The American Journal of Drug and Alcohol Abuse
Encompassing All Addictive Disorders

ISSN: 0095-2990 (Print) 1097-9891 (Online) Journal homepage: http://www.tandfonline.com/loi/iada20

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To cite this article: Emily E. Tanner-Smith PhD & Mark D. Risser PhD (2016) A meta-analysis of brief alcohol interventions for adolescents and young adults: variability in effects across alcohol measures, The American Journal of Drug and Alcohol Abuse, 42:2, 140-151, DOI: 10.3109/00952990.2015.1136638

To link to this article: http://dx.doi.org/10.3109/00952990.2015.1136638

AM J DRUG ALCOHOL ABUSE
2016, VOL. 42, NO. 2, 140–151
http://dx.doi.org/10.3109/00952990.2015.1136638

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ORIGINAL ARTICLE

A meta-analysis of brief alcohol interventions for adolescents and young adults: variability in effects across alcohol measures

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ABSTRACT

Background: Brief alcohol interventions are one approach for reducing drinking among youth, but may vary in effectiveness depending on the type of alcohol assessments used to measure effects. *Objectives*: To conduct a meta-analysis that examined the effectiveness of brief alcohol interventions for adolescents and young adults, with particular emphasis on exploring variability in effects across outcome measurement characteristics. *Method*: Eligible studies were those using an experimental or quasi-experimental design to examine the effects of a brief alcohol intervention on a post-intervention alcohol use measure for youth aged 11–30. A comprehensive literature review identified 190 unique samples that were included in the meta-analysis. Taking a Bayesian approach, we used random-effects multilevel models to estimate the average effect and model variability across outcome measurement types. *Results*: Brief alcohol interventions led to significant reductions in self-reported alcohol use among adolescents ($\overline{g}$ = 0.25, 95% credible interval [CrI 0.13, 0.37]) and young adults ($\overline{g}$ = 0.15, 95% CrI [0.12, 0.18]). These results were consistent across outcomes with varying reference periods, but varied across outcome construct type and assessment instruments. Among adolescents, effects were larger when measured using the Timeline Followback; among young adults, effects were smaller when measured using the Alcohol Use Disorders Identification Test. *Conclusion*: The strength of the beneficial effects of brief alcohol interventions on youth's alcohol use may vary depending upon the outcome measure utilized. Nevertheless, significant effects were observed across measures. Although effects were modest in size, they were clinically significant and show promise for interrupting problematic alcohol use trajectories among youth.

ARTICLE HISTORY
Received 25 September 2015
Revised 22 December 2015
Accepted 23 December 2015

KEYWORDS
Adolescents; alcohol use; brief alcohol intervention; meta-analysis; systematic review; youth

Introduction

In 2013, the estimated rate of past month heavy episodic drinking (five or more drinks on the same occasion for males, four or more for females) was 13% for 16–17-year-olds, 29% for 18–20-year-olds, and 43% for 21–25-year-olds (1). Heavy episodic drinking among youth is associated with numerous detrimental consequences, including academic problems, driving under the influence, risky sexual behavior, victimization, and subsequent substance use disorders (2–5). In response, a growing body of research has sought to develop early intervention programs that may be effective for preventing alcohol use, or interrupting the progression to alcohol use disorders. Brief alcohol interventions are one such family of interventions, defined broadly here as interventions aimed at promoting alcohol-related behavior change in a relatively circumscribed time (e.g. one to five sessions). Brief alcohol interventions are attractive to service providers because of their brevity and transportability to diverse settings, and promise for offering a cost-effective way to address a potentially lethal public health issue (6–9). The current study reports findings from an update to a meta-analysis on the effectiveness of brief alcohol interventions for adolescents and young adults, with specific emphasis on examining variability in effects across outcome measurement characteristics.

Numerous systematic reviews and meta-analyses have synthesized the existing research on the effectiveness of alcohol interventions, and more specifically brief interventions, for reducing alcohol consumption among youth (10–15). The results from these meta-analyses consistently show that brief alcohol interventions yield statistically significant reductions in alcohol consumption among youth, typically in the range of a 0.1–0.3 standard deviation improvement over no-treatment control or minimal contact comparison conditions (based on standardized mean difference effect sizes estimated from diverse types of alcohol measures,

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such as number of drinks, heavy drinking days, etc.). Whether this magnitude of an effect is clinically significant, however, will depend on youth circumstances such as baseline alcohol consumption, intervention setting, provider preferences, and considerations related to cost and implementation. Furthermore, the effects of brief alcohol interventions can vary across settings, populations (including severity of alcohol use), and the specific therapeutic components included in the intervention (10,11,15).

Given the consistent evidence that brief alcohol interventions can lead to significant (but perhaps modest) reductions in alcohol consumption among youth, an important task is identifying variability in their effectiveness (16,17). Most commonly, meta-analyses will examine whether the effects of brief alcohol interventions vary according to the characteristics of the interventions or participant samples. For instance, a recent meta-analysis on brief alcohol interventions (and the one on which the current study is based) found that for adolescents, the use of decisional balance and goal-setting therapeutic components were associated with larger beneficial effects (15). That same meta-analysis, however, reported minimal variability in effects according to other intervention characteristics such as length, format, and delivery mode; and minimal variability across sample demographics.

