DRUG POLICY MODELLING PROJECT

MONOGRAPH 07

SCHOOL BASED DRUG PREVENTION: A SYSTEMATIC REVIEW OF THE EFFECTIVENESS ON ILLICT DRUG USE

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THE DRUG MODELLING POLICY PROJECT

This monograph forms part of the Drug Policy Modelling Project (DPMP) Monograph Series.

Drugs are a major social problem and are inextricably linked to the major socio-economic issues of our time. Our current drug policies are inadequate and governments are not getting the best returns on their investment. There are a number of reasons why: there is a lack of evidence upon which to base policies; the evidence that does exist is not necessarily analysed and used in policy decision-making; we do not have adequate approaches or models to help policy-makers make good decisions about dealing with drug problems; and drug policy is a highly complicated and politicised arena.

The aim of the Drug Policy Modelling Project (DPMP) is to create valuable new drug policy insights, ideas and interventions that will allow Australia to respond with alacrity and success to illicit drug use. DPMP addresses drug policy using a comprehensive approach, that includes consideration of law enforcement, prevention, treatment and harm reduction. The dynamic interaction between policy options is an essential component in understanding best investment in drug policy. Stage One has: a) produced new insights into heroin use, harms, and the economics of drug markets; b) identified what we know about what works (through systematic reviews); c) identified valuable dynamic modelling approaches to underpin decision support tools; and d) mapped out the national policy-making process in a new way, as a prelude to gaining new understanding of policy-making processes and building highly effective research-policy interaction.

This Monograph (No. 07) outlines a systematic review of school based drug education. Whilst the Griffith team started with the broad brief of prevention, it became clear that a focus on school based drug education would be most useful, particularly as a systematic review in relation to its impact on illicit drugs had not been previously conducted. The review identified 58 relevant studies, and both a qualitative (narrative) and quantitative (meta-analytic) review was undertaken. Those programs demonstrating most effectiveness were social influence and competency enhancement programs. Less promising and iatrogenic effects were found for affective education and knowledge dissemination. In contrast to previous research on school based drug education, this review found that professionals were less effective than teachers, that multifaceted programs did not demonstrate substantially greater efficacy; and involvement of peers or booster session had minimal impact. Programs with a greater number of sessions were more effective, and interactive programs were associated with greater effectiveness.

Monographs in the series are:

01. What is Australia's "drug budget"? The policy mix of illicit drug-related government spending in Australia
02. Drug policy interventions: A comprehensive list and a review of classification schemes
03. Estimating the prevalence of problematic heroin use in Melbourne
04. Australian illicit drugs policy: Mapping structures and processes
05. Drug law enforcement: the evidence

06. A systematic review of harm reduction
07. School based drug prevention: A systematic review of the effectiveness on illicit drug use
08. A review of approaches to studying illicit drug markets
09. Heroin markets in Australia: Current understandings and future possibilities
10. Data sources on illicit drug use and harm in Australia
11. SimDrug: Exploring the complexity of heroin use in Melbourne
12. Popular culture and the prevention of illicit drug use: A pilot study of popular music and the acceptability of drugs
13. Scoping the potential uses of systems thinking in developing policy on illicit drugs

DPMP strives to generate new policies, new ways of making policy and new policy activity and evaluation. Ultimately our program of work aims to generate effective new illicit drug policy in Australia. I hope this Monograph contributes to Australian drug policy and that you find it informative and useful.

Alison Ritter
Director, DPMP

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

This report investigates the effectiveness of school-based drug prevention programs in preventing or reducing rates of illicit drug use. We conducted a narrative review of 58 studies (contributing 61 separate treatment-comparison contrasts) as well as a meta-analysis to further assess the effectiveness of 12 studies from which effect sizes could be calculated (contributing 16 separate treatment-comparison contrasts). Results of the narrative review suggest a number of approaches to school-based drug prevention have revealed encouraging results on rates of illicit drug consumption. Successful approaches include resistance skills training limited, generic skills training limited, social influence, and competency enhancement. Results of the narrative review and meta-analysis moderator analyses provide evidence to suggest that professionals were relatively ineffective program providers compared to other provider such as teachers, that interactive programs are more effective, as are universal programs, programs implemented in the middle school years, and more intensive programs. It was revealed that multifaceted programs may have negative effects. Few findings provided evidence to suggest an impact of the inclusion of booster sessions or peer involvement on program effectiveness. Limitations of the current review and policy implications are discussed.

INTRODUCTION

Drug prevention – a broad sweep of the literature

Drug control strategies aim to prevent and/or eliminate a wide range of problems that arise from drug use, abuse and dependence, and illegal markets. Programs are targeted at several levels and encompass several aims, including the reduction or elimination of the uptake of drugs (especially by young people), the reduction of drug-related harm for users, and the reduction of drug-related crime and disorder in neighbourhoods. Here we take prevention to cover those strategies and interventions aimed at preventing the uptake of drugs (primary prevention), or preventing the development of problematic drug use (secondary prevention). Other reviews in the DPMP series cover harm reduction, law enforcement and treatment strategies.

A number of broad prevention approaches exist including community-based, family-based, and media-based programs. A review of these prevention approaches suggests that each has shown some success in dealing with *illicit* drug use rates. We briefly review these prevention approaches here and outline their effectiveness. The remainder of the report then concentrates on a systematic review of school-based prevention programs.

Community-based approaches

Community-based drug prevention involves such interventions as community mobilisation, mentoring, and any program implemented by community organisations (churches, youth groups, neighbourhood coalition groups, etc) that seek to educate citizens of the harms created by drugs and engage them in strategies designed to reduce these harms. While many community drug prevention interventions exist there has been minimal empirical research assessing their effectiveness, especially in relation to the impact of such programs on illicit drug use. The literature that exists suggests that community-based prevention can indeed be an effective approach to substance abuse prevention (Aguirre-Molina & Gorman, 1996; Pentz, 1996; 1999). Specifically, comprehensive programs that are multi-componential and foster the goals of community empowerment and development appear to yield more effectiveness (Aguirre-Molina & Gorman, 1996; Pentz, 1996). Furthermore, community-based programs have also been shown to be an effective approach to other types of prevention, such as delinquency and crime, and have been found to increase the effectiveness of other approaches to prevention such as school-based and family-based programs (Pentz, 1999).

Family-based approaches

Family-based drug prevention programs include parent behavioural skills training, communication skills training, parental counselling and family therapy, and general parental drug education. The literature suggests a number of key elements of successful family-based prevention programs including, that programs be comprehensive and multi-componential, interactive, address family relations, communication, and parental monitoring, instigate behavioural, affective, and cognitive change, be developmentally and culturally appropriate, address risk and protective factors, also high-risk families and those with relationship problems will benefit more from family-centred approaches, than either child- or parent-focused approaches, and earlier and more intensive intervention. Furthermore, incentives have been found to improve participation, and program success is highly contingent on the ability of the program leader.

Finally, collaborative efforts where participants feel responsible for making the necessary changes are also more effective (Dusenbury, 2000; Kumpfer & Alvarado, 2003). The effectiveness of family-based prevention programs has also been evidenced in other areas such as delinquency, antisocial behaviour and child conduct problems (Farrington & Welsh, 2003; Lochman, 2000; Lochman & van den Steenhoven, 2002).

Media-based approaches

Media-based programs, as the name suggests, are drug education messages delivered through mediums such as print, television, or radio, or other forms of advertising such as billboards. Very little empirical research has been conducted investigating the impact of media-based approaches on rates of illicit drug use. From the available literature it appears that while a number of effective elements of media interventions can be identified, the effect of media interventions on actual substance use behaviours, attitudes and knowledge is fairly limited (Derzon & Lipsey, 2002; Palmgreen & Donohew, 2003). The element of media interventions that appears to be most effective is targeting high sensation-seeking (HSS) and developing high-sensation prevention messages.

Other important elements include using series of ads or sequenced messages (although there is evidence to suggest the use of one-time only messages can also be effective (Derzon & Lipsey, 2002), choosing video as the medium of message delivery (Derzon & Lipsey, 2002), however there is evidence that print, television, and radio could all be utilised effectively dependent on other characteristics of the intervention. Furthermore, targeting youths seems to be less effective than targeting parents, adults and retailers; however there is evidence that targeting youth may be able to produce positive effects, again dependent on other intervention factors (Derzon & Lipsey, 2002; Palmgreen & Donohew, 2003).

Strangely, targeting at-risk groups, males, or youth does not seem to make a media intervention any more effective, however this finding may be restricted to campaigns that do not use high-sensation messages (Derzon & Lipsey, 2002; Palmgreen & Donohew, 2003). Overall, it appears that for a media intervention to be optimally effective it must be well developed and address the aforementioned key elements. Without addressing such elements, media interventions tend to have fairly limited impact.

A focus on school-based drug prevention

Our review of existing drug prevention reviews led us to focus our study on understanding more about school-based drug prevention programs. Several reasons led to this school-based focus. First, our review of past reviews of drug prevention programs suggests school-based programs have shown substantial evidence of effectiveness in the past. The literature suggests school-based programs are most effective if they use social influence or competency enhancement approaches, are interactive, multifaceted, intensive and include booster sessions, and are targeted to the needs of the youth receiving the program (McBride, 2003; Tobler, et al., 2000). Second, while the impact of school-based drug prevention has been widely researched and reviewed, the focus has generally been on licit drug use or "gateway" drug use. Third, schools are a popular "platform" to launch community based crime prevention initiatives. Our research seeks to extend the current body of literature by conducting a systematic review of the effectiveness of school-based drug prevention programs in reducing *illicit* substance use behaviour.

For decades now, schools have been a popular starting point for the development and implementation of prevention efforts. Whereas the traditional role of schools was fundamentally

restricted to the education of youth, the function of schools has gradually expanded to include the responsibility of addressing a variety of social phenomena such as drug use, crime and delinquency, teenage sexual activity and pregnancy, and various health issues such as nutrition, exercise, and sexually transmitted disease (Botvin & Griffin, 2003). The school is both an appropriate and convenient "platform" from which to launch drug prevention efforts due to the ability to reach the majority of the population one seeks to target, and the relative ease in which a program can be implemented compared to programs of other types, such as family or community programs.

School-based drug prevention is certainly not a new research area, nor is it a research area that has been neglected. Indeed, there are a plethora of reviews that have assessed the effectiveness of such prevention efforts (Allott, Paxton & Leonard, 1999; Belcher & Shinitzky, 1998; Black, Tobler & Sciacca, 1998; Botvin & Griffin, 2003; 2004; Coggans, Cheyne & McKellar, 2003; Cuijpers, 2002; Dusenbury, Falco & Lake, 1997; Ennett et al., 1994; Flay, 2000; Gottfredson & Wilson, 2003; McBride, 2003; Midford, 2000; Skara & Sussman, 2003; Tobler, et al., 2000; White & Pitts, 1998). However, the majority of past reviews have predominately focused on the impact of school-based drug prevention in preventing or reducing *licit* substance use or "gateway" drug use, such as alcohol, tobacco and occasionally marijuana.

This focus on licit drug use makes intuitive sense, given that most school-based drug prevention programs are implemented at a developmental stage when illicit drug use rates are extremely low, making evaluation of the impact of such programs on this type of use very difficult. Nonetheless, we suggest there is a need to fill the gap in the literature regarding the impact of school-based programs on the prevention or reduction of *illicit* drug consumption. Past reviews provide evidence suggesting a number of effective components of school-based drug prevention in addressing *licit* substance use. Whether or not these characteristics of effectiveness can be reliably generalised to addressing *illicit* drug use, or whether another tact is required, is another question altogether. The following review of reviews outlines previous findings on the effectiveness of school-based drug prevention programs in reducing both licit and illicit drug use.

Previous reviews

Many reviews investigating the effectivness of school-based drug prevention have been conducted, with most suggesting that such programs can indeed prove fruitful. Further, many reviews have sought to identify the characteristics of effective programs. Possibly the most prominent finding from the plethora of reviews previously conducted is the contention that programs with greater levels of interactivity, or student involvement in the content and delivery of prevention efforts, are synonomous to improved efficacy of prevention programs.

In probably the most comprehensive of school-based drug prevention reviews conducted to date, Tobler et al. (2000), in a meta-analysis of 144 studies of 207 universal school-based drug prevention programs, found evidence to suggest that interactive programs were more effective than non-interactive programs, those delivered using didactic methods. Mean effect sizes for interactive and non-interactive programs (considering only the 93 high-quality studies that were included in the meta-analysis) were .16 and .03, respectively. For all 207 studies the mean effect sizes were .15 for interactive programs and .05 for non-interactive programs. A multitude of studies have corroborated this finding, and indeed many have stated that the participative nature of interactive programs is the key component of effectiveness (Allott, et al., 1999; Black, et al., 1998; Botvin & Griffin, 2003; Cuijpers, 2002; McBride, 2003).

Consistent with this finding, there is also substantial evidence to suggest greater effectiveness of prevention approaches that involved interactive teaching methods in the delivery of their content. Such approaches include social influence, competency enhancement and community or system-wide change approaches. Tobler, et al. (2000) found significant positive effects on self-reported drug use for social influence programs (.14), competency enhancement programs (.17), and programs utilising system-change approaches (.22). Conversely, variants of non-interactive programs, such as knowledge dissemination and affective education approaches were not found to have significant impacts on use. That is, knowledge dissemination and affective education approaches, as well as the over-emphasis on resistance skills (with relative ignorance of other important skills training approaches), that were most popular during the 1970s and early 1980s have been evidenced to be largely ineffective. Instead, it has been widely argued that programs that include a combination of information dissemination, resistance and generic life skills training, and normative education are more effective then any of these elements in isolation (Allott, et al., 1999; Botvin & Griffin, 2003; Cuijpers, 2002; McBride, 2003; Tobler, et al., 2000).

Botvin & Griffin (2003) reviewed approximately 45 studies evaluating school-based drug prevention programs and presented their results by approach. Information dissemination, an approach adopted by most programs of the 1970s and early 1980s, was described to have very little impact on drug use behaviour. However, this approach has been reported to have some positive effects on drug attitudes and knowledge. In more recent decades it has become evident that while information dissemination may be important, in isolation from other approaches it is not enough to produce change in such a complex behaviour as drug use.

Affective education is critiqued as being even less effective than information dissemination. Not only has this approach shown very little effect on drug use but it has also shown disappointing results on intermediate outcomes as well. This approach is criticised as being incomplete in focus and employing inappropriate methods to achieve program goals. The social influence approach is the most popular, and the most heavily researched and evaluated approach to drug prevention. Social influence methods vary, including psychological inoculation, correcting normative expectations, and social resistance skills training. This approach has been evidenced as having positive effects on rates of tobacco use, however far less research exists investigating the effectiveness of this approach on alcohol or marijuana use. Those that do exist, however, do report similar findings as those studies concerned with tobacco.

There is also considerable support for competency enhancement approaches, with many evaluations showing relatively large positive effects on drug use behaviour. Overall, it is argued that "programs that emphasize resistance skills and general life skills (such as competence-enhancement approaches) appear to show the most promise of all school-based prevention approaches" (Botvin & Griffin, 2003: 62). Contrary to other reviews, Gorman (1998) in his review of school-based drug prevention noted the lack of empirical evidence in the development of school-based drug prevention policy in the United States. He argued that "perceptions concerning the effectiveness of social influence programs have been shaped to a considerable degree by the findings of a handful of large-scale evaluation studies" (Gorman, 1998: 129). The results of these programs (LST, Project SMART, Project ALERT) produced mixed results with some reporting positive effects on substance abuse, others reporting no such effects, and others suggesting short-term effects only that decayed over time. Overall, the author suggests that the social influence approach to drug education is far less effective than what has been cited elsewhere, and suggests that its purported effectiveness is evidenced by selective empirical research only.

Previous reviews have also investigated the differential impact of various types of program providers, namely professionals[1], teachers and peers. The evidence regarding which provider produces the most effective changes in drug related behaviour and attitudes is mixed. A number of reviews have found evidence that programs led by peers can be as, if not more, effective than adult-led programs (Allott, et al., 1999; Black, et al., 1998; Cuijpers, 2002; McBride, 2003). Gottfredson & Wilson (2003) found no significant differences in the effectiveness of programs dependent on the deliverer; however programs that involved peers (without teachers) are more effective than when peers are not involved or when both peers and teachers are involved.

Overall, it is purported that more research on this issue is necessary (McBride, 2003), that any findings regarding differences in effectiveness across the various types of providers are likely mitigated by a number of other factors such as program interactivity (Allott, et al., 1999; Black, et al., 1998; Cuijpers, 2002). Further, it has been argued that all providers are capable of producing positive outcomes, and no single group can achieve all goals of drug prevention (Allott, et al., 1999). In contrast to these findings, Tobler, et al. (2000) found evidence to suggest that professional program providers outperformed both peers and teachers, and that peers also outperformed teachers.

There is sufficient evidence suggesting the validity of developing programs that contain a greater number of sessions. The evidence suggests that programs of greater intensity have been found to be more effective (Botvin & Griffin, 2003; Gottfredson & Wilson, 2003; McBride, 2003; Tobler, et al., 2000; White & Pitts, 1998). Further, there is some evidence that the inclusion of booster sessions, designed to reiterate and build upon original program content, can enhance the effectiveness of school-based drug prevention programs (Botvin & Griffin, 2003; Gottfredson & Wilson, 2003; McBride, 2003; Skara & Sussman, 2003; White & Pitts, 1998), however the additional effectiveness of booster sessions may be contingent on other factors of the program (Cuijpers, 2002). Indeed, given that many long-term studies indicate a gradual decay of program effects over time, the "need for ongoing intervention or booster sessions" (Botvin & Griffin, 2003: 60) becomes evident.

A number of reviews have also investigated the impact of including multifaceted components in addition to the school-based component of the program in an attempt to increase program effectiveness. Flay (2000) conducted a review assessing school-based drug prevention programs with social environment change components and reported little evidence of a positive effect of adding school-wide climate change components. While student behaviour, performance and smoking behaviour may be positively affected, it appears these effects are generally short-term, and there was only minimal evidence to suggest favourable outcomes for drug use, attitudes, knowledge, and decision-making.

Parent and family components were found to have an effect on parenting practices and a slight positive impact on drug outcomes, however it is argued that this impact is contingent on the parenting or family component being added to an indicated or selective program, with very little said to be gained by adding such components to universal programs[2] (Flay, 2000). Programs adding mass media components all targeted tobacco use and were predominately unsuccessful (Flay, 2000). The few programs with the necessary designs to disentangle the effects of adding

1 Professionals are defined as project staff, health educators, police officers, counsellors, and other trained professionals. Teachers are defined under a separate category.

2 Universal programs are those in which all members of the population are indiscriminately offered the prevention program. There are two types of targeted approaches; selective and indicated. Selective programs are those where at-risk *groups* are targeted, while indicated programs target specific *individuals* who are defined as being at-risk (Offord, 2000).

community components provided evidence that such additions can add to the effectiveness of school programs. Further, evidence existed to suggest that such approaches can positively impact not only on licit, but illicit, drug behaviour (Flay, 2000). The positive impact of community-based components has also been expressed in other reviews (Allott, et al., 1999; Cuijpers, 2002).

The evidence regarding the most appropriate developmental stage to implement school-based drug prevention efforts is mixed. There are some who have suggested that programs implemented later in the developmental cycle (i.e. high school) when drug use is more likely to be a problem, show greater effectiveness (Tobler et al., 2000). Others have argued that the most effective programs are generally implemented in the middle or junior high school years, when the risk of experimentation with drugs is greatest but drug abuse has not yet occurred for the majority of students, rather in the elementary or senior high school years (Botvin & Griffin, 2003; Gottfredson & Wilson, 2003).

In their study, Gottfredson & Wilson (2003) found a significant difference between programs implemented during the middle or junior high school years and those implemented during the late elementary or senior high school years, however note the confounding nature of differences in average follow-up periods. Specifically, the author suggests that the effect of programs targeted toward late elementary students were probably underestimated due to the fact that these programs were more often evaluated with longer follow-up periods, allowing for a greater chance of the deterioration of effects (Gottfredson & Wilson, 2003).

Further, Botvin & Griffin (2003) argue that universal programs are more effective when implemented earlier in the developmental cycle, before drug problems become severe, while selective or indicated programs are generally more effective later when drug problems have already been identified. In addition, a number of reviews have suggested that while younger children may benefit from multi-drug focused programs, there is evidence to suggest that older children and adolescents may benefit more from programs that target a single drug (Botvin & Griffin, 2003; McBride, 2003).

A number of additional important findings have been produced by past reviews, with the recent, comprehensive review conducted by McBride (2003) highlighting a number of important considerations. Needless to say, it is essential that drug prevention be based on the specific needs of the group being targeted. Furthermore, harm minimisation should be the major goal of school-based drug prevention, and the focus should be on behavioural change, rather than changes in knowledge or attitudes. Effective programs should be made readily available to schools, and those programs that do not achieve effectiveness must be reorganised, retested, or their use ceased, with the most parsimonious, yet effective, program made readily available to schools (McBride, 2003).

The issue of implementation fidelity is also important. That is, providers, in particular teachers, need to be trained better in the correct content and delivery of the proposed programs (McBride, 2003). Indeed, even if a program is based on an empirically supported theoretical approach, improper implementation will result in ineffectiveness (much is the case with the DARE curriculum, where the over-emphasis on resistance-skills training and the inappropriate use of authority figures appears to detract from the potential efficacy of the program). Thus process evaluation is deemed as important (Botvin & Griffin, 2003).

On top of the need for process evaluation, improved outcome evaluation is also necessary in the field of school-based drug prevention (McBride, 2003; Midford, 2000; White & Pitts, 1998). In particular, while a number of studies have suggested that programs can be equally effective when implemented with minority populations, there is a general lack of research in this area (Botvin & Griffin, 2003).

In addition to reviews investigating the effective characteristics of school-based drug prevention programs, there have been a number of reviews assessing a number of popular prevention programs, namely the Life Skills Training (LST) program and the Drug Abuse Resistance Education (DARE) program. In separate reviews of the LST curriculum, Botvin and Griffin (2004), Coggans, et al. (2003), and Dusenbury, et al., (1997) all highlighted that the program has been extensively evaluated, both by small scale efficacy trials and larger randomised trials. In both instances evaluations have shown consistent positive effects of the program on drug use behaviour, attitudes and knowledge, for both licit drugs such as alcohol and tobacco, as well as illicit drugs such as marijuana. Further, the LST program has shown consistent positive effects on a host of intermediate variables known to be correlated with drug use, such as assertiveness, refusal skills, problem-solving, and decision-making. Further, the impact of the LST program on both drug outcomes and intermediate outcomes has been reported to be both immediate and long-lasting, and the program also showed effectiveness within minority populations. Coggans, et al. (2003) also found unexpected effects on mediating variables, such as the finding that peer leaders were more effective than teachers.

Evaluations, and indeed reviews, of the DARE curricula have been far less favourable. Ennett et al. (1994) conducted a meta-analysis investigating the impact of the program and found that the mean effect size of the impact of DARE on drug use behaviour was .06. There were however some short-term effects on drug knowledge, attitudes about drugs, social skills, self-esteem, and attitude toward police. It has been argued that despite the inclusion of social influence approaches, which have been shown to be effective, the lack of the interaction and the use of an authority figure to disseminate information may explain the general lack of empirical support of DARE (Botvin & Griffin, 2003).

Allott, et al., (1999), Belcher & Shinitzky (1998), and Dusenbury, et al. (1997) have reiterated these findings highlighting the impact of DARE as being restricted to short-term effects on intermediate variables such as attitudes toward police, knowledge of drugs, and resistance to peer pressure, and describing the program as having little effect on reducing drug use behaviour and unfavourable long-term effectiveness. The conclusion reached is that the program has been shown to be ineffective in comparison to more interactive programs, and the focus on building resistance skills appears to be a product of the overestimation of the influence of peer influence on drug use (Botvin & Griffin, 2003; Allott, et al., 1999).

In summary, past reviews suggest that interactive programs are more effective than non-interactive programs, as are programs with a greater number of sessions and programs that include booster sessions. The affective education and knowledge dissemination approaches that were so common in the 1970s have made way for approaches focused on social influence, skills training, and normative education, the addition of community or family components to school-based prevention efforts can enhance the effectiveness of the program in some instances, however the evidence is far from clear.

The evidence surrounding the most appropriate developmental stage in which to implement school-based drug prevention programs is also unclear, however there is some evidence to

suggest that prevention efforts in the middle school years, when youth are at the highest risk of drug experimentation, are effective. The success of any individual program, it seems, is the product of finding the correct blend of content, implementation, delivery, and intensity, among other things and that programs must be targeted to the needs of those youth receiving the program. There is definitely evidence that school-based drug prevention has a place on the agenda of policy-makers; however such programs have to be meticulously designed, implemented, and evaluated.

