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# Expectancy Challenge Interventions to Reduce Alcohol Consumption Among High School and College Students: A Meta-Analysis

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**Objective:** Alcohol expectancies are a critical factor in the development of problematic alcohol use. Expectancy challenge (EC) interventions aim to manipulate positive alcohol expectancies to reduce or prevent alcohol use among young people. The present meta-analysis investigated the effects of ECs at changing expectations and alcohol use among high school and college students, and moderating effects of study and individual characteristics on these changes. **Method:** A total of 23 EC studies ( $N = 4,122$ ; mean age = 19.0; 57% males) was included as they reported enough information to calculate effect sizes, had a control condition that did not receive an active intervention, and were presented as of August 1, 2020. Two independent coders coded relevant variables and calculated effect sizes at posttest using a random-effects model. **Results:** ECs showed significant yet small effects at modifying alcohol consumption and alcohol expectancies in the desired direction ( $g$ 's ranged from  $-.18$  to  $-.42$ ). Changes in social, tension, liquid courage, and risk aggression expectancies explained significant variance in change in alcohol use. The effects of ECs at changing social, sexual, tension, and liquid courage expectancies were stronger among college students compared to high school students. More favorable results were observed for interventions delivered at a higher dose. **Conclusions:** ECs targeting high school and college students produce small effects at reducing alcohol use and changing alcohol expectancies. Future efforts are needed to determine under which circumstances and among which subgroups ECs are expected to produce greater effects.

## Public Health Significance

This meta-analysis suggests that EC interventions modestly reduce alcohol use among college and high school students, and that ECs that target college students and that are delivered at a higher dose can produce more favorable effects.

**Keywords:** alcohol, meta-analysis, expectancy challenge, college students, high school students

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Despite trends suggesting declines in alcohol consumption rates among young people (Jackson et al., 2017), alcohol remains the most frequently consumed and abused substance among high school (Johnston et al., 2014) and college (Schilling et al., 2017) students. Findings indicate that college students consume higher alcohol volumes than non-college-attending young adults; largely explained by demographic characteristics and exposure to a campus environment increasing the likelihood of drinking (White & Hingson, 2013). Moreover, a high percentage of high school students reportedly drink alcohol (Miller et al., 2007). Alcohol consumption among high school and college students has been consistently linked to a cluster of adverse consequences such as higher risk of future alcohol dependence (Miller et al., 2007), poor academic

performance (DuRant et al., 1999; Wechsler et al., 2002), risky sexual behavior (Hingson et al., 2009), and delinquency (Hingson et al., 2009).

## Alcohol-Related Expectations

In response to the evident burden of alcohol use among the student population, scholars have investigated the influence of alcohol expectancies, or beliefs about the positive or negative effects of alcohol, as a critical factor in the development of problematic alcohol use (Goldman et al., 1999). Alcohol expectancies exist at early ages prior to the initial drinking experience (Dunn & Goldman, 1996), predict onset of drinking (Stacy, 1997), and mediate the influence of precursor factors on alcohol consumption (Darkes & Goldman, 1998). Positive drinking expectancies (e.g., regarding sociability, sexual arousal, and tension reduction) may also motivate an individual to maintain drinking behavior (Wechsler & Nelson, 2008). Alcohol expectancies can increase the likelihood of alcohol consumption among adolescents (Copeland et al., 2014) and college students (Derby, 2011). In contrast, negative alcohol expectancies (e.g., impeded cognitive, social, or motor skills) can prevent, reduce, or end the occurrence of heavy drinking (Jones, 2004). Thereby, a decrease in positive expectations and increase in negative

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expectancies may be mechanisms through which drinking behavior can be prevented or reduced. Mixed findings exist regarding sex differences, with a set of results indicating that males report higher levels of positive expectancies than females (Wood et al., 1996), whereas another study found no significant differences (Carey, 1995).

### Alcohol Expectancy Challenge Interventions

The association between problematic alcohol use and alcohol expectancies has led to the development of expectancy challenge (EC) interventions aimed at manipulating positive expectancies to prevent or reduce alcohol use among young individuals (Darkes & Goldman, 1993). ECs were designated by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) as suggested interventions to decrease problematic alcohol use among college students (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2002). Darkes and Goldman (1993) implemented the first extensive EC procedure targeting heavy-drinking college students without a preceding history of alcohol dependency. The EC was delivered in three separate sessions and involved a bar lab setting where groups of students were served beverages and were told that the beverages would either contain alcohol or not. Participants engaged in learning experiences and in social activities and were asked to identify who, including themselves, had consumed alcohol. This judgment was based on the observations of behavioral changes (e.g., social facilitation) expected to occur after drinking alcohol. Participant's expectations were challenged as they were subsequently presented with correct information regarding who had consumed alcohol, which reflected that their judgments were no more accurate than if they were to respond randomly. Participants' inability to accurately identify drinkers is hypothesized to alter their expectations and to help them better differentiate between experiences lived due to expectations about drinking than to the actual pharmacological effects of alcohol. Compared to a traditional information and an assessment-only condition, EC participants showed significantly stronger decreases in alcohol use.