When considering variability in the effectiveness of brief alcohol interventions, other important factors may be characteristics of the alcohol outcome measures themselves (18–20). Most brief alcohol interventions take a harm reduction approach and therefore do not necessarily promote abstinence. Rather, many encourage participants to reduce heavy episodic drinking, which tends to correlate with negative drinking-related consequences (21). As such, the theories of change underlying many brief alcohol interventions suggest that, if effective, these interventions might yield larger effects on measures of heavy drinking compared to other measures such as frequency of (non-heavy) drinking days. For instance, the personalized feedback provided to participants in many brief alcohol interventions (22) advises youth to limit the number of drinks consumed per occasion, and provides suggestions for moderation strategies. Brief alcohol interventions might therefore yield larger effects on alcohol outcome measures that tap the most proximal outcomes relevant to the intervention – i.e. those related to heavy drinking rather than simple drinking frequency or abstinence.

In a comprehensive meta-analysis of individually delivered alcohol interventions (many of which were brief interventions) for college students, Carey and colleagues found that intervention effects varied considerably across different types of alcohol measures (10). For instance, the average effect sizes at 4–13 week follow-up were largest for measures of frequency of heavy drinking (average standardized mean difference effect size $\overline{g}$ = 0.21), quantity of drinking ($\overline{g}$ = 0.14), and peak blood alcohol concentration ($\overline{g}$ = 0.13); whereas there was no evidence of a significant effect for measures of frequency of drinking days ($\overline{g}$ = 0.08). Although that meta-analysis did not focus solely on brief alcohol interventions, these findings are nonetheless suggestive that outcome measurement is an important factor when assessing alcohol intervention effects. We are unaware of any other meta-analyses on brief alcohol interventions for youth that have systematically examined variability in intervention effects across alcohol measurement characteristics. This gap in the meta-analytic literature is unfortunate; researchers and practitioners need to know what types of outcome assessments may be most sensitive to measuring the effectiveness of brief alcohol interventions for youth.

Thus, the study reported here used meta-analytic methods to examine whether the effects of brief alcohol interventions for youth varied according to the measurement characteristics of the alcohol outcomes used to capture intervention effects. Specifically, this meta-analysis examined: (i) variation in the effects of brief alcohol interventions associated with the type of alcohol outcome (e.g. frequency, quantity, blood alcohol concentration), (ii) variation across different assessment instruments, e.g. Timeline Followback (23), Daily Drinking Questionnaire (24), and (iii) variation across alcohol outcomes with different reference periods (e.g. past 30 days, past 90 days). This study provides a unique contribution to the literature by examining variability in brief alcohol intervention effects across outcome measurement characteristics. The original meta-analysis on which this study is based (15) did not examine any variation across alcohol outcome types, assessment instruments, or reference periods; thus the current study is the first meta-analysis of brief alcohol interventions for youth to systematically examine variability across alcohol measurement characteristics.

Methods

The current study presents findings from an update to a meta-analysis on brief alcohol interventions for adolescents and young adults (15). Here we provide a brief overview of the methods used in the meta-analysis, but refer readers to the original parent meta-analysis for more detailed information (15).

Inclusion and exclusion criteria

To be eligible for inclusion, studies had to focus on brief interventions explicitly aimed at reducing alcohol use or alcohol-related problems. Interventions could target any risk level (universal, selective, or indicated) of participants, as long as they involved five or fewer hours of total contact time and four or fewer weeks between the first and last intervention session (excluding booster sessions). Eligible studies had to include comparison conditions of no treatment, a wait-list control, or routine treatment as usual. Eligible samples included adolescents and young adults, defined as individuals aged 11–25. Samples comprised entirely of undergraduate college students up to age 30 were also eligible. Eligible research designs included randomized controlled designs and controlled quasi-experimental designs that provided enough information to permit estimation of a pretest effect size that could be used to adjust the posttest effect estimates for any initial group differences. Eligible studies were required to assess intervention effects on at least one outcome variable that measured alcohol use or alcohol-related problems (e.g. DUI/DWI). Finally, only studies conducted in 1980 or later were included in the review. There were no geographic or language restrictions on eligibility.

Search strategy

A comprehensive search strategy was used to identify studies that met the aforementioned inclusion criteria. The original literature search was completed on 31 December 2012. For the current study, we updated the literature search through 31 December 2013. The following electronic databases were searched: CINAHL, Clinical Trials Register, Dissertation Abstracts International, ERIC, International Bibliography of the Social Sciences, NIH RePORTER, PsycARTICLES, PsycINFO, PubMed, Social Services Abstracts, Sociological Abstracts, and WorldWideScience.org. We also conducted extensive supplementary searches of research registers (including Cochrane CENTRAL), websites, conference proceedings, key journals in the field, and bibliographies of prior reviews.

Screening and coding procedures

All screening and coding was conducted by a team of six master's level research assistants who worked under supervision of the first author. Titles and abstracts were first screened to eliminate obviously ineligible studies. Full text reports were then retrieved and screened for all reports that were not judged ineligible at the abstract level. All eligibility decisions were completed independently by one research assistant and the principal investigator. Any disagreements were discussed until consensus was reached. All data extraction followed a standardized coding protocol, with data entered directly into a FileMaker Pro database. Each study was coded by a research assistant, and the principal investigator independently reviewed all coding. Any disagreements about coding items were discussed and resolved via consensus.

Statistical methods

Effect size metric

The effects of interventions were indexed with standardized mean difference effect sizes (g), calculated as the difference between the intervention and comparison group means on a post-intervention measure of alcohol consumption, divided by the pooled standard deviation and adjusted with a small-sample correction factor (25). All effect sizes were coded so that positive values indicate better outcomes (e.g. lower alcohol consumption, higher abstinence). Effect size and sample size outliers were Winsorized to less extreme values to prevent them from having disproportionate influence on the meta-analysis (26). The standard errors of effect sizes from cluster randomized trials were adjusted to account for the nesting of participants within clusters (27).

