REVIEW ARTICLE

Interventions for Reducing Adolescent Alcohol Abuse

A Meta-analytic Review

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Objective: To assess the effectiveness of substance abuse interventions for their ability to reduce adolescent alcohol use.

Data Sources: MEDLINE; PsycINFO; ERIC; Wilson Social Science Abstracts; Criminal Justice Abstracts; Social Work Abstracts; Social Science Citation Index; Dissertations Abstracts International; National Criminal Justice Research Service; Social, Psychological, Criminological, Educational Trials Register; and the PsiTri databases from 1960 through 2008.

Study Selection: Of 64 titles and abstracts identified, 16 studies and 26 outcomes constituted the sample. The researchers calculated Hedges g effect sizes and used a random-effects model to calculate adjusted pooled effect sizes. Heterogeneity was explored using stratified analyses.

Main Exposure: Completion of a substance abuse intervention that aimed to reduce or eliminate alcohol consumption.

Main Outcome Measures: Abstinence, frequency of alcohol use, and quantity of alcohol use measured between 1 month and 1 year upon completion of treatment.

Results: Pooled effects of standardized mean differences indicate that interventions significantly reduce adolescent alcohol use (Hedges $g=-0.61$; 95% confidence interval [CI], −0.83 to −0.40). Stratified analyses revealed larger effects for individual treatment (Hedges $g=-0.75$; 95% CI, −1.05 to −0.40) compared with family-based treatments (Hedges $g=-0.46$; 95% CI, −0.66 to −0.26).

Conclusions: Treatments for adolescent substance abuse appear to be effective in reducing alcohol use. Individual-only interventions had larger effect sizes than family-based interventions and effect sizes decreased as length of follow-up increased. Furthermore, behavior-oriented treatments demonstrated promise in attaining long-term effects.

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ALCOHOL USE DURING ADOLESCENCE remains a significant concern. Alcohol is the most frequently used substance among adolescents.[1,2] Results from the Monitoring the Future national study indicate that 16% of eighth graders report having had a drink within the past 30 days, as did 33% of 10th and 44% of 12th graders.[2] Because alcohol is easily accessible and lacks the same legal consequences of more illicit substances, its use begins at young ages, with just under 50% of eighth graders having used alcohol,[2] initiating use at an average age of 14 years.[3] Misuse of alcohol also occurs at high frequencies, with over half of 12th graders reporting ever having been drunk, 30% reporting binge drinking, and 3% reporting daily drinking.[2,4,5]

Adolescent alcohol use disorders are associated with serious psychosocial problems. Youth dependent on alcohol report increased rates of comorbid mental health disorders[6] and neurocognitive deficits.[7] They also demonstrate reduced motivation in regard to academic success.[8] Furthermore, alcohol misuse in adolescence places youth at increased risk for subsequent adult alcohol abuse and its related problems.[9]

Considering the serious consequences associated with adolescent alcohol use, several treatments have been developed to reduce youths' alcohol consumption and related behavioral problems. Interventions to reduce alcohol use are provided in 2 primary formats with treatment provided either directly to the adolescent or in the context of his or her family. Common individual treatments use behavioral interventions to identify internal and external stimuli that trigger alcohol use and then implement skills training to teach refusal skills, relaxation techniques, and behavioral management techniques.[5,10] Often, cognitively oriented therapies will additionally focus on distorted thoughts and maladaptive perceptions that lead to problematic behaviors.[11] Motivational interviewing, a third common treatment ap-

proach, helps clients recognize their problem behavior and build internal motivation toward behavioral change.[12] According to Thatcher and Clark,[5] motivational interviewing may be especially pertinent for adolescents because they are often coerced into treatment and are often unwilling to acknowledge their problematic behaviors. Several randomized clinical trials have demonstrated reductions in adolescent alcohol use across individual intervention approaches.[8,13]