Succeeding applications of EC interventions have incorporated changes to the protocol proposed by Darkes and Goldman (1993) such as variations in dose and in delivery. Furthermore, to address concerns regarding the number of sessions, the administration of alcohol, and the need of a bar lab in traditional EC interventions (Wiers & Kummeling, 2004), researchers have modified these characteristics resulting in a single-session intervention delivered in a typical classroom setting (Cruz & Dunn, 2003). This evolution has facilitated the expansion of the intervention and has allowed for its application among high school and elementary school students—a favorable progression as alcohol expectations are often formed during childhood (Cruz & Dunn, 2003). Moreover, evidence supports the association between exposure to alcohol-related media depicting positive experiences associated with alcohol consumption and the formation of alcohol expectancies, leading to actual alcohol consumption (Stacy et al., 2004). To approach this matter, the EC Alcohol Literacy Curriculum (ECALC) was validated for use with high school and college students placing a strong focus on increasing media literacy to train subjects to more accurately determine the validity of alcohol advertisement and to defy positive media portrayals of alcohol use (Sivasithamparam, 2008). Further developments in the delivery of ECs led to the use of recorder narrations to deliver scripted information, which guarantees cost-effectiveness

and consistency of delivery, and facilitates distribution of the intervention (Dunn et al., 2019).

Mixed findings exist in regard to the effects of EC interventions at reducing alcohol use and at modifying alcohol expectations among adolescents and young adults. Drawing from a mixed-gender sample of high school students, Cruz (2007) found a significantly stronger decrease in alcohol consumption and changes in alcohol expectancies among higher drinking male EC participants compared to participants in the traditional information and assessment only conditions. However, results among mixed-gender groups of college students are inconclusive (Labbe & Maisto, 2011). Dietz (2016) reported a significant decrease in positive expectancies among high school students with drinking experience in the EC condition, and a significantly stronger decrease in alcohol consumption among females in the EC condition compared to the control condition. Furthermore, studies have demonstrated a stronger decline in alcohol use following the successful modification of expectations resulting from participation EC interventions compared to traditional information and assessment-only conditions among moderate to heavy-drinking male (Darkes & Goldman, 1993, 1998) and female (Lau-Barraco & Dunn, 2008) college students. Yet, other studies did not find significantly stronger changes in drinking or expectations among male (Keillor et al., 1999) nor female (Wiers & Kummeling, 2004) college students participating in ECs compared to those in control conditions. Moreover, evidence supports the effects of ECs at reducing alcohol use and positive alcohol expectancies among males, yet, studies applying EC interventions to women-only groups have not found consistent intervention effects and research on this gender group remains scarce. Thus, a gap in the literature on EC interventions exists concerning the effects of the intervention on females.

A meta-analysis investigating alcohol interventions for mandated college students found that interventions challenging alcohol expectancies reduced drinking frequency (Carey et al., 2016). However, when adjusted for multiple univariate testing, this association was not significant ( $p = .43$ ). An earlier meta-analysis exclusively evaluating EC interventions included 14 studies and reported a significant overall effect of EC interventions at reducing positive alcohol expectations and the quantity and frequency of heavy drinking among a college population; however, effect sizes were small ( $d$ 's ranged from 0.23 to 0.28; Scott-Sheldon et al., 2012).

### The Present Meta-Analysis

Earlier efforts to investigate the effects of interventions challenging alcohol expectancies have provided mixed evidence for their effects at modifying alcohol use and expectancies among college students (Carey et al., 2016; Scott-Sheldon et al., 2012). Also, they are limited to samples of college students despite findings suggesting that adolescence is a critical period to challenge alcohol expectancies (Dietz, 2016). An earlier systematic analysis of ECs only reported moderating effects of gender (Labbe & Maisto, 2011), and a previous meta-analysis investigated moderating effects of study and individual characteristics on the effects of ECs among college students found only moderating effects of age (Scott-Sheldon et al., 2012). Additional moderating effects of study and individual characteristics could exist but may have not been identified due to the small sample of included studies. It is crucial to thoroughly understand which intervention and participant characteristics moderate

the effects of these interventions because they define under which circumstances ECs are more likely to promote desired outcomes. The present meta-analysis addressed these gaps by investigating changes in expectations and in alcohol use among high school and college students and moderating effects of study characteristics on these changes, that is, dose (number of sessions and session length), methodological quality of studies, training on media literacy, delivery format (experimental bar vs. no experimental bar), and of individual factors (age, sex, ethnic minority status, and college vs. high school students).