METHOD

Inclusion/exclusion criteria

Our study seeks to identify the effective components of school-based drug prevention programs that have been shown to have a positive impact on *illicit* drug use, and assess the similarities and dissimilarities to the components identified as effective in addressing *licit* drug use. Our systematic review includes any drug prevention interventions involving, in part, a school-based component in the prevention program. The selection criteria allowed the program to also contain family-based, community-based, or media-based components or other multifaceted components, but the prerequisite was made that some school-based component was an essential part of the program. The school-based component could vary from curriculum-based education to policy/structural change. The content of the prevention efforts were not necessarily required to specifically target or address preventing or reducing rates of illicit drug use, but were required to have a greater scope than attempting to prevent or reduce licit substance use only[3]. That is, programs focused on gateway substance use (alcohol, tobacco and marijuana) were eligible for inclusion in the review[4].

The intention of our study was to assess the impact of school-based programs on *illicit* substance use. Therefore, intuitively, for a study to be included, the evaluation was required to include an illicit drug outcome[5]. Further, only behavioural change was of interest, and thus studies were required to have at least one illicit drug *use* outcome. Studies published prior to 1990 were excluded from the review, with the exception of studies published prior to 1990 that analysed the same sample of participants as studies published post-1990. Relevant studies written in languages other than English were obtained, however of the five non-English papers obtained none were translated due to financial and resource constraints, and thus were not included in the review. Further, time and resource constraints forced the review to be limited to studies published in journals only.

A number of design considerations were also made. Included studies were restricted to those with pretest-posttest, comparison/control group designs. These criteria were seen as imperative. School-based drug prevention programs are typically implemented at a time when the developmental progression of drug use amongst youth reflects a strong upward trend. Thus, it is common for drug use to increase from pretest to posttest among both the experimental and control groups, and intervention success to be signified by a significantly smaller rate in this increase amongst treatment group participants. Thus, without a control group, evaluation of the impact of the intervention is problematic. In terms of the necessity of having a pretest measurement, it is very common for experimental and control groups to differ significantly in rates of use and on other intermediate variables that may partially explain use rates reported at posttest. Thus, a pretest measurement, and further a statistical comparison of pretest group equivalence with appropriate adjustments for any existing baseline differences help bolster the reliability of subsequent findings.

3 This criterion served the function of eliminating the multitude of the specific smoking and alcohol prevention programs that have been evaluated.
4 Given that most school-based drug prevention programs are implemented at a developmental stage when illicit drug use rates are extremely low very few focus on preventing or reducing illicit drug use only.
5 Illicit drugs included marijuana, cocaine, crack cocaine, heroin (and other opiates), stimulants (amphetamines, crystal meth, speed, ice, etc), depressants (barbiturates, etc), party/designer drugs (MDHA/ecstasy, etc), and hallucinogens (LSD, PSP, acid, angel dust, magic mushrooms, etc). Inhalants were not classified as an illicit drug given that such licit substances as glue and paints are typically included under the common definition of this category of drug use.

Further, the decision was made to include only studies that conducted significance testing, avoiding inappropriate conclusions such as the effectiveness of a program if results are non-significant but in a positive direction. However, one must be careful not to assume that statistical significance equates to practical significance, hence the importance of the qualitative narrative review (Midford, 2000). The only exception to this rule occurred when a study didn't use significance testing but provided enough data from which to calculate an effect size[6].

Search for relevant studies

Relevant studies were identified by guided, iterative processes utilizing appropriate keyword searches of major databases from a number of disciplines including psychology and behavioural science, education, health, criminology and the law, and politics and government[7]. In addition to the search of key databases, the reference lists of all retrieved meta-analyses, systematic reviews, and literature reviews of school-based drug education published since 1990 were also hand-searched for relevant evaluation studies. Furthermore, key journals in the area of substance use were also hand-searched for the years of 1990 onwards[8]. Two research assistants conducted the searches and retrieved relevant studies. Eligibility assessment was based initially on careful examination of abstracts; however when the abstract did not provide enough information to determine eligibility of the study, the full text was retrieved. To resolve discrepancies regarding eligibility the two researchers consulted with each other, and with the project leader.

This search process resulted in the identification of 149 studies evaluating school-based drug prevention programs with illicit drug outcomes (see Figure 1). Of these studies 58 were included in the narrative review, with 12 of these 58 studies also included in the meta-analysis (see below for more detail). Of the remaining 91 studies 20 failed to meet study design criteria (e.g., did not have a control group or did not have a pretest measurement period) and 27 did not have use outcomes (e.g., had illicit drug *attitude* or *knowledge* outcomes). A further 39 studies were excluded given they did not fit the publication type criterion (e.g., reports, theses/dissertations, etc). Finally, five non-English papers obtained were unable to be translated due to financial and resource constraints, and thus were not included in the review.

6 This occurred in one instance only (Forman, Linney & Bordino, 1990).

7 These databases cover published and unpublished material, and unpublished studies that appeared relevant were recorded in a database irrespective of their not meeting inclusion criteria. Searches covered 1990 onwards. Pre-1990 studies related to included studies were identified upon perusal of these included studies. A number of databases (Applied Social Science Index and Abstracts (ASSIA), Acompline (Greater London Authority), Planex (IDOX plc), SOLIS (German), and Inside Web), were not accessed due to financial constraints of the project.

8 A total of 25 journals were hand-searched including Addiction, Addictive Behaviors, Drug and Alcohol Review, Journal of Addictive Diseases, Journal of Alcohol and Drug Education, Journal of Child and Adolescent Substance Abuse, Journal of Drug Education, Journal of Primary Prevention, Preventive Medicine, Psychology of Addictive Behaviors, and Substance Use and Misuse.

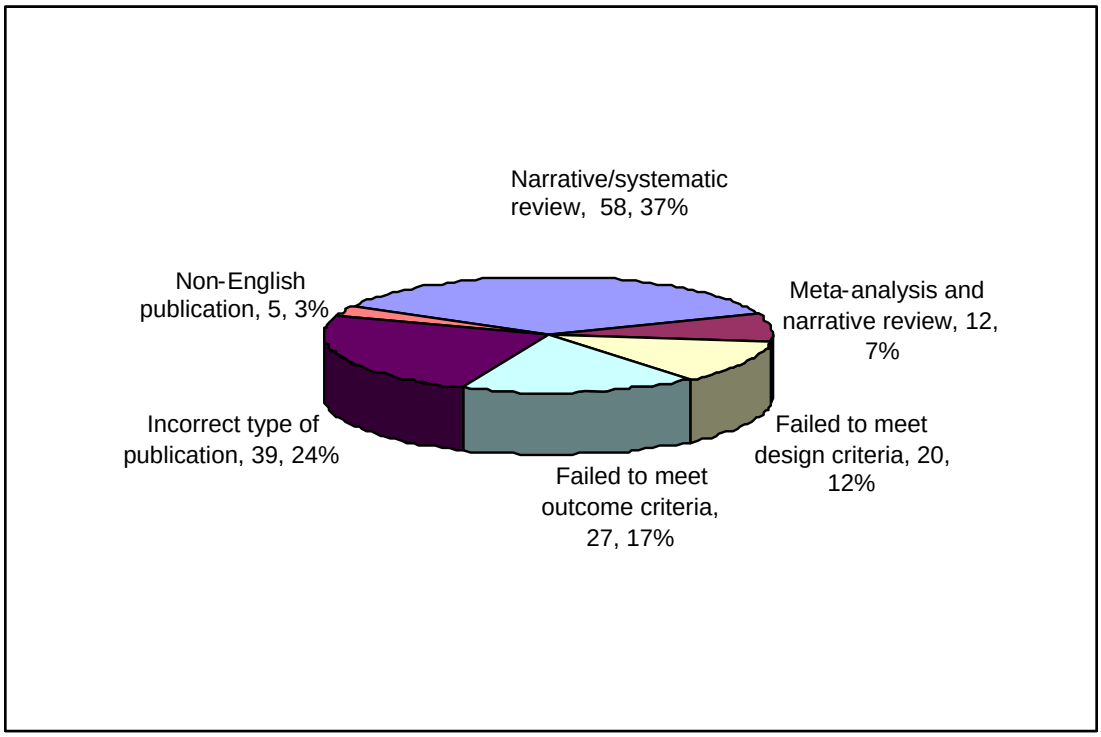


Figure 1: Study inclusion status

Treatment-comparison contrast was the unit of analysis for both the narrative review and the meta-analysis. The narrative review consisted of two parts. Firstly, the intervention particulars and main findings of the 58 studies were discussed qualitatively. Further, effectiveness scores were calculated for each of the 58 studies, based on information regarding the direction, significance and whether the results had a long-term impact (see below for more) to allow for a quantification of findings. Typically, for a study to be included in a meta-analysis, an individual study participant must not contribute to more than one effect size per meta-analysis, so as not to violate the assumption of independence (Lipsey & Wilson, 2001). That is, a single study can only contribute multiple effect sizes to a meta-analysis if the effect sizes are based on independent samples. In the current systematic review this assumption was violated. Given that the unit of analysis was treatment-comparison contrasts (rather than study) a single study was able to contribute multiple effect sizes even if the samples were not completely independent. This violation of independence was only tolerated in instances where studies compared multiple independent treatment groups to a common comparison group however (see Wilson, Gottfredson & Najaka, 2001). The 58 studies included in the quantitative component of the narrative review contributed 61 separate treatment-comparison contrasts, while the 12 studies included in the meta-analysis contributed 16 separate treatment-comparison contrasts.

Coding of study characteristics

Each study was coded using a 48-item codebook that recorded design, sample, setting, and intervention particulars. In addition, a summary of the intervention and the main findings, as well as details regarding attrition and pretest group equivalence were coded for each study. This information was collated to create the synopsis table that can be found in Appendix A.

NARRATIVE REVIEW

The purpose of the narrative review was to provide descriptive results for those evaluation studies where the generation of an effect size on an illicit drug use outcome was not possible. The narrative review was divided into two sections; a qualitative review and a quantitative component. As stated, a total of 58 studies contributed 61 separate treatment-comparison contrasts to the narrative review. Those studies included in the meta-analysis were also included in the narrative review. The intervention and study characteristics of these treatment-comparison contrasts are shown in Table 1 below.

Table 1: Characteristics of the treatment-comparison contrasts included in the systematic review

Intervention Characteristics	*n* of program evaluations*	% of program evaluations
Implementation Date		
Pre-1990	26	42.60
1990-1994	8	13.10
1995-1999	12	19.70
2000-2005	2	3.30
Unclear	13	21.30
Intervention Type		
Affective education	1	1.60
Knowledge dissemination/Affective education	3	4.90
Resistance skills training limited	6	9.80
Generic skills training limited	8	13.10
Social influence	11	19.70
Competency enhancement	25	39.30
System-wide change	5	8.20
Other	2	3.30
Level of Intervention		
Universal	42	68.90
Selective	5	8.20
Indicated	8	13.10
Mix	6	9.80
Multifaceted		
Yes	19	31.15
Family	*7*	*11.48*
Community	*3*	*4.92*
Media	*2*	*3.28*
Mix	*7*	*11.48*
No	42	68.85
Interaction		
Extreme	31	50.82
Considerable	12	19.67
Minimal	8	13.11
Low	1	1.64
Unclear	9	14.75
Intensity		
6-9 sessions	6	9.84

10-19 sessions	31	50.82
20-29 sessions	10	16.39
30-39 sessions	1	1.64
40-49 sessions	1	1.64
50+ sessions	2	3.28
Not a curriculum-based program	6	9.84
Unclear	4	6.56
Booster Sessions		
Yes	20	32.79
No	35	57.38
Not a curriculum-based program	6	9.84
Type of Provider		
Professional	16	26.23
Health educator	*4*	*6.56*
Trained professional	*3*	*4.92*
Project staff	*3*	*4.92*
Police officer	*4*	*6.56*
Counsellor	*2*	*3.28*
Teacher	26	42.62
Older peer	3	4.92
Mix	10	16.39
Unclear	6	9.84
Peer involved in program delivery		
Yes	13	21.31
No	42	68.85
Unclear	6	9.84
Provider Training		
Specially trained	23	37.70
Considerable training	23	37.70
Minimal training	3	4.92
No training	1	1.64
Unclear	11	18.03
Sample Characteristics		
Student Grade Level		
Elementary school	10	16.39
Middle school	44	72.13
High/secondary school	7	11.48
Male (%)		
≤50%	30	49.18
>50%	17	27.87
Unclear	14	22.95
White (%)		
≤10%	5	8.20
>10% - ≤25%	5	8.20
>25% - ≤50%	7	11.48
>50% - ≤75%	6	9.84
>75% - ≤90%	12	19.67
>90%	9	14.75
Unclear	17	27.87
Design Characteristics		
Implementation Fidelity		
High	20	32.79

Medium	2	3.28
Low	6	9.84
Unclear	33	54.10
Comparison Group Status		
No treatment	16	26.23
Standard care	27	44.26
Lower level of treatment	4	6.56
Mix	1	1.64
Unclear	13	21.31

* N studies = 58; N treatment-comparison contrasts = 61

As can be seen, despite restricting inclusion of studies to those published post-1990, the majority of evaluated programs were implemented prior to 1990. A greater number of studies were included for intervention approaches described as being more interactive. That is, far fewer affective education (n=1) and knowledge and affective education programs (n=3) were included, with increasing numbers of resistance skills training limited (n=6), generic skills training limited (n=8), social influence (n=12), and competency enhancement (n=25) programs (see below for a detailed explanation of the various types of intervention approaches). This probably reflects the increased popularity of these intervention approaches since the early 1980s, but may also reflect a publication bias towards studies reporting significant or positive results. That is, affective education and knowledge dissemination programs have been show to be relatively ineffective and thus studies assessing programs adopting such approaches may have been more likely to find negative or nonsignificant results and not have been published.

The majority of studies were implemented universally (n=43 or 69.4%), rather than indicated (n=8) or selective (n=5). While most studies did not have multifaceted components (n=42 or 67.7%), a large enough proportion did (n=20 or 31.3%) to allow for the effects of such components to be analysed. Of the 20 programs that involved multifaceted components, 7 had family-based components, 3 had community-based components, 2 had media based components, and 8 had a mixture of multifaceted components. The majority of programs (n=44 or 71%) had high (extreme or considerable) interaction. The majority of programs (n=31 or 50%) consisted of between 10 and 19 sessions, while 10 programs (16.1%) consisted of more than 20 sessions, and only 6 (9.7%) consisted of less than 10 sessions. Booster sessions were included in 20 (32.3%) of the reviewed programs. Teachers were the most common provider (n=26 or 41.9%), followed by professionals (n=16 or 25.8%). The most common type of professional was a health educator (n=9), followed by project staff (n=7), trained professionals (n=5), police officers (n=3), and counsellors (n=2). Only 3 programs were delivered by peers alone, however of the 11 programs delivered by a mix of providers all involved peers in the delivery of the programs. In the majority of cases the provider was either specially trained (n=23 or 37.1%) or had received considerable training (n=24 or 38.7%). Programs were most commonly delivered during middle school (n=45 or 72.6%), rather than elementary school (n=10 or 16.1%) or high/secondary school (n=7 or 11.3%).

The samples utilised in the majority of studies were predominately white and consisted of roughly equivalent proportions of males and females. In general, attrition rates were higher among males, racial minorities, and students who reported baseline drug use. The majority of program evaluations (53.2%) failed to document implementation fidelity. Of those that did (n=29), 21 reported high implementation fidelity; however this may reflect reporting bias. Standard care was the most common comparison group status (n=28 or 45.2%) with only 16 programs (25.8%)

utilising no treatment control groups. There were missing data on a number of important variables (such as implementation date, number of sessions, interaction, etc) suggesting a need for authors of program evaluations to increase reporting validity.

Explanation of intervention approaches

This section examines the intervention approach categories used in our review. The reviewed drug prevention programs were broken into the following 8 categories: affective education (A), knowledge plus affective education (K+A), resistance skills training limited (RSTL), generic skills training limited (GSTL), social influence (SI), competency enhancement (CE), system-wide change (SWC), and other (O). These categories fundamentally follow those employed by Tobler, et al. (2000) with the notable exclusion of the DARE-type program category, instead broken into programs described as being limited to either resistance skills training or generic skills training.

Knowledge/information dissemination programs refer to programs that "increase knowledge of drugs and consequences of use; promote anti-drug use attitudes" (Botvin & Griffin, 2003: 46). These programs generally use non-interactive teaching methods such as didactic instruction. The purpose of such programs is generally to educate students of the physiological, social and health consequences of drug use, with the focus on the long-term consequences rather than immediate consequences. Achievement of these goals are generally sought through the provision of factual information emphasising anti-drug attitudes, with programs often adopting zero tolerance approaches that encourage complete abstinence. These programs typically are void of affective components or the teaching of any higher-level skills such as refusal skills training, normative education, and generic skills training (Botvin & Griffin, 2003; Tobler, et al., 2000).

Affective education programs focus on interpersonal development such as self-esteem enhancement, improving coping and stress management skills, as well as improving personal decision-making through self-reflection. Programs adopting this approach generally do not include information dissemination and generally do not have a specific emphasis on drug use, instead addressing intermediate factors presumed to be correlated with susceptibility to use drugs. Simply, these programs target the interpersonal factors associated with substance use and attempt to reduce use through the strengthening of such protective factors. Furthermore, these approaches do not teach any higher-level skills such as refusal skills training, normative education, and generic skills training. Similar to information dissemination approaches however, affective education approaches are typically delivered using non-interactive methods such as didactic instruction (Botvin & Griffin, 2003; Tobler, et al., 2000).

Resistance skills training limited are programs that typically have a strong knowledge component and emphasise refusal and resistance skills training. These programs may have an affective education component and place far less, or no, emphasis on social influence, normative education, and generic skills training. Generic skills limited programs also tend to include a knowledge component as well as a focus on teaching generic life skills such as decision-making, problem solving, communication, assertiveness and coping skills. Essentially, this approach reflects programs that fall short of the competency enhancement approach given the absence of vital components such as social influence, resistance skills training or normative education. Such programs are generally void of an affective component. Far less emphasis is put on the refusal skills component of such programs, which makes them distinctive from competence enhancement programs. Both resistance skills training limited and generic skills training limited approaches tend to be more interactive than knowledge dissemination or affective education

approaches, but slightly less interactive than social influence or competency enhancement approaches.

Social influence programs are designed to "increase awareness of social influence to smoke, drink, or use drugs; develop skills for resisting substance use influences; increase knowledge of immediate negative consequences; [and] establish non-substance-use norms" (Botvin & Griffin, 2000: 46). That is, youths are educated about the influence of the media, peers, and adults on subsequent drug use. A variety of refusal skills are taught to aid the young person's ability to abstain from use, and misconceptions regarding drug use amongst youth are corrected and replaced with more accurate information. Programs adopting such an approach typically include a knowledge dissemination component and may involve a limited affective component. However, unlike strict information dissemination approaches, the social influence approach places a far greater emphasis on the immediate physiological, health and social consequences of drug use. Such programs are generally void of generic skills training. The interactivity of these programs is generally high (Botvin & Griffin, 2003; Tobler, et al., 2000).

Competence enhancement programs emphasise the teaching of generic life skills such as communication skills, decision making, problem solving, coping skills and stress management, assertiveness, and other socially relevant skills such as those pertaining to dating and relationships. Programs adopting this approach may also include components highly similar to social influences programs such as refusal skills training, normative behaviour and identification of the social influence on drug use. However, many do not directly address drug use, instead addressing a variety of intermediate, interpersonal factors believed to be associated with drug use susceptibility. The interactivity of these programs is generally high (Botvin & Griffin, 2003; Tobler, et al., 2000).

Systems-wide change programs consist of two types. Simply, the first type of system-wide change programs are multi-component programs that involve inclusion of family, community and/or media interventions, and attempt to address prevention of drug use not only at the school level but rather at a broader community level, mobilizing the whole community in the prevention effort. The second involves policy level changes that affect the overall school climate (Tobler, et al., 2000). Other programs include counselling, sporting and recreational activities programs, theatre and drama based drug education, or programs that promote alternative options to drug use. The interventions can best be viewed as a pyramid of approaches; with each approach adding elements that were not included in the previous approach (see Figure 2).

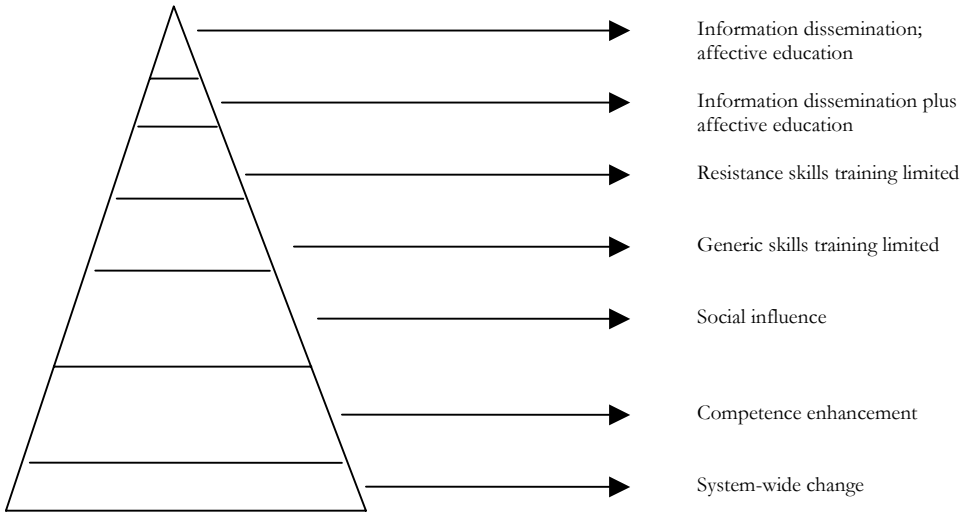


Figure 2: Pyramid of types of intervention approaches to school-based drug prevention

Qualitative review

A total of 58 studies contributing 61 treatment-comparison contrasts were included in the qualitative review. The qualitative review is presented by intervention approach. Furthermore, the effect of numerous moderator variables such as interactivity, type of provider, intensity of the program and the inclusion of booster sessions, on the overall effectiveness of programs is discussed.

Affective Education (A)

One study evaluating a single treatment-comparison contrast (Hansen, Johnson, Flay, Graham & Sobel, 1988) was reviewed under this intervention approach. The study evaluated the US program, Project SMART (Self-Management And Resistance Training), conducted in 1982-1983. The 12 session, universal program implemented in the 7th grade, did not include multifaceted components, nor did it include booster sessions. The program was delivered by teachers, health educators and older peers and had considerable interaction. The program resulted in negative impacts on rates of marijuana incidence and prevalence, with treatment students reporting significantly higher rates of use and greater rates of initiation at follow-up than their control counterparts.

Knowledge plus Affective Education (K+A)

One study evaluating three treatment-comparison contrasts[9] (Forman, Linney & Brodino, 1990) was reviewed under this intervention approach. The study evaluated the US program, Coping Skills School Intervention which was conducted sometime prior to 1990. The indicated program involved 10 sessions and 2 booster sessions (a year later) and implemented in secondary school by project staff. Two of the three treatment-comparison contrasts were multifaceted, including a parenting program, one in which the parents attended the parenting program and a condition in

9 The study compared three levels of the program: (1) school-only curriculum, (2) school curriculum plus parenting program where students' parents attended the program, and (3) school curriculum plus parenting program where parents were absent from the parenting program.

which the parents did not. Overall, the program had minimal interaction. While no significance testing was conducted[10], the results suggested that the school-based only curriculum and school-based curriculum plus parenting program (parents absent) produced some positive effects on marijuana use compared to the control group. The school curriculum plus parenting program condition performed unfavourably however, suggesting that the addition of the parenting program may have had negative effects.

Resistance Skills Training Limited (RSTL)

Seven studies evaluating six treatment-comparison contrasts (Graham, Johnson, Hansen, Flay & Gee, 1990; Hansen, Johnson, Flay, Graham & Sobel, 1988; Hurry, Lloyd & McGurk, 2000; Kim, McLeod & Shantzis, 1993; Shope, Copeland, Kamp & Lang, 1998; Shope, Copeland, Marcoux & Kamp, 1996; Stevens, Freeman, Mott & Youells, 1996) were reviewed under this intervention approach.

