured during their senior year. Moreover, earlier expectancy theory suggests that expectations associated with alcohol use are self-confirming; that is, response expectancies determine our experiences and behaviors after alcohol is consumed (Kirsch, 1997). Thus, alcohol expectancies influence both the onset and the maintenance of alcohol use.

More recent conceptualizations of alcohol expectancies suggest that "expectancies [are] associations between mental representations in long-term memory" that are automatically activated under certain conditions (Moss & Albery, 2009), p. 519; see also (Redish, Jensen, & Johnson, 2008). In an experimental study, Friedman, McCarthy, Forster, and Denzler (2005) sought to active men's pre-existing alcohol-related expectancies associated with sexual attractiveness using task that primed alcohol-related or control words. Priming alcohol-related words led to increased expectations of alcohol's effects on sexual attractiveness; increased alcohol-sexual expectations predicted higher attractiveness ratings for photographs of similar-aged women. These findings suggest that automatically activated expectancies, in the absence of alcohol consumption and without conscious awareness of the expectancies, may change behavior. Furthermore, this growing body of literature also shows that both explicit and implicit measures of alcohol expectancies predict alcohol consumption (Reich, Below, & Goldman, 2010). For example, Thush and Wiers (2007) found an association between both implicit and explicit positive alcohol expectancies and heavier drinking among older adolescents. Therefore, implicit or explicit challenges to expectancies may lead to changes in alcohol-related behaviors.

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Interventions challenging alcohol expectancies have been developed as a means to reduce alcohol consumption. The expectancy challenge (EC) intervention, originally developed by Darkes and Goldman (1993), was designed to illustrate the effects of alcohol-related expectancies through experiential learning in a group setting. An EC intervention typically includes the provision of beverages to groups of drinkers in a bar-like setting; some contain alcohol and others contain a placebo beverage, but the participants do not know the content of their drinks. Participants engage in activities that promote social interaction, and after time passes, participants are asked to evaluate whether other participants were drinking alcohol versus a placebo. Incorrect identification provides opportunities to consider the effects of alcohol attributable to expectancies. The procedure may be repeated in one or more separate sessions. Modification to the original EC design have included direct challenges to alcohol expectancies (i.e., participants asked to refute alcohol expectancies; e.g., (Corbin, McNair, & Carter, 2001), tailoring the intervention to the group (e.g., women vs. men), and delivery of the intervention in fewer sessions to name a few. EC interventions have been adapted using didactic presentations instead of experiential learning. Thus, EC interventions vary in terms of their content, delivery, and dose (B. T. Jones, et al., 2001; Labbe & Maisto, 2011; National Institute on Alcohol Abuse and Alcoholism, 2002)

Prior reviews of alcohol interventions for college students have indicated inconsistent support for interventions challenging alcohol-related expectancies. Literature reviews of individual-level alcohol interventions (B. T. Jones, et al., 2001; Larimer & Cronce, 2002, 2007) found EC interventions that included an experiential component were effective, in contrast, didactically focused EC interventions were ineffective in reducing alcohol consumption. Larimer and Cronce (2007) also noted that experiential EC interventions were associated with decreases in alcohol consumption for men but could not be evaluated among women (due to insufficient studies sampling women). Labbe and Maisto (2011) found decreases in alcohol expectancies and consumption when EC interventions were delivered to men. In contrast, EC were effective in lowering alcohol expectancies among women but were inconsistent with respect to alcohol consumption when the intervention was delivered to women or mixed-gender groups. Meta-analyses examining individual-level alcohol interventions for college students found no differences in alcohol expectancies between participants who were or were not exposed to an intervention that included an expectancy component (Scott-Sheldon, DeMartini, Carey, & Carey, 2009) but have suggested that interventions including an EC component were less effective at reducing alcohol-related problems compared to controls (Carey, Scott-Sheldon, Carey, & DeMartini, 2007).

None of the extent reviews, with exception to Labbe and Maisto (2011), have exclusively focused on the efficacy of EC interventions for college students. Therefore, the purpose of this meta-analytic study was to systematically evaluate the efficacy of interventions challenging alcohol-related expectancies among college students. Intervention success was measured with two outcomes: (a) alcohol expectancies and (b) alcohol consumption (quantity consumed, frequency of heavy drinking). Although EC interventions targeting negative alcohol expectancies have not been studied among college students, Jones (B. T. Jones, 2004; B. T. Jones, et al., 2001) has suggested a need to evaluate the efficacy of EC intervention on *both* positive and negative expectancies. Challenging positive alcohol expectancies may inadvertently strengthen participants' negative expectancies, and possibly increase the number of negative expectancies endorsed. For example, Cruz and Dunn (2003) found children exposed to an expectancy challenge intervention (specifically challenging the sedating and arousing effects of alcohol consumption) endorsed fewer positive expectancies and more negative alcohol expectancies than controls. Furthermore, prior research has shown that negative expectancies are associated with reduced alcohol consumption among heavy drinkers (B. T. Jones, 2004). Therefore, we hypothesized that college students who

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received an EC intervention would report *lower* positive alcohol expectancies, *greater* negative alcohol expectancies, and *reduced* alcohol consumption.