Drawing on the aforementioned findings, we first hypothesized that EC interventions would be effective at reducing alcohol use and positive alcohol expectancies among the general high school and college student population. Second, as expectancies are critical predictors of alcohol use (Jones et al., 2001), we investigated the mediation role of expectancy change in drinking reduction and expected that change in expectancies predicts change in alcohol consumption. Furthermore, we investigated whether intervention characteristics and individual factors had a moderating effect on the size of change in alcohol consumption and in alcohol expectations. Accordingly, our third hypothesis anticipated that younger participants and high school students would exhibit better outcomes from EC interventions than older participants and college students due to the lower likelihood of holding exceptionally strong positive alcohol expectancies during earlier stages of alcohol use (Dietz, 2016); existing evidence suggests that drinking behavior becomes more stable with age making it more difficult to change (White & Jackson, 2004), and promising outcomes reported for this younger age group (Sivasithamparam, 2011). Fourth, we hypothesized that EC interventions would show more favorable results when delivered to groups with a high percentage of male participants as males display more positive alcohol expectancies than females (Jones et al., 2001), tend to drink more than females (Darkes & Goldman, 1993), and previous ECs targeting this group format has presented superior outcomes than in mixed and female-only groups (Labbe & Maisto, 2011). Fifth, we hypothesized that EC interventions delivered at a higher dose would show more favorable results as longer interventions allow for more opportunities to challenge alcohol use and expectancies compared to shorter interventions (Gottfredson & Wilson, 2003). Sixth, due to the influence of media sources on youth decision making and on the formation of positive alcohol expectancies (Dunn et al., 2019), we expected EC interventions to be more effective when they included a media literacy component. Furthermore, we investigated whether the methodological quality of the studies had any moderating effects. We also explored whether an experimental bar delivery format and a non-experimental-bar delivery format lead to different effects. Superior positive effects of a non-experimental-bar format may support this delivery format's faculty to facilitate the implementation of EC interventions and to reach a larger number of subjects without the need of administering alcohol to participants (Sivasithamparam, 2011). Finally, we explored whether the percentage of members of ethnic minority groups had moderating effects on changes in alcohol consumption and expectancies.

## Method

### Literature Search

Relevant studies were retrieved from the electronic databases PsycInfo, ERIC, Medline, and PubMed through a systematic search

using the following terms: (expectancy challenge) AND (young adults OR students OR adolescent) AND (alcohol expectanc\*). Additional studies were identified by checking the reference section of literature from the electronic databases. Studies were included if they

1. Reported enough information for calculating the effects of EC interventions on alcohol expectancy change and/or alcohol use among high school or college students.
2. Randomized participants into an experimental condition or a control condition that did not receive an active intervention.
3. Were published or presented before August 1, 2020.

We excluded studies that

1. Did not use an EC intervention.
2. Did not assess EC effects on alcohol consumption or related expectancies.

When a study met the inclusion criteria but provided insufficient information to calculate effect sizes, we sought to obtain the additional information by contacting the authors. Studies that also included other alcohol interventions (e.g., Brief Motivational Intervention [BMI]) were only included if the study had an EC-only group that could be compared to an assessment only control group. To minimize the possibility of publication bias (Rosenthal, 1979), we included several unpublished articles that were identified by the literature search described above.

A total of 245 articles were identified using the listed search terms. After screening the results and assessing them for eligibility, 222 articles were excluded. A total of 23 studies were included in the present meta-analysis (see Figure 1) resulting in a combined sample of 4,122 participants. All included studies are listed in the References section and marked with an asterisk.

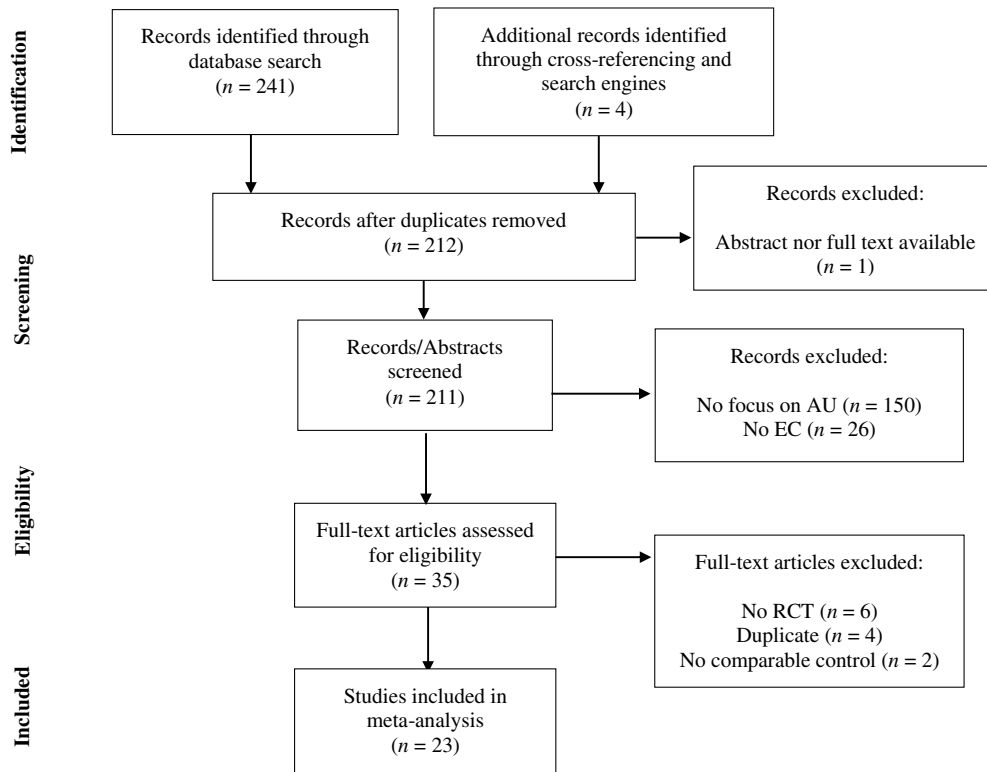
### Coding Procedures

Variables were coded based on three potential mediating categories as follows:

1. Study characteristics (i.e., publication status, methodological quality, and sample size).
2. Intervention characteristics (i.e., dose, components, delivery format, interval between intervention and outcome assessment, and instruments used).
3. Sociodemographic characteristics (i.e., age, sex, ethnic minority status, and population).