Because effect sizes can be influenced by the methodological and quality characteristics of studies, all analyses used effect sizes that were covariate-adjusted to provide more conservative estimates of intervention effects (see 15 for the adjustment model). This technique provides additional assurances that any variance in effect sizes associated with differences in methods between studies (e.g. attrition, design, baseline group differences) has been at least partially removed from the analysis of the influence of other substantive variables (i.e. alcohol measurement characteristics). For all moderator analyses, we conducted sensitivity analyses using the unadjusted effect sizes and found substantively similar results, so elected to present the more conservative estimates using the covariate-adjusted effect sizes.

Moderator variables

The following outcome measurement characteristics were explored as potential effect size moderators: type of alcohol construct, assessment instrument, and outcome reference period. Alcohol construct type was measured with seven different categories: *abstinence, frequency of drinking days, frequency of heavy drinking, quantity of drinking, maximum quantity/peak consumption, blood alcohol concentration, two or more types*

combined. Assessment instrument was measured with ten different categories: *Alcohol Consumption Index* [*ACI*] (28); *Alcohol Use Disorders Identification Test* [*AUDIT*] (29); *Brief Drinking Profile* [*BDP*] (30); *Daily Drinking Questionnaire* [*DDQ*] (24); *Timeline Followback* [*TLFB*] (31); *Quantity-Frequency Index* [*QFI*] (22); *Quantity/Frequency Scale* [*QFS*] (32); *other standardized scale, combination of two or more scales*, and *not reported/cannot tell*. Finally, outcome reference period was measured as the number of days covered in the alcohol outcome measure (e.g. past 30 days, past 90 days).

Control variables

Three additional control variables were used in the outcome analyses: risk level of sample (high risk screened sample versus not), study setting (school/university versus other), and focal intervention type (motivational enhancement therapy [MET] versus other).

Analytic strategies

Most studies reported multiple measures of alcohol consumption (e.g. frequency of drinking days, quantity of drinking, blood alcohol concentration). We therefore used a three-level random-effects meta-analysis approach to model the dependent effect sizes (33–35), where primary study participants (Level 1) provide multiple effect size estimates (Level 2), which are nested within studies (Level 3). The three-level meta-analytic model can be written as:

$$y_{ij} = \beta_0 + u_{(2)ij} + u_{(3)j} + e_{ij}$$

where y_{ij} is the ith effect size in the jth study; β_0 is the average population effect; $u_{(2)ij}$ and $u_{(3)j}$ are the Level 2 and Level 3 random effects such that $\mathrm{Var}(u_{(2)ij}) = \tau^2_{L2}$ and $\mathrm{Var}(u_{(3)j}) = \tau^2_{L3}$ are the within-study and between-study variance components; and e_{ij} is the residual for the ith effect size in the jth study. This intercept only three-level meta-regression model is used to summarize the overall effects of brief alcohol interventions. Extending the model to include effect size level covariates x_i then permits examining the potential moderating effects of the outcome measurement characteristics of interest.

All analyses were conducted using Bayesian methods, which permit the use of flexible models, provide intuitive parameter interpretations, and allow models to incorporate prior information (36). In contrast to the classical (frequentist) paradigm where parameters are considered fixed and unknown, in the Bayesian paradigm the model parameters are random variables themselves. Thus, each parameter is assigned both a range of possible values and a likelihood (probability) of taking on each of these possible values (i.e. a distribution). As a result, in addition to the model specified for the data (e.g. the three-level meta-regression model), a Bayesian approach also requires a prior distribution for the parameters, which reflects the *a priori* knowledge about each parameter. The Bayesian paradigm provides a systematic way to combine the prior distribution with the data model to arrive at the posterior distribution, which summaries the updated knowledge about each parameter *a posteriori*, or after accounting for observed data, and upon which all inference is based.

Although prior distributions can be specified as informative (i.e. containing some degree of information about the parameters), we elected to use non-informative prior distributions for all parameters. These non-informative priors specify no prior knowledge about the parameters and minimize any concerns about the potential bias associated with unreasonable prior distributions. Thus, the prior distributions for the meta-regression coefficient parameters (β_0 and β_p) were Normal (0, 100); the prior distributions for the variance parameters (τ^2_{L2} and τ^2_{L3}) were Uniform (0, ∞).

Missing data

There were no missing data for the moderators of interest in this analysis, but there was a modest amount of missing data for covariates included in the adjustment model. For those covariates, we imputed missing data using an expectation-maximization algorithm so that all cases could be included within any given analysis (see 15). If primary studies failed to provide sufficient information needed to estimate effect sizes, we contacted study authors for that information. We had an excellent response from authors; only 17 studies failed to provide the necessary information needed for effect size estimation. We did not impute missing effect sizes for any outcome variables, but omitted them from the meta-analysis.