We also examined the extent to which efficacy depended upon participant or intervention characteristics. Potential moderators included (a) age, (b) EC intervention design (experiential learning involving alcohol administration vs. didactic presentation), (c) expectancy domain challenged (social, sexual, or arousal), (d) intervention content (targeted or tailored), (e) intervention delivery (male-only, female-only, or mixed-sex groups), and (f) intervention length. We hypothesized that EC interventions would be more efficacious when they: (a) sampled greater proportions of those who may have had less experience consuming alcohol—that is, students under the legal drinking age of 21; (b) challenged expectancies experientially, highlighting that experiences previously associated with alcohol use are actually placebo effects; (c) challenged sexual enhancement or social pleasure expectancies, due to the strong relationships of these dimensions to drinking among young adults (Carey, 1995; Dimeff, Baer, Kivlahan, & Marlatt, 1999); (d) tailored content to the individual, thus increasing message relevancy (Kreuter & Wray, 2003); (e) targeted content toward specific groups (e.g., heavy drinkers, men) because heavy drinkers and men hold more positive alcohol-related expectancies than light drinkers and women (B. T. Jones, et al., 2001); (f) were delivered to single-sex rather than mixed-sex groups, given that content of the original expectancy challenge paradigm was specifically designed for single-sex groups (Darkes & Goldman, 1993; Labbe & Maisto, 2011); and (g) were of longer duration, providing additional time to challenge alcohol outcome expectancies.

## Method

### Sample of Studies

As part of a larger group of meta-analyses examining alcohol-related interventions for college students, a comprehensive search strategy was used to obtain relevant studies. Studies were retrieved from (a) electronic databases (PsycInfo, PubMed, Dissertation Abstracts, ERIC, CINAHL, and The Cochrane Library) using a broad search strategy with the following terms: ((alcohol or drink* or binge) and (college or university) and (intervention or prevention)), (b) reference sections of relevant manuscripts, (c) electronic content of professional journals, (d) databases of alcohol-related interventions for college students held by the College Drinking Meta-Analytic Team at Syracuse University (now Brown University), and (e) responses to listserv requests (message sent to listservs on October, 2009). To optimize thoroughness, we conducted the database search at study onset (June, 2009) and again upon completion of the initial coding (May, 2010).

### Selection Criteria

Studies were included if the author(s) (a) examined a behavioral intervention to reduce alcohol-related expectancies,1 (b) sampled college students, (c) used a randomized controlled trial (RCT) or a quasi-experimental design with a control condition or a within-group design reporting pre- and post-test outcomes, (d) assessed alcohol expectancies, and (e) provided information needed to calculate effect sizes. Studies were excluded if they (a) did not focus on alcohol use (e.g., combined substance use interventions), (b) sampled non-college students, (c) did not assess alcohol expectancies, or (d) included a mass media or structural-level intervention component. When authors reported details and/or outcomes in multiple manuscripts, the studies were linked in the database and represented as a single study. If a study reported on more than one control condition, the control condition with the

[1]Intervention conditions without an expectancy challenge component evaluated in three studies (Darkes & Goldman, 1993; Lau-Barraco & Dunn, 2008; Wood, Capone, Laforge, Erickson, & Brand, 2007) were excluded.

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least contact (e.g., assessment only) was used. When author(s) reported insufficient details, they were contacted for information. Of the five authors contacted, 80% responded resulting in the retention of five studies (two by the same authors) and the exclusion of two studies (both by the same authors). Studies that fulfilled the selection criteria and were available by June of 2010 were included. Thus, we included 15 manuscripts with 20 separate interventions (Figure 1).

## Coding and Reliability

Two independent coders rated the study information, sample characteristics (e.g., sex), design and measurement specifics (e.g., number of follow-ups), and length and content of EC intervention and control condition(s) (e.g., number of total minutes). Study quality was assessed using 12 items (e.g., random assignment) adapted from validated measures (Jadad et al., 1996; Miller et al., 1995); scores range from 0 to 17. All studies were used to assess inter-rater reliability. For the categorical variables, raters agreed on 80% of the judgments. Reliability for the continuous variables (calculated using the intraclass correlation coefficient; ρ) yielded an average ρ = .93 across categories (median = .98). Disagreements between coders were resolved through discussion.

## Study Outcomes

For each study, effect size estimates were calculated for alcohol-related expectancies and consumption. Studies assessed *alcohol expectancies* using a variety of validated measures (e.g., *Alcohol Expectancy Questionnaire, Comprehensive Effects of Alcohol Scale*; a supplemental table of measures used to assess expectances is available by request from the first author). Studies varied in the reporting of *alcohol expectancies*; that is, some reported global alcohol expectancies (total positive or negative alcohol expectancy scores) whereas other studies reported outcomes based on the individual subscales (e.g., social, sexual, and arousal expectancies). Thus, *alcohol expectancies* were assessed both globally and specifically. *Alcohol consumption* measures included: (a) quantity consumed over time (e.g., week, month) and (b) frequency of heavy drinking, usually defined as 5 or more drinks for men and 4 or more drinks for women (Wechsler, Davenport, Dowdall, Moeykens, & Rimm, 1995).

