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A systematic review of the effectiveness of brief interventions with substance using adolescents by type of drug

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Abstract

The aim of this paper is to evaluate the effectiveness of brief interventions (BI) with adolescents (mean age < 20) in reducing alcohol, tobacco or other drug (ATOD) use by means of a systematic review of BI for adolescent substance use in the English language literature up to 2002. We identified 11 studies involving 3734 adolescents. Follow-up ranged from 6 weeks to 24 months. Motivational interviewing was the predominant approach, underpinning eight studies: the remaining three provided personalized health information. Seven papers reported outcomes for alcohol interventions and four involved other substances (including one with separate alcohol outcomes). The overall effect size was d = *0.126 with borderline homogeneity (*Q = *14.9, df* = *9,* p = *0.09). The effect size from the eight alcohol interventions (*n = *1075) was classified as significant but ''small'' (*d = *0.275). The remaining non-alcohol studies were considered separately as interventions involving tobacco or multiple substance use. The two interventions with tobacco involved a substantial sample (*n = *2626) but had a very small effect (*d = *0.037), while the two interventions addressing multiple substances involved few participants (*n = *110) but had a medium – large effect (*d = *0.78). Across a diverse range of settings (dental clinic, schools, universities, substance treatment centres) and, therefore, probably diverse clients, BI conferred benefits to adolescent substance users. BI had a small effect on alcohol consumption and related measures. The data for tobacco interventions suggested a very small reduction, particularly with general community interventions. The effect of BI with multiple substances appears substantial but the small sample cautions against expansive generalization.* [Tait RJ, Hulse GK. A systematic review of the effectiveness of brief interventions with substance using adolescents by type of drug. *Drug Alcohol Rev* 2003;22:337 – 346]

Key words: adolescent, alcohol, brief intervention, illicit drugs, review.

Introduction

A recent commentary on brief interventions (BI) to reduce alcohol consumption asserted that ''the effectiveness of brief interventions has been proved, to borrow the legal concept, beyond reasonable doubt'' [1 p. 293]. This claim was made in the light of a meta-analysis of brief interventions in both treatment-seeking and non-treatment-seeking populations [2]. However, Moyer and colleagues inserted a number of caveats restricting generalizations concerning the effectiveness of BI. The effect sizes associated with these interventions are generally small to medium and appear to decay over time, although typical follow-up periods of 12 months or less restrict the long-term evaluation of BI. Nevertheless, they found a clear benefit of BI over control subjects in opportunistically recruited samples, particularly where those people with severe alcohol problems or alcohol dependence were excluded. In studies comparing BI with extended treatment among people seeking treatment, BI was not more effective and in the 3 – 6-month post-treatment interval, extended treatments out-performed BI [2]. However, further support for the effectiveness of brief interven-

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tions was garnered from a review of 361 alcohol interventions conducted as controlled trials. This found that, among the psychosocial interventions, brief interventions were the highest-rated treatment for both clinical and general populations [3].

In addition to the treatment of alcohol use problems, BI have been used in the treatment of other substance use problems. Brief advice by a physician leads to a small but significant increase in the odds of quitting smoking (odds ratio 1.69, 95% confidence interval 1.45 – 1.98), which represents a difference between the BI and ''usual care'' control group of about 2.5% [4]. Similar findings have been shown in a meta-analysis of interventions delivered by nurses, where the increase in the odds of quitting was reported as 1.43 [5]. Brief interventions may also be effective in promoting other changes in lifestyle, such as dietary behaviour and exercise, although the findings are less robust than those for smoking and alcohol reduction [6].

The use of BI with young people has been advocated [7], but the effectiveness of BI in adolescent populations has not been investigated widely [8]. As the reasons for adolescent substance use and their motivations to change behaviours are likely to differ from those of adults, interventions for adolescents should be tailored to accommodate the developmental characteristics and problems of young people [9]. Furthermore, adolescent substance users are likely to have a shorter history of substance use than adults with substance use problems, and will be unlikely to have experienced the same chronic health impacts [10]. Therefore, the effectiveness of BI in this age group needs to be analysed separately from adult interventions as their outcomes may differ from those shown by adults. In addition, as with the adult interventions, the effectiveness of BI with adolescents may vary with the substance or behaviour that is targeted.

There are relatively few studies that have used BI with adolescents and these have generally had small sample sizes. Meta-analysis provides a method to enhance statistical power by combining the results of a number of studies reporting on similar interventions with similar outcomes and such analyses can be used to attempt to discern the underlying pattern of outcomes from investigations in diverse settings [11].