The evaluations included England's Project Charlie, as well as a number of US programs (Here's Looking At You – 2000 (HLAY); Project SMART; and an unnamed program conducted in Michigan). All were conducted either during the 1980s or early 1990s and all were universal. Two of the six treatment-comparison contrasts included multifaceted components, with two of the HLAY evaluations including family-based program and one also involving a community component. Project SMART and the unnamed program consisted of 12 and 15 sessions, respectively, while HLAY involved 28 lessons and Project Charlie involved weekly lessons throughout an entire academic year. Booster sessions were not evident in any of the programs. Project SMART, the unnamed program, and one of the evaluations of the HLAY curricula were implemented in the middle school years, while Project Charlie and the other two HLAY evaluations were implemented in the elementary school years. Teachers, health educators and older peers were responsible for delivering the SMART curriculum, while teachers alone were responsible for delivery of the other evaluated programs[11]. HLAY was reported to have minimal interaction while the other evaluated programs involved considerable levels of interactivity.

The Project Charlie evaluation found no significant program effects on rates of illicit drug use in two of their three subsets. There were significant positive effects for treatment students when all students from the first two subsets were analysed (Hurry, et al., 2000), however the small sample sizes and unequal number of students in the control and treatment conditions raises serious concerns. The unnamed program showed some evidence of reducing rates of marijuana and cocaine use, however significant findings were restricted to students in the 6th-7th grade cohort and there was evidence that males benefited less from the program than girls (Shope, et al., 1998; Shope, et al., 1996). Stevens, et al. (1996) evaluated the HLAY program, both as a school-based curriculum only and with additional family and community components to the program. They found no significant program effects on either initiation, or regular use of, marijuana irrespective of the multifaceted nature of the program. Both applications of the program produced more favourable results compared to the control group however, with the school curricula plus family and community components version of the program producing slightly more favourable results than the school-curricula only version. Kim, et al. (1993) evaluated the impact of the HLAY program on illicit drug use, and found no significant effect of the program. Nevertheless, there was a slightly lower increase in rates of use amongst treatment students compared to the control condition. The evaluation of Project SMART (Graham, et al., 1990; Hansen, et al., 1988)

10 This was the only study included in the review without meeting the criteria of having significance testing. This study provided sufficient statistical information from which to calculate an effect size, and was thus included in the meta-analysis. See the meta-analysis for more information regarding the impact of this intervention.

11 With the exception of Project Charlie where the provider was unclear.

revealed few significant findings. There was a positive significant immediate impact on marijuana initiation rates among baseline nonusers; however this effect had decayed by the follow-up. There was also evidence to suggest that girls benefited from the program more than boys.

Generic Skills Training Limited (GSTL)

Six studies evaluating eight treatment-comparison contrasts (Aseltine, Dupre & Lamlein, 2000; Dent, Sussman & Stacy, 2001; Hansen & Dusenbury, 2004; Snow, Tebes & Ayers, 1997; Sussman, Dent, Stacy & Craig, 1998; Sussman, Sun, McCuller & Dent, 2003) were reviewed under this intervention approach.

All evaluations were of US programs, including All Stars Core, Project Toward No Drug Abuse (TND), the Adolescent Decision Making (ADM) Program, and the Positive Youth Development Curriculum (PDYC)[12]. Four of the evaluated programs were implemented in the late 1990s, one in the early 1980s, another in the early 1990s, and one in 2003[13]. Five of the programs were universal and the other three were indicated[14]. Only one program evaluation included a multifaceted component; the Across Ages mentoring component added to the PDYC curriculum. Two of the reviewed TND curricula consisted of just 9 sessions, while the other two, as well as the ADM program consisted of 12 sessions. The All Stars Core curriculum involved 14 sessions, while the PDYC curricula involved 27 sessions. Booster sessions were not evident in any of the reviewed programs. The TND curriculum was implemented during high school, while the ADM and PDYC programs were implemented during middle school. The TND curriculum was delivered by health, educators and the All Stars Core curriculum by teachers[15]. The TND curriculum involved minimal to no interaction depending on method of delivery (self-instruction versus health-educator led), the All Stars Core program involved extreme interactivity, and the PDYC program considerable interaction[16].

Four treatment-comparison contrasts evaluated the TND program. Sussman, et al. (2003) evaluated the program delivered both by health educators and via self-instruction. The authors found that when delivered by health educators, the program had a positive significant effect on hard drug use and a favourable, but nonsignificant, impact on marijuana use. There was also evidence to suggest that male, baseline nonusers benefited more from the program. The self-instruction condition failed to have significant main or interaction effects on either marijuana or hard drug use, raising questions of the effectiveness of this approach to delivery. Dent, et al. (2001) found no significant effects of the program on rates of marijuana use, however found that students who reported low rates of baseline hard drug use benefited more from the program than those students who reported higher rates of use. Sussman, et al. (1998) found very similar results, with no program effects on marijuana, a significant positive effect on hard drug use, and an interaction between baseline use rates and a reduction in follow-up use rates. Taken together, it appears that the TND program may have more impact on reducing or preventing harder drug use, rather than marijuana use, and its effectiveness might be restricted to low-risk youths who do not report baseline use.

The evaluation of the All Stars Core program (Hansen & Dusenbury, 2004) revealed no significant differences in rates of marijuana use between treatment and control students. The PDYC program was evaluated, both with and without the inclusion of a community-based

12 The PDYC was evaluated with and without the inclusion of the Across Ages mentoring program.
13 One study did not report the necessary information to ascertain the date of the program implementation.
14 All indicated program evaluations were of Project TND.
15 The Evaluations of the PDYC and ADM programs did not report the necessary information to ascertain the deliverer of the program.
16 One of the TND program evaluations and the ADM program evaluation did not report the necessary information to ascertain the level of interaction of the program.

multifaceted mentoring component, Across Ages (Aseltine, et al., 2000). The authors found the inclusion of the mentoring component slightly increased the effectiveness of the program. That is, students in the mentoring plus curriculum condition reported significantly less increase in rates of marijuana use, compared to control students, while the curriculum only condition reported favourable, but nonsignificant, changes in comparison to the control group. The difference between changes in marijuana use rates between the two program conditions was not significant however. The ADM program failed to significantly impact rates of marijuana or hard drug use, both in the short-term (Gersick, Grady & Snow, 1988) and long-term (Snow, et al., 1997).

Social Influence (SI)

Sixteen studies evaluating 12 treatment-comparison contrasts (Becker, Agopian & Yeh, 1992; Bell, Ellickson & Harrison, 1993; Chou, et al., 1998; Clayton, Cattarello & Johnstone, 1996; Clayton, Cattarello & Waldren, 1991; Eischens, Komro, Perry, Bosma & Farbakhsh, 2004; Ellickson & Bell, 1990; Ellickson, Bell & McGuigan, 1993; Ellickson, McCafferey, Ghosh-Dastidar & Longshore, 2003; Harmon, 1993; Johnson, et al., 1990; Lynam, et al., 1999; Mackinnon, et al., 1991; Moberg & Piper, 1990; Pentz, et al., 1990; Wragg, 1990) were reviewed under this intervention approach.

The evaluations included the Illawarra Program conducted in NSW, Australia, as well as a number of USA programs including Drug Abuse Resistance Education (DARE), DARE Plus, Project ALERT, the Midwestern Prevention Program (MPP), and Project Model Health (PMH). All except two of the programs evaluated were implemented prior to 1990, with the others implemented in the late 1990s, and all were universal programs. The MPP evaluations incorporated media, family and community components alongside the school curriculum, while the Illawarra Program had a parenting program running concurrently with the school-based program, and parents were peripherally involved in one of the evaluations of the ALERT curriculum.

Most of the evaluated programs consisted of between 10 and 19 sessions, however there were exceptions, with PMH involving 64 sessions. Further, one of the evaluations of Project ALERT consisted of only 8 sessions, with the Illawarra program also consisting of less then 10 sessions, involving just 6 units. These two latter programs involved booster sessions, whereas none of the more intensive programs did. All except one program was implemented during the middle school years, with the only exception (one of the DARE evaluations) being implemented during the elementary school years. The four DARE evaluations were delivered by police officers, the MPP by teachers and same age peers[17], while Project ALERT was evaluated under delivery of a number of providers including teachers and health educators (with and without peers involved in the delivery). In all programs the level of interaction was deemed to be either considerable or extreme, supporting the theory that social influence programs tend to be more interactive than other types of approaches such as knowledge dissemination or affective education.

There were four evaluations of the DARE curriculum, one being an evaluation of the DARE Plus curriculum, which took the original curriculum and added multifaceted family and community components. Overall, the three evaluations of the standard DARE curriculum failed to find evidence of the effectiveness of the program (Becker, et al., 1992; Clayton, et al., 1996; Clayton, et al., 1991; Harmon, 1993; Lynam, et al., 1999). The program failed to significantly impact either marijuana or other illicit drug use, either in the short- or long-term. Follow-up rates of hard drug use were almost identical amongst treatment and comparison youths. There

17 Two studies evaluating the MPP did not report the necessary information to ascertain the deliverer of the program.

was also very little evidence to suggest favourable impacts of the program on marijuana use trajectories, with one study suggesting a significant negative impact of the program on marijuana use rates (Clayton, et al., 1991). The added family and community components of the DARE Plus program failed to improve the effectiveness of the program, finding no significant impact on marijuana use rates (Eischens, et al., 2004). These findings align with findings of previous reviews and meta-analyses of the DARE program (Ennett, et al., 1994).

Three treatment-comparison contrasts investigated the effectiveness of the ALERT program. The program was found to significantly reduce initiation of marijuana use, as well as have positive effects on current and regular use of the drug. However, evidence suggested that the effectiveness of the program was restricted to short-term benefits, with effects dissipating in the long-term. There was also some evidence to suggest that the program benefits those identified as low- to moderate-risk for use at baseline (Ellickson, et al., 2003). A number of studies also assessed the effect of peer involvement in the delivery of the program on program success (Bell, et al., 1993; Ellickson & Bell, 1990; Ellickson, et al., 1993), with evidence suggesting slightly greater effectiveness of the program when peers were involved, however this finding did not reach statistical significance.

In addition, the added effectiveness of booster sessions was also reported, with the positive program effect strengthening after implementation of the booster sessions, however this finding also failed to reach statistical significance. Three evaluations were conducted assessing the effectiveness of the MPP. Two of the three treatment-comparison contrasts reported significant positive program effects on rates of marijuana use, with significantly smaller increases in use rates amongst treatment youths. There were also significant positive effects on intentions to use the drug (Johnson, 1990; Mackinnon, et al., 1991; Pentz, et al., 1990).

The final evaluation also found positive trends in use rates among program students relative to comparison students, however these findings failed to reach significance (Chou, et al., 1998). The Illawarra Program showed significant positive effects on rates of marijuana use that persisted for three years after the completion of the program (Wragg, 1990). Finally, while PMH reduced rates of marijuana use among program students compared to comparison students, this finding failed to reach significance (Moberg & Piper, 1990).

Competency Enhancement (CE)

Nineteen studies evaluating 23 treatment-comparison contrasts (Botvin, Baker, Dusenbury, Botvin & Diaz, 1995; Botvin, Baker, Dusenbury, Tortu & Botvin, 1990; Botvin, Baker, Filazzola & Botvin, 1990; Botvin, Baker, Renick, Filazzola & Botvin, 1984; Botvin, Epstein, Baker, Diaz & Ifill-Williams, 1997; Botvin, Griffin, Diaz & Ifill-Williams, 2001; Botvin, et al., 2000; Botvin, Schinke, Epstein, Diaz & Botvin, 1995; DeWit, et al., 2000; Eisen, Zellman, Massett & Murray, 2002; Eisen, Zellman & Murray, 2003; Griffin, Botvin, Nichols & Doyle, 2003; Hansen & Dusenbury, 2004; Hecht, et al., 2003; McNeal, Hansen, Harrington & Giles, 2004; Piper, Moberg & King, 2000; Scheier, Botvin & Griffin, 2001; Schinke, Tepavac & Cole, 2000; Smith, et al., 2004; Spoth, Redmond, Trudeau & Shin, 2002) were reviewed under this intervention approach. Competency enhancement was the most empirical evaluated intervention approach of the reviewed studies.

The evaluations included Canada's Opening Doors Program, as well as a host of US programs including, most notably Life Skills Training (LST), or variations of the curriculum[18], the Healthy for Life Project, Skills for Adolescence (SFA) program, All Stars (and All Stars Plus), Keepin' it REAL, and an unnamed skills training program. Information regarding the date of implementation was not reported in 11 of the treatment-comparison contrasts. For 7 of the 8 LST evaluations that provided implementation date data, the program was implemented during the 1980s, while an evaluation of the Infused LST curriculum was implemented between 1999 and 2002. The SFA, Keepin' it REAL, and All Stars Plus programs were implemented during the late 1990s or early in the 21st century. As was the case for the majority of studies included in this review, the majority of the studies under this intervention approach were universal (15 of the 23 treatment-comparison contrasts). Three selective, culturally-focused applications of the LST intervention were reviewed, and the unnamed skills training program was also selective prevention. The Opening Doors program was indicated prevention and the All Stars program also contained indicated prevention components.

A number of programs were implemented with concurrent multifaceted components. Keepin' it REAL included an educative media component while the Healthy for Life program contained both family and community components. The Opening Doors Program also had a family program in addition to the school-based curriculum, and the skills training program was evaluated with and without an added community component. An evaluation of LST with the addition of the Strengthening Families Program (SFP) was also reviewed. The LST program involved, in general 15-20 sessions with a large number of booster sessions occurring in the two years following the completion of the program[19]. The Opening Doors, Keepin' it REAL, and unnamed skills training programs involved between 10 and 20 sessions, with the Keepin' it REAL and skills training programs also involving booster sessions following the curriculum. All Stars and All Stars Plus consisted of between 22 and 25 sessions but did not administer booster sessions. The SFA and Healthy for Life Programs, while not including booster sessions in their design, were far more intensive, involving 40 and 58 sessions, respectively.

The majority of the programs were designed for implementation in the middle school years, with the only exceptions being the skills training program designed for elementary students, and the Opening Doors Program designed for both middle and high school students. Teachers were the most common program provider (SFA, Keepin' it REAL, All Stars, LST, Healthy for Life). Professionals were also involved in the delivery of All Stars, LST, and Healthy for Life, and were solely responsible for delivery in some cases. The Opening Doors Program was also delivered by professionals. Peers were involved in the delivery of the LST program, Healthy for Life project, and the skills training program. In alignment with the theory behind this intervention approach, the majority of the programs involved extreme or considerable interaction.

As stated, evaluations of the LST program made up 15 of the 23 treatment-comparison contrasts under this intervention approach. The program has been evaluated under a variety of program providers, with providers of varying degrees of training, with and without booster sessions, and with and without the inclusion of multifaceted components. Botvin, et al. (1990) and Botvin, et al. (1984)[20] found that peer delivery of the program was significantly more effective in reducing

18 Fifteen of the 23 treatment-comparison contrasts reviewed under this intervention approach were conducted on the LST program or variants of the program.

19 The Infused LST program is not a curriculum-based program per se, given that there is no fixed number of sessions. Rather the content of the program is infused into normal classes, such as normative education being taught in mathematics through the discussion of myth-defeating statistics regrading actual rates of drug use among youth (Smith, et al., 2004).

20 Four treatment-comparison contrasts were made: (1) teacher delivered with booster sessions; (2) teacher delivered without booster sessions; (3) older peer delivered with booster sessions; (4) older peer delivered without booster sessions.

marijuana use rates compared to delivery by teachers, irrespective of the inclusion of booster sessions. In fact, the teacher-led condition was not found to significantly impact marijuana use rates. Booster sessions slightly increased the effectiveness of both methods of delivery. Comparing teachers who received minimal training with those who received considerable training[21], both conditions produced significant positive effects on marijuana and other illicit drug use, and, while the difference between the two conditions was not significant, the considerable training condition reported more favourable outcomes than the minimal training condition (Botvin, Baker, et al., 1995; Botvin, et al., 1990; Botvin, et al., 2000).

Similar results were found when assessing the impact of adding multifaceted components to the LST curriculum. Spoth, et al. (2002) reported significant positive effects on marijuana use initiation, irrespective of the inclusion of the SFP, and, while there were no significant differences between the two conditions, slightly more favourable outcomes were observed when the family-based program was included. In addition to positive effects on marijuana use, the LST program has also shown to be effective in reducing rates of other illicit drug use among program students relative to comparison students (Botvin, et al., 1997).

However, there have also been a number of evaluations that have failed to find evidence of the effectiveness of the program. Botvin, Schinke, et al. (1995) found no impact of a selective administration of the LST program on marijuana use and intentions to use the drug, irrespective of whether the program was culturally focused or not. Further, very little effect on rates of marijuana use was observed in another evaluation of the program (Botvin, et al., 2001; Griffin, et al, 2003), and nonsignificant but positive results observed in another (Scheier, et al., 2001). There is also evidence to suggest that females benefit more from the program than males (Smith, et al., 2004), however no evidence to suggest that infusing the curriculum content into normal school classes improved the effectiveness of the program.

All Stars was evaluated to assess the impact of provider type on effectiveness (McNeal, et al., 2004). The authors found that neither teachers nor trained professionals produced significant positive impacts on marijuana use rates; however teachers slightly outperformed the professionals, and both conditions led to reduced rates of use among program students compared to control students. An evaluation of the All Stars Plus program revealed similar findings, with program students reporting less follow-up use than their control counterparts; however the difference was again nonsignificant (Hansen & Dusenbury, 2004). Keepin' it REAL was found to have a significant effect on marijuana use, with program students reporting a significantly lesser increase in use rates than their control counterparts. There was also evidence to suggest that the Mexican/American version of the curriculum outperformed the versions designed for African-American and Caucasian students, and a multicultural version for other students (Hecht, et al., 2003). The SFA program was found to have had an immediate significant positive effect on marijuana use, intentions to use the drug, and progression from licit substances such as alcohol and tobacco to marijuana, and some of these effects were also observed a year later at follow-up (Eisen, et al., 2002; Eisen, et al., 2003).

The Healthy for Life program evaluation tested intensive and age-appropriate versions of the curriculum and found evidence of effectiveness of the intensive version of the program, with significantly less monthly marijuana use among program students at follow-up (Piper, et al., 2000). Conversely, the age-appropriate version was found to have negative effects on marijuana

21 Those teachers who received minimal training received videotape training only, with no feedback from project staff. Those teachers who received considerable training attended a training workshop and received feedback from project staff.

use, with program students reporting more use at follow-up than control students. The Opening Doors Program also had a significant positive effect on marijuana use rates among program students, however this finding was short-term only and had largely dissipated by one-year follow-up (De Wit, et al., 2000). The unnamed skills training program was evaluated with and without an added community component. The multifaceted addition failed to produce the hypothesised benefits with no significant findings at any of the follow-up periods. The program, without the community component significantly impacted on three-year follow-up rates of marijuana use, with program students reporting less use, relative to comparison students (Schinke, et al., 2000), suggesting perhaps a negative effect of the multifaceted component.

System-wide change (SWC)

Six studies evaluating five treatment-comparison contrasts (Bond, et al., 2004; Cuijpers, Jonkers, de Weerdt & de Jong, 2002; Furr-Holden, Ialongo, Anthony, Petras & Kellman, 2004; Morris, Parker & Aldridge, 2002; Zavela, et al., 1997; Zavela, Battistich, Gosselink & Dean, 2004) were reviewed under this intervention approach.

Among the evaluated program was Australia's Gatehouse Project (Melbourne), England's Integrated Programme (IP), and the Netherlands' Healthy Schools and Drugs Project, as well as the US programs Say Yes First – To Rural Youth and Family Alcohol/Drug Prevention (SYF) and an unnamed school-family partnership intervention. All programs were implemented during the 1990s. Further, all had a mix universal as well as selective and/or indicated components, with the exception of the Gatehouse Project which was strictly universally implemented. SYF and the IP incorporated concurrent community and family components, and the school-family partnership intervention also involved a family component.

The majority of the programs were not curriculum-based programs, however two of these programs (The Gatehouse Project and the Healthy Schools & Drugs Project) involved curriculum-based components, with neither implementing booster sessions. The programs were implemented at various times across the developmental cycle, including elementary school (school-family partnership intervention), high/secondary school (The Gatehouse Project, IP, Healthy Schools and Drugs Project), and across all age groups (SYF). Typically, the teacher was the predominate provider, however the SYF program involved project staff, trained professionals, teachers, parents, the community, and the involved students themselves when considering the design and implementation of the project and its activities.

There was evidence to suggest that the SYF program had a positive impact on rates of marijuana and cocaine use, however only the findings for cocaine use were significant. There was also evidence to suggest that students identified as higher-risk at baseline benefited less from the program (Zavela, et al., 1997; Zavela, et al., 2004). The Gatehouse Project reported similar effects on marijuana use, with program students reporting lower rates of use and initiation than their control counterparts; however this finding was not significant. There was again evidence to suggest that students at low-risk at baseline benefited more from the program than high-risk students (Bond, et al., 2004).

The results of the IP program evaluation were mixed, with some evidence to suggest positive effects on both marijuana and other illicit drug use. However, there was also evidence to suggest ineffectiveness of the program. The success of the program, it seems, may be largely a function of the characteristics of the students involved (such as age, socio-economic status, race, etc) (Morris, et al., 2002). The school-family partnership intervention failed to have a significant impact on either marijuana or illicit drug use rates. In fact, the program had negative effects on

rates of marijuana use, with program students reporting greater increases in use over time than their comparison counterparts (Furr-Holden, et al., 2004). The Healthy Schools and Drugs Project also failed to have an effect on marijuana use initiation and resulted in higher rates of use at follow-up among program students compared to control students (Cuijpers, et al., 2002).

Other (O)

Three studies evaluating two treatment-comparison contrasts (Furr-Holden, Ialongo, Anthony, Petras & Kellman, 2004; Valentine, Gottlieb, Keel, Griffith & Ruthazer, 1998; Valentine, Griffith, Ruthazer, Gottlieb & Keel, 1998) were reviewed under this heading. The first program involved behaviour management while the second involved counselling, and thus these programs could not fit neatly into previously discussed categories. Both programs, the Urban Youth Connection (UYC) and the classroom-centred intervention, were conducted in the USA in the early to mid 1990s, with the former an indicated program implemented in the middle and high school years by professional counsellors, and the latter a universal program implemented in elementary school by regular classroom teachers. Neither had multifaceted components, nor was either curriculum-based. Both programs suggested negative effects on rates of marijuana use, with program students reporting greater levels of use. The classroom-centred intervention did provide evidence of having a positive effect on other illicit drug use however (Furr-Holden, et al., 2004), and the UYC program may have been more beneficial for younger students (Valentine, et al., 1998; Valentine, et al., 1998).

Summary of the qualitative review

The single study evaluating an affective education program (Project SMART) resulted in negative impacts on rates of marijuana incidence and prevalence. The single study evaluating a knowledge dissemination and affective education program (Coping Skills School Intervention) suggested some positive effects on marijuana use, with negative effects of the addition of a parenting program. The evaluations of resistance skills training limited interventions produced mixed results. Evaluations of Project Charlie and the unnamed Michigan program found evidence of significant reductions in rates of marijuana and other illicit drug use, while HLAY and Project SMART failed to have a significant impact on drug use rates. Again, the multifaceted nature of the program seemed to have very little impact of the effectiveness of the program.

The evaluations of generic skills training limited interventions also produced mixed findings. Evaluations of the TND program found some evidence of the effectiveness of the program. Specifically, it appears that the TND program may have more impact on reducing or preventing harder drug use, rather than marijuana use, and its effectiveness might be restricted to low-risk youths who do not report baseline use. The All Stars Core program and ADM program both failed to reveal any significant impacts on rates of marijuana use. The PDYC program was found to have a significant impact on rates of marijuana use contingent on the inclusion of a community-based mentoring program.

Again, the studies evaluating social influence programs produced mixed results. Overall, the three evaluations of the standard DARE curriculum failed to find evidence of a significant program impact on either marijuana or other illicit drug use, either in the short- or long-term. The added family and community components of the DARE Plus program failed to improve the effectiveness of the program. The ALERT program was found to have a significant short-term effect on rates of marijuana use initiation, as well as positive effects on current and regular use of marijuana. There was some evidence to suggest that the program was more effective when delivered by peers, and that program effects were improved with the inclusion of booster sessions. Further, there was evidence to suggest that the program benefits were restricted to

those identified as low- or moderate-risk. Both the MPP and Illawarra Program found significant effects on rates of marijuana use and intentions to use the drug, while PMH failed to find significant effects on marijuana use.

The majority of evaluations of competency enhancement interventions were of the LST program (15 of 23). The majority report significant positive effects of the program on rates of marijuana and other illicit drug use and initiation. However, there are also a number of studies that failed to find a significant impact of the program. A number of moderator variables have also been investigated. Specifically, peer delivery of the program has been found to be significantly more effective than delivery by teachers. Also, the inclusion of booster sessions has been found to slightly increase the effectiveness of the program.