## Effect Size Derivation

Because the majority of the author(s) reported continuous measures, effect sizes (*d*) were defined as the mean difference between the treatment and control groups divided by the pooled standard deviation (Cohen, 1988). As a supplement to this strategy, effect sizes were also calculated for time-related change within each of the intervention and control groups as the mean difference between the post- and pre-test divided by the *SD* of the pre-post difference score (Morris & DeShon, 2002). When means and standard deviations were not provided, other information (e.g., *t*- or *F*-test) was used (Lipsey & Wilson, 2001). If a study reported dichotomous outcomes, we calculated an odds ratio and transformed it to *d* using the Cox transformation (Sanchez-Meca, Marin-Martinez, & Chacon-Moscoso, 2003). If no statistical information was available (and could not be obtained) and the author(s) reported no significant between- or within-group differences, we estimated that effect size as zero (Lipsey & Wilson, 2001). In calculating *d*, we controlled for baseline differences when pre-intervention measures were available (Morris & DeShon, 2002). All effect sizes were corrected for sample size bias (L.V. Hedges, 1981). For between-group differences, positive effect sizes indicate that participants receiving an EC intervention reported the intended effects (*lower* positive alcohol expectancies, *higher* negative alcohol expectances, and *less* alcohol consumption compared to controls). For within-group changes, a positive effect size indicates that participants reported *lower* positive alcohol expectancies, *higher* negative expectancies, or consumed *less* alcohol at post-test relative to their pre-test scores.

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Multiple effect sizes were calculated from individual studies when they had more than one outcome, multiple intervention conditions, or when outcomes were separated by sample characteristics (e.g., gender). Effect sizes calculated for each intervention and by sample characteristic were analyzed as a separate study (Lipsey & Wilson, 2001). When a study contained multiple measures of the same outcome, the effect sizes were averaged by post-intervention assessment interval. Two coders independently calculated effect sizes; all effect sizes were examined for consistency and discrepancies were corrected.

### Statistical Analysis

The timing and number of post-intervention assessments varied; first ($k$ = 19), second ($k$ = 14), and third ($k$ = 6) assessments typically occurred at 2 weeks ($M$ = 2.07 weeks; range = 0 to 4.33 weeks), 4 weeks ($M$ = 6.95 weeks; range = 2 to 13 weeks), and 26 weeks ($M$ = 20.96 weeks; range = 3 to 26 weeks) post-intervention, respectively. Only a single study had a fourth assessment at 4 weeks post-intervention. To avoid violating the assumption of independence, we focused our analyses on the first assessment interval but we report the weighted mean effect size at the final assessment (8 of the 13 studies; $M$ = 8.67 weeks; range = 2 to 26 weeks) when more than one post-intervention assessment was reported.

Weighted mean effect sizes, $d_+$, were calculated using fixed- and random-effects procedures (Lipsey & Wilson, 2001). The homogeneity statistic, $Q$, determined whether each set of $d_+$s shared a common effect size. The homogeneity of variance statistic has an approximate chi-square distribution with the number of effect sizes ($k$) minus 1 degrees of freedom (L.V. Hedges & Olkin, 1985); a significant $Q$ indicates a lack of homogeneity. To further assess homogeneity, the $I^2$ index and its corresponding 95% confidence intervals (CIs) were calculated (Higgins & Thompson, 2002; Huedo-Medina, Sanchez-Meca, Marin-Martinez, & Botella, 2006). Percentages of 25%, 50%, and 75%, are considered low, medium, and high heterogeneity, respectively (Higgins, Thompson, Deeks, & Altman, 2003). If the 95% confidence interval around $I^2$ includes zero, the set of effect sizes is considered homogeneous.

### Moderator Analyses

To explain variability in effect sizes, the relation between sample, methodological, or intervention characteristics and the magnitude of the effects were examined using a modified weighted least squares regression analyses with weights equivalent to the inverse of the variance for each effect size (L. V. Hedges, 1994; Lipsey & Wilson, 2001). Univariate regression analyses examined *a priori* determined moderators of alcohol expectancies or consumption effect sizes. Sample characteristics (age), intervention design (experiential vs. didactic), intervention content (expectancy domain challenged, individually tailored or group targeted), delivery of the intervention (same- or mixed-sex groups), and intervention length (total intervention dose) were examined. To control for Type I error, we used the Bonferroni correction to adjust the $P$-values, in this case $P$ = .005.

## Results

### Study, Sample, and Intervention Details

Table 1 provides sample and intervention details for the 14 included studies ($k$ = 19 interventions). Studies were typically conducted at large public universities in the United States (71%; 36% Southeast, 14% Midwest, 7% Northeast, 7% Southwest, 7% multiple U.S. regions), the Netherlands (14%) or Sweden (7%). Most studies were published in journals (86%; 14% were unpublished dissertations) between 1986 and 2008 (median publication year was 2001). Methodological quality score (MQS) of the studies ranged from 6 to 14 ($M$ = 10.67, $SD$ = 2.54). Publication year and MQS were correlated ($r$ = 0.80, $p$ <.001) with

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newer studies (studies published in or after the year 2001) of higher quality ($M$ = 12.39, $SD$ = 1.45) than older studies ($M$ = 8.96, $SD$ = 2.24).

Of the 1,417 participants sampled (*median* = 72 participants), 60% were men, 88% White, and 49% first year students with a mean age was 20 ($SD$ = 0.93; range = 19 to 21). Most participants (91%, $k$ = 13) reported using alcohol; none of the participants reported past history of or current alcohol treatment. Studies targeted current drinkers (64%), men (7%), women (7%), or a combination of men who were current drinkers (22%).

Interventions varied by method of expectancy challenge (i.e., experiential vs. didactic). EC interventions delivered experientially (58%, $k$ = 11) were typically conducted in three sessions (range = 1 – 3) with each session lasting a median of 105 minutes (range = 75 to 105). Facilitators typically delivered the experiential EC interventions to small groups (91%) with a median of 11.5 participants. In contrast, didactic EC interventions (42%; $k$ = 8) were typically conducted in two sessions (range = 1 – 3) with each session lasting a median of 45 minutes (range = 12 to 90). Didactic EC interventions were delivered to individuals ($k$ = 2) and small groups ($k$ = 6).