Before selecting studies appropriate for inclusion, there are a number of definitional issues to be addressed. First, there is no universally accepted definition of ''brief intervention''. Miller & Wilbourne suggest one to two sessions as a threshold [3] while Babor [12] suggested that one session represents a ''minimal'' intervention, one to three sessions form a ''brief'' intervention and five to seven sessions constitute a ''moderate'' intervention. Using the latter definitions, Moyer and co-workers [2] used a threshold of four sessions in their meta-analysis to define ''brief intervention''. This still leaves unresolved the duration of sessions and, particularly, their content. Interested readers are referred to the excellent summary by Bien and colleagues for an outline of typical features of effective interventions [13] and to Babor *et al.* [14] for an examination of the cognitive, behavioural and social psychological principles thought to underpin successful interventions.

A second issue to be resolved is the definition of ''adolescents''. Although BI for alcohol use problems in the general population often use a minimum age of 18 [15,16] others have included younger subjects [17,18]. Similarly, interventions with smokers may include younger adults (e.g. minimum age 16 years [19]). Therefore, there will be some overlap in the populations eligible to participate in ''adult'' and ''adolescent'' studies.

The primary objective of the review was to assess separately the effectiveness of BI in treating adolescents who use alcohol, tobacco or other drugs (ATOD). A secondary objective was to use this information to make specific recommendations for the use of BI with adolescents.

Methods

Inclusion criteria

To be eligible for inclusion in the review, studies needed to meet the following criteria. They had to compare a BI to treat the use of ATOD versus no advice/usual care or compare differing levels of advice. Interventions could target either a specific drug or multiple substances and we defined BI as a maximum of four intervention sessions including booster/follow-up sessions. Additional contacts to enable pre-randomization screening and to collect follow-up data were permitted. The treatment could also include supplementary materials (e.g. booklets, audiotapes and videos). The mean age for the study sample had to be less than 20 years.

Exclusion criteria

We excluded studies that evaluated the effectiveness of school curriculum based interventions and studies where the outcome was solely attitudinal rather than behavioural change.

Search strategy to identify studies

We searched for studies in a range of electronic databases: MEDLINE, PsychINFO, Current Contents, Cochrane Database of Systematic Reviews, Sociological Abstracts and AustHealth (including the DRUG and CINCH-Health databases). We also

searched the CD version of EMBASE (Pharmacology and Drugs 1993–1998). The search terms used were: (adolescent and (alcohol or drugs or tobacco or substance)) and (brief or motivational) with wild cards where appropriate. In addition, we conducted a manual search of the references in the selected studies and in review articles to identify additional studies. The search was limited to English language publications.

Analyses

The data were analysed with Meta Analysis software 5.2 [20]. The chosen effect size index was Cohen's *d* (difference between post-test means/pooled standard deviation) with a correction for small sample size to provide an unbiased estimator {1-(3/(4n-9))}. Where the relevant descriptive statistics were not available, effect sizes were estimated from available inferential statistics. Where there was more than one control group, the effect size was calculated between the BI and the least intensive control. Where multiple outcome measures were reported, the arithmetic mean effect size was used. Where an effect was reported as not significant and with insufficient data to calculate an effect size, a value of zero was used and included in the calculation of the mean value.

Results

We identified 11 studies involving 3734 adolescents. Seven of the studies were interventions to reduce alcohol consumption, plus one study that intervened with multiple substances and that provided separate outcome details for change in alcohol consumption [21]. Four studies intervened with either multiple substances ($n = 110$) or to reduce tobacco consumption ($n = 2626$). The period of follow-up varied from 6 weeks to 24 months. All the studies used cohort designs, with most adopting a two-group randomized control design. Three of the studies reported that they used either computer-generated or random number tables in the randomization process [21–23] and five did not specify a randomization procedure [8,24–27], although Murphy and colleagues did report stratification by gender and an alcohol measure [25]. Two studies used a pseudo-randomization process (coin toss [28] and date of birth [29]) and one study provided control and intervention arms of the programme to allocated fraternity houses [30] rather than by randomizing individuals.