The methodological quality of the studies was assessed using the National Institutes of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Institutes of Health [NIH], 2014) which included 14 items (e.g., was the study described as randomized control trial?) and scores could vary from 0 to 14. Effect sizes ( $d$ ) were calculated for changes in alcohol use and changes in alcohol expectancies by computing the difference between change in the intervention condition and the control condition, divided by the pooled standard deviation at pretest

**Figure 1**  
*PRISMA Flow Diagram*



Note. AU = alcohol use; EC = expectancy challenge; RCT = randomized control trial.

(Cohen, 1988). As studies used different measures for assessing alcohol use and alcohol expectancies, we conceptualized changes in alcohol consumption as changes in the quantity of drinks consumed over time and frequency of drinking occasions for evidence shows that alcohol expectancies are associated with quantity and frequency of drinking among adolescents (Fromme & D'Amico, 2000) and college students (Carey, 1995). For studies that reported results on alcohol consumption quantity and frequency of drinking occasions separately, a mean effect size combining both effect sizes was calculated. In addition, alcohol expectancies were coded separately for change in general expectancies (i.e., global expectancies) and in domain-specific expectancies (e.g., sexual enhancement, social enhancement, tension reduction, liquid courage, cognitive consequences, risk aggression, and negative self-perception). Effects sizes were calculated separately for groups with different drinking patterns, different demographic characteristics (e.g., age and sex), and having more than one EC group. In the absence of mean scores, *F* scores were utilized to calculate effect sizes (Lipsey & Wilson, 2001). Negative effect sizes reflect changes in the desired direction (i.e., decrease of positive alcohol expectancies, increase of negative alcohol expectancies, and decrease in quantity and frequency of drinking) in the EC condition. Studies were screened and coded by two independent coders. The first author coded 100% of the studies, while a graduate student coded a random sample of 44% of the studies. Discrepancies regarding variable coding were solved through discussions between the two coders. Interrater reliability was high (80%).

## Outcomes

Only variables for which at least nine effect sizes were available were included to identify a small effect size of  $g = .20$  with a test power of 80%, as indicated by the Power Calculator Tool (Harrer et al., 2019). These outcome variables include the following: alcohol consumption, global alcohol expectancies (i.e., total positive expectancy scores), sexual enhancement expectancies (e.g., "I would be a better lover"), sociability expectancies (e.g., "I would be outgoing"), tension reduction expectancies (e.g., "My body would feel relaxed"), liquid courage expectancies (e.g., "I would feel brave"), cognitive consequences expectancies (e.g., "I would have difficulty thinking" or "I would think faster"), risk aggression expectancies (e.g., "I would act aggressively"), and negative self-perception expectancies (e.g., "I would feel self-critical").

## Statistical Analysis

Data analysis was conducted using the *Comprehensive Meta-Analysis* software (Borenstein et al., 2009). Most studies did not report follow-up results, and none of the outcome variables analyzed presented nine or more effect sizes at follow-up. Therefore, only posttest outcomes were included in our analysis. All effect sizes were transformed to Hedge's  $g$ . Results of  $g = .20$  were interpreted as small, of  $g = .50$  as medium, and of  $g = .80$  as large (Cohen, 1988). Outliers presenting more than two standard deviations (*SDs*) away from the mean were corrected to the value at two *SDs*.



Weighted mean effect sizes and 95% confidence intervals (CIs) were calculated using a random-effects model (Lipsey & Wilson, 2001). The significance of the mean was tested by dividing the weighted mean effect size by the standard error of the mean. Trim-and-fill analysis was computed for correcting potential publication bias (Shi & Lin, 2019). To test homogeneity between effect sizes, we computed  $Q$  scores and  $I^2$  indices. Inverse variance weighted regressions were used to calculate moderator analysis for continuous variables and inverse variance weighted one-way ANOVAs were used for categorical variables (Lipsey & Wilson, 2001).

## Results

### Sample and Study Characteristics

Characteristics of each included study are reported in Table S1 on the electronic supplementary material. Concerning the  $k = 23$  studies included in our analysis, 57% were published in an academic journal while 43% were dissertations. Studies were conducted between 1993 and 2018 ( $M = 2005$ ). The methodological quality score of studies ranged from 6 to 13 points, with 9.61 being the median score. One study targeted participants who were either nondrinkers or who had limited drinking experiences, 8 studies targeted participants who were heavy drinkers (without current or past history of any other intervention to treat problematic alcohol use), while 13 studies targeted participants who were moderate to heavy drinkers. The mean age of the  $n = 4,122$  participants was  $M = 19$  years ( $SD = 2.32$ ). Moreover, 57% were males, 78% were college students, and 80% were White. Seven ECs delivered in a bar lab setting served participants either an alcoholic beverage or a placebo beverage. Studies with and without a bar lab setting provided education about alcohol expectancies and about the effects of alcohol, and integrated discussions about existing expectancies and their sources to challenge them. Moreover, 8 interventions included a media literacy component. The number of sessions ranged from 1 to 4 ( $M = 1.87$ ,  $SD = .97$ ) and the duration of each session ranged from 35 to 105 min ( $M = 59.35$ ,  $SD = 20.41$ ). Typically, interventions consisted of one session (47.80%), followed by three (26.10%), two (21.70%), and four (4.30%) sessions. The average interval between the intervention and posttest was of

34.91 days. Sessions were typically delivered to groups (22 studies) as opposed to individuals.