Participants in experientially-delivered EC interventions received either alcoholic beverages or a placebo (100%; $k$ = 11); all participants in two of these studies ($k$ = 3) received placebos with a minimal dose of alcohol on the rim of the glass in lieu of providing alcohol to a portion of participants (Kulick, 2001; Musher-Eizenman & Kulick, 2003; Wiers, van de Luitgaarden, van den Wildenberg, & Smulders, 2005). Experientially-delivered EC interventions usually included games intended to elicit social expectancies (27%, $k$ = 3), arousal expectancies (9%; $k$ = 1), or both social and sexual expectancies (45%; $k$ = 5). Participants in all eleven experientially-delivered interventions were asked to identify participants who had or had not been consuming alcohol.

Intervention content typically included alcohol information about the pharmacological effects of alcohol use (79%) and/or expectancy theory (95%). A few interventions asked participants to list self- or other-endorsed expectancies (16% and 11%, respectively). Many interventions included discussions or participant monitoring of sources of expectancies (63%) as well was writing and/or journaling about alcohol expectancies (63%). Some interventions included personalized feedback (32%), normative comparisons (5%), or decisional balance exercises (11%). Only 16% of the interventions specifically reported providing a booster session and/or materials to enhance the intervention.

Control conditions were most often an active comparison (53%; e.g., brief form of the intervention) or an assessment-only control (41%). Active comparisons were typically conducted in two sessions (range = 1 to 3) of a median of 21 minutes each (range = 10 to 105 minutes). Two studies (Dunn, Lau, & Cruz, 2000; Gustafson, 1986) did not have a comparison/control condition.

## Impact of Expectancy Challenge Interventions Compared with Controls

Table 2 provides the weighted mean effect sizes, $d_+$, for the 12 studies examining differences between EC and control conditions. College students participating in an alcohol expectancy challenge intervention reported lower positive alcohol expectancies ($d_+$ = 0.28, 95% CI 0.14, 0.43), reduced their quantity of alcohol consumed ($d_+$ = 0.23, 95% CI 0.08, 0.38), and reduced their frequency of heavy drinking ($d_+$ = 0.27, 95% CI 0.06, 0.47) relative to those in a control condition. No differences in negative alcohol expectancies were found. The pattern of results was consistent using fixed- or random-effects assumptions. All of the effects sizes at first assessment were homogeneous with one exception: the hypothesis of homogeneity was rejected for negative AE. When the studies' last available assessments

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were considered, there were no differences in negative alcohol expectancies, alcohol consumption, and frequency of heavy drinking between EC interventions and control groups. There was an overall trend for EC interventions to lower the number of positive alcohol expectancies ($k = 5$; $d_+ = 0.30$, 95% CI = 0.07, 0.52). All of the effects were homogeneous.

## Moderators of Intervention Impact on Alcohol Expectancies and Consumption

Because we had *a priori* moderation hypotheses, we conducted moderator tests to examine whether sample, methodological, or intervention characteristics related to the variability in effect sizes (see Supplemental Table A). To reduce potential interpretation bias from a single intervention, moderator tests were conducted only if a minimum of five interventions were available per outcome. Due to insufficient sample size ($k = 4$, see Table 2), we did not conduct moderator tests for combined alcohol expectancies.

### Inexperienced drinkers

Contrary to our hypotheses, legal drinking age (21 years or older vs. under 21 years of age) did not moderate alcohol expectancies or consumption. When we examined age as a continuous variable, however, we found the average age of participant was a significant moderator of negative AE. Compared to controls, participants in EC interventions endorsed *more* negative AE when they were older rather than younger ($\beta = 0.94$, $SE = .04$, $Q_{Residual}[1] = 8.07$, $p = .005$).

**Expectancy challenge design and domain challenged—**Expectancies challenged experientially (vs. didactically) or type of expectancies challenged (social, sexual, or arousal) did not moderate alcohol expectancies or alcohol consumption.

**Interventions targeted to a group or tailored to individuals—**Compared to controls, college students participating in EC interventions *reduced* the quantity of alcohol consumed when the intervention was targeted to men rather than women ($\beta = 0.98$, $SE = .02$, $Q_{Residual}[1] = 7.81$, $p = .005$). Targeting the intervention to heavy drinkers (vs. moderate/light drinkers) or tailoring the intervention to individual participants did not moderate alcohol expectancies or alcohol consumption.

**Intervention delivery and dose—**EC interventions delivered to same-sex (vs. mixed-sex) groups or individual (vs. group) delivery of the EC intervention did not moderate alcohol expectancies or alcohol consumption. Dose of the intervention did not moderate alcohol expectancies or alcohol consumption.

## Within-Group Changes

As shown in Table 3, participation in an EC intervention reduced all measured outcomes, except for global negative expectancies relative to baseline scores; within-group effect sizes ranged from 0.13 to 0.36 at the first post-intervention assessment. Participants receiving control condition did not change their alcohol expectancies or consumption at post-test.

To examine variation in improvement across the EC interventions and control groups, we calculated $Q_B$. Compared to controls, EC participants reported lower positive alcohol expectancies ($Q_B$ [1] = 10.76, $p < .01$), reduced their quantity of alcohol consumed ($Q_B$ [1] = 6.11, $p < .01$), and reduced their frequency of heavy drinking ($Q_B$ [1] = 5.53, $p < .02$).