An initial analysis evaluated the overall effect size for all the studies as being $d = 0.126$ (weighted integration method), a finding that was significantly different from zero ($Z = 3.11$, $p < 0.001$). However, while the homogeneity statistic indicated that there was not significant heterogeneity and that differences were probably accounted for by sample error alone ($Q = 14.9$, df = 9, $p = 0.094$), a conservative approach to combining the data was adopted. Because of this, and because the effectiveness of BI may depend on the substance targeted, the BI targeting alcohol, tobacco and multiple substances were analysed separately and a random effects model was utilized.

Alcohol

The basic characteristics of the eight studies reporting outcomes for interventions impacting on alcohol consumption are summarized in Table 1. All the studies were based in the United States, with the majority of the 1075 participants recruited via university based programmes ($n = 622$, 58%). The remainder were recruited via school-based interventions ($n = 282$), a hospital emergency department (ED) ($n = 94$) and an outpatient clinic ($n = 77$) There were six interventions that were founded on the motivational interviewing (MI) approach [31]. In Table 1, studies using this approach are designated as either MI or BASIC (Brief Alcohol Screening and Intervention for College Students [32]).

Adjunctive treatments were used in a number of the studies that adopted the MI paradigm. The intervention by Larimer and colleagues [30] randomized university fraternity houses rather than individuals, so an additional group intervention was provided, also based on the motivational approach. It was postulated that providing feedback on perceived and actual drinking norms within the participants' social network would result in additional benefits. The intervention based ED used standard hospital care as the control condition [8]. This involved providing participants with leaflets concerning the dangers of drinking and driving and a list of local alcohol treatment agencies. The MI group received the same information in addition to the interview. Marlatt *et al.* [22] provided written feedback at 12 months based on data collected at baseline, 6 months and 12 months. Those identified as being at high or extreme risk were contacted personally and offered further advice or intervention. It should be noted that a 4-year follow-up of the participants has now been published [33]. This was not included in the analysis as the results reported standardized factor scores, which were not directly comparable with the earlier outcome measures [22].

The two school-based interventions did not use the MI approach, but did involve a health professional in delivering the Start Taking Alcohol Seriously (STARS) programme [23,24]. In one study [23] this involved three phases: first a self-instruction module with audiotape, then a health consultation with a nurse or physician and thirdly a follow-up session with a peer health model (eighth-grade student) who delivered a

Table 1. *Key features of the studies reporting alcohol interventions*

Study	Country and setting	Subjects BI/control	Female n (%)	Intervention/control	Age Mean (SD)	Follow -up periods	Follow-up n (%)
Aubrey [21] (also see Tables 3 and 4)	USA Outpatient treatment	Substance users 39/38	17 (22)	MI/usual care	16.9 (1.7)	3 months	39 (51)
Borsari & Carey 2000 [28]	USA University	High-risk alcohol users 29/31	34 (57)	BASIC/no treatment control	≅18.6 (≅0.14)	6 weeks	59 (98)
Larimer *et al.* [30]	USA University fraternity houses	Students 77/82	Not reported	Individual MI + group MI/group alcohol feedback	18.8 (0.91)	12 months	120 (75)
Marlatt *et al.* [22]	USA University	High-risk alcohol users 174/174*	184 (54)	MI + feedback + booklet + follow-up feedback/no treatment control	19	6 months 12 months 24 months	- - 299 (86)
Monti *et al.* [8]	USA Hospital ED	Alcohol users 52/42	34 (36)	MI + booklet + feedback/standard care + booklet	18.4 (0.5)	3 months 6 months	87 (93) 84 (89)
Murphy *et al.* [25]	USA University	High-risk alcohol users 30/29/25	45 (84)	BASIC/individual education control/no treatment control	19.6 (0.90)	3 months 9 months	- 79 (94)
Werch *et al.* [23]	USA School clinic	School sample 52/52	56 (54)	STARS programme: self-instruction + PHI + contract/ booklet, refusal skills training	13.8 (0.9)	30 days 10 weeks	104 (100) 101 (97)
Werch *et al.* [24]	USA School sports medical	School sample 178 (group sizes not reported)	86 (48)	STARS programme with telephone consultation by nurse + information postcards/no intervention control	≅13 (SD ≅1)	6 months	166 (93)

BASIC = Brief Alcohol Screening and Intervention for College Students (32), STARS = start taking alcohol seriously: MI = motivational interview: PHI = personalized health information. *A third normative control group was used for descriptive purposes.

prevention message using pre-prepared message sheets. The second study [24] used nurses to deliver health interventions via telephone. This was supplemented by postcards mailed to parents/guardians with prevention messages to be discussed with the participant. A further two studies using the STARS programme were identified, but were excluded from the analysis due to the extent of additional treatments [34,35] (see Appendix I for details of the studies excluded from the review).