### Effects of EC Interventions

Weighted mean effect sizes of all outcome variables at posttest are shown in Table 1. Overall, EC interventions showed positive effects at reducing alcohol consumption and general positive alcohol expectancies among participants in the experimental condition as opposed to those in the control condition. However, the effects were small, particularly for alcohol consumption. Moreover, EC participants also showed significant changes in the desired direction on sexual, social, tension reduction, liquid courage, and risk aggression expectancies. Nevertheless, effect sizes were also small (Cohen, 1988). Accordingly, our first hypothesis was predominantly supported, yet effect sizes were small. Furthermore, the effects for alcohol consumption and for global, sexual, risk aggression, cognitive consequences, and self-perception expectancies were heterogeneous, indicating variability between the included studies. Our second hypothesis was partially supported as changes in social, tension, liquid courage, and risk aggression expectancies explained significant variance of change in alcohol use (see Table 2).

Trim-and-fill analysis added effect sizes of possible missing studies on five out of nine outcome variables (see Table S2 on the electronic supplementary material). The corrected effect sizes differed only slightly from the original effect sizes with results showing variability in size (i.e., larger than the original effect size in some cases, and smaller in other cases), indicating no consistent evidence of publication bias. Change in cognitive consequences expectancies became significant indicating a stronger increase in the intervention group on this domain.

### Analysis of Moderator Effects

Moderator analysis was conducted to investigate whether intervention characteristics and individual factors had a moderating effect on the intervention's effect on change in behavior and in

**Table 1**  
*Mean Effect Sizes of Outcome Variables*

Outcome	$k$	$g$	95%	CI	$Z$	$Q$
Alcohol consumption	30	-.17	-.26	-.09	-3.89 <sup>c</sup>	36.49
Global alcohol expectancies	10	-.35	-.59	-.11	-2.88 <sup>b</sup>	7.79
Sexual expectancies	19	-.32	-.42	-.21	-5.92 <sup>c</sup>	24.39
Social expectancies	17	-.42	-.53	-.31	-7.75 <sup>c</sup>	33.51 <sup>a</sup>
Tension expectancies	18	-.37	-.47	-.26	-6.96 <sup>c</sup>	28.63 <sup>a</sup>
Liquid courage expectancies	12	-.38	-.49	-.26	-6.43 <sup>c</sup>	42.45 <sup>c</sup>
Cognitive consequences	14	.10	-.06	.27	1.24	23.20 <sup>a</sup>
Risk aggression expectancies	13	-.24	-.35	-.13	-4.30 <sup>c</sup>	13.99
Self-perception expectancies	12	-.11	-.22	.00	-1.90	7.84

*Note.*  $k$  = number of effect sizes included in the analysis;  $g$  = weighted mean effect size; 95% CI = lower and upper limits of the 95% confidence interval;  $Z$  = test for significance of  $g$ ;  $Q$  = test for homogeneity of effect sizes.

Negative effect sizes reflect changes in the desired direction (i.e., decrease of alcohol consumption and positive alcohol expectancies, and increase of negative expectancies).

<sup>a</sup> $p < .05$ . <sup>b</sup> $p < .01$ . <sup>c</sup> $p < .001$ .

**Table 2***Association of Expectancy Change with Change in Alcohol Consumption*

Expectancy	<i>k</i>	$\beta$	<i>B</i>	95%	CI	<i>Z</i>	<i>R</i> <sup>2</sup>
Global alcohol Expectancies	8	.32	.20	-.41	.82	.65	.10
Sexual expectancies	16	-.23	-.23	-.72	.26	-.91	.05
Social expectancies	14	-.43	-.59	-1.14	-.03	-2.10 <sup>a</sup>	.18
Tension expectancies	14	-.42	-.49	-.97	-.01	-2.01 <sup>a</sup>	.18
Liquid courage expectancies	10	-.58	-.98	-1.54	-.41	-3.38 <sup>b</sup>	.34
Cognitive consequences	12	.40	.54	-.02	1.10	1.89	.16
Risk aggression expectancies	11	-.66	-.69	-1.25	-.13	-2.40 <sup>a</sup>	.44
Self-perception expectancies	10	-.27	-.21	-.77	.35	-.74	.07

*Note.* *k* = number of effect sizes included in the analysis;  $\beta$  = standardized regression coefficient; *B* = unstandardized regression coefficient; 95% CI = lower and upper limits of the 95% confidence interval; *Z* = test for significance of *B*; *R*<sup>2</sup> = explained variance.

<sup>a</sup>*p* < .05. <sup>b</sup>*p* < .01.

alcohol expectations. Results for continuous variables are shown in Table 3, and results for categorical variables are shown in Table 4.