Results

Literature search

Figure 1 presents the study identification flow diagram for the updated meta-analysis. The updated literature search yielded 1245 candidate reports; 1164 of which were screened at the abstract level and 308 of which were screened at the full-text level. A total of 24 reports met the eligibility criteria, 14 of which were linked to studies included in the original meta-analysis, and 10 that reported findings for eight new unique studies that were not included in the original meta-analysis. Three studies included in the original meta-analysis were not included

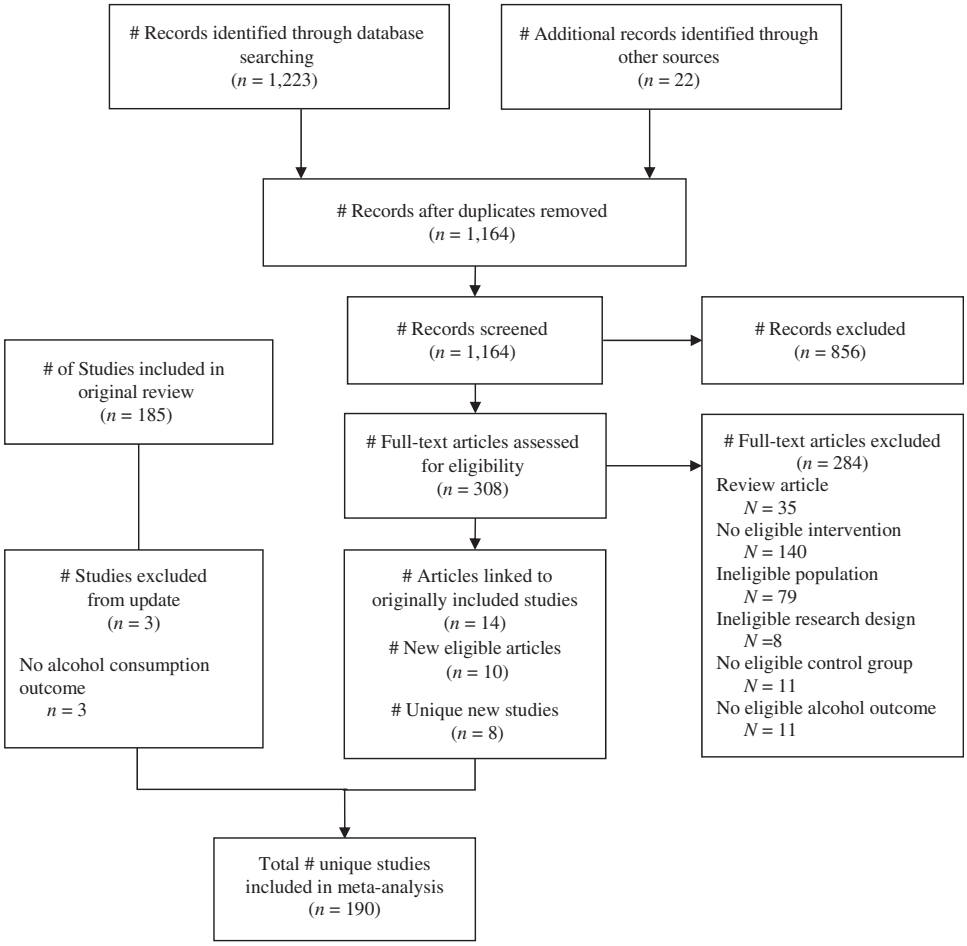

Figure 1. Study flow diagram for update to the Tanner-Smith & Lipsey (2015) meta-analysis [15]. After abstract screening and full-text eligibility screening, a total of 190 unique studies were eligible and included in the quantitative synthesis (i.e. meta-analysis).

in the current study (i.e. because they only reported alcohol-related problem outcomes, and no measures of alcohol consumption), thus, the final updated meta-analysis synthesized results from 190 unique studies (see Supplemental Appendix A [online only] for a list of references to reports providing effect sizes included in the meta-analysis).

Characteristics of included studies

Table 1 presents descriptive statistics for the studies included in the meta-analysis, shown separately for the 26 adolescent and 164 young adult samples. Most studies were conducted in the United States, used randomized controlled designs, and had low to moderate attrition rates. In the adolescent samples, there was almost an even distribution of effect sizes measuring quantity of drinking (26%), frequency of heavy drinking (25%), and frequency of drinking days (23%). In the young adult samples, there were many effect sizes measuring quantity of drinking (37%) and frequency of heavy drinking (18%). Most of the studies with adolescent samples failed to report the use of a standardized outcome assessment scale; among those that did, the TLFB was the most common (16%). In contrast, most of the young adult samples reported using standardized alcohol assessments, with the most commonly reported scales being the DDQ (32%) or the TLFB (15%). Finally, the outcome reference period was notably longer for adolescents sample (M = 61.51, SD = 45.27) than for young adult samples (M = 33.75, SD = 25.05).

Average effects of brief alcohol interventions

Results for adolescents

As shown in Table 2, the random-effects mean of 145 covariate-adjusted effect sizes estimated from 26 studies indicated that, on average, adolescents aged 11–18 who received brief alcohol interventions reported significantly lower levels of alcohol consumption than those in comparison conditions ($\overline{g}$ = 0.25, 95% CrI [0.13, 0.37]). The between-studies variance component (τ^2) was 0.07, which is the average squared distance from

Table 1. Characteristics of the studies included in the meta-analysis, by age group.