Most research on reducing adolescents' substance use has evaluated family-based interventions.[5] Because family dynamics are an integral component in the lives of adolescents, many consider the family to be an essential consideration when treating substance-abusing adolescents.[14] The 4 most common family-based programs that aim to reduce substance use are multisystemic therapy, integrated family and cognitive behavioral therapy, multidimensional family therapy, and brief strategic family therapy. Each of these treatments uses a multisystem approach in which the intervention not only attempts to change youth behavior but also to reduce risk factors for substance use present in the youth's family or other social systems (school, peers, or community). Several trials of family-based interventions have demonstrated effectiveness in reducing alcohol use.[15-19]

With multiple studies evaluating the effects of interventions to reduce adolescent alcohol use, synthesis across studies is necessary to gain a clear picture of overall effects. Several articles have synthesized related topics. For example, there are currently published meta-analyses and systematic reviews that assess the effectiveness of various substance abuse interventions for adults,[20] preventive interventions for adolescent substance use,[21] and brief interventions for reducing substance use.[22] Moreover, Vaughn and Howard[23] conducted a synthesis for controlled evaluations of adolescent substance abuse treatment. To date, however, a meta-analysis of outcomes for interventions to reduce alcohol use among adolescents does not exist. Consequently, a primary purpose of this article is to assess the effectiveness of individual- and family-based interventions for their ability to reduce adolescent alcohol use.

Additionally, questions remain regarding whether individual counseling or family-based treatments are more effective at reducing alcohol use. In a meta-analysis on drug abuse outcomes, Stanton and Shadish[24] found that family treatment was superior to individual counseling; however, this study was conducted more than 12 years ago and included both adolescents and adults seeking treatment for substance abuse. Thus, along with determining the effects of treatments to reduce adolescent alcohol use, a secondary aim of the current study is to compare the effects of individual treatments with family-based treatment approaches.

METHODS

DATA SOURCES AND SEARCHES

We followed standardized protocols for the identification, acquisition, coding, and analysis of studies of treatment effects on alcohol use outcomes consistent with the Quality of Reporting of Meta-analyses statement.[25] The search objective was to identify all studies that involved a comparison with a focal treatment targeting alcohol use outcomes for adolescent clients between the ages of 12 and 19 years for a 48-year span (between 1960 and 2008). This time frame was selected to capture all potential studies. Databases systematically searched included MEDLINE; PsycINFO; ERIC; Wilson Social Science Abstracts; Criminal Justice Abstracts; Social Work Abstracts; Social Science Citation Index; Dissertation Abstracts International; National Criminal Justice Research Service; Social, Psychological, Criminological, Educational Trials Register; and the PsiTri database of randomized and controlled trials in mental health. Supplemental searches of alcohol and drug treatment Web sites, such as the National Institute on Drug Abuse, the Alcohol and Drug Abuse Institute at the University of Washington, and the Center on Alcoholism, Substance Abuse and Addictions at the University of New Mexico, were also searched to augment formal systematic searches. Manual searches of the reference sections of identified studies, reference sections of recent pertinent books, and government documents were also conducted. Keyword searches included the following descriptors entered singularly and in Boolean format with *and* or *or*: *adolescent*, *alcohol*, *alcohol abuse*, *ethanol*, *alcohol dependence*, *substance abuse*, *substance use disorders*, *psychosocial interventions*, *psychosocial treatments*, *youth*, *behavioral interventions*, *behavioral treatments*, *psychotherapy*, *randomized controlled trials*, and *controlled clinical trials*. If a study appeared promising, we retrieved the full-text version. Following search descriptor refinements, duplicate citation removal, and step-by-step screening and filtering of articles vis-à-vis inclusion criteria, full-text articles were reexamined for relevance and final study selection.

STUDY SELECTION

Studies were selected according to eligibility criteria established a priori. To be included, studies must have (1) tested an intervention to reduce alcohol use (excluding prevention studies, observational studies, and literature review/conceptual articles); (2) targeted adolescents (aged 12-19 years), unless studies of mixed groups of adolescents and adults could allow specific determinations as to the effectiveness of treatment outcomes for adolescent subjects; (3) examined quantitative alcohol use treatment outcomes, such as alcohol abstinence, frequency of drinking, and quantity of drinking (as opposed to compliance, safety, other problem behaviors, or prevention-only outcomes); and (4) used a contrast condition for comparison (ie, comparison group that included a control group, wait-list control, or contrasting treatment group as part of the design (excluding 1 group prepost design or case studies). (5) Investigations using pharmacological therapies were included only if drugs were administered as part of an integrated treatment protocol combining medications with 1 or more psychosocial interventions. The Quality of Reporting of Meta-analyses flowchart[25] illustrates the study screening process (**Figure**).