Further, very little additional effectiveness is observed with the addition of multifaceted components to the LST curriculum. All Stars and All Stars Plus failed to produce significant effects on marijuana use rates irrespective of whether it was delivered by teachers or trained professionals. Keepin' it REAL and the SFA program were both found to have a significant effect on marijuana use and intentions to use the drug. The Healthy for Life program also produced significant impacts on marijuana use, however only when students received the intensive version of the program. Further, the Opening Doors Program was found to have short-term significant positive effects on marijuana use.

The evaluations of systems-wide change interventions produced mixed results. The SYF program found a significant program impact on rates of cocaine use and suggested greater program effectiveness for low-risk students. The Gatehouse Project failed to find significant effects on marijuana use and also suggested a greater program benefit for low-risk students. The IP produced mixed evidence of effectiveness on both marijuana and other illicit drug use, while the school-family partnership intervention and the Healthy Schools and Drugs Project had negative effects on rates of marijuana use. Both programs that did not fit neatly into any of the intervention categories were found to have negative effects on rates of marijuana use.

Narrative Review Moderator Analysis

The same 61 treatment-comparison contrasts were included in a quantitative review. Effectiveness scores that considered the significance and direction of findings, as well as whether the findings were short- or long-term, were calculated for each program evaluation. Effectiveness scores were calculated separately for short-term outcomes and long-term outcomes on 7-point Likert scales[22]. Long-term findings were weighted to reflect the fact that positive findings that persist into the long-term are more desirable than short-term effects that decay[23]. To assess the overall effectiveness of the program, scores from the two scales were summed, with possible values ranging between 9 and -9[24]. In addition to separate calculation of

22 The response categories were as followed: majority positive significant effects; equal positive significant/positive nonsignificant effects; majority positive nonsignificant effects; null effects, mixed findings, or no measurement; majority negative nonsignificant effects; equal negative significant/negative nonsignificant effects; majority negative significant effects.

23 Effectiveness scores calculated on long-term outcomes were assigned values of 6 through -6 (intervals of 2) for the above categories (see footnote 20). Conversely, effectiveness scores calculated on short-term outcomes were assigned values of 3 through -3 (intervals of 1).

24 A number of a priori considerations were made regarding the calculation of effectiveness scores: (1) if there were an equal proportion of positive non/significant findings and null/negative non/significant findings, then the treatment-comparison contrast was coded as having mixed effectiveness; (2) equal proportions were defined as two categories having exactly the same number of findings as one another - in all other cases, the category with the majority of findings was chosen; (3) no consideration was made regarding different outcome types (e.g. lifetime vs 30-day use); (4) no consideration was made regarding different posttest measurement periods (e.g. immediate posttest vs 6-month posttest – short-term; 1-year follow-up vs 6-year follow-up – long-term).

effectiveness scores for short-term and long-term outcomes, effectiveness scores were also calculated separately for marijuana use outcomes and other illicit drug use outcomes.

A series of independent group t-tests were conducted, with effectiveness scores as the dependant variable and a variety of moderator variables used as independent variables in the analyses. The alpha level was set at .10 for these analyses based on one-tailed hypotheses. Corrections were made based on the Bonferroni principle to account for multiple contrasts. The initial criteria was made that a minimum of 10 studies was needed in each group for a contrast to be made. This resulted in 10 contrasts for short-term marijuana use outcomes (alpha = .01), 13 for long-term marijuana use outcomes (alpha = .007), and 21 for overall marijuana use outcomes (alpha = .004). There were not a sufficient number of studies included in any of the other illicit drug use outcomes analyses. Of all analyses conducted only one contrast was significant after the Bonferroni correction; professional involvement in delivery of the program produced significantly worse effects on short-term marijuana use outcomes (t=-3.08, df=32, p=.004).

While there were very few statistically significant results of the narrative review moderator analysis, a number of consistent trends that may have practical significance can be observed when analysing the descriptive statistics from the moderator analysis[25]. As can be seen in Figures 3 to 16 greater effectiveness scores are consistently observed for programs that are universal, more interactive, implemented after 1990, involve booster sessions, are delivered by teachers and implemented during the middle school years. Further, multifaceted programs, whether the multifaceted component is family-based or community-based, typically have greater long-term and overall effectiveness scores.

Contrary to hypotheses peer involvement did not produce higher effectiveness scores, nor did involving a professional in the delivery of the program. Interpreting the differences in effectiveness scores across the various intervention approaches is somewhat spurious given the very limited number of studies included under some of the approaches. Nevertheless, it seems that programs involving affective education and knowledge dissemination produce limited or negative effects, with increasing effectiveness scores observed for resistance skills training limited, generic skills training limited, social influence and competency enhancement programs. System-wide change and other programs also appeared to have limited effectiveness. The impact of program intensity is also difficult to interpret. It appears that programs involving a greater number of sessions are correlated to higher effectiveness scores for short-term marijuana use outcomes, however this trend is reversed for long-term use outcomes, with shorter programs yielding higher effectiveness scores.

25 Given the small number of studies included in the other illicit drugs outcome analyses, discussion of the descriptive statistics from the systematic review moderator analysis are limited to marijuana outcomes.

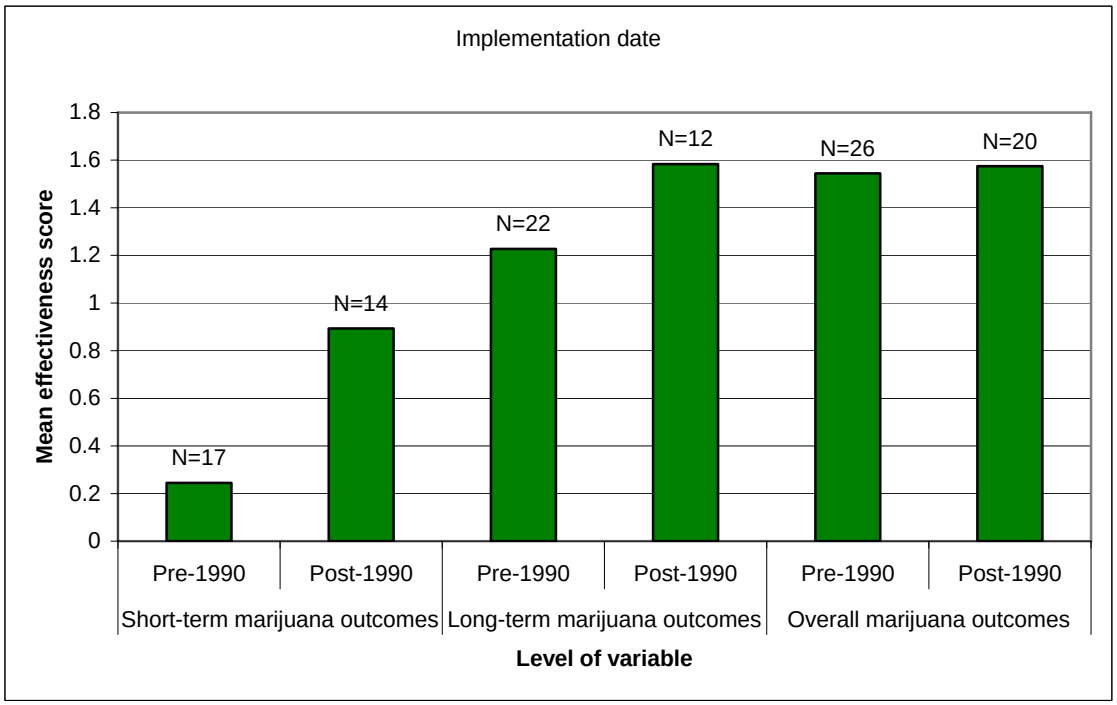


Figure 3: Impact of implementation date on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

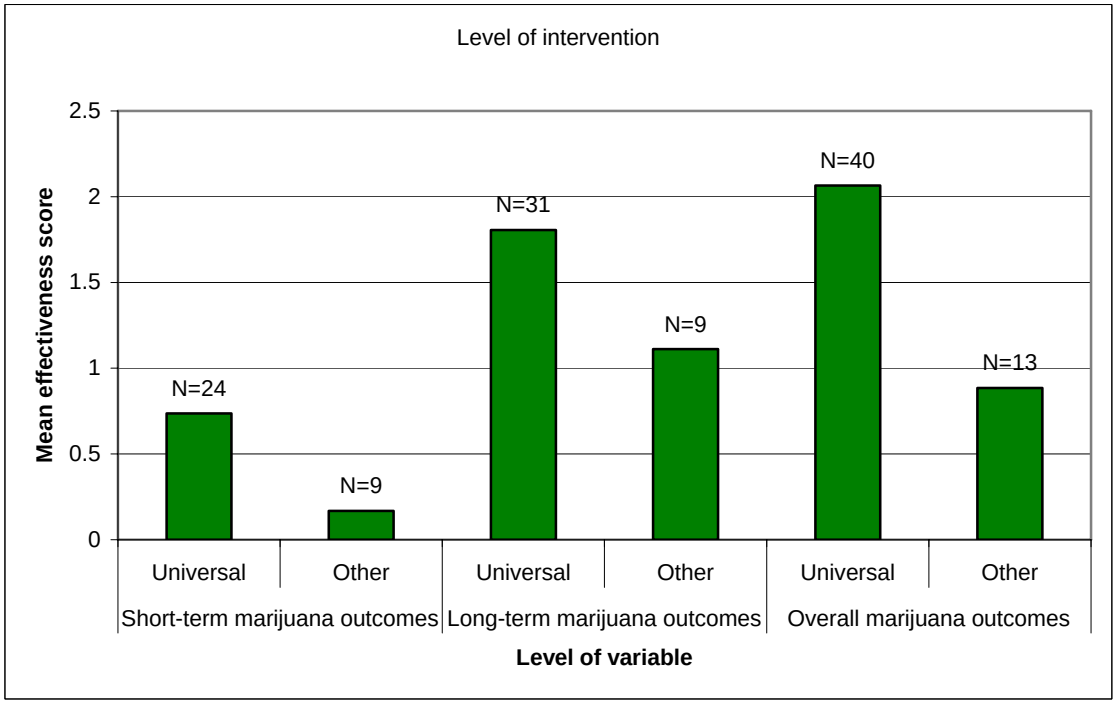


Figure 4: Impact of level of intervention on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

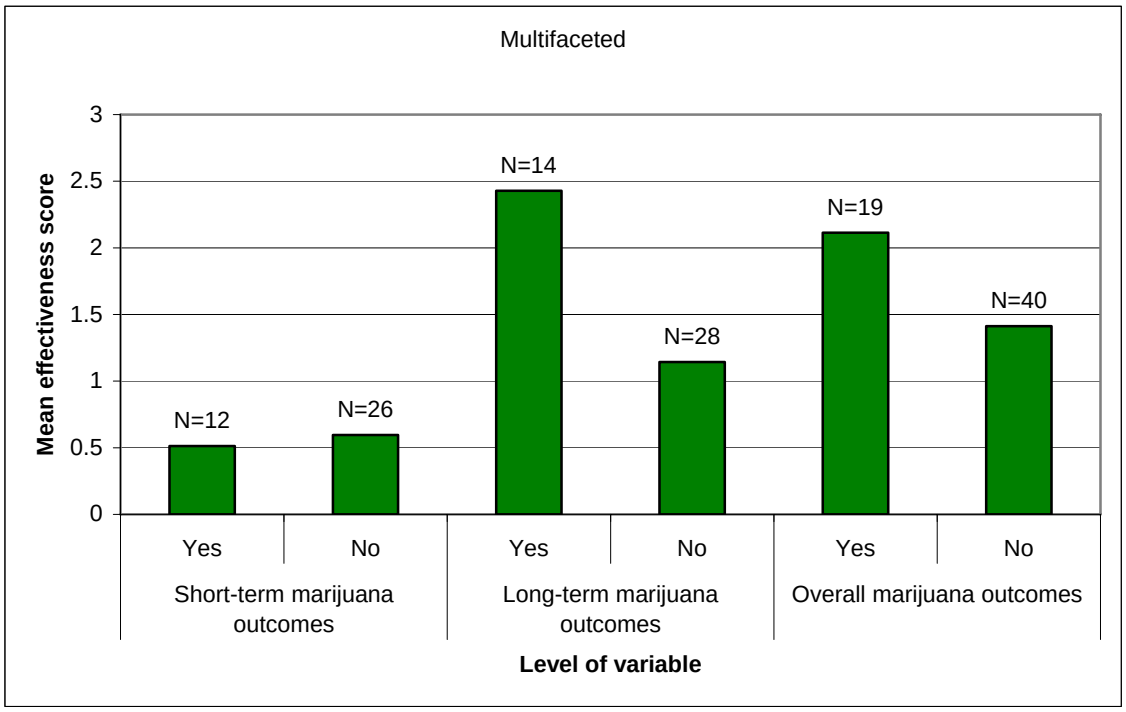


Figure 5: Impact of multifaceted nature of program on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

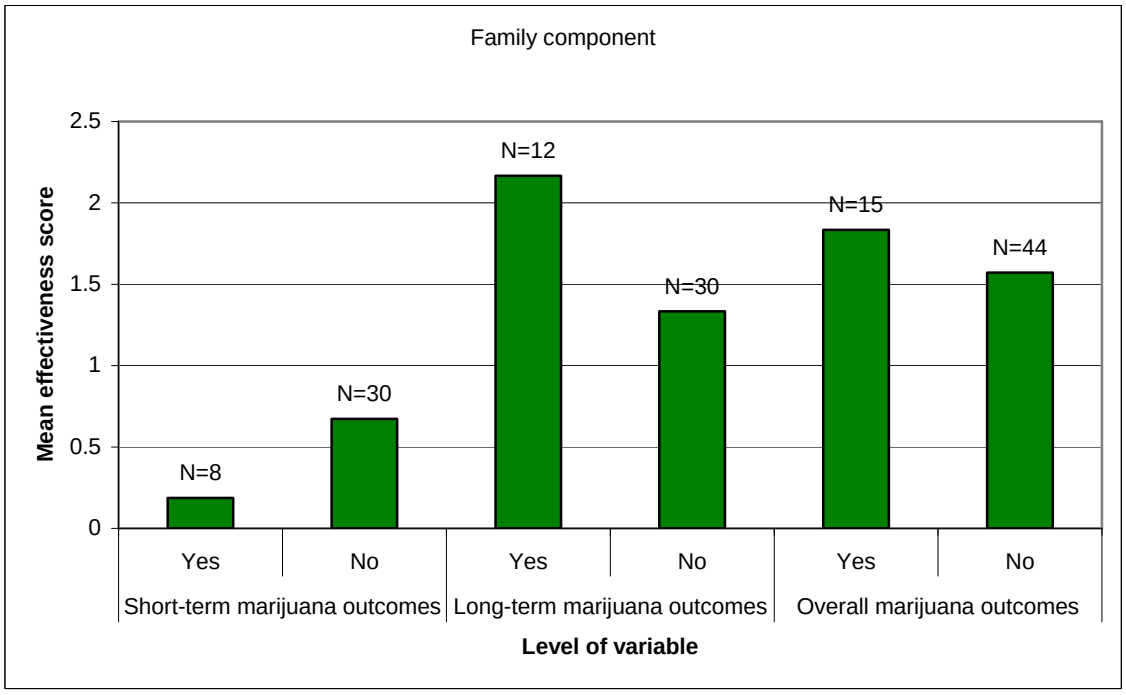


Figure 6: Impact of additional family-based component on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

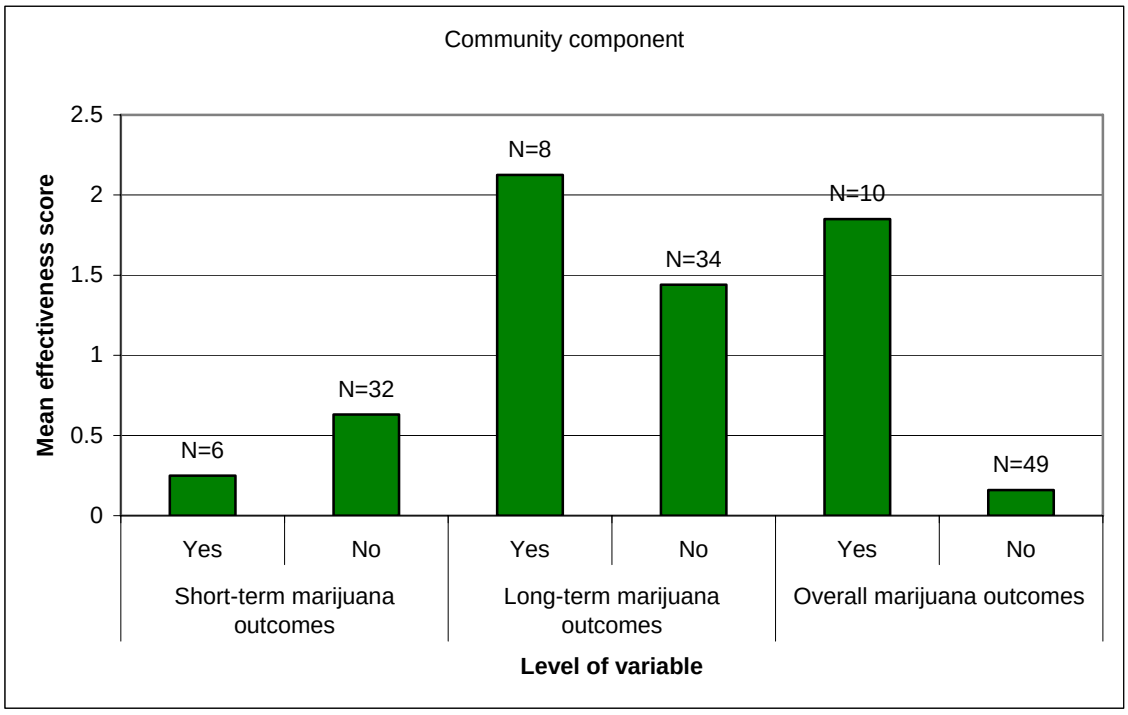


Figure 7: Impact of additional community-based component on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

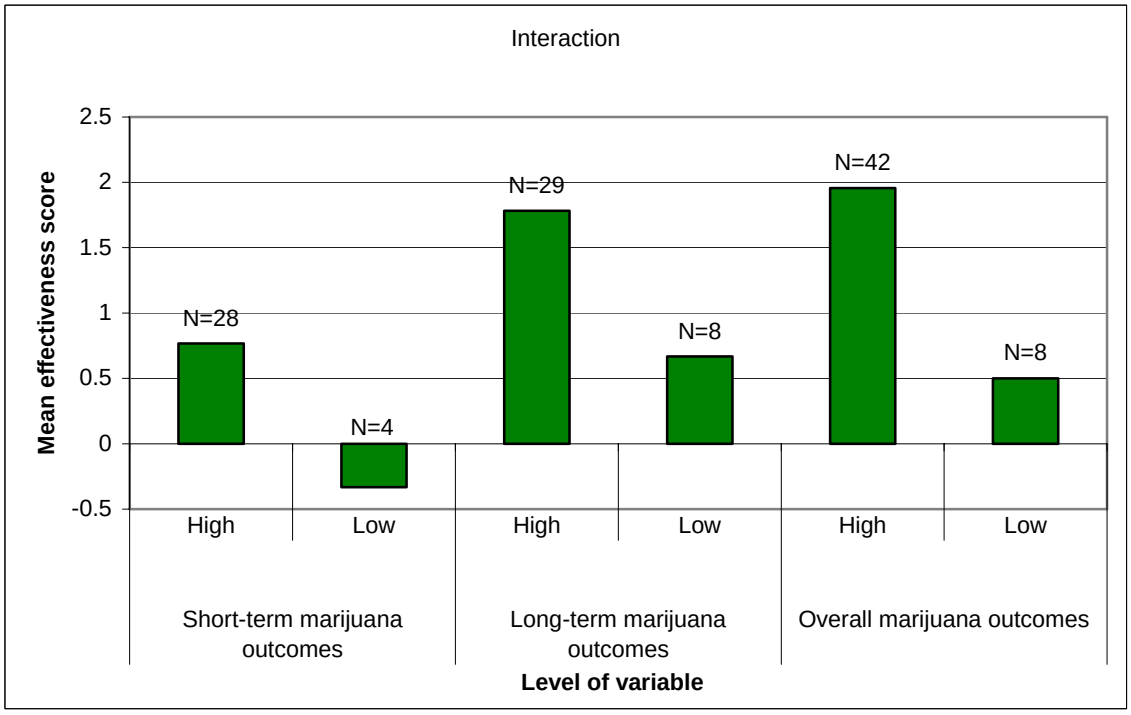


Figure 8: Impact of interaction on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

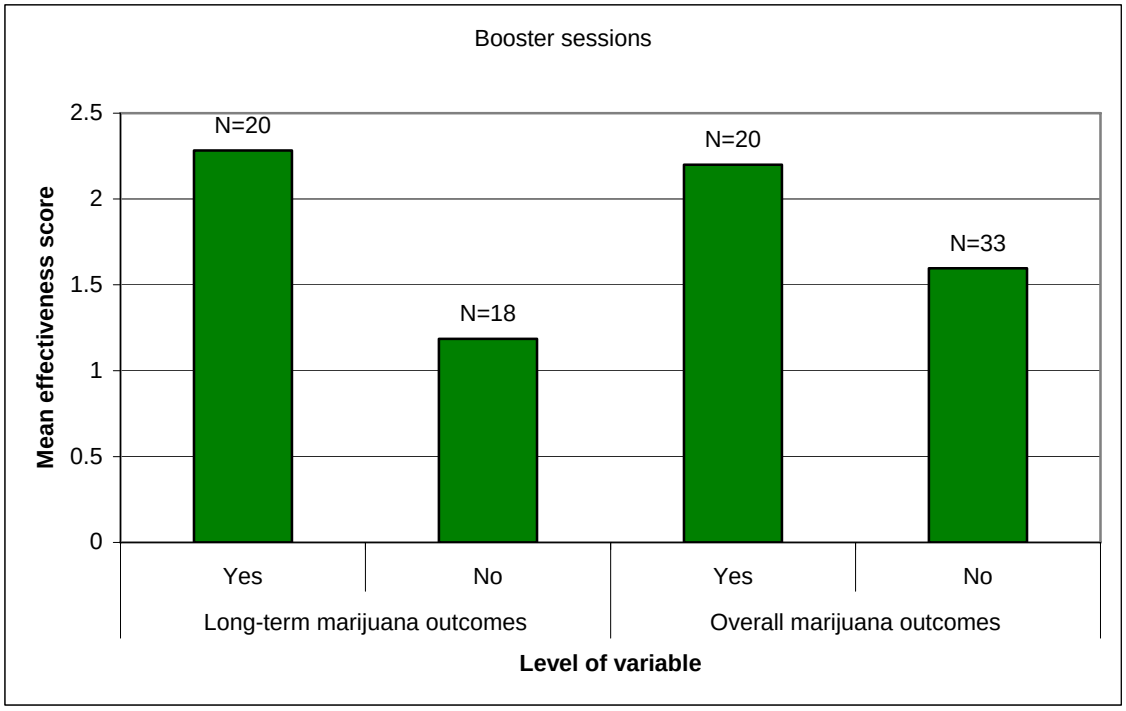


Figure 9: Impact of booster sessions on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