Table 2 summarizes the outcome measures and results for the alcohol interventions. Where possible, effect sizes were calculated from descriptive data; however, in the interventions by Monti *et al* [8] and Werch and colleagues [24] effect sizes were derived from inferential statistics. In the former study, the percentage of adolescents who incurred specific alcohol-related problems is also reported, for example 62% of the MI group and 85% of the control group reported drinking and driving.

The overall effect size for the eight alcohol interventions was $d = 0.275$, which was significantly different from zero and the outcomes of the studies were homogeneous ($Z = 4.0$, $p < 0.0001$, $Q = 3.6$, df = 7, $p = 0.82$). A subanalysis was also conducted considering only the interventions that used the MI approach. The effect size was $d = 0.241$; again, this was significantly different from zero, and the Q statistic indicated that the outcomes were homogeneous ($Z = 3.06$, $p < 0.01$, $Q = 2.7$, df = 5, $p = 0.74$).

Tobacco and multiple substances

Descriptive summaries of the remaining interventions are provided in Table 3. These studies intervened either to reduce tobacco consumption or the use of multiple substances. There were two studies intervening with adolescent users of tobacco, which comprised a combined sample of 2626 adolescents [27,29]. The study by Kentala and colleagues [29] attempted to intervene with the entire adolescent cohort (birth year 1979) of four cities in Finland. At an annual dental check, non-smoking behaviour was reinforced and the effects of smoking on dental hygiene and appearance were emphasized. The study lasted for 3 years, but due to the high level of attrition (79% lost), only data for the first 2 years (61% followed-up) were analysed by the authors. The second intervention to reduce tobacco consumption was a pilot study that used a MI with adolescent smokers identified across a number of hospital departments.

The two multi-substance interventions were both based in specialist treatment centres [21,26]. The intervention by Aubrey involved out-patients (aged 14–21 years) attending a university-based substance abuse and addictions programme and utilized the MI approach. It should be noted that the study by Aubrey also contributed data to the alcohol analyses [21]. The final intervention was at a community-based clinic, which screened for adolescents ''at risk'' of substance abuse. The intervention was primarily educational (although mention was also made of a motivation interview) and was delivered by a nurse with the messages reinforced by a physician [26].

Table 4 summarizes the outcome measures of the non-alcohol interventions. The effect size for the tobacco interventions was $d = 0.037$ which was not significantly different from zero ($Z = 0.74$, $p = 0.67$, $Q = 0.15$, df = 1, $p = 0.70$). The data presented for the study by Oliansky and colleagues [26], did not allow an effect size to be calculated. The mean effect size for the remaining multi-substance intervention was $d = 0.736$: this represents a medium to large effect size.

Discussion

The effectiveness of BI with adults who consume hazardous or harmful amounts of alcohol has been demonstrated [2,13], along with effectiveness of BI to reduce tobacco consumption by adults [4]. This review suggested that BI, including those based on the motivational approach, were effective in reducing alcohol consumption by young people. However, contrary to the situation with adults, BI had a very small effect in reducing adolescent cigarette consumption. The limited evidence for the use of BI in treating adolescents who use multiple substances suggested that the technique may be effective, but further studies are needed with this group to provide more robust evidence.

Cohen provided a heuristic guideline in evaluating effect sizes. An effect of $d = 0.2$ was deemed ''small'', 0.5 was termed ''medium'' and 0.80 was described as ''large'' [36]. A medium effect was operationalized as an effect that would be visible to a careful observer, while small was noticeably smaller than this, but not to such an extent to render it trivial [36]. As a hypothetical example with respect to alcohol consumption, if a BI reduced average weekly consumption in a group of men, from 35 units (hazardous usage [37]) to 28 units (safe usage) while usual care produced a change of half that size, and if the SD was 14 units per week, the effect size would be 0.25.