DATA EXTRACTION AND QUALITY ASSESSMENT

Study authors independently recorded study characteristics such as citation information, methodological attributes, outcome variable information, measures, key findings, intervention description, as well as other pertinent information such as sample size onto an intervention coding form. Following this initial coding procedure, a second coder double-coded the information for all studies. Two dyads of authors independently coded studies, and interrater agreement assessment showed minimal coding error for dyad 1 ($\kappa = 0.76$) and dyad 2 ($\kappa = 0.78$). Reitzel and Carbonell[26] suggest that the κ statistic is a superior calculation because it adjusts for the proportion of the rater's agreement that could occur between raters owing to chance. Study authors met to evaluate any remaining discrepant codes and a consensus was achieved via discussion.

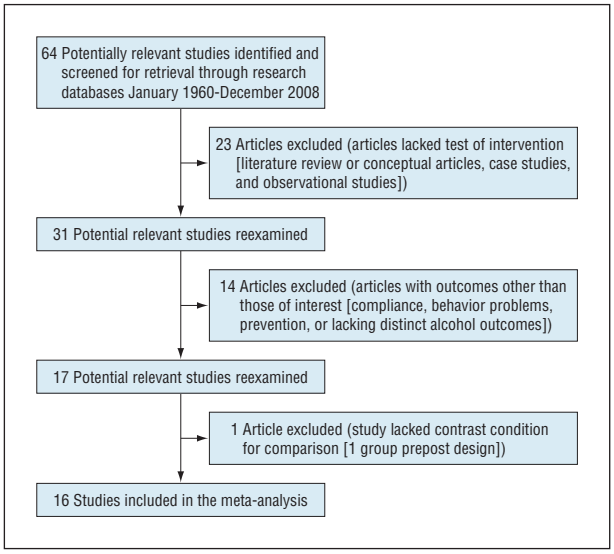

Figure. Study screening process flowchart.

ANALYSIS OF METHODOLOGICAL QUALITY

Each study was rated with regard to methodological characteristics using an adapted version of the Methodological Quality Rating Scale. This scale was developed by Miller et al[27] and the Mesa Grande project evaluating alcohol dependence treatment outcome studies[28,29] and has been used in other systematic reviews[23,30] and meta-analyses.[31] Each study was evaluated across 13 methodological attributes. The number of points a study could garner ranged from 1 (extremely poor quality) to 16 (exceptionally high quality).

DATA SYNTHESIS AND ANALYSIS

We combined data from multiple intervention studies targeting alcohol use outcomes. Alcohol use outcomes were measured as reductions in the frequency of alcohol use (ie, drinking days and number of drinks consumed) assessed by structured interviews. We used the software Comprehensive Meta-Analysis 2.0.[32] For intervention studies with sufficient statistical information, this program calculates the standardized mean difference effect size. We used the Hedges adjusted *g* for effect sizes to correct for sample size bias.[33,34] For treatment/comparison design studies, the effect size was calculated as the difference between the intervention group's mean posttest score and the comparison group's mean posttest score divided by the pooled standard deviation and adjusted for sample size. We examined and corrected extreme values using winsorizing techniques.[35] This process results in identifying effects greater than 2 SDs from the mean and assigning these effects a value equivalent to 2 SDs. Owing to dispersion based on clinical inference and supported by statistically significant *Q* values and relatively high τ^2 and I^2 values, we could not assume the true effect was identical across studies and subsequently used a random-effects model over a fixed-effects model to estimate pooled effects. The random-effects model takes into account sources of variation within and between studies.[36] Fixed effects often inflate effect size precision owing to narrower confidence intervals (CIs) compared with random-effects models.[37] As such, random-effects models provide a more conservative estimate. We also tested pooled effects using a mixed-effects model, which did not assume common variance among studies across subgroups, but combined subgroups using a fixed effect.[38] Heterogeneity was explored using stratified analyses. Funnel plots and associated statistics were examined to evaluate publication bias. A fail-safe population size was computed to assess the file drawer problem inherent in meta-analyses (ie, how many studies with null or differential effect are necessary to invalidate study results).