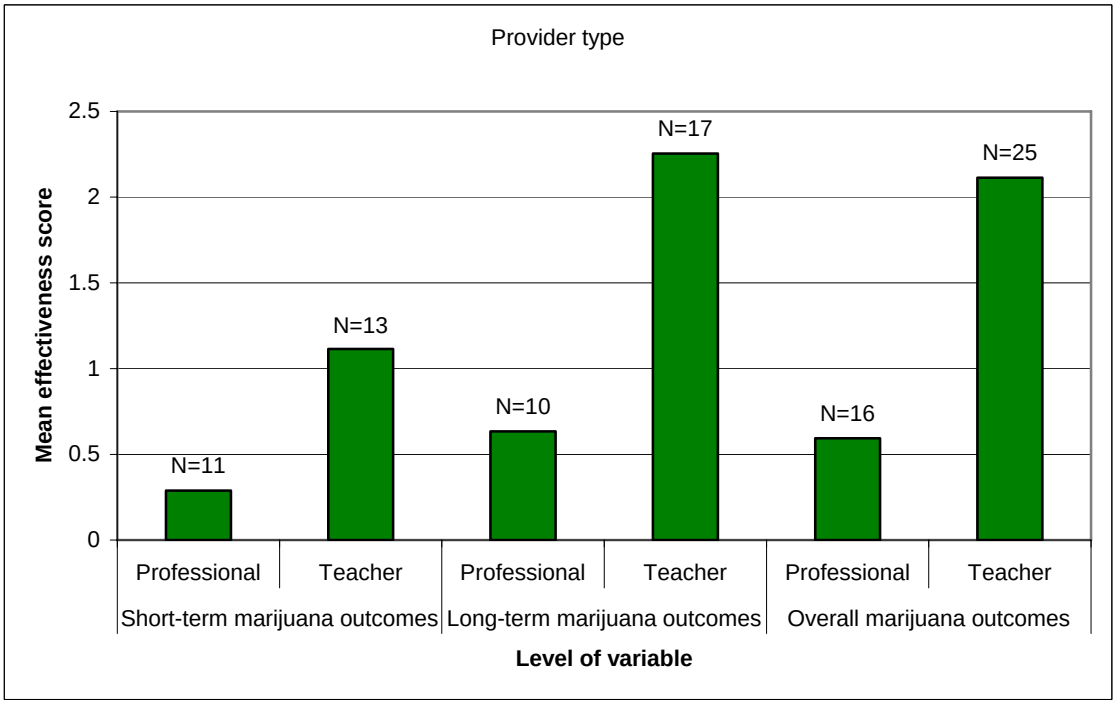


Figure 10: Impact of type of provider on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

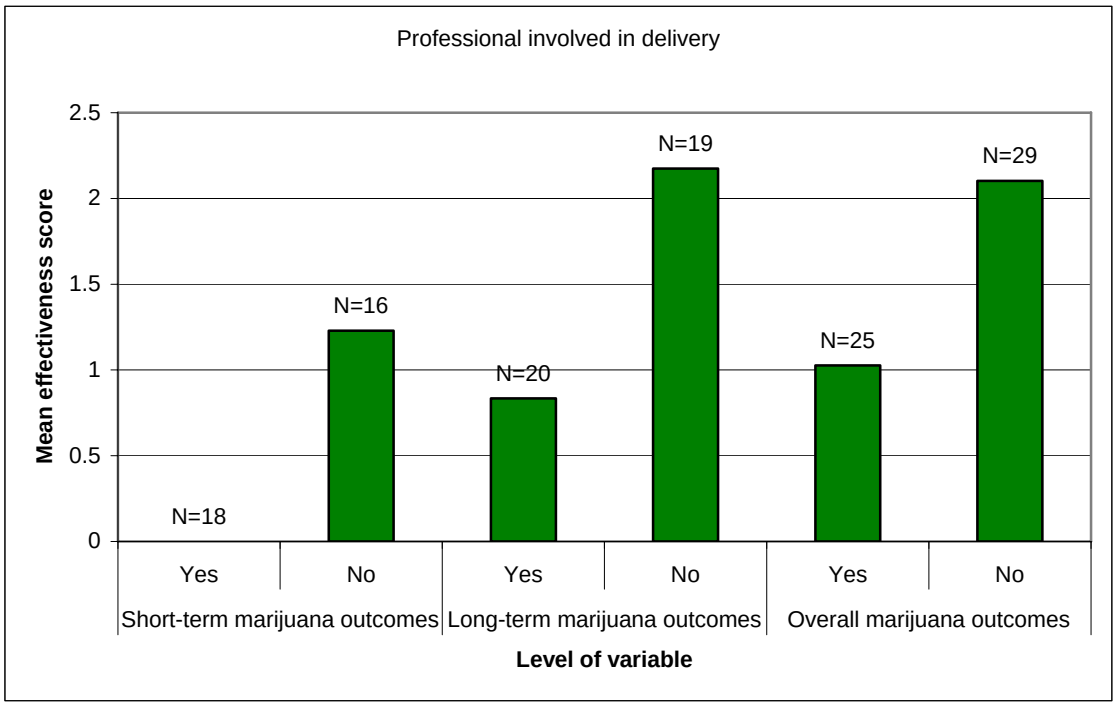


Figure 11: Impact of professional involvement in program delivery on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

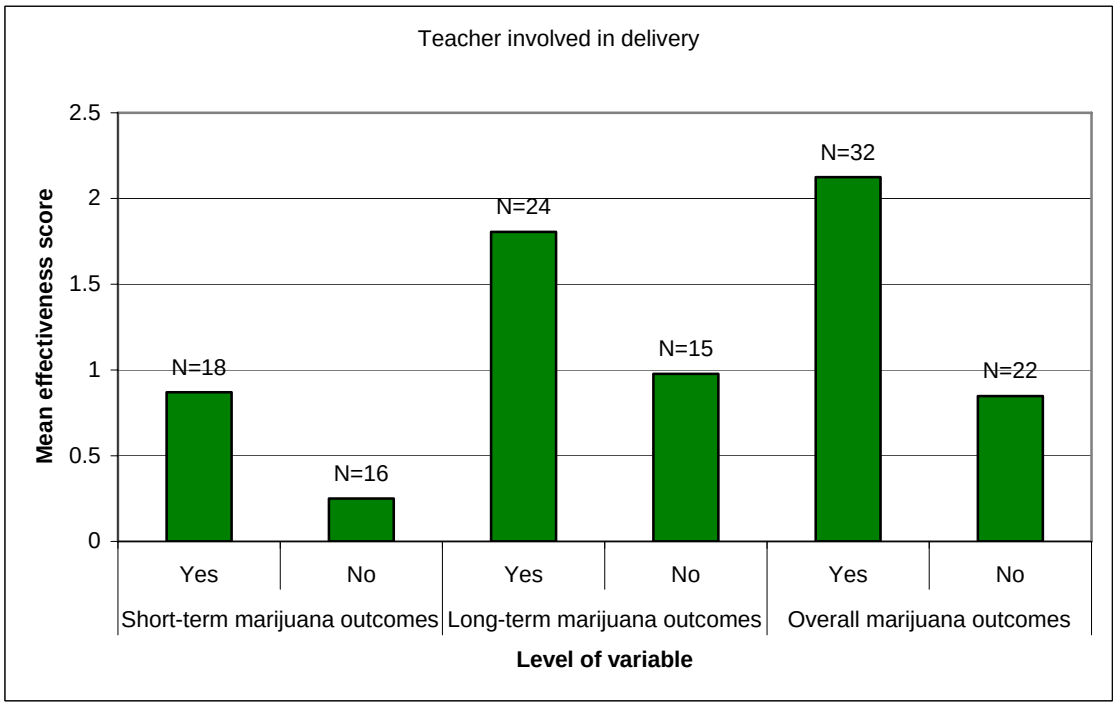


Figure 12: Impact of teacher involvement in program delivery on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

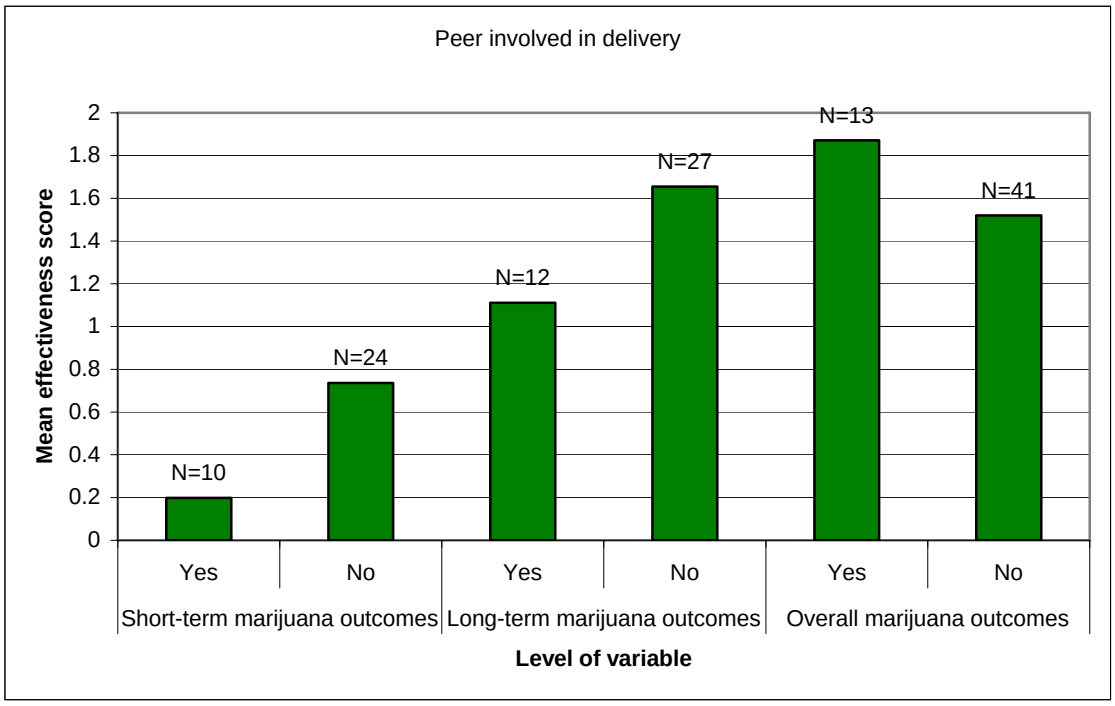


Figure 13: Impact of peer involvement in program delivery on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

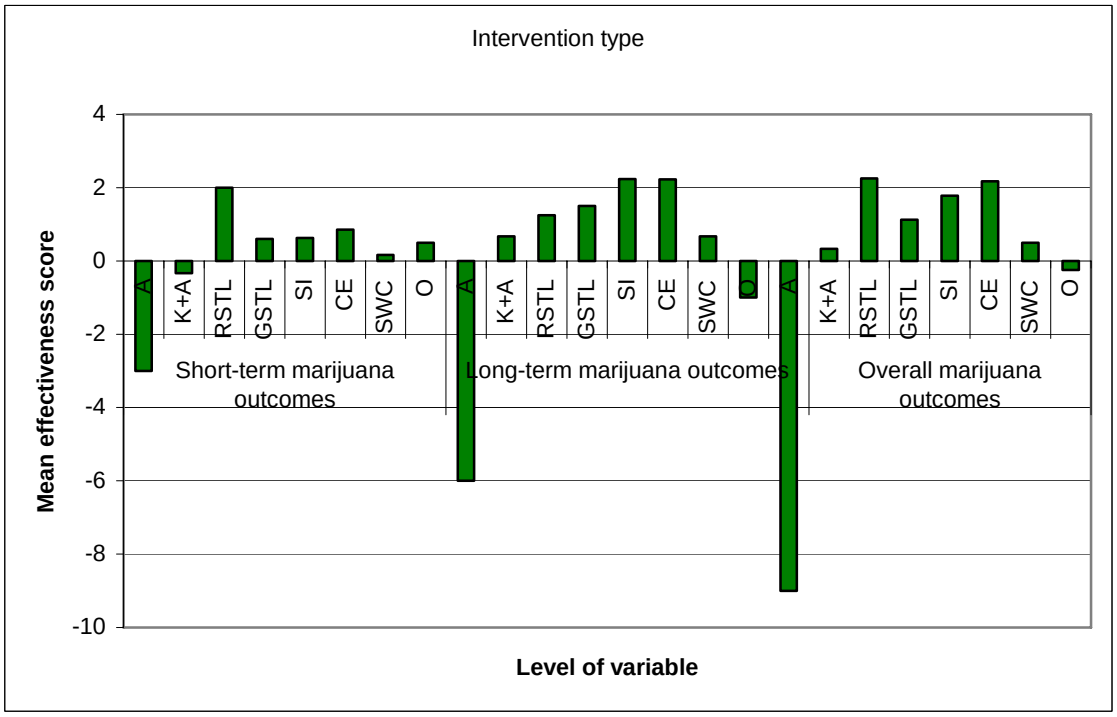


Figure 14: Impact of intervention approach on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

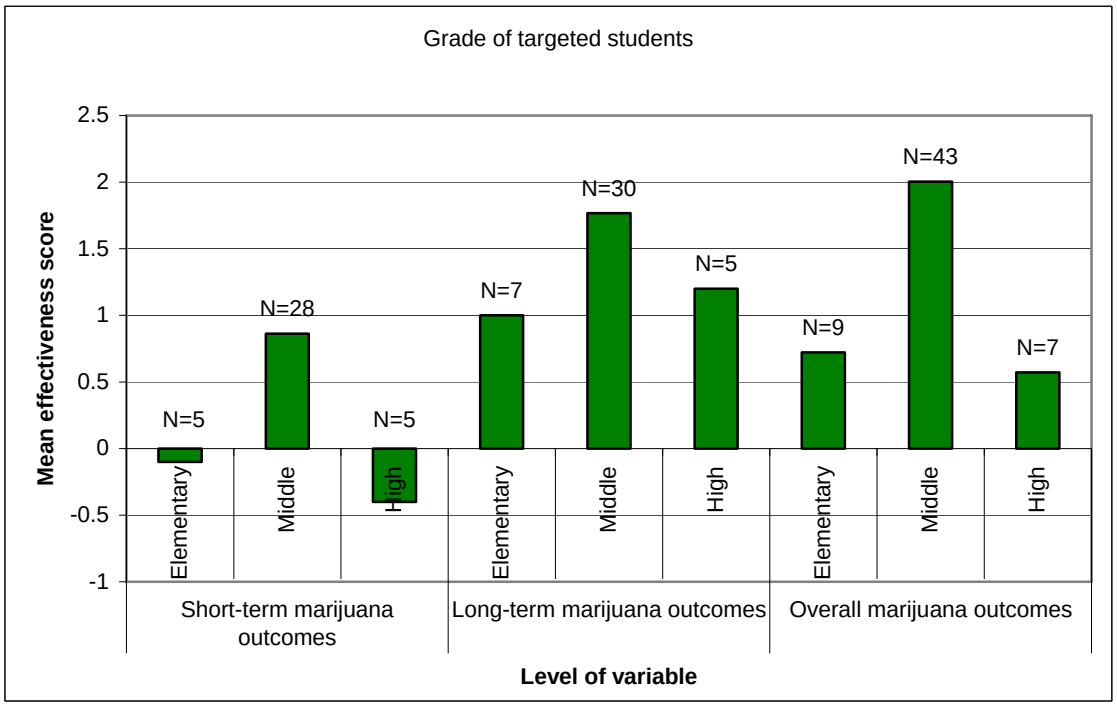


Figure 15: Impact of grade of targeted students on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

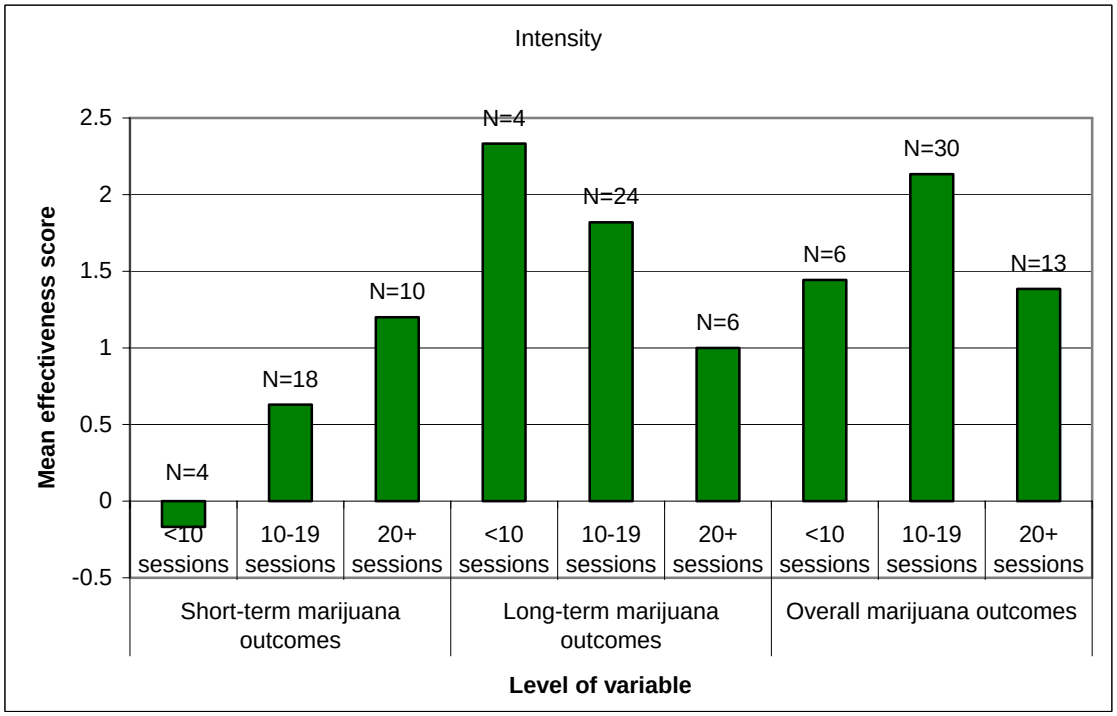


Figure 16: Impact of intensity (number of sessions) on mean effectiveness scores: descriptive results from the narrative review moderator analysis.

META-ANALYSIS

The meta-analytic approach

The results of all evaluations providing sufficient data for the calculation of an effect size were synthesised using meta-analytic techniques. Meta-analysis is a range of systematic, quantitative methods used to synthesise research findings from multiple studies investigating similar outcome variables. There are a number of stages in the meta-analytic process, including setting inclusion/exclusion criteria, study location and selection, data extraction, effect size calculation, effect size combination, examination of the heterogeneity of effect size distributions, and interpretation of the meta-analytic results. The key to meta-analysis is the calculation of an effect size. Calculating an effect size enables one to compare individual research findings using a common metric. An effect size is a parameter of the magnitude of the effect of a specific intervention independent of the sample size of the study, and allows for a combination and comparison of multiple individual research findings. It is the common metric that allows for studies with differing design and participant characteristics to be statistically compared. After the calculation of individual effect sizes for each individual outcome from each individual study, mean effect sizes are calculated that allow for inferences to be made regarding the overall effect of the intervention on the corresponding outcome variable, across studies (Lipsey & Wilson, 2001).

As stated, treatment-comparison contrast was the unit of analysis for both the quantitative narrative review and the meta-analysis in the current paper. In addition, the current systematic review has adopted an approach that somewhat violates the assumption of independence. Given the choice of unit of analysis a single study was able to contribute multiple effect sizes even if the samples employed by those studies were not completely independent. This violation of independence was restricted to instances where studies compared multiple independent treatment groups to a common comparison group (see Wilson, Gottfredson & Najaka, 2001). It is argued that valuable information can be attained by relaxing the assumption of independence, rather than attempting to collate findings from multiple treatment-comparison contrasts from a single study. Typically, to allow for a meta-analysis to be meaningful, there must be a sufficient number of studies (or in this case, treatment-comparison contrasts) testing the same general hypothesis, employing the same or highly similar designs, and measuring the same or similar outcome variables (Lipsey & Wilson, 2001). The current meta-analysis also conducted moderator analyses to assess the impact of variables that may have mediated program effectiveness.

All meta-analyses in the current paper were conducted adopting a random effects model approach to homogeneity. Nonetheless, all Q-statistics[26] from the four major meta-analyses conducted were extremely nonsignificant suggesting homogeneity of the treatment-comparison contrasts included in the analyses. The random effects model calculates variance considering both between study variance and within study variance, whereas the latter is used to compute variance under the fixed effects model. Thus, if there exists no between study variability the computations from the fixed and random effects models will not differ. The random effects model assumes *"the underlying true effects do vary from one another …[and] are assumed to be sampled from a normal distribution with a fixed mean and variance that are estimated from the data*" (Song, et al., 2001: 131).

26 The fixed effects model is chosen if it is assumed that the effect sizes from the individual studies are essentially obtained from the same population and thus only affected by within-study variability. The Q-statistic is then used to assess the appropriateness of that assumption. The Q-test is a chi-square test with k – 1 degrees of freedom investigating whether the observed variance between-studies is greater than that expected by chance. A significant Q-statistic suggests heterogeneity of studies.

The random effects model is a more conservative estimate of variance and thus, the confidence intervals computed using the random effects model are generally wider, and the *p*-value less likely to be significant. The random effect model was chosen for a number of reasons. It was purported that there did indeed exist random differences between the studies, and thus the fixed effects model would have underestimated the variance. Secondly, as stated, only a small number of effect sizes contributed to many of the analyses, and such instances are not dealt with well by the fixed effect model (Song, et al., 2001).

Calculation of intervention effects

Effect sizes were calculated for all studies with sufficient data. Cohen's *d*, also known as the standardised mean difference was the effect size of choice in the current meta-analysis. Effect sizes were computed from various forms of data including pretest-posttest means and standard deviations[27], *F*-values, *t*-values, pretest-posttest frequencies, and effect size and sample size data provided by retrieved evaluations (see Appendix B). A Microsoft Excel program was created that allowed for the effect size, variance, and confidence intervals to be calculated for individual treatment-comparison contrasts. SPSS for Windows version 12.0.1 was used to combine effect sizes and conduct moderator analyses (Wilson, personal communication). Given that the majority of moderator variables were categorical, ANOVA's were used to conduct the moderator analyses.

Creating comparable outcome variables

Separate meta-analyses were conducted for marijuana use outcomes, other illicit drug use outcomes (including cocaine/crack, heroin/opiates, stimulants, depressants, party drugs, hallucinogens, etc), and all drug use outcomes (combination of marijuana and other illicit drug use outcomes). Further, separate meta-analyses were conducted for short-term outcomes (posttest measurements less than one-year after completion of program) and long-term outcomes (posttest measurements one year or more after completion of the program). All analyses were run using a random effects model[28]. Thus a total of six meta-analyses were conducted, of which four will be considered in detail[29]. The total number of treatment-comparison contrasts that contributed to each of the meta-analyses is as such: short-term marijuana outcomes (N=9); long-term marijuana outcomes (N=9); short-term other illicit drug outcomes (N=2); long-term other illicit drug outcomes (N=2); short-term all drug outcomes (N=10); long-term all drug outcomes (N=9). Similar to the narrative review moderator analysis, there were serious problems with a lack of treatment-comparison contrasts allowing for sufficient power in the meta-analysis moderator analyses.

A total of 12 studies had sufficient data for calculation of one or more effect sizes. The 12 studies yielded 16 separate treatment-comparison contrasts. A total of 30 effect sizes were calculated across the 16 contrasts. Multiple effect sizes calculated from a single treatment-comparison contrast[30] were combined to calculate a mean effect size for the contrast, and this

27 Effect sizes calculated using this data were calculated with *p* being set at the less conservative .5 (see Appendix B for formula).
28 As stated, the justification of using a random effects model was twofold. First, between-study variation was assumed and the random-effects accommodates for such variance. Secondly, the meta-analyses included a relatively small number of studies and the fixed-effects model is known to be inappropriate in such instances.
29 Two meta-analyses assessed the short-term and long-term impact of school-based drug prevention programs on other illicit drug outcomes. In both of these meta-analyses, only two program evaluations contributed effect sizes, raising serious concerns regarding the validity of the findings, and negating the possibility of conducting moderator analyses. Thus, for these analyses the results are presented, with caution, and then no further discussion is entered into.
30 For example when there were multiple short- or long-term outcomes, multiple marijuana or other illicit drug outcomes, or multiple subsamples receiving the same level of treatment.

effect size was used in the subsequent meta-analyses. Table 2 below outlines the study and design characteristics of the evaluations included in the meta-analyses.