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### Supplemental Analyses of Studies Measuring Specific Alcohol Expectancies

Many of the included studies (Corbin, 1997; Darkes & Goldman, 1993, 1998; Dunn, et al., 2000; Fillmore & Vogel-Sprott, 1996; Gustafson, 1986; Hunt, 2004; L. M. Jones, Silvia, & Richman, 1995; Keillor, Perkins, & Horan, 1999; Lau-Barraco & Dunn, 2008; Musher-Eizenman & Kulick, 2003; Wiers & Kummeling, 2004; Wiers, et al., 2005; Wood, et al., 2007) reported outcomes for alcohol expectancies with focused content. Specifically, studies measured expectancies associated with *social* disinhibition, *sexual* enhancement, *tension* reduction, and *arousal*/interpersonal power of alcohol. As shown in Table 2, participants in the EC intervention conditions endorsed *lower* social-, sexual-, tension-, or arousal-related alcohol expectancies than those in a control condition ($d_+$s = 0.22 to 0.34).

When examining within-group changes (Table 3), participants in EC interventions endorsed *lower* social-, sexual-, tension-, or arousal-related alcohol expectancies at post-test ($d_+$s = 0.15 to 0.33). Participants receiving a control condition showed no change among these specific alcohol expectancies at post-test. Compared to controls, EC participants endorsed lower expectancies associated with social disinhibition ($Q_B$ [1] = 10.32, $p$ <.01), sexual enhancement ($Q_B$ [1] = 9.54, $p$ <.01), tension reduction ($Q_B$ [1] = 5.35, $p$ =.02), and arousal/interpersonal power ($Q_B$ [1] = 3.80, $p$ =.05).

## Discussion

We examined 14 manuscripts evaluating 19 separate interventions challenging alcohol-related expectancies among 1,415 college students; we evaluated both between- and within-group effect sizes to examine fully the efficacy of expectancy challenge interventions at changing alcohol expectancies or reducing alcohol consumption among college students. Overall, expectancy challenge interventions succeeded at reducing positive alcohol expectancies, the quantity of alcohol consumed, and the frequency of heavy drinking for as long as one month post-intervention. Quantity of alcohol consumed and the frequency of heavy drinking was not sustained at longer follow-ups (i.e., up to six months post-intervention). To our knowledge, this is the first meta-analysis to examine the efficacy of expectancy challenge interventions to alter alcohol expectancies (the purported theoretical mechanism) in service of reducing alcohol consumption among college drinkers.

Compared to controls, expectancy challenge interventions were more successful at reducing positive alcohol expectancies, the quantity of alcohol consumed, and the frequency of heavy drinking; the magnitude of effect sizes were small ($d_+$s ranged from 0.23 to 0.28). In the current meta-analysis, the expectancy challenge interventions were most often compared with an active comparison rather than an assessment-only control. Prior research indicates that between-groups effect sizes are generally smaller when comparing an intervention to an active comparison relative to a no-treatment control (Grissom, 1996). Nonetheless, the magnitude of effects for the quantity of alcohol consumed and the frequency of heavy drinking alcohol consumption variables corroborates effects reported in a previous meta-analysis of individual-level alcohol interventions for college students (Carey, et al., 2007).

Relatively few studies have examined EC intervention at lengthier follow-ups. For the studies included in the current meta-analysis, the longest assessment interval was 6 months post-intervention. When we examined the last assessment interval (among studies with multiple assessments), EC interventions did not improve alcohol consumption or the frequency of heavy drinking relatively to control groups. Interventions were successful at lowering positive alcohol expectancies at the final assessment. Although expectancy manipulations are successful at lowering positive alcohol expectancies for longer time periods, the usefulness of EC interventions to ameliorate college student alcohol use long-term has not yet been demonstrated (B. T. Jones, et al., 2001).

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Few study, sample, and intervention features moderated the efficacy of an expectancy challenge intervention at first assessment. Because younger participants typically have less experience with alcohol use, we expected younger, rather than older, participants to show greater benefits after participation in an EC intervention. Contrary to our hypothesis, EC interventions increased negative alcohol-related expectancies among older, rather than younger, participants. One possible explanation for this finding is that many of these participants had prior experience with the negative effects of alcohol consumption and were ready (and able) to change their alcohol consumption behavior (B. T. Jones, 2004). An alternative explanation is that older college students have had simply more personal experience with negative alcohol-related outcomes (Gadon, Bruce, McConnochie, & Jones, 2004; Leigh & Stacy, 2004); thus, the EC intervention may have inadvertently triggered implicit negative alcohol expectancies. Because none of the interventions targeted negative alcohol-related expectancies, our explanations for these findings are speculative at best. Future research is needed to fully assess the efficacy of expectancy challenge interventions to strengthen and/or reinforce negative alcohol expectancies.

Within-group changes provided additional support for the efficacy of expectancy challenge interventions. EC interventions were successful in reducing positive alcohol expectancies, the quantity of alcohol consumed, and the frequency of heavy drinking from pre- to post-test; the magnitude of effect sizes were small ($d_+$s ranged from 0.13 to 0.36). In contrast, control conditions were unsuccessful in reducing alcohol expectancies or consumption ($d_+$s = − 0.11 to 0.01; all effect sizes *ns*). In the current meta-analysis, changes from pre- to post-test were observed most often two weeks following the intervention. Thus, EC effects can be seen quickly and providing college students with an expectancy challenge intervention suppresses drinking more than an alternative condition (nothing or an active comparison) in the short-term. Additional research is needed to fully evaluate the long-term efficacy of EC interventions.