Table 1. Characteristics of Studies Included in the Meta-analysis

Characteristic	No. (%) of Studies (N=16)
Journal article	16 (100)
Publication year	
2007-2008	5 (31)
2005-2006	1 (6)
2003-2004	3 (19)
2001-2002	4 (25)
1999-2000	2 (13)
Before 1999	1 (6)
Intervention tested	
Family	5 (31)
Individual	10 (62)
Both	1 (7)
Methodological attributes	
Considered replicable	15 (94)
Reported baseline characteristics	16 (100)
Quality control	15 (94)
Outcome follow-up length, mo	
<6	7 (44)
6-11	9 (56)
≥12	3 (19)
Follow-up rate completion, %	
<70	2 (13)
70-84.9	5 (31)
85-100	6 (38)
Not reported	1 (6)
Collateral verification	11 (69)
Objective verification	11 (69)
Dropouts enumerated	14 (88)
Attrition delineated	14 (88)
Single site	15 (94)
Study design	
Experimental	14 (87.5)
Quasi-experimental	2 (6)

RESULTS

SEARCH RESULTS

The Figure illustrates the results of the study screening process. Sixty-four potentially relevant studies were initially identified. After literature review articles, case studies, and other article formats not meeting search criteria were removed, 31 publications remained. Articles were reexamined for relevance and design qualifications for final study selection. Findings from 16 investigations published between 1994 and 2008 constituted the final study sample.

STUDY CHARACTERISTICS

As shown in **Table 1**, all 16 of the studies contained in this analysis were journal article publications. Nearly 40% were published between 2006 and 2008. More than half (57%) were published between 2000 and 2004, while less

Table 2. Design and Treatment Characteristics of Included Studies

Source	Design	Intervention	Postrandomization Group Comparison	Collaterals	Attrition	Site	Duration and No. of Sessions	Outcome	Follow-up, mo
Azrin et al,[13] 1994	Experimental	BT	Yes	Collaterals interviewed	Considered in outcome	Clinic	Average 19 sessions, 1 session/wk	Days of alcohol use	12
Baer et al,[8] 2007	Experimental	BMI	Yes	No collateral verification	Considered in outcome	Homeless drop-in center	4 wk, 1 session/wk	Alcohol use	3
D'Amico et al,[9] 2008	Experimental	BMI	Yes	No collateral verification	Considered in outcome	Clinic	1 session with a "booster" call 1 month later	Frequency of alcohol use	6
Friedman et al,[39] 2002	Experimental	TMSL	Yes	Collaterals interviewed	Considered in outcome	Clinic	24 wk, 1 session/wk	Alcohol use	6
Godley et al,[40] 2002	Experimental	ACC	Yes	Collaterals interviewed	Considered in outcome	Home	12 wk, frequency not reported	Days to alcohol use	3
Godley et al,[41] 2007	Experimental	ACC	Yes	Collaterals interviewed	Considered in outcome	Aftercare services	90 d, 1 session/wk	Time absent from alcohol	9
Henggeler et al,[15] 1999	Quasi-experimental	MST	Yes (no randomization)	Collaterals interviewed	Considered in self-report	Home/school community center	40 h direct contact with therapist in 4-5 mo	Frequency of alcohol use	10
Kaminer and Burleson,[42] 1999	Experimental	CBT	Yes	Collaterals interviewed	Considered in outcome	Residential facility	12 wk, 1 session/wk	Severity of alcohol use	6
Kaminer et al,[43] 2008	Experimental	AA and CBT	Yes	No collateral verification	Considered in outcome	Home	12 wk, 5 total sessions	Frequency of alcohol use and heavy alcohol use	3-6
Latimer et al,[16] 2003	Experimental	IF-CBT	Yes	Collaterals interviewed	Not considered in outcome	Clinic	16 wk, 3 sessions/wk	Frequency of alcohol use	6
Liddle et al,[17] 2001	Experimental	MDFT	Yes	Collaterals interviewed	Considered in outcome	Clinic	16 wk, 1 session/wk	Alcohol use	12
Liddle et al,[18] 2008	Experimental	MDFT	Yes	No collateral verification	Considered in outcome	Clinic	1 session/wk	Alcohol use	12
McGillicuddy et al,[44] 2001	Experimental	PCST	Yes	Collaterals interviewed	No dropouts	Clinic	8 wk, 1 session/wk	Frequency of alcohol use	50 d
Santisteban et al,[45] 2003	Experimental	BSFT	Yes	Collaterals interviewed	Considered in outcome	Clinic	Average 11 sessions, 1 session/wk	Frequency of alcohol use	5
Tomlinson et al,[46] 2004	Quasi-experimental	CBT/12-step	Yes (no randomization)	Collaterals interviewed	Considered in outcome	Residential facility	NA	Frequency of alcohol use	6
Winters and Leitten,[19] 2007	Experimental	BI, BI-A, BI-AP	Yes	No collateral verification	Considered in outcome	School	2 or 3 sessions	Alcohol use days; alcohol binge days	6