	Adolescents n = 145 k = 26				Young adults n = 1532 k = 164			
	M	(*SD*)	%	(*n*)	*M*	(*SD*)	%	(*n*)
Study/Design characteristics								
US sample [a]			50	(13)			80	(131)
Randomized controlled trial[a]			81	(21)			91	(149)
Attrition[b]	0.12	(0.12)			0.21	(0.17)		
Follow-up timing (weeks)	22.44	(14.30)			18.83	(22.22)		
Alcohol measurement characteristics[b]								
Construct type								
Abstinence			13	(19)			3	(45)
Frequency of drinking days			23	(34)			14	(211)
Frequency of heavy drinking			25	(37)			18	(272)
Quantity of drinking			26	(38)			37	(573)
Maximum quantity			1	(2)			10	(153)
BAC			0	(0)			11	(174)
Two or more types			10	(15)			7	(104)
Instrument								
ACI			0	(0)			2	(20)
AUDIT			8	(12)			4	(60)
BDP			0	(0)			1	(21)
DDQ			1	(1)			32	(483)
TLFB			16	(23)			15	(226)
QFI			0	(0)			6	(90)
QFS			0	(0)			0.3	(4)
Not reported			59	(86)			31	(471)
Two or more instruments			0	(0)			1	(16)
Other instrument			16	(23)			9	(141)
Reference period (days)	61.51	(45.27)			33.75	(25.05)		
Participant characteristics								
Average age[c]	15.43	(1.57)			19.95	(1.60)		
Percent male composition[c]	0.53	(0.11)			0.47	(0.18)		
Percent White composition[c]	0.60	(0.28)			0.76	(0.19)		
High-risk screened sample[a]			31	(8)			53	(87)
Intervention characteristics[c]								
Site: school/university			83	(29)			90	(241)
Type: motivational enhancement therapy (MET)			40	(14)			35	(94)
Total contact time (minutes)	93.37	(75.49)			50.79	(52.17)		
Total number of sessions	1.77	(1.07)			1.31	(0.97)		

Means and standard deviations shown for continuous measures; percentages and counts shown for dichotomous measures. k = number of studies; n = number of effect sizes. [a]Estimates calculated at study level. [b]Estimates calculated at effect size level. [c]Estimates calculated at intervention group level. ACI, Alcohol Consumption Index; AUDIT, Alcohol Use Disorders Identification Test; BAC, blood alcohol concentration; BDP, Brief Drinking Profile; DDQ, Daily Drinking Questionnaire; TLFB, Timeline Followback; QFTI, Quantity-Frequency Index; QFS, Quantity-Frequency Scale.

Table 2. Unadjusted and covariate-adjusted mean effect sizes and 95% credible intervals, by age group.

	Adolescents		Young adults	
	Unadjusted	Covariate-adjusted	Unadjusted	Covariate-adjusted
$\bar{g}$	0.18	0.25	0.13	0.15
95% CrI	[0.05, 0.32]	[0.13, 0.37]	[0.10, 0.16]	[0.12, 0.18]
τ^2_{L2}	0.01	0.01	0.00	0.00
τ^2_{L3}	0.09	0.07	0.04	0.03
n	145		1532	
k	26		64	

$\bar{g}$= mean effect size; CrI, credible interval; k, number of studies; n = number of effect sizes; τ^2_{L2} = within-study between-effect size variance component; τ^2_{L3} = between-study variance component.

the mean effect size, thus indicating heterogeneity in effects for the adolescent samples.

Results for young adults

A total of 164 studies contributed 1532 covariate-adjusted effect sizes measuring effects on alcohol consumption among young adults aged 19–30 (see Table 2). Young adults who received brief alcohol interventions reported significantly lower levels of alcohol consumption than those in comparison conditions ($\bar{g}$ = 0.15, 95% CrI [0.12, 0.18]). The between-studies variance component (τ^2) was 0.03, indicating a modest amount of heterogeneity in effects for the young adult samples. Although the mean effect size for young adults (0.15) was slightly smaller than that found for adolescents (0.25), there was no evidence that these mean effect sizes were significantly different (b = 0.08, 95% CrI [−0.01, 0.18]).

Variability across outcome measurement characteristics

Results for adolescents

Table 3 presents results from the multilevel meta-regression models used to examine whether the outcome construct type, assessment instrument, and reference period were associated with the magnitude of the effects of the brief alcohol interventions (after adjusting

Table 3. Unstandardized coefficients and 95% credible intervals from meta-regression models predicting covariate-adjusted effect sizes by alcohol measurement characteristics, by age group.

	Adolescents		Young adults	
	b	95% CrI	b	95% CrI
Construct type				
Abstinence	Ref		Ref	
Frequency of drinking	−0.17*	[−0.28, −0.05]	−0.06*	[−0.10, −0.01]
Frequency of heavy drinking	−0.19*	[−0.31, −0.07]	−0.03	[−0.07, 0.01]
Quantity of drinking	−0.19*	[−0.32, −0.06]	−0.04	[−0.08, 0.00]
Maximum quantity	−0.30*	[−0.55, −0.07]	−0.05*	[−0.10, −0.01]
Blood alcohol concentration	-		−0.03	[−0.08, 0.02]
Two or more types	−0.12	[−0.28, 0.04]	−0.01	[−0.07, 0.04]
Assessment instrument				
ACI	-		Ref	
AUDIT	Ref		−0.09	[−0.19, 0.001
BDP	-		0.02	[−0.14, 0.19]
DDQ	−0.21	[−0.85, 0.39]	0.00	[−0.07, 0.07]
TLFB	0.27	[−0.34, 0.84]	0.02	[−0.07, 0.10]
QFI	-		0.01	[−0.07, 0.10]
QFS	-		−0.15	[−0.39, 0.09]
Not reported	−0.12	[−0.69, 0.42]	0.02	[−0.06, 0.09]
Two or more instruments	-		−0.01	[−0.12, 0.10]
Other instrument	−0.23	[−0.81, 0.30]	0.02	[−0.07, 0.10]
Reference period (days)	0.00	[0.00, 0.00]	0.00	[0.00, 0.00]
Control variables				
High-risk screened sample	0.08	[−0.16, 0.31]	0.02	[−0.05, 0.09]
Site: school/university	0.02	[−0.28, 0.32]	0.03	[−0.07, 0.13]
Type: motivational enhancement therapy (MET)	0.22*	[0.00, 0.44]	0.04	[−0.01, 0.09]
Intercept	0.33	[−0.16, 0.84]	0.12	[−0.01, 0.25]
τ^2_{L2}	0.004		0.00	
τ^2_{L3}	0.04		0.04	
n	145		1,532	
k			64	