Table 2: Characteristics of the treatment-comparison contrasts included in the meta-analysis

Intervention Characteristics	*n* of program evaluations*	% of program evaluations
Implementation Date		
Pre-1990	6	37.5
1990-1994	3	18.8
1995-1999	3	18.8
2000-2005	2	12.5
Unclear	2	12.5
Intervention Type		
Affective education	0	0
Knowledge dissemination/Affective education	3	18.8
Resistance skills training limited	2	12.5
Generic skills training limited	4	25
Social influence	2	12.5
Competency enhancement	4	25
System-wide change	1	6.3
Other	0	0
Level of Intervention		
Universal	12	75
Selective	0	0
Indicated	3	18.8
Mix	1	6.3
Multifaceted		
Yes	6	37.5
Family	*3*	*18.8*
Community	*1*	*6.3*
Media	*0*	*0*
Mix	*2*	*12.5*
No	10	62.5
Interaction		
Extreme	6	37.5
Considerable	5	31.3
Minimal	5	31.3
Low	0	0
Unclear	0	0
Intensity		
6-9 sessions	1	6.3
10-19 sessions	9	56.3
20-29 sessions	4	25
30-39 sessions	0	0
40-49 sessions	0	0
50+ sessions	1	6.3
Not a curriculum-based program	1	6.3
Unclear	0	0
Booster Sessions		
Yes	6	37.5

No	9	56.3
Not a curriculum-based program	1	6.3
Type of Provider		
Professional	5	31.3
Health educator	*1*	*6.3*
Trained professional	*0*	*0*
Project staff	*4*	*25*
Police officer	*1*	*6.3*
Counsellor	*0*	*0*
Teacher	7	43.8
Older peer	1	6.3
Mix	1	6.3
Unclear	2	12.5
Peer involved in program delivery		
Yes	2	12.5
No	12	75
Unclear	2	12.5
Provider Training		
Specially trained	6	37.5
Considerable training	3	18.8
Minimal training	2	12.5
No training	0	0
Unclear	5	31.3
Sample Characteristics		
Student Grade Level		
Elementary school (grades K-5)	1	6.3
Middle school (grades 6-9)	12	75
High/secondary school (grades 10-12)	3	18.8
Male (%)		
≤50%	8	50
>50%	2	12.5
Unclear	6	37.5
White (%)		
≤10%	1	6.3
>10% - ≤25%	0	0
>25% - ≤50%	1	6.3
>50% - ≤75%	3	18.8
>75% - ≤90%	4	25
>90%	3	18.8
Unclear	4	25
Design Characteristics		
Implementation Fidelity		
High	6	37.5
Medium	1	6.3
Low	1	6.3
Unclear	8	50
Comparison Group Status		
No treatment	5	31.3
Standard care	9	56.3
Lower level of treatment	0	0
Mix	1	6.3
Unclear	1	6.3

* N studies = 12; N treatment-comparison contrasts = 16

Results of the meta-analyses

Tables 3-7 outline the effect sizes for each of the treatment-comparison contrasts[31], as well the combined effect sizes, and all corresponding 95% confidence intervals and *p*-values for the six meta-analyses conducted[32]. As can be seen there were a number of significant findings. Four of the six meta-analyses conducted produced significant mean effect sizes. Further, all analyses produced mean effect sizes in the desired direction, suggesting program effectiveness. The meta-analyses assessing the impact of school-based drug prevention programs on marijuana use, provided significant results both in the short-term (*d.* = .136, 95% CI = .035-.237, *p* = <.01) and the long-term (*d.* = .219, 95% CI = .071-.367, *p* = <.01). Similarly, the meta-analyses assessing the impact of school-based drug prevention programs on all drug use also provided significant results both in the short-term (*d.* = .141, 95% CI = .042-.24, *p* = <.01) and the long-term (*d.* = .208, 95% CI = .087-.329, *p* = <.001)[33].

In both the marijuana and all drug analyses, results suggest that school-based drug prevention programs not only have an immediate impact on use rates, but that this impact is also evident in the longer-term. Furthermore, this positive effect actually strengthens, as made evident by the larger and more significant mean effect sizes. Not surprisingly, the two meta-analyses that produced non-significant findings, short-term other illicit drug outcomes (*d.* = .237, 95% CI = -.208-.682, *ns*) and long-term other illicit drug outcomes (*d.* = .918, 95% CI = -.7 -2.536, *ns*), were those with only two treatment-comparison contrasts contributing to each meta-analysis.

31 The meta-analyses were conducted both with each of the treatment-comparison contrasts and with each study contributing only one effect size (effect sizes from multiple treatment-comparison contrasts combined). The inclusion/exclusion of these effect sizes had no significant impact on the overall findings of the meta-analyses. Thus, only the results of the former are discussed here.

32 Although a random effects model was chosen to analyse the meta-analytic data, Q-statistics were still calculated. Except in one meta-analysis (long-term, other illicit drug outcomes) all Q-statistics were highly non-significant, suggesting considerable homogeneity across the treatment-comparison contrasts included in each of the meta-analyses.

33 Obviously, the all drug use analyses were largely driven by the marijuana use analyses.

Table 3: Results of the meta-analyses

Meta-Analysis	k	d.	95% CI Lower	95% CI Upper	p
All drug outcomes (short-term)	10	0.1409	0.0421	0.2397	0.0052
All drug outcomes (long-term)	9	0.2079	0.0867	0.3291	0.0008
Marijuana outcomes (short-term)	9	0.1359	0.0346	0.2373	0.0086
Marijuana outcomes (long-term)	9	0.2192	0.0714	0.367	0.0037
Other illicit drug outcomes (short-term)	2	0.2372	-0.2076	0.6819	0.2959
Other illicit drug outcomes (long-term)	2	0.918	-0.6999	2.5359	0.2661

Table 4: Effect sizes of the treatment-comparison contrasts on short-term marijuana outcomes

Study	Group Comparison	Effect size (d)	Lower 95% CI*	Upper 95% CI*	p-value*
Forman, et al. (1990)	School vs control	0.0111325	-0.354102637	0.376367637	ns
Forman, et al. (1990)	School + Parent vs Control	-0.0928217	-0.65861961	0.47297621	ns
Forman, et al. (1990)	School + Parent (absent) vs Control	-0.0686527	-0.538599768	0.401294368	ns
Shope, et al. (1996)	Experimental vs control	0.3891003	-0.686451814	1.464652414	ns
Hansen & Dusenbury (2004)	Core vs control	0.054	-0.16515	0.273147	ns
Hansen & Dusenbury (2004)	Plus vs control	0.194	0.002667	0.385333	<.05
Moberg & Piper (1990)	Experimental vs control	0.165714225	-0.19635548	0.527783929	ns
Aseltine, et al. (2000)	School + Mentor vs control	0.026570203	-0.141209099	0.194349505	ns
Aseltine, et al. (2000)	School only vs control	0.223929028	0.026157193	0.421700862	<.05

Table 5: Effect sizes of the treatment-comparison contrasts on long-term marijuana outcomes

Study	Group Comparison	Effect size (d)	Lower 95% CI*	Upper 95% CI*	p-value*
Forman, et al. (1990)	School vs control	0.078663	-0.736921251	0.894247251	ns
Forman, et al. (1990)	School + Parent vs Control	-0.0975004	-1.220734421	1.025733621	ns
Forman, et al. (1990)	School + Parent (absent) vs Control	0.1089388	-0.722069395	0.939946995	ns
Scheier, et al. (2001)	Experimental vs control	0.059711511	-0.915164336	1.034587358	ns
Botvin, et al. (2001)	LST vs control	0.2435004	-1.962993281	2.449994081	ns
Eischens, et al. (2004)	Experimental vs control	0.0973056	-1.306934192	1.501545392	ns
Zavela, et al. (2004)	Experimental vs control	0.22	-0.02962	0.469621	ns
Botvin, et al. (2000)	Experimental vs control	0.229852	0.023847	0.435858	<.05
Dent, et al. (2001)	Experimental vs control	0.477171	-0.30247	1.25681	ns

Table 6: Effect sizes of the treatment-comparison contrasts on short-term all drug outcomes.

Study	Group Comparison	Effect size (d)	Lower 95% CI*	Upper 95% CI*	p-value*
Forman, et al. (1990)	School vs control	0.0111325	-0.354102637	0.376367637	ns
Forman, et al. (1990)	School + Parent vs Control	-0.0928217	-0.65861961	0.47297621	ns
Forman, et al. (1990)	School + Parent (absent) vs Control	-0.0686527	-0.538599768	0.401294368	ns
Kim, et al. (1993)	Experimental vs Control	0.3822424	-0.447890862	1.212375662	ns
Shope, et al. (1996)	Experimental vs control	0.219441941	-0.402026856	0.840910738	ns
Hansen & Dusenbury (2004)	Core vs control	0.054	-0.16515	0.273147	ns
Hansen & Dusenbury (2004)	Plus vs control	0.194	0.002667	0.385333	<.05
Moberg & Piper (1990)	Experimental vs control	0.165714225	-0.19635548	0.527783929	ns
Aseltine, et al. (2000)	School + Mentor vs control	0.026570203	-0.141209099	0.194349505	ns
Aseltine, et al. (2000)	School only vs control	0.223929028	0.026157193	0.421700862	<.05

Table 7: Effect sizes of the treatment-comparison contrasts on long-term all drug outcomes.

Study	Group Comparison	Effect size (d)	Lower 95% CI*	Upper 95% CI*	p-value*
Forman, et al. (1990)	School vs control	0.078663	-0.736921251	0.894247251	ns
Forman, et al. (1990)	School + Parent vs Control	-0.0975004	-1.220734421	1.025733621	ns
Forman, et al. (1990)	School + Parent (absent) vs Control	0.1089388	-0.722069395	0.939946995	ns
Scheier, et al. (2001)	Experimental vs control	0.059711511	-0.915164336	1.034587358	ns
Botvin, et al. (2001)	LST vs control	0.2435004	-1.962993281	2.449994081	ns
Eischens, et al. (2004)	Experimental vs control	0.0973056	-1.306934192	1.501545392	ns
Zavela, et al. (2004)	Experimental vs control	0.22	-0.02962	0.469621	ns
Botvin, et al. (2000)	Experimental vs control	0.169662865	0.077672062	0.261653667	<.01
Dent, et al. (2001)	Experimental vs control	1.039633044	0.446799839	1.632466249	<.01

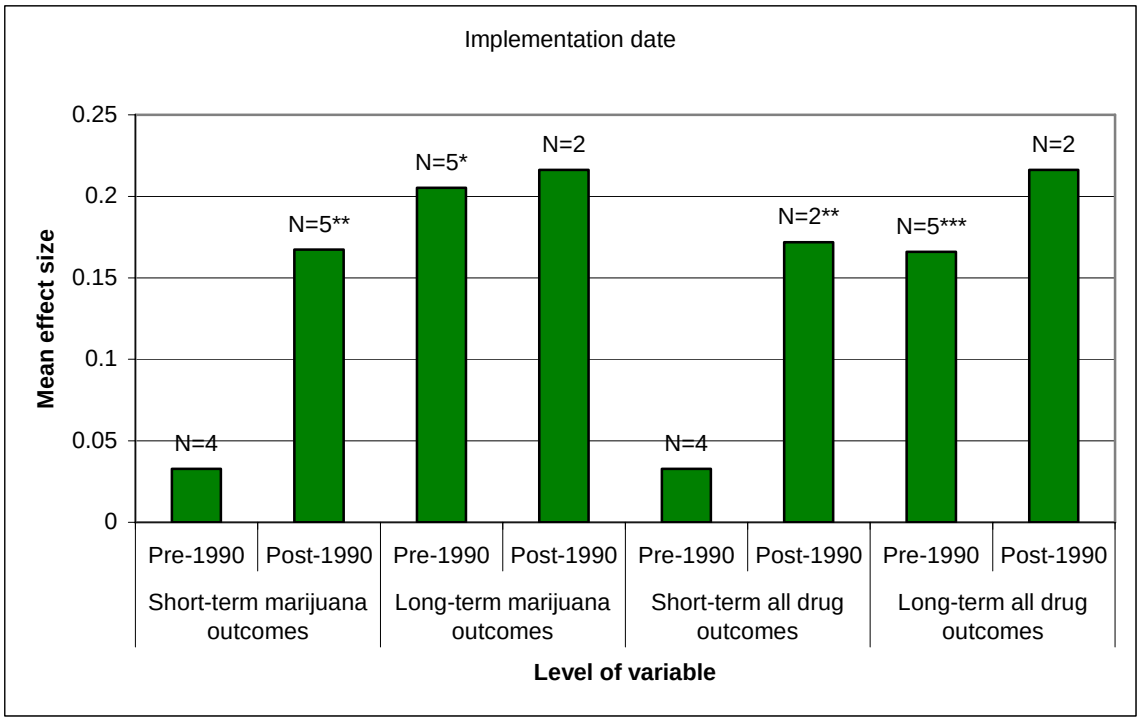
Results of the meta-analysis moderator analyses

The moderator analyses conducted on the meta-analytic data were severely limited by the limited number of studies included in the meta-analysis which failed to allow for sufficient power. Indeed, there were no significant moderator effects. Thus, little can be reliably concluded from these analyses. However, the lack of significant results does not necessarily suggest the absence of any moderator effects. Instead, given the limited number of studies included in the contrasts made in our analyses, there may simply not have had enough power to identify the effect of moderator variables on the effectiveness of the evaluated programs. Accordingly, the reader is directed to the results of the narrative review moderator analysis to gain a better understanding of the effects of various moderator variables on program success.

As with the narrative review moderator analysis the lack of statistically significant results evident in the meta-analysis moderator analysis must not cause us to throw the baby out with the bathwater in haste. When attempting to interpret the trends in the descriptive results of the meta-analysis moderator analysis it is more important to consider the significance of the mean effect sizes rather than simply the magnitude. Given the limited number of studies included in the analyses it is possible that differences in the variability of the individual effect sizes may have adversely impacted the results of the moderator analysis. For example, imagine a comparison of the mean effect sizes of two levels of a moderator variable. While the mean effect size for the first level of the variable may be greater, the corresponding variance may be such that this mean effect size is nonsignificant. Conversely, the smaller mean effect size may have less variance and be significant. Thus, the latter level of the moderator variable would be indicative of greater program effectiveness.

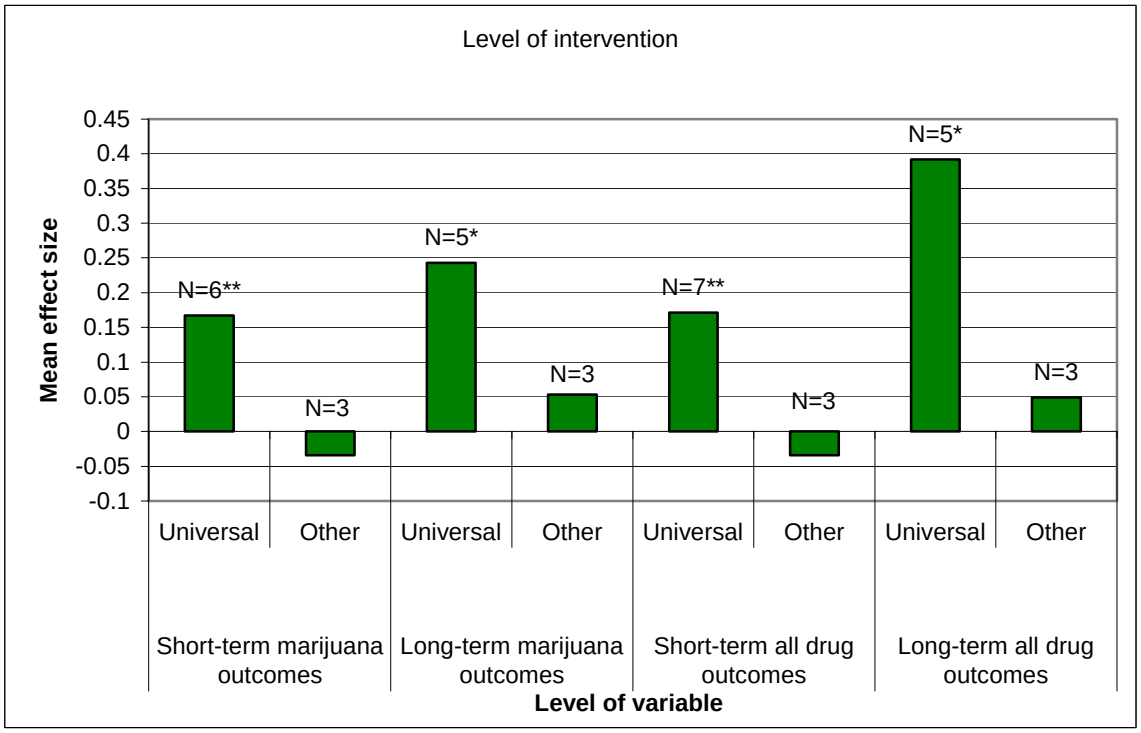
Figures 17 through 25, inclusive, outline the results of the descriptive result analyses of the meta-analysis moderator analysis. In these analyses, z-tests assessed the effect of each individual level of each of the moderator variables on the outcome variables. While the standard meta-analysis moderator analysis found no significant differences between levels of any of the moderator variables, it is important to investigate the effect of each level of the moderator variables separately. For example, while the meta-analysis moderator analysis found no significant differences between programs that had high or low interaction, it is interesting to note that those programs with high interaction had significant effects on outcome variables whereas those with low interaction did not have significant effects on outcome variables. In short, while the moderator analysis revealed that the impact of programs with high and low levels of interaction did not differ significant from one another, the analysis of the descriptive results reveals that programs with high levels of interaction had significant impacts on a number of illicit drug use outcomes, whereas programs with low levels of interaction did not have any such significant effects. Thus, the descriptive analysis analyses the impact of each level of the moderator variables on the outcome to assess significance of effects, whereas the moderator analysis analysed whether the differing levels of the moderator variables were significantly different from each other.

When analysing the descriptive results of the meta-analysis moderator analysis this way, a number of consistent trends can be observed that help to identify potential moderator effects (see Figures 17 to 25). Interpreting the differences in mean effect sizes across the various intervention approaches is again somewhat spurious given the very limited number of studies included under some of the approaches. The only consistent trend is the effectiveness of competency enhancement programs, with this approach having a significant impact on illicit drug use outcomes.



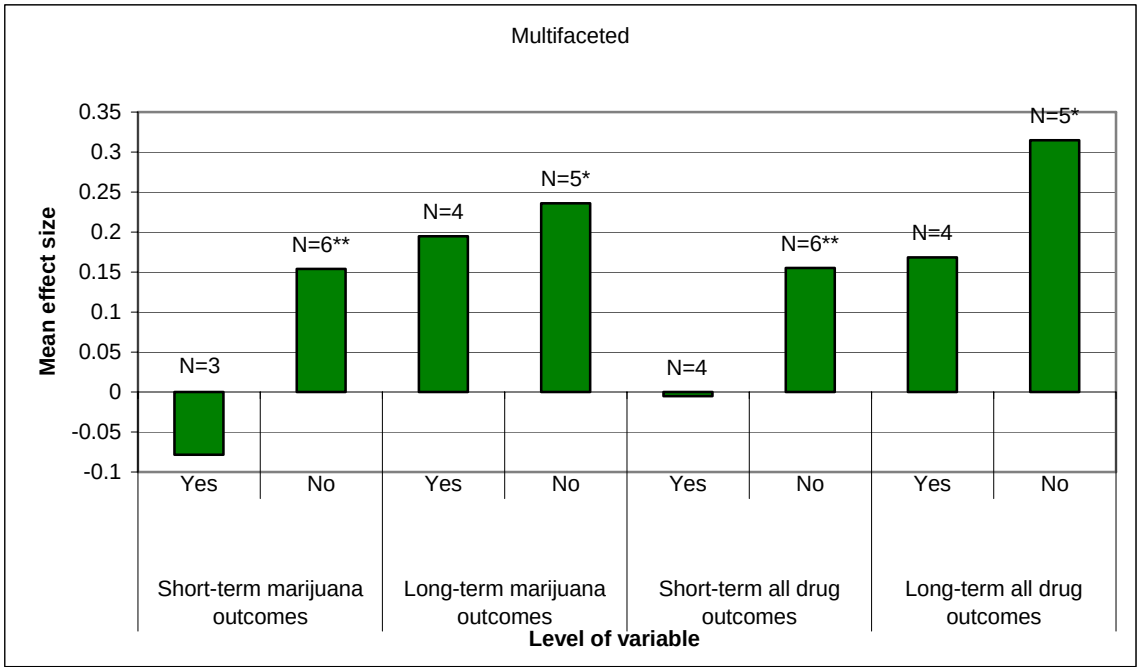
* p<.05, ** p<.01, *** p<.001

Figure 17: Impact of implementation date on mean effect sizes: descriptive results from the meta-analysis moderator analysis.



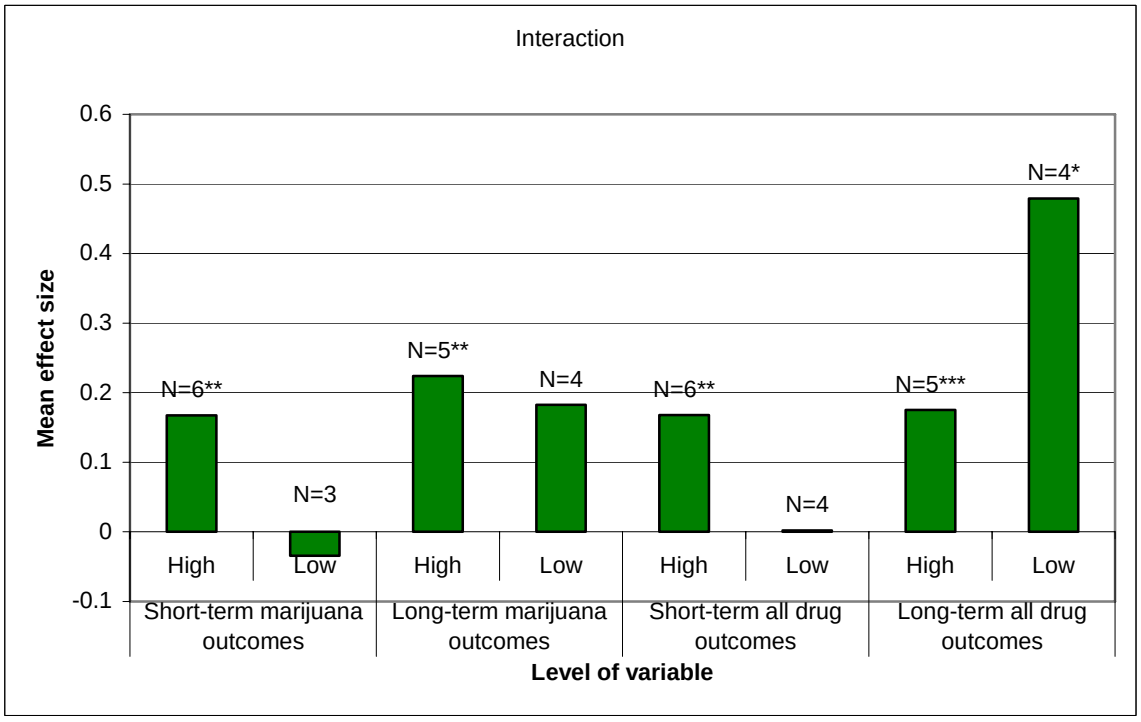
* p<.05, ** p<.01, *** p<.001

Figure 18: Impact of level of intervention on mean effect sizes: descriptive results from the meta-analysis moderator analysis.



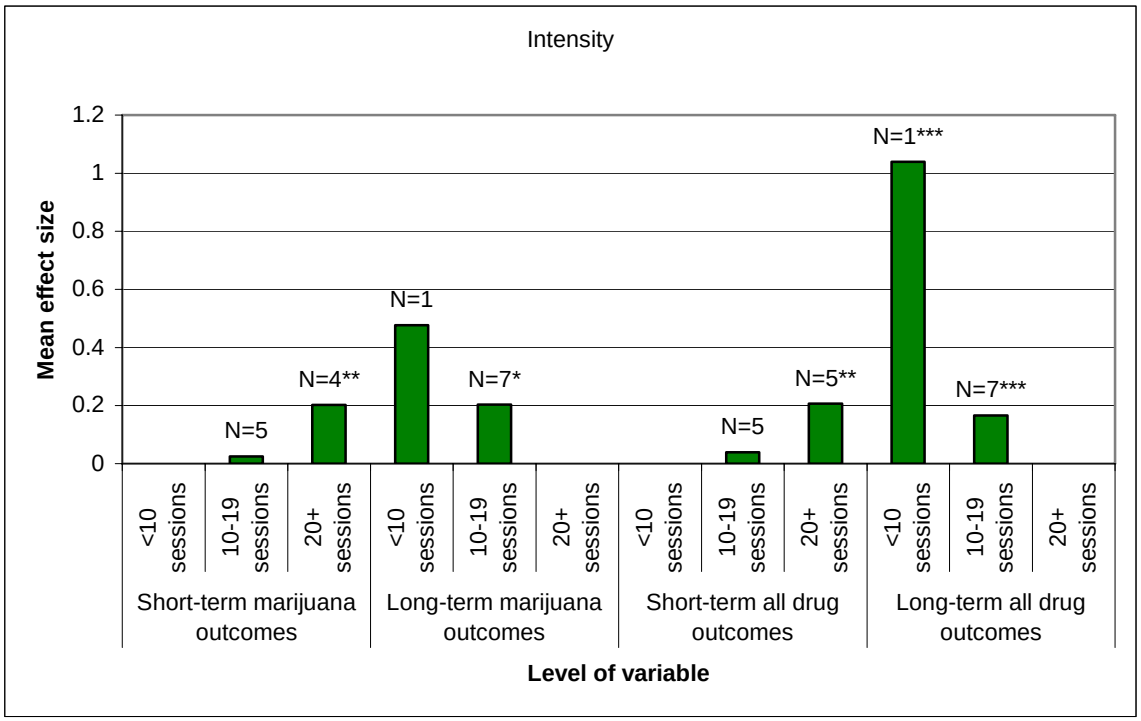
* p<.05, ** p<.01, *** p<.001

Figure 19: Impact of multifaceted nature of the program on mean effect sizes: descriptive results from the meta-analysis moderator analysis.