Abbreviations: AA, active aftercare; ACC, assertive continuing care; BI, brief intervention; BI-A, brief intervention with adolescent only; BI-AP, brief intervention with adolescent and 1 parent only; BMI, brief motivational interviewing; BT, behavioral treatment; BSFT, brief strategic family therapy; CBT, cognitive behavioral therapy; CBT/12-step, cognitive behavioral therapy integrated with 12 steps; IF-CBT, integrated family and cognitive behavioral therapy; MDFT, multidimensional family therapy; MST, multisystemic therapy; NA, not applicable; PCST, parent coping skills training; TMSL, triple modality social learning.

than 10% predate 1999. The entire sample of youth participants within this meta-analysis was younger than 19 years, and all studies were carried out within the United States. Most (62%) of the studies tested individual-based therapies and approximately one-third tested family therapies. With regard to study design, 14 (87.5%) used experimental designs. Only 2 studies were quasi-experimental. Nearly all (94%) of the studies were conducted at single-site locations, were considered replicable, and reported baseline participant characteristics. The vast majority (94%) of the studies reported that their interventions were standardized by a manual or required the specific training of research staff. Most studies (69%) reported using objective verification when collecting data and 69% reported using collateral verification. Most (56%) studies had a follow-up length from 6 to 11 months. Assessment of follow-up times revealed that only 38% of the studies were able to maintain 85% to 100% of their original study participants. Although only 44% of studies reported having lower than 85% follow-up rates, a large majority (88%) enumerated their participants who had dropped out of the study. One study[39] did not report follow-up details. **Table 2** describes design and treatment information for each included study.

OVERALL COMPARISONS OF TREATMENT EFFECTS

As shown in **Table 3**, using the random-effects model, the adjusted pooled effect size (Hedges *g*) was −0.62 (95% CI, −0.83 to −0.40). All tested interventions yielded reductions in alcohol use. The range of standardized effects for reducing alcohol use was substantial, ranging from −0.09 (95% CI, −0.45 to 0.27) for brief motivational interviewing[8] to −1.991 (95% CI, −2.37 to −1.61) for cognitive-behavioral therapy integrated with the 12-step approach.[46] In addition to cognitive-behavioral therapy with the 12-step approach,

Table 3. Standardized Effects of Intervention Studies Targeting Adolescent Alcohol Use (n = 16)