CrI, credible interval; *k* = number of studies; *n* = number of effect sizes; τ^2_{L2} = within-study between-effect size variance component; τ^2_{L3} = between-study variance component. - = category not present in adolescent samples so not included in model. Ref, reference category for dummy variables.

for sample risk level, study setting, and intervention type). For the moderators coded as binary dummy variables (construct type and assessment instrument), the meta-regression coefficients (*b*s) reflect the average difference in mean effect sizes across categories of the moderators, and can be used to evaluate whether the mean effect size differs across categories.

As shown in the left panel of Table 3, in the adolescent samples all outcome construct types yielded significantly smaller mean effect sizes when compared to abstinence measures (the reference category). Shifting the reference category provided no other evidence that effects varied across the other outcome construct types.

The next section of Table 3 shows that there were no differences in effect sizes for outcomes measured with the AUDIT (the reference category) versus other assessment instruments. Additional tests of coefficient equality (i.e. via shifting of the reference category); however, indicated that effect sizes for outcomes measured with the TLFB were significantly larger than those measured using the DDQ (b = 0.48, 95% CrI [0.09, 0.87]), some other standardized scale (b = 0.50, 95% CrI [0.22, 0.78]), or an unknown instrument (b = 0.39, 95% CrI [0.14, 0.64]). Finally, there was no evidence that intervention effects varied across outcome assessment period.

To better display the findings from Table 3, Figure 2 presents the density plots of the mean effect size distributions for adolescent samples across the different outcome construct types (rows) and assessment instruments (columns). For each of these density plots, the other covariates in the model were fixed at their modes (i.e. past 30 day measurement, not a high-risk screened sample, school/university setting, and not an MET intervention). Comparing the distributions across columns demonstrates that with the exception of the TLFB instrument, there was minimal variability in effects across assessment instruments. Comparing the distributions within each column highlights that effects were largest for the abstinence outcomes.

Results for young adults

In the young adult samples, effect sizes for abstinence measures (the reference category) were significantly larger than those for frequency of drinking (b = −0.06, 95% CrI [−0.10, −0.01]) and maximum quantity measures (b = −0.05, 95% CrI [−0.10, −0.01]). Shifting the reference category provided no other evidence that effects varied across the other outcome construct types.

In the young adult samples, there were no differences in effect sizes for outcomes measured with the