## Limitations

Several limitations should be considered when interpreting these findings. First, all outcomes involve self-reports, which are vulnerable to cognitive (e.g., memory) and social (e.g., self-presentation) biases (Schroder, Carey, & Vanable, 2003; Weinhardt, Forsyth, Carey, Jaworski, & Durant, 1998). Self-report is imperfect, but most researchers employed methods designed to optimize data quality. Second, to optimize statistical power, our primary analyses were restricted to assessments of expectancies and consumption measures at first post-intervention, typically two weeks after the receipt of the EC intervention. Thus, our findings are restricted to short-term outcomes and may not be replicated at longer follow-ups. Indeed, analyses at last assessment (among the eight studies with multiple follow-ups) indicate that reductions in quantity of alcohol consumed and the frequency of heavy drinking were not maintained two months following the intervention. Third, the limited number of studies available precluded the evaluation of potentially interesting predictors. For example, only two studies ($k = 3$) reported the proportion of students across the four years of college; thus, evaluation of the potentially interesting association between first and later year students exposed to an EC intervention could not be tested. Finally, the small number of studies available at the first assessment interval could not support multivariate moderator tests. Thus, our moderator analyses should be considered preliminary.

## Implications

Our findings have several implications for those aiming to prevent at-risk alcohol use among college students. First, EC interventions might be considered as an additional strategy to reduce widespread alcohol use on college campuses, which has been recognized as a

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nationwide public health problem (National Institute on Alcohol Abuse and Alcoholism, 2002). Second, the availability of relatively brief interventions offered in a group setting might facilitate implementation within the context of campus activities that are normally conducted in groups (e.g., student orientation, residence life programs, or student organization events). Most EC interventions were delivered in three or fewer group sessions and may not require as many resources as individualized interventions that are commonly employed for college drinkers (e.g., BASICS; (Dimeff, et al., 1999). Third, the effects of EC interventions are relatively brief. Therefore, providers might consider implementing EC interventions before periods when students are more likely to engage in at-risk drinking behavior (e.g, spring break; (Del Boca, Darkes, Greenbaum, & Goldman, 2004) to maximize their utility. Finally, refinement of EC interventions should seek to improve long-term reductions in alcohol use and to determine ways to increase the impact of the intervention.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

This research was facilitated by National Institute of Health Grant R01-AA012518 to Kate B. Carey. We thank Jennifer C. Elliott and Melissa Melton for assisting with the study and the authors who provided additional intervention details or data for this study.

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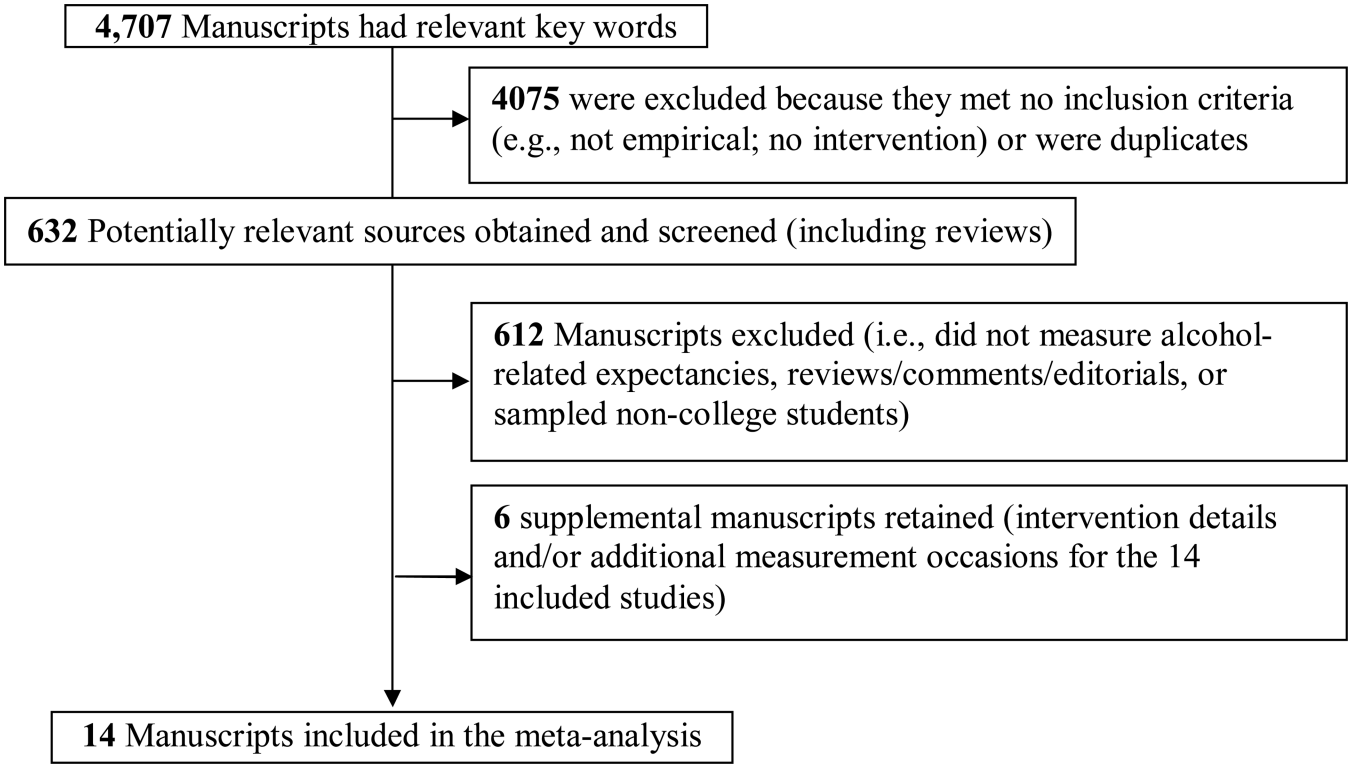