Source	Comparison (Study Time)	Sample Size, No.		Hedges *g* (95% CI)	*z* Value	*P* Value
		Treatment	Completed			
Azrin et al,[13] 1994	BT vs SC (12 mo)[a]	81	81	−0.657 (−0.972 to −0.343)	−4.093	<.001
Baer et al,[8] 2007	BMI vs TAU (1 mo)[a]	66	51	−0.120 (−0.483 to 0.244)	−0.645	.52
	BMI vs TAU (3 mo)[a]	85	51	−0.089 (−0.452 to 0.275)	−0.478	.63
D'Amico et al,[9] 2008	BMI vs TAU (6 mo)[a]	110	85	−1.540 (−1.881 to −1.199)	−8.849	<.001
Friedman et al,[39] 2002	TMSL vs BRT (6 mo)[a]	63	91	−0.514 (−0.796 to −0.233)	−3.585	<.001
Godley et al,[40] 2002	ACC vs TAU (3 mo)[a]	98	51	−0.477 (−1.811 to 0.858)	−0.700	.48
Godley et al,[41] 2007	ACC vs TAU (3 mo)[a]	98	78	−0.129 (−1.509 to 1.250)	−0.184	.85
	ACC vs TAU (9 mo)[a]	54	78	−0.100 (−1.479 to 1.280)	−0.141	.89
Henggeler et al,[15] 1999	MST vs TAU (posttreatment)[b]	58	56	−0.390 (−0.758 to −0.022)	−2.074	.04
	MST vs TAU (6 mo)[b]	54	54	−0.337 (−0.714 to 0.041)	−1.749	.08
Kaminer and Burleson,[42] 1999	CBT vs IT (15 mo)[a]	5	7	−0.535 (−1.616 to 0.546)	−0.970	.33
Kaminer et al,[43] 2008	AA (CBT vs no AA) (3-6 mo)[a]	70	41	−0.866 (−1.255 to −0.476)	−4.354	<.001
Latimer et al,[16] 2003	IF-CBT vs PC (6 mo)[a]	38	21	−0.739 (−1.353 to −0.124)	−2.357	.02
Liddle et al,[17] 2001	MDFT vs FE (6 mo)[b]	38	35	−0.814 (−1.287 to −0.341)	−3.371	.001
	MDFT vs FE (12 mo)[b]	38	35	−0.442 (−0.902 to 0.018)	−1.885	.06
	MDFT vs GT (6 mo)[b]	38	28	−0.592 (−1.085 to −0.099)	−2.353	.02
	MDFT vs GT (12 mo)[b]	39	28	−0.565 (−1.057 to −0.073)	−2.250	.02
Liddle et al,[18] 2008	MDFT vs CBT (3 mo)[b]	47	49	−0.402 (−0.791 to −0.013)	−2.024	.04
	MDFT vs CBT (6 mo)[b]	45	53	−0.194 (−0.584 to 0.197)	−0.971	.33
	MDFT vs CBT (12 mo)[b]	14	59	−0.166 (−0.583 to 0.252)	−0.777	.44
McGillicuddy et al,[44] 2001	PCST vs DTC (50 d)[b]	126	8	−0.122 (−0.959 to 0.714)	−0.287	.77
Santisteban et al,[45] 2003	BSFT vs GT (5 mo)[b]	70	85	−0.037 (−0.311 to 0.237)	−0.263	.79
Tomlinson et al,[46] 2004	CBT/12-step SUD and PC vs CBT/12-step SUD (6 mo)[a]	70	88	−1.991 (−2.373 to −1.609)	−10.22	<.001
Winters and Leitten,[19] 2007	BI-AP vs CON (6 mo)[a]	26	26	−1.711 (−2.340 to −1.083)	−5.338	<.001
	BI-A vs CON (6 mo)[a]	26	26	−1.372 (−1.969 to −0.775)	−4.506	<.001
	BI-A vs BI-AP (6 mo)[a]	26	26	−0.557 (−1.103 to −0.011)	−2.000	.046
Random effects						
Overall				−0.616 (−0.834 to −0.397)	−5.528	<.001
Family only				−0.462 (−0.662 to −0.262)	−4.527	<.001
Individual only				−0.754 (−1.105 to −0.403)	−4.208	<.001
Outcomes for >6 mo follow-up				−0.499 (−0.679 to −0.320)	−5.450	<.001
Outcomes for ≤6 mo or follow-up				−0.661 (−0.945 to −0.377)	−4.557	<.001