A recent review [2] of BI to reduce alcohol consumption found that among non-treatment-seeking groups, where dependent alcohol consumers were often excluded, BI had a small to medium effect (ranging from $d = 0.14$ to $d = 0.67$). An earlier review suggested a similar sized effect ($d = 0.33$) for BI compared with a control group [13]. Therefore, the extent of change

Table 2. *Outcome measures for alcohol interventions*

Study	Outcome	End-point sample Intervention/control	Intervention mean (SD)	Control mean (SD)	Effect size	mean *d*
Aubrey [21]	Days light alcohol use	25/14	3.12 (13.99)	0.79 (2.67)	$d = -0.200$	0.272
	Days moderate alcohol use		1.92 (3.56)	2.86 (6.47)	$d = 0.192$	
	Days heavy alcohol use		5.20 (10.79)	23.71 (34.16)	$d = 0.823$	
Borsari *et al.* [28]	No of drinks/week	29/30	11.4 (7.03)	15.78 (8.17)	$d = 0.566$	0.527
	Frequency alcohol used last month		3.83 (0.89)	4.57 (1.07)	$d = 0.741$	
	Frequency binge drink last month		2.55 (1.40)	3.37 (1.25)	$d = 0.61$	
	RAPI score		6.71 (1.40)	6.41 (5.49)	$d = 0.073$	
Larimer *et al.* [30]	Drinking (composite measure)	Total = 120: group	12.27 (10.85)	17.51 (16.96)	$d = 0.366$	0.166
	BAC (typical peak)	sizes not specified.	0.07 (0.05)	0.08 (0.07)	$d = 0.163$	
	RAPI	Estimated 60/group	6.03 (4.94)	5.52 (5.81)	$d = 0.094$	
	ADS		7.69 (5.1)	7.44 (6.71)	$d = 0.042$	
Marlatt *et al.* [22]	Q-F-P scale: drinking frequency	143/156	2.2 (1.0)	2.4 (0.9)	$d = 0.21$	0.208
	Q-F-P scale: drinking quantity		1.9 (1.4)	2.1 (1.5)	$d = 0.137$	
	Q-F-P scale: drinking peak		3.3 (1.6)	3.6 (1.4)	$d = 0.20$	
	DDQ: drinking frequency		2.0 (1.3)	2.1 (1.1)	$d = 0.08$	
	DDQ: drinking average quantity		3.6 (2.5)	4.0 (2.5)	$d = 0.16$	
	RAPI		3.3 (3.5)	4.7 (4.4)	$d = 0.35$	
	ADS		6.5 (3.5)	7.8 (4.5)	$d = 0.320$	
Monti *et al.* [8]		$n = 84$, group sizes not reported				0.432
	Alcohol use		Not significant		$d = 0.0$	
	Drink driving	$n = 73$, $\chi^2 = 5.82$	62%	85%	$d = 0.56$†	
	Traffic offences	$n = 62$: $\chi^2 = 5.17$	3%	23%	$d = 0.57$†	
	Alcohol-related injuries	$n = 82$, $\chi^2 = 7.72$	21%	50%	$d = 0.608$†	
	Alcohol-related problems	$n = 84$	0.89 (1.18)	1.44 (1.43)	$d = 0.42$	
Murphy *et al.* [25]*	Number drinks/week	30/24	16.63 (9.29)	15.72 (7.75)	$d = -0.104$	0.0014
	Drinking days/week		3.17 (1.21)	3.37 (1.14)	$d = 0.167$	
	Binge drink days/week		1.87 (1.11)	1.90 (1.33)	$d = 0.024$	
	RAPI		6.46 (3.51)	6.07 (3.86)	$d = -0.105$	
	ADS		7.80 (5.65)	7.93 (4.37)	$d = 0.025$	
Werch *et al.* [23]	Heavy drinking	50/51	0.04 (0.2)	0.18 (0.48)	$d = 0.377$	0.437
	30-day quantity		0.08 (0.27)	0.44 (0.93)	$d = 0.52$	
	30 frequency		0.06 (0.24)	0.37 (0.92)	$d = 0.456$	
	Recent alcohol use		2.04 (0.29)	2.2 (0.49)	$d = 0.393$	
Werch‡ [24]	% Intention to use alcohol	Total 107‡, group		$\chi^2 = 4.75$ df = 1	$d = 0.419$†	0.329
	% Drank last 7 days	sizes not reported		Not significant	$d = 0.0$	
	% Drank last 30 days			$\chi^2 = 5.41$ df = 1	$d = 0.446$†	
	% Drank heavily last 30 days			$\chi^2 = 5.54$ df = 1	$d = 0.452$†	

†Effect size calculated from reported statistic. BAC = blood alcohol concentration. RAPI = Rutgers alcohol problem inventory. ADS: alcohol dependence scale. DDQ = daily drinking questionnaire. Q-F-P = quantity – frequency – peak drinking. *Effect size calculated between BASIC intervention and no treatment controls. ‡Urban ($n = 56$) results not significant on all measures. Data for suburban ($n = 66$) and rural ($n = 41$) samples combined in paper: effect sizes are for these combined data.