**Figure 1.**
Selection process for study inclusion in the meta-analysis

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**Table 1**

Study, Sample, and Intervention Characteristics of the 14 Studies Included in the Meta-Analysis

| Study | Sample | Control Group | Intervention Details | | | | | Study Quality |
|---|---|---|---|---|---|---|---|---|
| | | | Delivery | Sessions | Dose[a] | Type | Description | |
| Corbin, McNair, and Carter (2001) *Supplemental:* Corbin (1997) | *N* = 87 (29%); 50% F; 87% W; *M* age = 20; 100% current drinkers | Relevant content, not time matched | Group | 3 | 180 | DID | Face-to-face presentation of AE, generated statements refuting AE, and monitored media sources of AE. | 11 |
| Darkes and Goldman (1993) | *N* = 74 (32%); 0% F; 95% W; *M* age = 20; 100% current drinkers | Assessment Only | Group | 3 | 315 | EXP | Consumed alcohol or placebo, social activity, rated attractiveness, identified who consumed alcohol, info on AE, and monitored AE exposure. | 9.47 |
| Darkes and Goldman (1998) *Supplemental:* Darkes (1994) | *N* = 67 (19%); 0% F; 87% W; *M* age = 21; 100% current drinkers | Irrelevant content, not time matched | Group | 3 | 225 | EXP | *Social/sexual.* Consumed alcohol or placebo, social activity, rated attractiveness, info on AE, and monitored AE exposure. | 11 |
| | | | | | | EXP | *Affective/cognitive.* Consumed alcohol or placebo, listened to recording disconfirming AE, group problem-solving exercise, identified who had and had not consumed alcohol, info on AE, and monitored reactions to alcohol. | |
| Dunn et al. (2000) | *N* = 38 (0%); 50% F; 100% W; *M* age = 21; 100% current drinkers | Not reported | Group | 2 | 210 | EXP | Consumed alcohol or placebo, engaged in party games, identified who consumed alcohol, and discussed AE. | 6.67 |
| Gustafson (1986) | *N* = 40 (0%); 0% F | Not reported | Group | 1 | 30 | DID | Consumed alcohol or placebo, viewed video, and read articles about the effect of alcohol on aggression. | 5.6 |
| Hunt (2004) | *N* = 158 (0%); 0% F; 64% W; *M* age = 21; 100% current drinkers | Irrelevant content, time matched | IND | 1 | 12 | DID | *Low-level engagement.* Viewed AE presentation. | 11.1 |
| | | | | | 20 | DID | *High-level engagement.* Viewed AE presentation, video of mock EC, and completed interactive components. | |
| L. M. Jones et al. (1995) | *N* = 100 (10%); 46% F; 90% W; *M* age = 19; 100% current drinkers | Irrelevant content, time matched | Group | 2 | NR | DID | *EC.* Received info on AE, watched video exhibiting AE, and completed AE diary | 11 |
| | | | | | | DID | *EC with Self-Challenge or Inoculation.* Received info on AE, watched video exhibiting AE, completed AE diary, and wrote essay on AE | |
| Keillor et al. (1999) | *N* = 31 (19%); 0% F; *M* age = 19; 100% current drinkers | Relevant content, time matched | Group | 2 | 180 | DID | Watched video of other participants engaging in EC, identified beverage consumed by participants in video, info on AE, and monitored AE exposure. | 11 |
| Lau-Barraco and Dunn (2008) *Supplemental:* Lau (2007) | *N* = 239 (9%); 57% F; 76% W; *M* age = 20; 100% current drinkers | Irrelevant content, time matched | Group | 1 | 105 | EXP | Consumed alcohol or placebo, engaged in social activity, identified who consumed alcohol, and discussed AE. (Gender Specific) | 14 |