Abbreviations: AA, active aftercare; ACC, assertive continuing care; BI-A, brief intervention with adolescent only; BI-AP, brief intervention with adolescent and 1 parent only; BMI, brief motivational interviewing; BRT, basic residential treatment; BSFT, brief strategic family therapy; BT, behavioral treatment; CBT, cognitive behavioral therapy; CBT/12-step SUD, cognitive behavioral therapy integrated with 12 steps for substance use disorders; CI, confidence interval; CON, assessment-only control condition; DTC, delayed treatment condition; FE, family education; IF-CBT, integrated family and cognitive behavioral therapy; GT, group treatment/therapy; IT, interactional treatment; MDFT, multidimensional family therapy; MST, multisystemic therapy; PC, psychoeducation curriculum; PCST, parent coping skills training; SC, supportive counseling; TAU, treatment as usual; TMSL, triple modality social learning.

[a] Denotes intervention focus on the individual.

[b] Denotes intervention focus on the family.

brief motivational interviewing,[9] active aftercare,[43] multidimensional family therapy,[17] and brief intervention with adolescent and parent[19] yielded large (>0.80) effects. Intervention effects tended to wane over time. Although most studies did not include such long-term assessments of intervention results (≥12 months), those studies that did revealed enduring effects for behavioral treatment compared with supportive counseling (Hedges *g*=−0.66; 95% CI, −0.97 to −0.34), multidimensional family treatment compared with family education (Hedges *g*=−0.81; 95% CI, −1.29 to −0.34), and multidimensional family therapy compared with group therapy (Hedges *g*=−0.57; 95% CI, −1.06 to −0.07).

STRATIFIED AND SENSITIVITY ANALYSES

Stratified analyses by individual vs family intervention classifications showed that pooled effects revealed somewhat larger effects for individual interventions (Hedges *g*=−0.75; 95% CI, −1.10 to −0.40) compared with family-based interventions (Hedges *g*=−0.46; 95% CI, −0.66 to −0.26). Moreover, pooled effects for stratified analyses by follow-up length revealed larger effect sizes for outcomes with follow-up data of 6 months or less (Hedges *g*=−0.66; 95% CI, −0.95 to −0.38) compared with follow-up data of longer than 6 months (Hedges *g*=−0.50; 95% CI, −0.68 to −0.32). Results of stratified analyses are shown in Table 3. We used Duval and Tweedie's trim and fill method[47] to examine and impute studies based on any asymmetric pattern, and results showed a negligible change in overall pooled effects based on imputation of 3 studies (increase of 0.04 in Hedges *g*), suggesting that publication bias is minimal. A fail-safe population was also computed to address the file drawer problem, and results showed that 1053 null studies would be necessary to change the α to a nonsignificant value. Although relatively low in power, rank correlation and the Egger regression intercept were both nonsignificant, also suggesting a lack of publication bias.

COMMENT

This meta-analysis finds that numerous treatments for adolescents contribute to the reduction of alcohol use over time. When synthesizing all 16 studies and 26 outcomes, the overall pooled effect size is –0.62 ($P < .001$), indicating treatment has a medium effect on the reduction of alcohol use for adolescents according to Cohen[48] heuristics (<0.20 = small, 0.50 = moderate, and >0.80 = large).

Intervention approaches varied in their effects on alcohol reduction. Interventions with large effect sizes (>0.80) include brief motivational interviewing, cognitive-behavioral therapy with 12 steps, cognitive-behavioral therapy with aftercare, multidimensional family therapy, brief interventions with the adolescent, and brief interventions with the adolescent and a parent. Interventions with medium effect sizes include integrated family and cognitive behavioral therapy, behavioral treatment, triple modality social learning, multidimensional family therapy, and brief interventions only with the adolescent. The outcomes for multisystemic therapy were statistically significant, yet this treatment demonstrated a relatively small effect on the reduction of alcohol use.