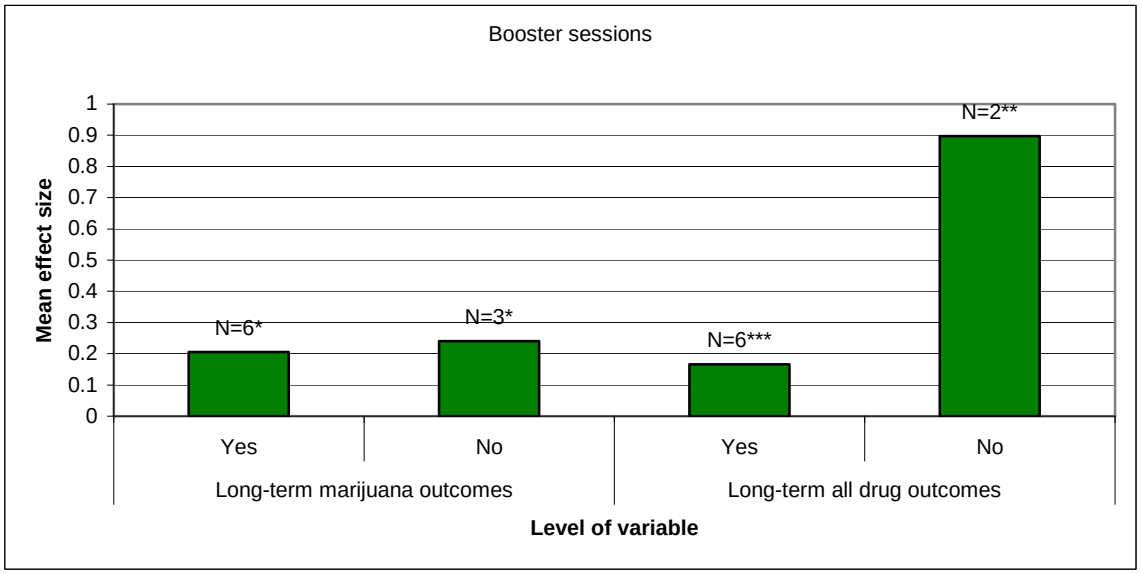
* p<.05, ** p<.01, *** p<.001

Figure 20: Impact of interaction on mean effect sizes: descriptive results from the meta-analysis moderator analysis.



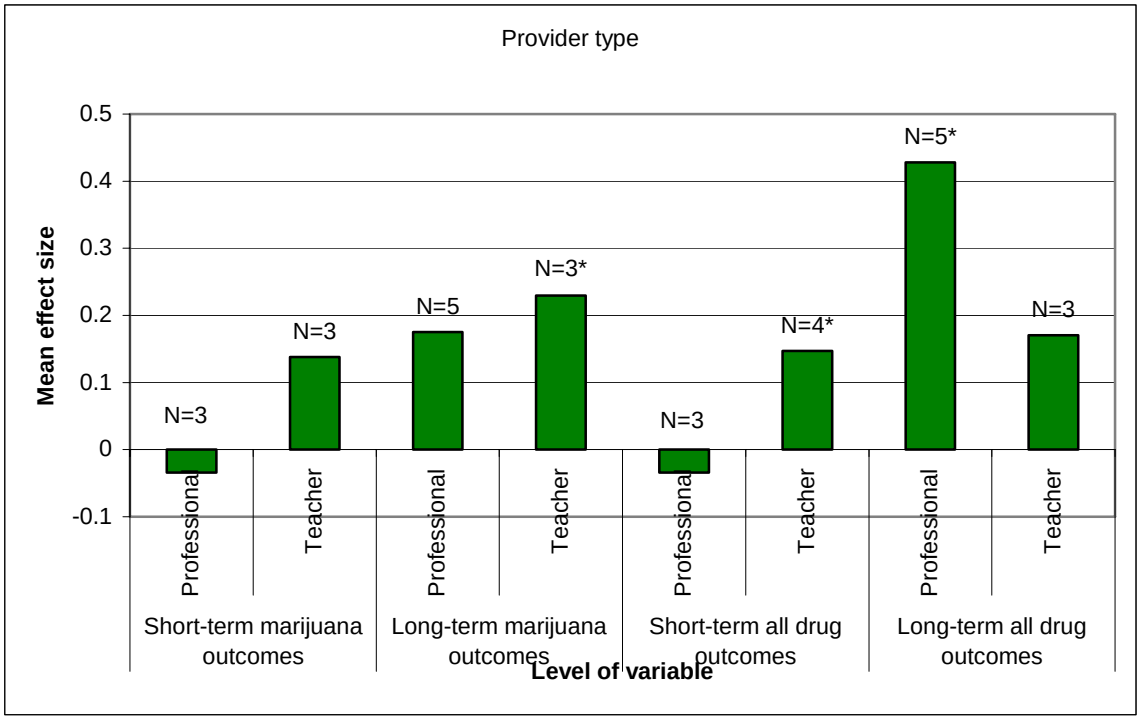
* p<.05, ** p<.01, *** p<.001

Figure 21: Impact of intensity (number of sessions) on mean effect sizes: descriptive results from the meta-analysis moderator analysis.



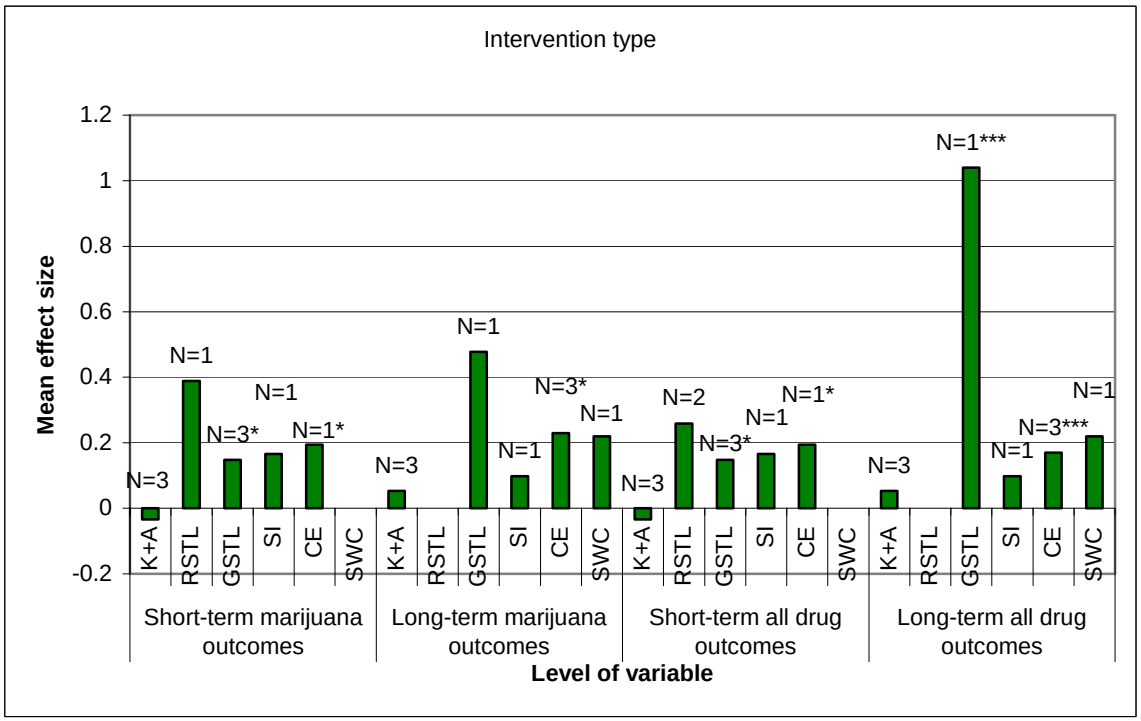
* p<.05, ** p<.01, *** p<.001

Figure 22: Impact of booster sessions on mean effect sizes: descriptive results from the meta-analysis moderator analysis.



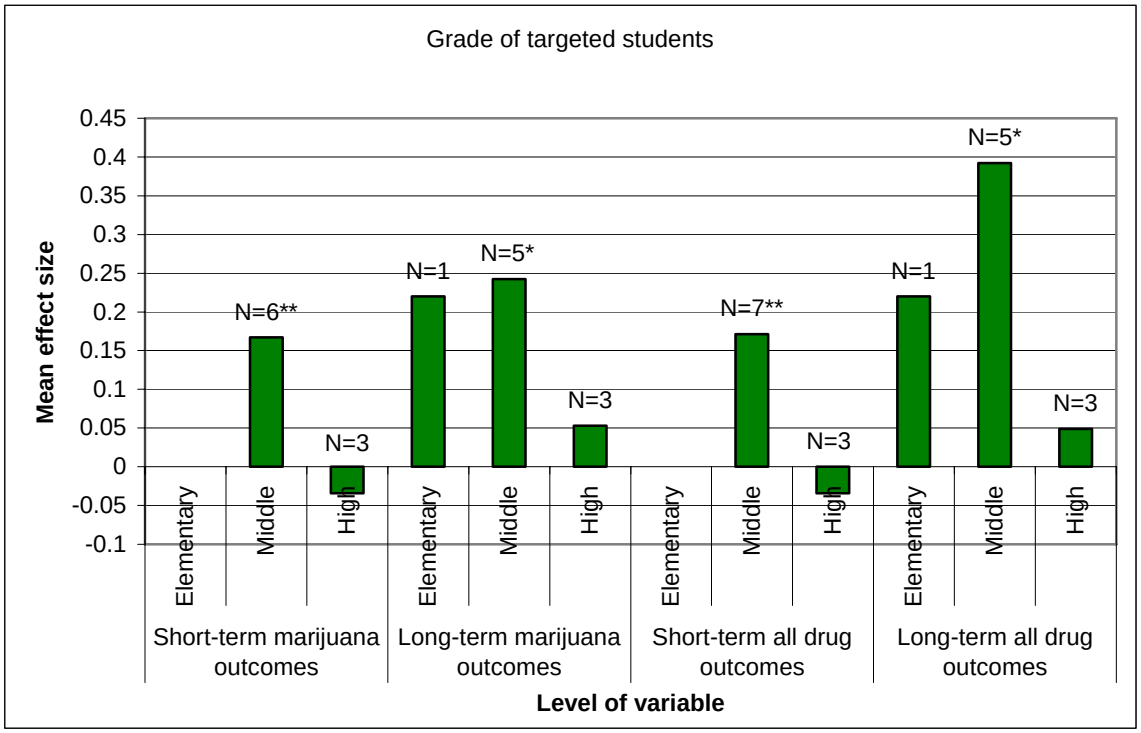
* p<.05, ** p<.01, *** p<.001

Figure 23: Impact of type of provider on mean effect sizes: descriptive results from the meta-analysis moderator analysis.



* p<.05, ** p<.01, *** p<.001

Figure 24: Impact of intervention approach on mean effect sizes: descriptive results from the meta-analysis moderator analysis.



* p<.05, ** p<.01, *** p<.001

Figure 25: Impact of grade of targeted students on mean effect sizes: descriptive results from the meta-analysis moderator analysis

Typically, greater mean effect sizes were observed for programs with higher levels of interaction, and in all cases programs with high interaction reported significant mean effect sizes. Similarly, universal programs and programs implemented in the middle school generally had greater and more significant mean effect sizes. While programs with a greater number of sessions did not always report greater mean effect sizes, more intensive programs showed more significant impacts than shorter programs. The effect of implementation date was interesting, with programs conducted after 1990 reporting significant effects on short-term outcomes, and programs implemented prior to 1990 reporting significant effects on long-term outcomes. This finding probably reflects design issues and the fact that programs implemented prior to 1990 have been more readily able to investigate the long-term impact of the programs.

Contrary to hypotheses, adding booster sessions to a program failed to show evidence of increasing program effectiveness, with programs showing significant signs of effectiveness irrespective of the implementation of booster sessions. It also appears that multifaceted programs have negative effects on program effectiveness. From the limited information available it appeared that teachers are slightly more effective program providers than professionals.

DISCUSSION AND CONCLUSIONS

Integrating the findings

Collating the findings from the narrative review and meta-analysis is problematic given the stated limitations. Nonetheless, a number of conclusions can be reached. From the narrative review a number of approaches appear effective including social influence and competency enhancement, with mixed results of resistance skills training limited, generic skills training limited, and system-wide change approaches. Less promising or negative findings were observed for affective education, knowledge dissemination and affective education, and other interventions. A limited number of moderator effects were found across the analysed studies. Most consistent was the finding that multifaceted components did little to improve the effectiveness of a school-based drug prevention program, however there were exceptions. There was some minimal evidence suggesting increased effectiveness of programs involving peers and programs involving booster sessions. Further, a number of programs have shown to have a greater impact on low-risk students; however this finding could reflect the predominance of universal programs in the studies reviewed.

The meta-analysis revealed a number of significant findings. Specifically, school-based drug prevention programs were found to have significant positive impacts on marijuana use, both in the short-term ($d.$ = .136, 95% CI = .035-.237, p = <.01) and the long-term ($d.$ = .219, 95% CI = .071-.367, p = <.01). Similarly, the analyses revealed a significant positive impact of school-based drug prevention programs on all drug use at both the short-term ($d.$ = .141, 95% CI = .042-.24, p = <.01) and long-term ($d.$ = .208, 95% CI = .087-.329, p = <.001)[34].

Both the narrative review and meta-analysis moderator analyses were heavily restricted by the limited number of included treatment-comparison contrasts and the subsequent lack of statistical power. Overall, there were very few significant findings recorded from either of the moderator analyses. The only tentative conclusion that can be reached from the statistical analyses was the finding that professionals appear to be relatively ineffective program providers compared to other providers such as teachers. There was no evidence to suggest other moderator effects regarding variables such as interactivity, the developmental stage of program implementation, the multifaceted nature of programs, intensity of programs, inclusion of booster sessions, or peer involvement. The lack of significant findings does not necessarily suggest the absence of any moderator effects however. Given the limited number of studies included in any of the moderator analyses, it was not possible to reach adequate levels of power. It is likely that a number of these variables do indeed significantly impact program effectiveness and that with more research these moderating effects could be teased out.

Given the limited number of studies included in the analyses and the subsequent lack of adequate power the descriptive analyses of both the narrative review and meta-analysis moderator analyses are important. These descriptive results provide additional information regarding the impact of moderator variables and help to tease out a number of trends that, while not reaching statistical significance, are perhaps of practical significance. Specifically, these findings suggest greater effectiveness of more interactive, universal programs, implemented during the middle school years, by teachers rather than professionals. In addition, program effectiveness appears to be somewhat related to a greater number of sessions, and there was some evidence supporting the effectiveness of booster sessions. Further, consistent with the finding that more interactive

34 Obviously, all the drug use analyses were largely driven by the marijuana use analyses.

programs are associated with greater levels of effectiveness, intervention approaches adopting such philosophies, such as social influence and competency enhancement, appear to be more effective. Contrary to hypotheses, multifaceted programs appeared to have a negative impact on program effectiveness and peer involvement did not appear to be associated with greater program effectiveness.

Policy implications & recommendations for further research

The current review adds to the plethora of evaluative research that has been conducted previously regarding the effectiveness of school-based drug prevention programs in addressing licit drug use. It uniquely identifies and documents the impact of school-based prevention on *illicit* drug outcomes. The meta-analysis found a significant positive impact of school-based drug prevention programs on both marijuana use and all illicit drug use, both in the short-term and long-term. Indeed, the effect actually strengthened over time.

While the meta-analysis moderator analysis revealed no significant results a number of trends were found in an analysis of the descriptive results that have practical significance. Specifically, consistent with prior research interactive programs adopting either a social influence or competency enhancement philosophy appear to be the most effective approaches to school-based drug prevention. In addition, programs appear to be most effectively implemented during the middle school years when experimentation with illicit drugs is most prominent, and more intensive programs involving booster sessions appear to increase program effectiveness.

However, this review does little to rectify the debate regarding the most appropriate program provider or the additional effectiveness offered contingent upon the inclusion of multifaceted program components. What is exceptionally clear is the increased need for researchers to investigate program effectiveness in relation to illicit drugs. Indeed, the majority of school-based drug prevention program outcome evaluations fail to address such effects, and when such effects are examined the investigation is typically limited to marijuana use.

LIMITATIONS OF THE REVIEW

Undoubtedly, there are a number of limitations to the current review. Firstly, our meta-analysis does not review the effectiveness of the whole population of school-based drug prevention programs aimed, at least in part, at reducing illicit drug use. Rather, it assesses a subset of programs that meet the following stringent criteria: (1) have been evaluated; (2) have investigated the impact of the program on an illicit drug outcome, and; (3) have been published post-1990 in a journal. That is, a plethora of school-based drug prevention programs exist whose effectiveness has not been investigated. Also, many of those that have been evaluated have not, for the intuitive reasons explained earlier, examined the impact of the program on illicit drug use. Furthermore, the inclusion of program evaluations to the meta-analysis was further restricted to studies with sufficient data from which to calculate an effect size.

Secondly, a major limitation of restricting a review of school-based drug prevention programs to studies assessing the impact of such interventions on illicit drug use is the fact that base rates of illicit drug use are often low at the time that such programs are implemented. That is, as can be seen in Table 1 the vast majority of programs reviewed in the current systematic review were implemented during the middle school years when adolescent experimentation with illicit drugs is typically just beginning. Thus, rates of illicit drug use are generally extremely low making identifying changes in this behaviour very difficult.

These limitations served to restrict the number of eligible studies included in the review, and subsequently the number of treatment-comparison contrasts that contributed to the analyses conducted. As has been stated a number of times during the review, both the narrative review and meta-analysis results are required to be received with extreme caution. In the majority of cases, the number of treatment-comparison contrasts included in any analysis was extremely small and insufficient to obtain an appropriate level of statistical power. This fact places serious concerns on the results of both the quantitative component of the narrative review and meta-analysis.

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* Included in the meta-analysis.

APPENDIX A: SYNOPSIS TABLES

Table 8: Summary of school based drug education research: author/s and publication year, project name, country and year of implementation, nature of intervention, level of prevention, multifaceted nature of program, grade level of targeted students, number of sessions and booster sessions, level of interaction, provider type and training, implementation fidelity, and type of control group.

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Affective Education Interventions											
Hansen, Johnson, Flay, Graham & Sobel (1988)	Project SMART (Self-Management And Resistance Training) - Los Angeles, USA	1982-1983	Affective	Universal	No	7th	12 sessions	Considerable	Teacher - considerable training; professional (health educator) - specially trained; older age peer - supervised	Unclear	No treatment
Knowledge Dissemination Plus Affective Education Interventions											
Forman, Linney & Brondino (1990)	Coping Skills School Intervention Plus Parent Intervention - South-eastern USA	Pre-1990	K+A	Indicated	Family component	Secondary school	10 sessions - 2 booster sessions (year later)	Minimal	Professional (project staff) - specially trained	High	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Resistance Skills Training Limited Interventions											
Hurry, Lloyd & McGurk (2000)	Project Charlie - Hackney, England, UK	1991-1993	RSTL	Universal	No	Primary school - students aged 9-10	Unclear - weekly lessons for entire academic year	Considerable	Unclear	Unclear	Unclear
Shope, Copeland, Kamp & Lang (1998)	Unnamed - Michigan, USA	1993	RSTL	Universal	No	6th-7th	15 sessions	Considerable	Teacher - considerable training	High	Lower level of treatment or no treatment
Shope, Copeland, Marcoux & Kamp (1996)	Unnamed - Michigan, USA	1993	RSTL	Universal	No	6th-7th	15 sessions	Considerable	Teacher - considerable training	High	Lower level of treatment or no treatment
Stevens, Freeman, Mott & Youells (1996)	Here's Looking at You (HLAY) 2000 (with parent and community components) - New England, New Hampshire, USA	1987-1988	RSTL	Universal	Family & community components	4th-6th	Unclear	Unclear	Teacher - considerable training	Unclear	Unclear
Stevens, Freeman, Mott & Youells (1996)	Here's Looking at You (HLAY) 2000 - New England, New Hampshire, USA	1987-1988	RSTL	Universal	No	4th-6th	Unclear	Unclear	Teacher - considerable training	Unclear	Unclear

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Kim, McLeod & Shantzis (1993)	Here's Looking at You (HLAY) 2000 - Yadkin County, North Carolina, USA	1990-91	RSTL	Universal	Family component	7th-8th	28 sessions	Minimal	Teacher - unclear	Unclear	Unclear
Graham, Johnson, Hansen, Flay & Gee (1990)	Project SMART (Self-Management And Resistance Training) - Los Angeles, USA	1982-1985	RSTL	Universal	No	7th	12 sessions	Considerable	Teacher - considerable training; professional (health educator) - specially trained; older age peer - supervised	Unclear	No treatment
Hansen, Johnson, Flay, Graham & Sobel (1988)	Project SMART (Self-Management And Resistance Training) - Los Angeles, USA	1982-1983	RSTL	Universal	No	7th	12 sessions	Considerable	Teacher - considerable training; professional (health educator) - specially trained; older age peer - supervised	Unclear	No treatment
Generic Skills Training Limited Interventions											
Hansen & Dusenbury (2004)	All Stars Core - Florence, South Carolina & western Texas, USA	2003	GSTL	Universal	No	Designed for youth aged 11 to 14	14 sessions	Extreme	Teacher - unclear	Unclear	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Sussman, Sun, McCuller & Dent (2003)	Project Towards No Drug Abuse - southern California, USA	1998-1999	GSTL	Indicated	No	High school	12 sessions	None	Professional (health educator) - specially trained	Unclear	Standard care
Sussman, Sun, McCuller & Dent (2003)	Project Towards No Drug Abuse - southern California, USA	1998-1999	GSTL	Indicated	No	High school	12 sessions	Minimal	Professional (health educator) - specially trained	Unclear	Standard care
Dent, Sussman & Stacy (2001)	Project Towards No Drug Abuse - Los Angeles, California, USA	Unclear	GSTL	Universal	No	9th-11th	9 sessions	Minimal	Professional (health educator) - specially trained	Unclear	Standard care
Aseltine, Dupre & Lamlein (2000)	Across Ages (Positive Youth Development Curriculum (PYDC) & mentoring) - Springfield, Massachusetts, USA	1997-1998	GSTL	Universal	Community component	6th	27 sessions	Considerable	Unclear	High	No treatment
Aseltine, Dupre & Lamlein (2000)	Positive Youth Development Curriculum (PYDC) - Springfield, Massachusetts, USA	1997-1998	GSTL	Universal	No	6th	27 sessions	Considerable	Unclear	High	No treatment
Sussman, Dent, Stacy & Craig (1998)	Project Towards No Drug Abuse	1994-1995	GSTL	Indicated	No	High school	9 sessions	Unclear	Professional (health educator) -	High	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
	(plus school-as-community component) - southern California, USA								specially trained		
Sussman, Dent, Stacy & Craig (1998)	Project Towards No Drug Abuse - southern California, USA	1994-1995	GSTL	Indicated	No	High school	9 sessions	Unclear	Professional (health educator) - specially trained	High	Standard care
Snow, Tebes & Ayers (1997)	Adolescent Decision-Making (ADM) Program - New England, USA	1980-1982	GSTL	Universal	No	6th	12 sessions	Unclear	Unclear	Unclear	Unclear
Snow, Tebes & Ayers (1997)	Adolescent Decision-Making (ADM) Program - New England, USA	1980-1982	GSTL	Universal	No	8th	12 sessions	None	Unclear	Unclear	Unclear
Social Influence Interventions											
Eischens, Komro, Perry, Bosma & Farbakhsh (2004)	Drug Abuse Resistance Education (DARE) Plus Project - Minneapolis/St. Paul, Minnesota, USA	1999-2001	SI	Universal	Family & community components	7th-8th	10 sessions	Considerable	Professional (police officers) - specially trained	Unclear	No treatment
Ellickson, McCafferey, Ghosh-	Project ALERT - South Dakota, USA	1997-1999	SI	Universal	Family component	7th-10th	14 sessions; booster	Extreme	Teacher - considerable training	High	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Dastidar & Longshore (2003)							sessions (ALERT Plus) not evaluated in current study				
Lynam, Milich, Zimmerman, Novak, Logan, Martin, Leukefeld & Clayton (1999)	Project DARE (Drug Abuse Resistance Education) - Lexington, Kentucky, USA	1987-1988	SI	Universal	No	6th	16 sessions	Considerable	Professional (police officers) - specially trained	High	Standard care
Clayton, Cattarello & Johnstone (1996)	Project DARE (Drug Abuse Resistance Education) - Lexington, Kentucky, USA	1987-1988	SI	Universal	No	6th	16 sessions	Considerable	Professional (police officers) - specially trained	High	Standard care
Clayton, Cattarello & Waldren (1991)	Project DARE (Drug Abuse Resistance Education) - Lexington, Kentucky, USA	1987-1988	SI	Universal	No	6th	16 sessions	Considerable	Professional (police officers) - specially trained	High	Standard care
Chou, Montgomery, Pentz, Rohrbach, Johnson, Flay & MacKinnon (1998)	Midwestern Prevention Program (MPP) - Marion County, Indianapolis, Indiana, USA	1987	SI	Universal	Family, community & media components	6th or 7th	10 sessions	Extreme	Unclear	Unclear	Lower level of treatment
Harmon (1993)	Project DARE (Drug Abuse Resistance	1989-1990	SI	Universal	No	5th	17 sessions	Considerable	Professional (police officers) - specially	Unclear	Unclear