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| Study | Sample | Control Group | Intervention Details | | | | | Study Quality |
|---|---|---|---|---|---|---|---|---|
| | | | Delivery | Sessions | Dose[a] | Type | Description | |
| Musher-Eizenman and Kulick (2003) *Supplemental:* Kulick (2001) | *N* = 70 (23%); 100% F; 94% W; *M* age = 19; 100% current drinkers | Assessment Only | Group | 3 | 315 | EXP | *Social/sexual.* Consumed placebo (told possibly alcohol), social activity, rated attractiveness, identified who consumed alcohol, info on AE, and monitored AE exposure. | 11 |
| | | | | | | EXP | *Cognitive/motor enhancement.* Consumed placebo (told possibly alcohol), motor activity, cognitive-based activities, identified who consumed alcohol, info on AE, and monitored AE exposure. | |
| Stanik (1996) | *N* = 59 (5%); 100% F; 93% W; *M* age = 20; 80% current drinkers | Assessment Only | Group | 2 | 120 | DID | Received lecture on AE, watched videotaped alcohol advertisements, and critiqued advertisements. | 8 |
| Wiers and Kummeling (2004) | *N* = 25 (0%); 56% F; 100% current drinkers | Assessment Only | Group | 3 | 315 | EXP | Consumed alcohol or placebo, social activity, rated attractiveness of opposite gender celebrities, reported celebrity the opposite gender would rate as most attractive, identified drinks consumed by others, info on AE, and monitored AE exposure. | 12.2 |
| Wiers et al. (2005) *Supplemental:* Wiers, van Woerden, Smulders, and de Jong (2002) | *N* = 92 (0%); 50% F; 88% W; *M* age = 21; 100% current drinkers | Relevant content, not time matched | Group | 2 | 120 | EXP | Told consumed alcohol (placebo), social activity, sexual expectancies challenge, identified who consumed alcohol, info on AE, and wrote essay on AE exposure. | 14.4 |
| Wood et al. (2007) *Supplemental:* Capone and Wood (2009) and Weirs et al. (2003) | *N* = 335 (18%); 53% F; 90% W; *M* age = 21; 100% current drinkers | Assessment Only | Group | 2 | 180 | EXP | *EC.* Consumed alcohol or placebo, social activity, identified who consumed alcohol, info on AE, and monitored AE exposure. | 13 |
| | | | Group & IND | 3 | 232.5 | EXP | *BMI and EC.* Received BMI, consumed alcohol or placebo, social activity, rated attractiveness, identified who consumed alcohol, info on AE, and monitored AE exposure. | |

*Note. N*, number of consenting participants (attrition); F, proportion female; W, proportion White; B, proportion Black; AO, assessment only control; IND, individual; EXP, experiential expectancy challenge presentation; DID, didactic expectancy challenge presentation; AE, alcohol expectancies; EC, expectancy challenge; BMI, brief motivational intervention.

[a]Estimated number of minutes of intervention content excluding measurement.

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**Table 2**

Efficacy of Alcohol Expectancy Challenges Relative to Control Conditions at First-Follow-up.

| Outcome | *k* | Weighed mean *d* (95% confidence interval) | | Homogeneity of effect sizes | | $I^2$ (95% uncertainty interval) |
|---|---|---|---|---|---|---|
| | | Fixed effects | Random effects | *Q* | *p* | |
| Alcohol Expectancies, Global | | | | | | |
| **Positive** | 11 | **0.28 (0.14, 0.43)** | **0.28 (0.14, 0.43)** | 5.90 | .823 | 0 |
| Negative | 5 | −0.17 (−0.37, 0.04) | −0.29 (−0.66, 0.08) | 10.02 | .040 | 0 |
| Combined[a] | 4 | 0.07 (−0.14, 0.28) | 0.07 (−0.14, 0.28) | 1.80 | .615 | 0 |
| Alcohol Consumption | | | | | | |
| **Quantity** | 11 | **0.23 (0.08, 0.38)** | **0.24 (0.05, 0.42)** | 14.27 | .161 | 0 |
| **Frequency of heavy drinking** | 5 | **0.27 (0.06, 0.47)** | **0.27 (0.02, 0.52)** | 5.72 | .221 | 0 |
| Alcohol Expectancies, Specified | | | | | | |
| **Social** | 9 | **0.22 (0.07, 0.37)** | **0.22 (0.07, 0.37)** | 8.02 | .432 | 0 |
| **Sexual** | 9 | **0.28 (0.13, 0.43)** | **0.32 (0.12, 0.52)** | 12.46 | .132 | 0 |
| **Tension** | 5 | **0.34 (0.14, 0.54)** | **0.38 (0.06, 0.71)** | 9.39 | .052 | 0 |
| **Arousal** | 8 | **0.23 (0.06, 0.40)** | **0.32 (0.03, 0.62)** | 18.67 | .009 | 63 (19–83) |

*Note. k*, number of interventions. Positive effect sizes may be interpreted as favoring EC relative to controls in the predicted direction.

[a]An overall alcohol expectancy score (combining both positive and negative expectancies) was reported for four interventions (Darkes & Goldman, 1993; Stanik, 1996; Wood, et al., 2007).

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## Table 3

Efficacy of Alcohol Expectancy Challenges and Control Conditions from Pre- to Post-Test.

| | EC | | Controls | |
|---|---|---|---|---|
| **Outcome** | ***k*** | ***d*+ (95% CI)** | ***k*** | ***d*+ (95% CI)** |
| Alcohol Expectancies, Global | | | | |
| **Positive** | 14 | **0.20 (0.11, 0.29)** | 9 | −0.03 (−0.14, 0.08) |
| Negative | 8 | 0.03 (−0.09, 0.15) | 4 | 0.07 (−0.10, 0.25) |
| Alcohol Consumption | | | | |
| **Quantity** | 10 | **0.13 (0.01, 0.25)** | 6 | −0.11 (−0.26, 0.04) |
| **Frequency of heavy drinking** | 4 | **0.36 (0.17, 0.56)** | 2 | 0.01 (−0.22, 0.23) |
| Alcohol Expectancies, Specified | | | | |
| **Social** | 11 | **0.33 (0.23, 0.44)** | 6 | 0.05 (−0.08, 0.19) |
| **Sexual** | 11 | **0.15 (0.05, 0.26)** | 6 | −0.11 (−0.25, 0.20) |
| **Tension** | 7 | **0.33 (0.20, 0.46)** | 4 | 0.09 (−0.07, 0.25) |
| **Arousal** | 8 | **0.17 (0.04, 0.31)** | 5 | −0.03 (−0.19, 0.13) |

*Note*. Fixed-effects only.