Interestingly, 3 of the 5 interventions that produced large effect sizes included brief interventions. This is in contrast to Tait and Hulse's[22] previous systematic review of the effectiveness of brief interventions for substance-using adolescents; they found that, though statistically significant, the effect size for alcohol interventions was small, with a Hedges *g* effect size of 0.27. Considering the emergence of brief interventions primarily owing to managed care, the larger effect sizes found in this review indicate that more recent tests of brief interventions are yielding stronger reductions in alcohol use. However, research on brief interventions is limited, and more research is needed to assess its effectiveness with alcohol reduction for adolescents and to understand the mechanisms that produce changes.

Surprisingly, individual-only interventions had larger effect sizes ($g = –0.75$) than family-based interventions ($g = –0.46$). These findings contrast previous work that finds family-based interventions to be the ideal mode of treatment for adolescents with alcohol use disorders.[5,14,49] Unequivocal claims that individual-based treatment is more effective than family-based treatment are not, however, warranted, as potentially confounding factors were not controlled for in stratified analyses. Furthermore, both types of treatment were statistically significant ($P < .001$) and many of the specific interventions for both modalities contained large effect sizes. Two of the family-based interventions had large effect sizes[17,19] as did 3 of the individual counseling interventions.[9,19,43] In fact, Winters and Leitten[19] assessed the effectiveness of brief interventions with solely the adolescent and a brief intervention with the adolescent and 1 parent and found that the inclusion of a parent had a much larger effect size ($g = –1.71$). Nevertheless, concerning the studies included in this meta-analysis, individual counseling had a larger influence on the reduction of alcohol use for adolescents with alcohol use disorders than family-based interventions. The differences between individual- and family-based interventions found in the study, however, may lack reliability because of the small number of studies that satisfied inclusion criteria, increasing the chances that there are alternative explanations for the differences in effect sizes. Thus, this comparison should be further studied as more research is conducted and disseminated.

Effect sizes decreased with length of follow-up. The time between the end of the intervention and follow-up data collection has an important influence on effect size when synthesizing the outcomes. While it is possible that treatment effects consolidate over time, making relapse less likely, this study finds the contrary: an increased chance that treatment participants returned to preintervention levels of drinking when there was a longer follow-up period. Reduced effects of interventions over time may occur as youths reduce how often they use skills developed in treatment, and other influences such as deviant peer groups may have greater influence over youth problem behavior postintervention. Nonetheless, the following interventions resulted in significant reductions in alcohol use at 12 months posttreatment: behavioral treatment[13] and multidimensional family treatment.[17] Considering that these interventions focus on altering maladaptive behaviors, it appears that behavior-based treatment, whether individual- or family-based, is beneficial in attaining long-term change.

Study conclusions should be interpreted within the context of several limitations. First, inclusion criteria were purposely narrow in an attempt to reduce heterogeneity among studies; however, specific alcohol use outcomes did differ slightly, increasing the chances of construct validity invariance.[50] Outcomes examined included alcohol use, alcohol use frequency, days of alcohol use, quantity of alcohol used, and past month alcohol use. While similar, results would be considered more valid if the outcomes were identical. Follow-up lengths also differed and, as previously discussed, greater follow-up periods are associated with smaller effect sizes because the treatment participant has more opportunities to increase frequency and quantity of alcohol use over time. While stratified analyses comparing follow-up periods of more than and less than 6 months revealed stronger effect sizes for follow-up periods of less than 6 months, our overall effect sizes represent a synthesis of different follow-up periods. Finally, we did not stratify results based on different types of control group, preventing us from comparing effect sizes for standard treatment vs waiting list control groups. Although all but 2 of the studies were randomized controlled trials, we cannot be assured that type of control group did not influence the magnitude of the effects-size results.

To our knowledge, this is the first known meta-analysis to examine interventions aimed at reducing alcohol consumption in adolescents. As the number of rigorously designed alcohol intervention studies for adolescents increases, future meta-analyses should synthesize studies with greater precision by intervention. Such analyses would help identify with more certainty interventions that are most effective in reducing adolescent alcohol use.

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