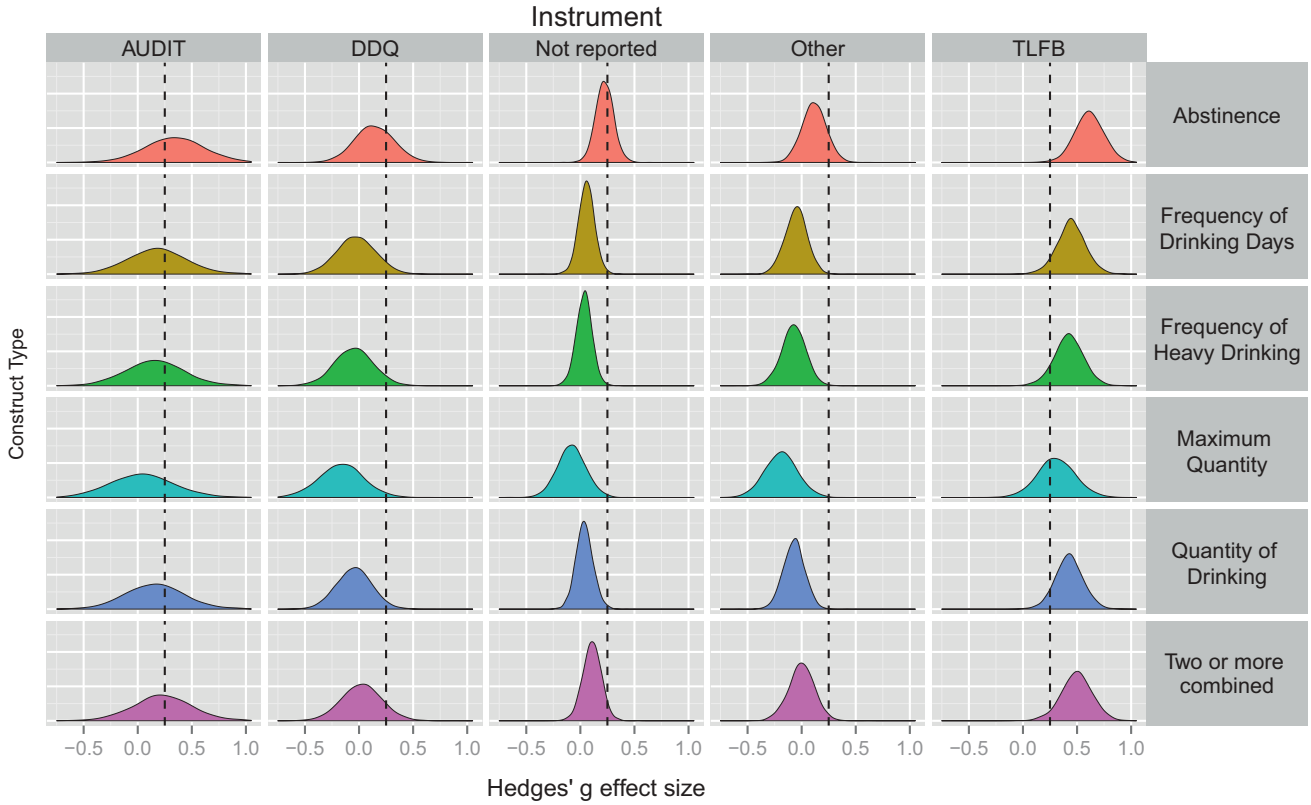

Figure 2. Densities of effect size distributions by alcohol assessment instrument and construct type, adolescent samples. Densities reflect the predicted mean effect size distributions for adolescent samples (k = 26) across outcome construct types (rows) and assessment instruments (columns). The overall weighted mean effect size (0.25) is displayed with a dashed line. The predicted mean effect sizes were estimated using the meta-regression model shown in the left panel of Table 3, with all covariates held at modal values.

ACI (the reference category) versus other assessment instruments. Additional tests of coefficient equality, however, indicated that effect sizes for outcomes measured with the AUDIT were significantly smaller than those measured using the TLFB (b = −0.11, 95% CrI [−0.18, −0.03]), QFI (b = −0.10, 95% CrI [−0.19, −0.02]), DDQ (b = −0.09, 95% CrI [−0.16, −0.02]), some other standardized scale (b = −0.11, 95% CrI [−0.18, −0.04]), or an unknown instrument (b = −0.11, 95% CrI [−0.17, −0.04]). There was no evidence, however, that intervention effects varied across outcome reference period. Figure 3 presents the density plots of the mean effect size distributions for the young adult samples across the different outcome construct types (rows) and assessment instruments (columns).

Discussion

This study updated findings from a meta-analysis examining the effects of brief alcohol interventions for adolescents and young adults, with specific emphasis on exploring variability in effects across outcome measurement characteristics. We synthesized findings from 190 experimental and quasi-experimental studies that examined the effects of brief alcohol interventions on post-intervention measures of alcohol consumption. The results indicated that brief alcohol interventions with up to five hours of total contact time were associated with significant post-intervention reductions in alcohol consumption. For adolescents, on average, the interventions led to a 0.25 standard deviation improvement in outcomes. Although smaller in magnitude, the benefits for young adults were also positive and significant, associated with a 0.15 a standard deviation improvement in outcomes. These average effect estimates are of the same order of magnitude as those reported in previous meta-analyses examining similar interventions for youth (10,14,37,38).

Although some scholars have recently questioned the practical significance of effect sizes in the range reported here (13), we maintain that these effects might be clinically meaningful in certain settings. For instance, using data from the comparison groups in the studies using TLFB measures in this meta-analysis,

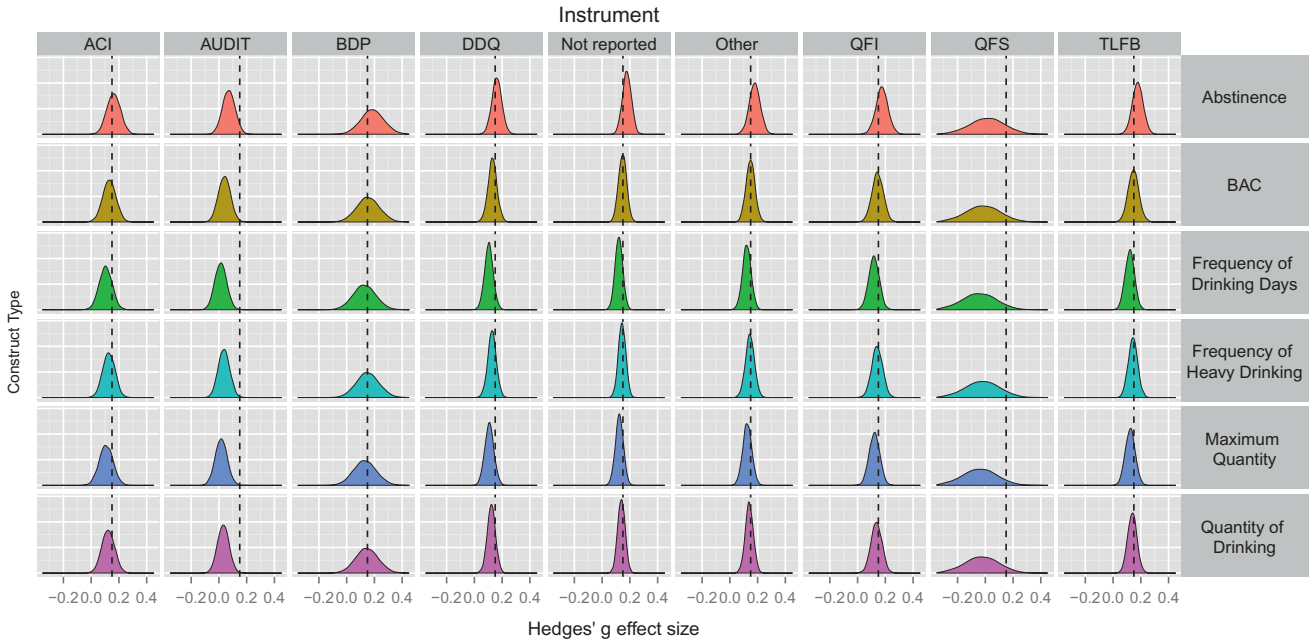

Figure 3. Densities of effect size distributions by alcohol assessment instrument and construct type, young adult samples. Densities reflect the predicted mean effect size distributions for young adult samples (k = 64) across outcome construct types (rows) and assessment instruments (columns). The overall weighted mean effect size (0.15) is displayed with a dashed line. The predicted mean effect sizes were estimated using the meta-regression model shown in the right panel of Table 3, with all covariates held at modal values.