### Age and Population

High school and college students showed significant decreases in alcohol consumption and global expectancies. Moreover, older participants showed significant positive effects in regard to social expectancies. In contrast to high school students, college students also showed significant intervention effects on sexual, social, tension, liquid courage, cognitive, risk aggression, and self-perception expectancies. Intervention effects were significantly higher in college students than in high school students with regard to sexual, social, tension, and liquid courage expectancies (see Table 3 and Table 4). As college students received, on average, a higher dose, we tested whether differences in dose explained the different effects of college versus high school students. Yet, meta-regressions showed that the higher effect sizes in college students remained significant after controlling for dose (*p* ranged from .01 to .04 and  $\beta$  ranged from -1.56 to .57).

### Sex

Contrasting our hypothesis, findings did not reveal significant moderating effects of sex (see Table 3).

### Dose

Interventions delivered at a higher dose showed significantly stronger effects at reducing alcohol consumption and changing liquid courage expectancies and cognitive behavioral consequences expectancies. Thus, there was some support for our hypothesis on more desirable results for interventions delivered at a higher dose (see Table 3).

### Media Literacy

Contrary to our hypothesis, no significant moderating effects of inclusion of a media literacy component were found (see Table 4).

### Methodological Quality

Study quality was a significant moderator only for liquid courage expectancies, where intervention effects were higher among studies with a higher methodological quality. Follow-up analysis revealed that this moderating effect was based on the dropout rate ( $Q_{\text{Between}} = 13.67$ ; *p* < .01), indicating stronger effects in the case of smaller dropout rates (*k* = 3, *g* = -.60, *z* = -7.11, *p* < .01 vs. *k* = 9, *g* = -.17, *z* = -2.11, *p* = .04).

### Exploratory Analysis

The experimental bar and the nonbar formats showed significant effects at reducing alcohol consumption and social expectancies. The bar format also showed positive effects in regard to global and cognitive consequences expectancies, whereas the nonbar format showed positive effects for sexual, tension, and risk aggression expectancies. No significant moderating effect of either format was found (see Table 4). As population and delivery format were moderately correlated (*r* = -.35), we tested whether significant effects of population persisted after controlling for delivery format. All moderating effects of population persisted after including delivery format as a second predictor.

In regard to ethnic minority status, inconsistent moderating effects were found for two dimensions. Namely, changes in liquid courage expectancies were stronger in samples with more members of ethnic minority groups, while the opposite was true for cognitive consequences expectancies (see Table 3).

### Discussion

The present meta-analysis investigated the effects of EC intervention at changing expectations and alcohol use among high school and college students and the moderating effects of study and individual characteristics on these changes. Our findings indicate that EC interventions produce effects at reducing alcohol consumption quantity and frequency and positive alcohol expectancies, and at increasing negative alcohol expectancies in the experimental condition as opposed to participants in the control condition. Still, the magnitude of effect sizes was very small to small (Hedges *g* ranging from -.11 to -.38). Our results corroborate those of a previous meta-analysis reporting that ECs succeeded at reducing

**Table 3**  
*Association of Continuous Personal and Study Characteristics with Change in Outcome Variables*

Predictor	Alcohol consumption		Global alcohol expectancies		Sexual expectancies		Social expectancies		Tension expectancies		Liquid courage expectancies		Cognitive consequences expectancies		Risk aggression expectancies		Self-perception expectancies	
	k	$\beta$	k	$\beta$	k	$\beta$	k	$\beta$	k	$\beta$	k	$\beta$	k	$\beta$	k	$\beta$	k	$\beta$
Age	30	-.19	10	.61	19	-.25	17	-.42 <sup>a</sup>	18	-.17	12	-.27	14	.22	13	-.16	12	.02
% Male	30	-.34	10	.11	19	.21	17	.23	18	.07	12	.13	14	-.34	13	.29	12	-.43
Dose	30	-.36 <sup>a</sup>	10	-.39	19	-.22	17	-.31	18	-.23	12	-.68 <sup>c</sup>	14	-.45 <sup>a</sup>	13	-.24	12	-.06
Quality	30	-.19	10	.30	19	-.15	17	-.05	18	-.18	12	-.33 <sup>a</sup>	14	.25	13	-.28	12	-.48
% Ethnic minority	30	.29	10	-.55	19	-.11	17	.13	18	.12	12	-.35 <sup>a</sup>	14	.68 <sup>b</sup>	13	-.40	12	-.23

Note. k = number of effect sizes;  $\beta$  = standardized regression coefficient.

<sup>a</sup>  $p < .05$ . <sup>b</sup>  $p < .01$ . <sup>c</sup>  $p < .001$ .