Table 3. *Key features of the studies reporting interventions for substances other than alcohol*

Study and target substances	Country and setting	Subjects BI/control	Female *n* (%)	Intervention/control	Age mean (SD)	Follow-up periods	Follow-up *n* (%)
Aubrey [21] substance abuse (also see Tables 1 and 2)	USA Out-patient treatment	Substance users 39/38	17 (22)	MI/usual care	16.9 (1.7)	3 months	39 (51)
Colby *et al.* [28] smoking	USA Hospital ED and patients	Smokers 20/20	23 (58)	MI + video + feedback + booklet/brief advice + booklet	16.1 (1.0)	3 months	38 (95)
Kentala *et al.* [29] smoking	Finland Community dental clinic	Population 1348/1238	1264 (49)	PHI + feedback/usual care	13.1	12 months 24 months 36 months‡	2178 (84) 1571 (61) 543 (21)‡
Olinansky *et al.* [26] ATOD	USA Community clinic	At-risk ATOD 33	17 (52)	MI + booklet + contract + physician advice/no treatment controls	15.7 (range 13–18)	1 month 3 months	29 (87) 25 (76)

ED = emergency department. ATOD = alcohol, tobacco or other drugs. MI = motivational interview: PHI = personalized health information. ‡Paper reported results at 24 months due to high ''loss to follow-up'' by 36 months.

Table 4. *Outcome measures for interventions with substances other than alcohol*

Study	Outcome	Endpoint sample Intervention/control	Intervention Mean (SD)	Control mean (SD)	Effect size	mean *d*
Aubrey [21]	Days abstinent in last 90 days (%)	25/14	70% (0.30)	43% (0.44)	$d = 0.925$	mean 0.736
	Days using drugs		94 (65)	165 (91)	$d = 0.639$	
	Number of drugs used		2.96 (2.05)	4.36 (2.31)	$d = 0.732$	
	Treatment sessions attended		17.36 (17.57)	6.43 (6.21)	$d = 0.777$	
	Counselling success score		1.16 (.37)	1.50 (0.52)		
Colby *et al.* [27]		18/20				0.161
	Point prevalence (abstinent)	$n = 38$, $\chi^2 = 0.78$	20%	10%	$d = 0.28$†	
	Cigarettes/day		9.2 (12.5)	8.8 (10.8)	$d = -0.034$	
	Smoking days/week		5.2 (2.8)	5.4 (2.7)	$d = 0.071$	
	Fagerstrom Tolerance Questionnaire		5.2 (2.8)	5.9 (2.9)	$d = 0.24$	
	Longest quit attempt (days)		18.8 (27.7)	14.4 (27.3)	$d = 0.157$	
	24-hour quit attempt (%)	$n = 38$, $\chi^2 = 0.63$	72%	60%	$d = 0.25$†	
Kentala *et al.* [29]		845/729				0.034
	Smokers (%)		18.1	20.8	$d = 0.068$	
	Cigarettes/week		36 (2.7)	36 (3.1)	$d = 0.0$	–
Olinansky *et al.* [26]	Substance use screening instrument score	12/13 ($p = 0.04$)	1.58	7.46		

†Effect size calculated from inferential statistic.

with respect to alcohol consumption by adolescents found in this analysis ($d = 0.277$) was of the same order of magnitude as that experienced by adults. Furthermore, even where the change in alcohol consumption was not significantly different from controls, there was evidence to support the harm-reduction capacity of BI. One programme based in a hospital ED found that both BI and standard care were associated with reduced alcohol consumption, but the BI group had significantly fewer alcohol-related injuries and alcohol-related social problems post-intervention [8]. Further investigation is required to elucidate the precise nature of the change in consumption patterns associated with this reduced morbidity.