these effects translate into a 1.2 reduction in past month heavy drinking days for adolescents (from 5.5–4.3), and a 0.70 reduction in past month heavy drinking days for young adults (from 5.5–4.8). Although modest in size, such small reductions might be clinically significant if they can interrupt the trajectories from alcohol experimentation to alcohol use disorder in samples of youth at high risk for alcohol related problems. Indeed, brief alcohol interventions are often delivered opportunistically at times when participants may have experienced alcohol-related negative consequences (e.g. after alcohol-related citations on a college campus, after admission into emergency rooms for alcohol-related injuries) and thus small effects may be clinically meaningful. Further, it may be difficult to identify other interventions appropriate for this population that have consistently larger effects than those observed for brief alcohol interventions. Any consideration of clinical significance, therefore, should factor in issues of implementation feasibility, local setting and provider buy-in, participant profiles and preferences, costs, and availability of alternative interventions; these factors are beyond the scope of the current study but are nonetheless important for practitioners to consider when selecting evidence-based interventions.

The results from this meta-analysis also indicated that the effects of brief alcohol interventions among youth were remarkably consistent across alcohol outcome assessment characteristics. There was no evidence that interventions yielded larger effects on measures of heavy drinking compared to other measures such as frequency of (non-heavy) drinking days. Rather, effects were slightly larger when researchers used binary measures of abstinence from alcohol, relative to other measures of alcohol consumption. Effects were also relatively consistent across assessment instruments, although among adolescent samples the TLFB yielded slightly larger effects compared to the DDQ instrument, and in the young adult samples the AUDIT yielded smaller effects compared to other assessment instruments.

Possible explanations for these findings are that certain outcome assessments are more sensitive to detecting changes in self-reported alcohol consumption, or conversely, that some outcome types (e.g. abstinence) may be overly crude measures that lead to exaggerated intervention effects. Indeed, the finding that effects were larger for abstinence measures was unexpected, given that brief alcohol interventions typically take a harm-reduction approach, are targeted toward non-dependent drinkers, and focus on the moderation and reduction of alcohol use. The larger effects observed for abstinence measures could thus be a function of the low baseline drinking levels of participant samples, or due to the crude nature of binary measures of abstinence. It

is impossible to test such competing explanations with the data from the current meta-analysis, but this is an important direction for future research.

Nonetheless, these results advance the field of brief alcohol intervention research by documenting that although effects are remarkably consistent across outcome types, the ways in which primary researchers elect to measure alcohol outcomes may have non-trivial implications for the observed magnitude of intervention effects. As such, efforts for promoting a core set of validated and standardized assessment instruments for measuring alcohol consumption among youth are critical for ensuring the comparability of observed intervention effects across trials (39). Such a core set of instruments would of course need to consider that the most appropriate alcohol measure may vary across clients and contexts (40,41) and by purpose (23,42). Establishing such a core set would ideally minimize the use of author-created homegrown measures with no established validity or reliability.

Of course, readers should interpret the findings from this meta-analysis in light of its strengths and limitations. The primary strengths of this study were the large number of studies included in the synthesis and the inclusion of multiple effect sizes from each study that permitted in-depth exploration of variability across outcome measurement characteristics. The main limitation of the current study revolved around inconsistent reporting in the primary studies included in the synthesis (e.g. reporting of assessment instruments), which limited our ability to examine variability across outcome measurement characteristics. Indeed, none of the included studies reported findings for biomarker outcomes (e.g. ethyl glucuronide, phosphatidylethanolamine); as these biomarker outcomes are increasingly used in the literature, future reviews should assess how effects from these biochemically verified outcomes compare to self-reported outcomes. Another limitation is the small number of studies that used certain assessment instruments (e.g. ACI, BDP, QFS). Thus, the results for these assessment instruments must be interpreted cautiously given that the findings reported here are based on a small number of studies. A final limitation, inherent in any meta-analysis relying on previously reported data, is the possibility of reporting or publication biases, which could yield biased overall effect estimates and/or biased findings from moderator analyses. Although it is impossible to address this issue directly in the current meta-analysis, results from sensitivity analyses indicated no obvious small-study bias in the current meta-analysis. Nonetheless, this serves as important reminder for alcohol intervention researchers to fully report all findings from planned analyses, regardless of the direction or statistical significance of the findings.

Despite these limitations, the findings from this updated meta-analysis provide evidence that brief alcohol interventions can yield beneficial effects on self-reported alcohol consumption among youth. The results also suggest that although the effects of brief alcohol interventions are generally consistent across different self-reported alcohol assessment instruments, there is some variability across outcome types. The type of alcohol assessment instrument used by primary study authors may therefore influence reported intervention effects in trials, which highlights the need for a core set of standardized alcohol assessment instruments to be used by brief alcohol intervention researchers.

Funding

This work was supported by Award Number R01AA020286 from the National Institute on Alcohol Abuse and Alcoholism. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Alcohol Abuse and Alcoholism or the National Institutes of Health.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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