positive alcohol expectations and the quantity and frequency of heavy drinking, yet effect sizes were also small (Scott-Sheldon et al., 2012). As Scott-Sheldon et al.'s (2012) earlier meta-analysis solely focused on EC interventions for college students, our findings that EC interventions also appear to be, in part, successful among high school students provide novel insights in the meta-analytic investigation of EC interventions. The magnitude of effect sizes found in our meta-analysis is consistent with those reported in other brief interventions against alcohol use and EC interventions (Carey et al., 2016; Tanner-Smith & Lipsey, 2015). A potential explanation as to why ECs delivered significant but small effects may be that brief alcohol interventions are typically intended to provide participants with resources to modify their consumption patterns but, due to their short nature, are not intended to provide a thorough treatment for participants who already exhibit problematic alcohol use nor to implement robust techniques to prevent alcohol consumption among participants without problematic alcohol use (Tanner-Smith & Lipsey, 2015). Small effect sizes may represent an acceptable benefit–cost ratio in light of the low average duration of these interventions, and the few resources needed to implement them. Furthermore, changes in social, tension, liquid courage, and risk aggression expectancies explained significant variance in change in alcohol use. This supports the basic assumption that EC interventions reduce alcohol use via changes of expectancies. More significant statistical effects of domain-specific expectancy change on change in alcohol consumption may be found if more studies become available that increase test power. Consistent evidence for possible publication bias was not found, which could be related to our inclusion of several unpublished studies. The surprising increase of pro-alcohol cognitive behavioral consequences expectancies that appeared in the trim-and-fill analysis could be related to the fact that some individual studies found increases while other found decreases, so that adding some of the former studies led to a significant mean effect. Additional research is needed to determine under which conditions cognitive consequences expectancies change in one or the other direction.

Few moderating effects of study and individual characteristics were observed. In regard to age and target population, results showed that older participants and college students presented more desirable outcomes from EC interventions in regard to social expectancies. College students also showed stronger decreases in sexual, tension, and liquid courage expectancies than high school students. On a similar note, Scott-Sheldon et al. (2012) posit that EC interventions were more efficient at increasing general negative alcohol expectancies among older college students. A possible explanation to our findings could be that older participants and college students tend to have more positive expectations about the consequences of drinking alcohol than younger participants and high school students (Frank et al., 1999) and, therefore, have more possibility to show improvement. Furthermore, the stronger effects in college students compared to high school student may be based on differences in aspects of the intervention. However, the higher dose received by college students did not explain the stronger effects on this population. Nonetheless, this effect might have been based on differences between both groups in other aspects of the intervention. Finally, studies with college students used different questionnaires than studies with high school students, and these questionnaires may show different sensitivity for change. The role of these factors should be empirically tested. Nonetheless, high school and college



**Table 4**  
*Association of Categorical Personal and Study Characteristics with Change in Outcome Variables*

Moderator	Alcohol consumption			Global alcohol expectancies			Sexual expectancies		
	k	g	95% CI	Z	Q		k	g	95% CI
Media					1.46				
Yes	13	-.13	-.24	-.02	-2.34 <sup>a</sup>	.28	-.35	-.48	-5.36 <sup>c</sup>
No	17	-.24	-.38	-.10	-3.33 <sup>c</sup>	-.15	9	-.25	-.07
Population					.37				
HSS	6	-.24	-.48	-.00	-1.98 <sup>a</sup>	-2.51	4	.05	-.25 .35
CS	24	-.16	-.25	-.07	-3.40 <sup>c</sup>	-.04	15	-.37	-.48
Delivery					3.74				
Bar	8	-.37	-.58	-.15	-3.37 <sup>c</sup>	-.04	2	-.32	-.71
No Bar	22	-.13	-.22	-.04	-2.78 <sup>b</sup>	.03	17	-.32	-.43
					23.45				
					9.30				
					2.17				
					5.59				
					.04				
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students showed significant decreases in alcohol consumption and global expectancies.

Furthermore, we expected ECs to deliver more positive effects when delivered to males. Results revealed no significant moderating effects of gender, which may indicate that ECs produce equivalent effects for male and female participants. Our findings contrast those of a previous review indicating that ECs targeting male groups produce more effects at reducing alcohol expectancies and consumption (Labbe & Maisto, 2011). An explanation to the lack of moderating effects of gender could be that male and female drinking patterns have become more similar (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2015), which leads to similar room for improvement in men and women. Alternatively, even when young men drink more and have more positive expectancies about alcohol use, and could, therefore, change more than women, some factors may prevent their stronger improvement, such as greater social acceptance of male drinking (Gebara et al., 2013), and greater influence of peers (Borsari & Carey, 2001) which can diminish the effects of adult-led interventions. It is worth noting that gender variance among the studies was restricted, with 40% male-only samples and 20% female-only samples. More studies with female-only samples could facilitate the detection of significant gender moderating effects.

In line with our hypothesis, EC interventions delivered at a higher dose showed significantly higher effects at reducing alcohol consumption, liquid courage expectancies, and changing cognitive behavioral consequences expectancies. Scott-Sheldon et al. (2012) previously reported no moderating effects of dose on the effects of EC interventions. The differential findings from this previous meta-analysis could be related to the higher number of studies included in our analysis rather than to a nonexistent moderating effect of intervention dose. Our findings propose insights in favor of longer EC interventions, which could provide prolonged opportunities to reduce alcohol use and to target alcohol expectancies among high school and college students (Jones et al., 2001). For instance, Tanner-Smith and Lipsey (2015) suggest that brief alcohol interventions (i.e., roughly five total intervention hours—compared to the average duration of 1 hr of the EC interventions in the present meta-analysis) have been associated with long-term reduced alcohol consumption and associated problems in these populations.

Furthermore, contrary to our hypothesis, no significant moderating effects of inclusion of a media literacy component were found. However, test power was limited as most studies did not integrate a media literacy component. Based on findings suggesting that the media is an important source of the formation of positive alcohol expectancies (Boucher, 2012), additional implementations of EC interventions with a media literacy component are needed to infer its actual moderating effect in these interventions.