The alcohol interventions included in the review covered a range of different populations. Most of the studies targeted ''at risk'' alcohol users, particularly among college students, but even in this population, there was also a general intervention (i.e. not just those adolescents identified as ''at risk'') [30]. Further interventions were conducted in schools, ED and a specialist drug treatment centre. Therefore, it seems likely that these findings will generalize to other groups. The main caveat to this conclusion is that all the studies were based in the United States, so further research would be necessary before generalizing these findings outside the established market economies [38]. Nevertheless, the current findings provide prima-facie evidence that BI is associated with a reduction in alcohol use in adolescents. Importantly, the prevalence of alcohol use by adolescents and the low cost of delivering BI suggest that this methodology is a viable approach to treating problem alcohol use by adolescents.

There are other limitations that should be recognised that apply to the study as a whole. First, as noted above, all of the data were collected in America. Restricting the literature search to English-language publications may have contributed to this problem. Secondly, there are a number of valid rationales for combining the studies in different ways to that chosen by the authors. For example, data could be combined by setting (e.g. university, ED, school) or by methodology (e.g. MI, STARS). However, given that most of the studies involved alcohol interventions, this was chosen as the starting point in subdividing the interventions. Thirdly, of the 48 outcome measures identified in the review, two were reported only as ''not significant'' and had insufficient data to calculate an effect size. By including a value of zero for these measures in calculating the mean effect sizes, the true effect was probably underestimated.

The findings with respect to reducing tobacco consumption were far less promising than those for alcohol. A large population level intervention found no difference in terms of the number of cigarettes smoked per week and only a very small difference between the groups in relation to the percentage of smokers ($d = 0.068$). However, it should be noted that of all the studies reviewed, this study appeared to be the least intensive intervention [29]. Of interest was that the hospital-based pilot study [27] used the MI approach. This method was effective in treating alcohol problems ($d = 0.241$), but it appeared less effective in changing cigarette consumption ($d = 0.161$). Parenthetically, the short period of follow-up (3 months) by the study restricts any generalization about its effectiveness as a public health measure.

There may be different consequences associated with alcohol and tobacco use that help to explain the differing levels of effectiveness found for alcohol and tobacco interventions. Brief interventions are generally used opportunistically and often at a ''teachable moment'' when the intervention will be particularly salient [39]. Among adolescents, the morbidity associated with alcohol consumption is likely to be immediate in nature, while the chronic morbidity associated with tobacco use will be encountered infrequently in this age group. Given that morbidity associated with smoking is likely to be some years distant, it is not surprising that BI to reduce tobacco consumption were less effective than alcohol interventions.

There are a number of meta-analyses currently at the protocol stage with the Cochrane Tobacco Addiction Group [40–42] as well as recently completed reviews examining a range of different approaches to controlling tobacco consumption by youth [43–45]. Until all these are completed, it would appear premature to endorse a particular approach to tobacco control in this age group.

The case for introducing BI for adolescent users of multiple substances is not clear-cut. The review only identified two studies that used BI with multiple substance users, and an estimate of effect size was only possible from one of these studies, which involved only 39 adolescents at the end-point [21]. The estimate of the average effect size for the study was larger than in any of the other interventions reviewed. Perhaps this impact is explained, similarly to alcohol, by the high level of immediate problems associated with multiple substance use. However, the authors recommend a cautious approach to the interpretation of this finding until these effects of BI on adolescent multiple substance use have been replicated.

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Appendix 1. *Studies excluded from the review and the reason for exclusions*

Study	Reason for exclusion
Baer *et al.* [46]	Brief intervention: mean age 21.2
Baer *et al.* [33]	4-year follow-up: results not directly comparable with 2-year data [22]
Botvin *et al.* [47]	Group intervention
Breslin *et al.* [48]	Individual assessment + 4 group sessions
D'Amico & Fromme [49]	Group intervention based in school
D'Amico & Fromme [50]	Group intervention based in school
Deas *et al.* [51]	HIV/AIDS risk behaviours
Dimeff & McNeely [52]	Computer + motivational intervention: mean age 21.2
Dunn & Ries [53]	Brief intervention: general hospital sample
Jamrozik & Tait [54]	Brief intervention: measured attitudinal change
Roberts *et al.* [55]	Re-analysis of Marlatt data [22]
Saunders *et al.* [56]	Brief intervention plus pharmacotherapy, mean age 28
Snow *et al.* [57]	Classroom-based intervention
Spoth *et al.* [58]	Multi-session intervention
Stevens *et al.* [59]	Brief intervention: mean age > 20
Werch *et al.* [35]	Brief intervention, classroom-based intervention, plus six follow-up interventions
Werch *et al.* [34]	Brief intervention plus up to nine home-based exercises