Concerning moderating effects of methodological study quality, effects on most outcomes did not vary by study quality indicating that these results are robust in regard to methodological quality. The lower intervention effects in studies with higher dropout rates could indicate that ECs with high dropout rates were less motivating to participate in and to change one's expectancies. To directly test this assumption, studies should measure perceived relevance and relate this to changes in alcohol consumption and expectancies. Scott-Sheldon et al.'s (2012) previous meta-analysis did not investigate moderating effects of methodological quality of studies on the

outcomes of EC interventions. Thus, our results present novel findings relevant for college and high school students.

Furthermore, we conducted exploratory analysis to identify whether an experimental bar delivery format and a non-experimental-bar delivery format moderate the effect size of intervention effects. Both delivery methods showed positive effects at decreasing alcohol consumption and social expectancies though more evidence for change in domain-specific expectancies was available for no-lab ECs. A bar lab setting restricts the implementation of EC interventions as well as its application in clinical settings (Corbin et al., 2001). Also, the use of a bar lab setting prevents the applicability of these interventions among younger populations who are legally not yet old enough to consume alcohol. Nevertheless, we can infer that directly challenging alcohol expectancies in a bar lab and a nonbar setting produces effects at decreasing alcohol consumption and social expectancies. Thus, ECs delivered in experimental bar settings can be suitable for participants who are in the legal age for drinking. Likewise, a nonbar delivery format can produce effects among younger populations not yet in the legal drinking age.

Finally, given the contradictory moderating effects of ethnic minority status, further research is needed for identifying the factors that explain this moderating effect of ethnicity.

## Limitations and Conclusions

The current meta-analysis represents an important step of additive value to understanding the effects of EC interventions among high school and college students. Nevertheless, our findings should be interpreted in light of potential limitations. First, although we had sufficient test power to identify small overall effects, the number of studies was limited for some subgroups, such as female-only samples and high school students. This restricted the elaboration of reliable inferences concerning the moderating effects of these study and individual characteristics on ECs. Accordingly, further moderating effects may appear once more studies become available. It is worth noting that additional outcome variables were not included in our meta-analysis as not enough studies reported relevant information on these variables (e.g., arousal expectancies, sedation expectancies, and personalities expectancies). Likewise, the comparisons of effects of ECs on some relevant subgroups (e.g., high drinking vs. low drinking participants) were not investigated as not enough studies reported outcomes among these subgroups. Nevertheless, the present meta-analysis updates the meta-analysis by Scott-Sheldon et al. (2012), which included 14 studies with samples of college students. Our inclusion of high school students allowed for a larger sample of 23 studies. Second, most ECs included in our analysis were executed in Western countries among White subjects. Future research on ECs should include more diverse and underrepresented samples to determine generalizable effects of ECs on different ethnic groups. Third, long-term effects of EC interventions could not be investigated as most studies did not include follow-up assessments. Future investigations would benefit from incorporating supplementary follow-up periods to detect long-term effects of ECs. Finally, studies only administered self-report measures, and some participants may have been reluctant or ashamed to answer truthfully or may have not been willing to answer and might have instead provided socially desirable responses. Nevertheless, research suggests that alcohol related self-report

measures can be regarded as accurate for light to moderate drinkers (Northcote & Livingston, 2011).

Despite these limitations, our findings present significant implications for practice and future research. In terms of effects, our findings suggest that EC interventions targeting high school and college students produce modest effects at reducing alcohol consumption and changing alcohol expectancies. However, effect sizes were small, and more efforts are needed to increase the effects of these interventions. Based on data suggesting that brief alcohol interventions for young people may be more effective when they include goal-setting exercises and money/cost information about drinking as components (Tanner-Smith & Lipsey, 2015), ECs may benefit from including such components as an additional strategy to potentiate their effect on alcohol consumption and expectations. Nonetheless, research is needed to examine further components, that, in combination with EC interventions, could be associated with larger effects across different populations of young people. In addition, it would be beneficial to identify more sources of heterogeneity to improve the size of effects. In regard to age and target group, evidence suggests that adolescence may be a critical age range to target alcohol expectancies as these tend to form during this period, and many individuals have their first experiences with alcohol as adolescents (Dietz, 2016). However, our results showed significant better effects of ECs among older participants and college students for alcohol use and all expectancy domains. Nevertheless, results also indicated that alcohol use and global expectancies also decreased among high school students. An important step for future research is to conduct additional EC interventions among samples of younger participants and high school students, as scarce investigations exist for EC interventions among this age group, making it difficult to build accurate inferences. Future research should also identify sources of higher effects in college as opposed to high school students. Finally, an important step for the future implementation of EC intervention is to revise its protocol by conducting additional analyses to identify further relevant needs in each target population, leading focus groups to reevaluate the design, and collecting feedback to make relevant modifications (McKleroy et al., 2006).

In summary, this meta-analysis summarizing the effects of EC interventions among high school and college students presents encouraging trends suggesting that these interventions serve to modestly reduce alcohol consumption and change alcohol expectancies among young individuals, particularly among older participants and college students, when delivered at a higher dose. Further research investigating under which circumstances and among which subgroups these interventions are expected to produce greater effects is needed.

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