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
	Education) - Charleston County, South Carolina, USA								trained		
Ellickson, Bell & McGuigan (1993)	Project ALERT - California & Oregon, USA	1984-1986	SI	Universal	No	7th-8th	8 sessions; 3 booster sessions the following year	Extreme	Professional (health educator) - specially trained; older peer - supervised	High	Standard care
Bell, Ellickson & Harrison (1993)	Project ALERT - California & Oregon, USA	1984-1986	SI	Universal	No	7th-8th	8 sessions; 3 booster sessions the following year	Extreme	Professional (health educator) - specially trained; older peer - supervised	High	Standard care
Ellickson & Bell (1990)	Project ALERT - California & Oregon, USA	1984-1986	SI	Universal	No	7th-8th	8 sessions; 3 booster sessions the following year	Extreme	Professional (health educator) - specially trained; older peer - supervised	High	Standard care
Ellickson, Bell & McGuigan (1993)	Project ALERT - California & Oregon, USA	1984-1986	SI	Universal	No	7th-8th	8 sessions; 3 booster sessions the following year	Extreme	Professional (health educator) - specially trained	High	Standard care
Bell, Ellickson & Harrison (1993)	Project ALERT - California & Oregon, USA	1984-1986	SI	Universal	No	7th-8th	8 sessions; 3 booster sessions	Extreme	Professional (health educator) -	High	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
							the following year		specially trained		
Ellickson & Bell (1990)	Project ALERT - California & Oregon, USA	1984-1986	SI	Universal	No	7th-8th	8 sessions; 3 booster sessions the following year	Extreme	Professional (health educator) - specially trained	High	Standard care
Becker, Agopian & Yeh (1992)	Project DARE (Drug Abuse Resistance Education) - Long Beach, California, USA	1989	SI	Universal	No	5th	17 sessions	Considerable	Professional (police officers) - specially trained	Unclear	Unclear
Mackinnon, Johnson, Pentz, Dwyer, Hansen, Flay & Wang (1991)	Midwestern Prevention Project (MPP) - Kansas City, Missouri & Kansas City, Kansas, USA	1984-1985	SI	Universal	Media component	6th-7th	10 sessions	Extreme	Teachers - considerable training; same age peers - supervised	Unclear	Standard care
Pentz, Trebow, Hansen, MacKinnon, Dwyer, Johnson, Flay, Daniels & Cormack (1990)	Midwestern Prevention Project (MPP) - Kansas City, Missouri & Kansas City, Kansas, USA	1984-1985	SI	Universal	Media component	6th-7th	10 sessions	Extreme	Teachers - considerable training; same age peers - supervised	High	Standard care
Wragg (1990)	The Illawarra Program - Illawarra, NSW,	1980; 1983-1984	SI	Universal	Family component	6th	6 units, plus booster phase	Extreme	Professional (project staff) - specially	Unclear	No treatment

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
	Australia								trained; teachers - unclear; same age & older peers - untrained		
Moberg & Piper (1990)	Project Model Health (PMH) - Madison, Wisconsin, USA	1984-1985	SI	Universal	No	8th	64 sessions	Considerable	Older peer - considerable training	Unclear	Standard care
Johnson, Pentz, Weber, Dwyer, Baer, MacKinnon, Hansen & Flay (1990)	Midwestern Prevention Program (MPP) - Kansas City, Missouri, USA	1984-1987	SI	Universal	Family, community & media components	6th or 7th	10 sessions	Extreme	Unclear	Unclear	Lower level of treatment
Competency Enhancement Interventions											
Smith, Swisher, Vicary, Bechtel, Minner, Henry & Palmer (2004)	Life Skills Training (LST) - Pennsylvania, USA	1999-2002	CE	Universal	No	7th-9th	15 sessions; 15 booster sessions (10 a year later, and a further 5 a year after that)	Extreme	Teacher - considerable training	High	Standard care
Smith, Swisher, Vicary, Bechtel, Minner, Henry & Palmer	Infused Life Skills Training (LST) - Pennsylvania, USA	1999-2002	CE	Universal	No	7th-9th	Not a curriculum-based program; continual program	Extreme	Teacher - considerable training	High	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
(2004)											
McNeal, Hansen, Harrington & Giles (2004)	All Stars - Lexington & Louisville, Kentucky - USA	Unclear	CE	Universal & indicated	No	Middle-school students aged 11 to 13	22 sessions	Extreme	Teacher - considerable training	Unclear	Standard care
McNeal, Hansen, Harrington & Giles (2004)	All Stars - Lexington & Louisville, Kentucky - USA	Unclear	CE	Universal & indicated	No	Middle-school students aged 11 to 13	22 sessions	Extreme	Professional (trained professional) - specially trained	Unclear	Standard care
Hansen & Dusenbury (2004)	All Stars Plus - Florence, South Carolina & western Texas, USA	2003	CE	Universal	No	Designed for youth aged 11 to 14	25 sessions	Extreme	Teacher - unclear	Unclear	Standard care
Griffin, Botvin, Nichols & Doyle (2003)	Life Skills Training (LST) - New York, USA	Unclear	CE	Universal	No	7th-8th	15 sessions; 10 booster sessions a year later	Extreme	Teacher - minimal training	Low	Standard care
Botvin, Griffin, Diaz & Ifill-Williams (2001)	Life Skills Training (LST) - New York, USA	Unclear	CE	Universal	No	7th-8th	15 sessions; 10 booster sessions a year later	Extreme	Teacher - minimal training	Low	Standard care
Hecht, Marsiglia, Elek, Wagstaff, Kulis, Dustman & Miller-Day (2003)	Keepin' it REAL - Phoenix, Arizona, USA	1998-2000	CE	Universal	Media component	7th-8th	10 sessions - monthly booster activities the following year	Considerable	Teacher - considerable training	High	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Eisen, Zellman & Murray (2003)	Skills for Adolescence (SFA) - Los Angeles, California; Washington, DC, Maryland; and Detroit and Wayne County, Michigan, USA	1998-1999	CE	Universal	No	7th	40 sessions	Unclear	Teacher - considerable training	High	Standard care
Eisen, Zellman, Massett & Murray (2002)	Skills for Adolescence (SFA) - Los Angeles, California; Washington, DC, Maryland; and Detroit and Wayne County, Michigan, USA	1998-1999	CE	Universal	No	7th	40 sessions	Unclear	Teacher - considerable training	High	Standard care
Spoth, Redmond, Trudeau & Shin (2002)	Life Skills Training (LST) & Strengthening Families Program (SFP) - Midwestern state, USA	Unclear	CE	Universal	Family component	7th-8th	15 sessions; 5 booster sessions a year later	Extreme	Teacher - considerable training	High	Unclear
Spoth, Redmond, Trudeau & Shin (2002)	Life Skills Training (LST) - Midwestern state, USA	Unclear	CE	Universal	No	7th-8th	15 sessions; 5 booster sessions a year later	Extreme	Teacher - considerable training	High	Unclear

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Scheier, Botvin & Griffin (2001)	Life Skills Training (LST) - North-east USA	1987-1991	CE	Universal	No	7th-9th	15 sessions; 15 booster sessions (10 a year later, and a further 5 a year after that)	Extreme	Teacher - minimal to considerable training	Unclear	No treatment
Schinke, Tepavac & Cole (2000)	Skills training program (with community component) - North Dakota, South Dakota, Idaho, Montana & Oklahoma, USA	Unclear	CE	Selective	Community component	3rd-5th	Weekly sessions over spring term, with semi-annual booster sessions	Extreme	Professional (trained professional) - specially trained; older peers - supervised	Unclear	No treatment
Schinke, Tepavac & Cole (2000)	Skills training program - North Dakota, South Dakota, Idaho, Montana & Oklahoma, USA	Unclear	CE	Selective	No	3rd-5th	Weekly sessions over spring term, with semi-annual booster sessions	Extreme	Professional (trained professional) - specially trained; older peers - supervised	Unclear	No treatment
Piper, Moberg & King (2000)	Healthy for Life Project (HLF) - Wisconsin, USA	1988-1991	CE	Universal	Family & community components	6th (intensive); 6th-8th (age-appropriate)	58 sessions	Extreme	Teacher - considerable training; professional (project staff) - specially trained; same age peer -	High	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
									supervised		
DeWit, Steep, Silverman, Stevens-Lavigne, Ellis, Smythe, Rye, Braun & Wood (2000)	Opening Doors Program - Ontario, Canada	Unclear	CE	Indicated	Family component	8th-10th	17 sessions	Considerable	Professional (guidance counsellor) - specially trained	Unclear	No treatment
Botvin, Griffin, Diaz, Scheier, Williams & Epstein (2000)	Life Skills Training (LST) - New York, USA	1985-87	CE	Universal	No	7th-9th	15 sessions; 15 booster sessions (10 a year later, and a further 5 a year after that)	Extreme	Teacher - minimal to considerable training	Medium	Standard care
Botvin, Baker, Dusenbury, Botvin & Diaz (1995)	Life Skills Training (LST) - New York, USA	1985-1987	CE	Universal	No	7th-9th	15 sessions; 15 booster sessions (10 a year later, and a further 5 a year after that)	Extreme	Teacher - minimal training	Medium	Standard care
Botvin, Baker, Dusenbury, Tortu & Botvin (1990)	Life Skills Training (LST) - New York, USA	1985-1987	CE	Universal	No	7th-9th	15 sessions; 15 booster sessions (10 a year later, and a further 5 a year after	Extreme	Teacher - minimal training	Medium	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
							that)				
Botvin, Epstein, Baker, Diaz & Ifill-Williams (1997)	Life Skills Training (LST) - New York, USA	Unclear	CE	Selective	No	7th	15 sessions	Extreme	Teacher - considerable training	Unclear	Standard care
Botvin, Schinke, Epstein, Diaz & Botvin (1995)	Life Skills Training (LST) - New York, USA	Unclear	CE	Selective	No	7th-8th	15 sessions; 8 booster sessions a year later	Extreme	Professional (trained professional) - specially trained	Unclear	Lower level of treatment
Botvin, Schinke, Epstein, Diaz & Botvin (1995)	Culturally-Focused Life Skills Training (LST) - New York, USA	Unclear	CE	Selective	No	7th-8th	15 sessions; 8 booster sessions a year later	Extreme	Professional (trained professional) - specially trained	Unclear	Lower level of treatment
Botvin, Baker, Dusenbury, Botvin & Diaz (1995)	Life Skills Training (LST) - New York, USA	1985-1987	CE	Universal	No	7th-9th	15 sessions; 15 booster sessions (10 a year later, and a further 5 a year after that)	Extreme	Teacher - considerable training	Medium	Standard care
Botvin, Baker, Dusenbury, Tortu & Botvin (1990)	Life Skills Training (LST) - New York, USA	1985-1987	CE	Universal	No	7th-9th	15 sessions; 15 booster sessions (10 a year later, and a further 5 a year after that)	Extreme	Teacher - considerable training	Medium	Standard care

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Botvin, Baker, Filazzola & Botvin (1990)	Life Skills Training (LST) - New York, USA	Pre-1990	CE	Universal	No	7th-8th	20 sessions; 10 booster sessions in the following year	Extreme	Teacher - considerable training	Low	Unclear
Botivin, Baker, Filazzola & Botvin (1990)	Life Skills Training (LST) - New York, USA	Pre-1990	CE	Universal	No	7th-8th	20 sessions; 10 booster sessions in the following year	Extreme	Older peer - considerable training	Low	Unclear
Botivin, Baker, Filazzola & Botvin (1990)	Life Skills Training (LST) - New York, USA	Pre-1990	CE	Universal	No	7th	20 sessions	Extreme	Teacher - considerable training	Low	Unclear
Botvin, Baker, Renick, Filazzola & Botvin (1984)	Life Skills Training (LST) - New York, USA	Pre-1990	CE	Universal	No	7th	20 sessions	Extreme	Teacher - considerable training	Low	Unclear
Botivin, Baker, Filazzola & Botvin (1990)	Life Skills Training (LST) - New York, USA	Pre-1990	CE	Universal	No	7th	20 sessions	Extreme	Older peer - considerable training	Low	Unclear
Botvin, Baker, Renick, Filazzola & Botvin (1984)	Life Skills Training (LST) - New York, USA	Pre-1990	CE	Universal	No	7th	20 sessions	Extreme	Older peer - considerable training	Low	Unclear
System-Wide Change Interventions											
Zavela, Battistich,	Say Yes First - To Rural Youth	1991-1996	SWC	Universal, selective, and	Family & community	4th-8th	Not a curriculum-	Extreme	Professionals (project staff &	Unclear	No treatment

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Gosselink & Dean (2004)	& Family Alcohol/Drug Prevention (SYF) - Colorado, USA			indicated	components		based program; continual program		trained professionals), teachers, parents, other community members and the students themselves were involved in the design and implementation of program activities		
Zavela, Battistich, Dean, Flores, Barton & Delaney (1997)	Say Yes First - To Rural Youth & Family Alcohol/Drug Prevention (SYF) - Colorado, USA	1991-1996	SWC	Universal, selective, and indicated	Family & community components	4th-8th	Not a curriculum-based program; continual program	Extreme	Professionals (project staff & trained professionals), teachers, parents, other community members and the students themselves were involved in the design and implementation of program activities	Unclear	No treatment
Furr-Holden, Ialongo, Anthony, Petras &	School-family partnership intervention (SFP) - USA	1993	SWC	Universal & indicated	Family component	1st	Not a curriculum-based program;	Minimal	Teacher - specially trained	High	No treatment

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
Kellman (2004)							continual program				
Bond, Thomas, Coffey, Glover, Butler, Carlin & Patton (2004)	The Gatehouse Project - Melbourne, Australia	1997-1998	SWC	Universal	No	8th-9th	More than 10 sessions	Unclear	Teacher - unclear	Unclear	No treatment
Morris, Parker & Aldridge (2002)	Integrated Programme (IP) - West Yorkshire & Northumbria, England	1998-1999	SWC	Universal, selective, and indicated	Family & community components	8th & 10th	Not a curriculum-based program; continual program	Unclear	Teacher - unclear	Low	Standard care
Cuijpers, Jonkers, de Weerdt & de Jong (2002)	Healthy Schools & Drugs Project - Netherlands	Unclear	SWC	Universal & indicated	No	Secondary school (ages 12-18)	9 sessions	Unclear	Teacher - minimal training	Unclear	No treatment
Other Interventions											
Furr-Holden, Ialongo, Anthony, Petras & Kellman (2004)	Classroom-centred intervention (CC) - USA	1993	Other	Universal	No	1st	Not a curriculum-based program; continual program	Considerable	Teacher - specially trained	High	No treatment
Valentine, Griffith, Ruthazer, Gottlieb & Keel (1998)	Urban Youth Connection - Boston, Massachusetts, USA	1993-1996	Other	Indicated	No	Middle & high school	Average of 16.7 counselling sessions for middle school students,	Extreme	Professional - specially trained	Unclear	No treatment

Authors & Publication Year	Project Name & Country	Year	Nature of Intervention	Level of Prevention	Multifaceted	Grade Level of Targeted Students	Number of Sessions & Booster Sessions	Level of interaction	Provider Type & Training	Implementation Fidelity	Control Group
							and 16.4 sessions for high school students				
Valentine, Gottlieb, Keel, Griffith & Ruthazer (1998)	Urban Youth Connection - Boston, Massachusetts, USA	1993-1994	Other	Indicated	No	Middle & high school	Average of 12.2 counselling sessions for middle school students, and 10.4 sessions for high school students	Extreme	Professional (counsellors) - specially trained	Unclear	No treatment

Acronyms:

K+A Knowledge and affective education
RSTL Resistance skills training limited
GSTL Generic skills training limited
SI Social influence
CE Competency enhancement
SWC System-wide changes

Table 9: Summary of school based drug education: intervention particulars, summary of findings, attrition analysis, and analysis of pretest group equivalence.

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
Affective Education Interventions			
Hansen, Johnson, Flay, Graham & Sobel (1988)	Project SMART involved two parts. One part involved social skills training aimed at increasing student awareness of the social pressures to use drugs (media, peers, adults, etc) and teaching a variety of skills used to resist such pressures. The second part involved affective education emphasising decision-making skills, values clarification and stress management techniques. Students in the current evaluation received the affective education curriculum	The intervention had significant impacts on both marijuana incidence and prevalence rates, compared to controls. At both the initial posttest and the follow-up, program students reported greater incidence rates than their control counterparts (F = 8.39, p = .004 and F = 13.19, p = .0003, respectively). Similar results were observed for prevalence rates at both the initial posttest and follow-up (F = 4.22, p = .04 and F = 15.37, p = .0001, respectively). Overall, rates of marijuana use were significantly higher among program students compared to the control. Among baseline marijuana nonusers, there were significant increases in the number of program students beginning use at both the initial posttest (p <.01) and follow-up (p <.001), compared to the control. The program failed to have a significant impact on the proportion of students increasing their marijuana use or ceasing use	Pretest analyses for group equivalence revealed a number of significant differences. Students in the social condition reported less drinking and smoking at baseline compared to the control students. Students in the affective condition also reported greater levels of baseline alcohol use. Attrition analyses revealed a number of significant differences. Males were more likely to drop out, as were black students, and those students reporting greater baseline drinking, smoking and marijuana use. There was more attrition among social students then control students, and less attrition among affective students, however there were no significant condition x outcome differential attrition effects
Knowledge Dissemination Plus Affective Education Interventions			
Forman, Linney & Brondino (1990)	The Coping Skills School Intervention is based on Botvin's (1983) Life Skills Training curriculum, and consisted of coping skills training in the areas of behavioural self-management, emotional self-management, decision-making, and interpersonal communication. General substance use information was also taught. The additional parenting program involved teaching parents more effective practices to manage the behaviour of their children, to disseminate information regarding what their children had been learning in the school component of the program, and allowing parents to form support networks with other parents	Frequency of marijuana use was compared for three levels of the intervention (school curriculum only, S; curriculum plus parenting condition, in which parents did attend, S+P; and curriculum plus parenting condition, in which parents did not attend, S+NP) and a control group (C). No significance testing was conducted to assess the effects of the varying levels of intervention on marijuana use rates. Changes in rates of use were different across conditions; however there were no decreases in use rates at any time for any condition. From pretest to posttest S experienced the least amount of change (no change) in use rates, followed by C (+0.01), then S+NP (+0.07), and finally S+P (+0.09). From pretest to follow-up S+NP experienced the	No test for effects of attrition, or tests for baseline equivalence of groups

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
		least amount of change (+0.19) in use rates, followed by S (+0.22), then C (+0.30), and finally S+P (+0.40). From posttest to follow-up S+NP experienced the least amount of change (+0.12) in use rates, followed by S (+0.22), then C (+0.29), and finally S+P (+0.31)	
Resistance Skills Training Limited Interventions			
Hurry, Lloyd & McGurk (2000)	Project Charlie is a school-based drug education program that follows the life skills model. The curriculum involves affective components such as self-esteem development and improving children's ability to express their feelings. Resistance skills training, in both the areas of peer pressure and social influence are also taught. The program also involves information dissemination, designed to inform children of both the positive and negative effects of drugs	In subset 1: there were no significant differences in illicit drug use between the experimental and control students at either pretest, immediate posttest, or 3-year follow-up. However, use rates in the experimental groups remained stable across the measurement points (1 student at each point) while from pretest to follow-up rates of use in the control went from zero students to two. In subset 2: there were no significant differences in illicit drug use between the experimental and control students at either immediate posttest (no students using) or 3-year follow-up. However, half as many experimental students reported having used an illicit drug at follow-up (3 vs. 6). In subset 3: significantly fewer experimental students had used an illicit substance ($\chi 2=6.6$ (1), $p<.01$) (10% or 4 students vs. 29% or 80 students). The small sample sizes evident in the first 2 subsets, and the mismatch of sample sizes in subset 3 (E=41; C=278), is concerning	Only significant difference in demographic or drug use variables across experimental and control groups in any of the 3 subsets at baseline was that in subset 2 the experimental group had significantly poorer verbal skills. No attrition analyses were conducted, however the authors state that a number of students were dropped from the experimental group for constant truanting and that this exclusion was likely to bias the results against finding an effect of the program
Shope, Copeland, Kamp & Lang (1998)	The curriculum focused on teaching students to understand, interpret and resist social influences to use drugs. Students were also taught about the short-term effects of drug use, peer pressure, and resistance skills to counteract peer pressure	Marijuana use showed a nearly significant treatment by gender by time interaction ($F = 2.51$ (3, 240), $p=.06$), with comparison boys using significantly more marijuana use at the seventh grade posttest than all the other groups. Although cocaine use was extremely low, there was also a significant treatment by gender by time interaction ($F = 3.01$ (3, 241), $p=.03$), and a significant curriculum effect ($F = 3.01$ (3, 241), $p=.03$). At the seventh grade posttest, comparison boys reported the most use, significantly more than girls from either treatment group ($p=.05$, $p=.03$). Curriculum girls' cocaine use stayed close to zero throughout, while comparison girls at the twelfth grade posttest reported significantly more use ($t=2.07$, $p=.04$)	There were no significant differences between the treatment and comparison conditions on outcome variables or demographic variables. Attrition analyses revealed that students who dropped out had significantly higher levels of alcohol and tobacco use. No tests for effects of differential attrition were conducted
Shope, Copeland,	The curriculum focused on teaching students to understand,	For the 6th-7th grade cohort: there was a significant	Tests for baseline equivalence revealed significant

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
Marcoux & Kamp (1996)	interpret and resist social influences to use drugs. Students were also taught about the short-term effects of drug use, peer pressure, and resistance skills to counteract peer pressure	intervention effect on marijuana use, with reported use increasing less among program students (.02-.08) than among comparison students (.03-.27), F=4.95, df=2,417, p<.01. Cocaine use was low, but a significant intervention effect was also observed for this outcome (F=3.35, df=2,419, p<.05); cocaine use among program participants increased from .01 to .03, while use in the comparison group increase from .00 to .08. There were no significant differences in use rates for the 5th-6th grade cohort. For the 8th-9th grade cohort significant intervention effects were observed for marijuana use (F=4.16, df=2,571, p<.05), with program students reported less marijuana use than comparison students, but this effect did not hold true to the second posttest (sample sizes for this cohort were small however)	differences between the groups (actual variables groups differed on not stated), and these variables were used as covariates in subsequent analyses. Attrition analyses revealed that attrition students had significantly higher rates of smokeless tobacco and alcohol use. Effects of differential attrition were not investigated
Stevens, Freeman, Mott & Youells (1996)	The intervention included the school-based curriculum, HLAY-2000, plus a parenting course and community taskforce. HLAY 2000 is a drug education curriculum that focuses on "gateway" drugs. A "no drug use" message is delivered through such mediums as puppetry, books, videos, games, and posters. In addition, the curriculum teaches social skills and advocates the importance of self-esteem (children participate in activities that promote self-exploration), positive family relationships, and strong bonds to other prosocial institutions, such as the school. Drug information, particularly related to "gateway" substances and the negative consequences of drug use, is also disseminated. The curriculum also involves social skills training relating to assertiveness, peer relationships, refusal skills, and peer pressure	The intervention did not have a significant impact on either initiation of marijuana (p=.37) or regular marijuana use (p=.31). However, the intervention did reduce initiation rates and rates of regular use, compared to controls. Risk ratios (adjusted for important variables) were 0.74 (CI=0.48, 1.14) for initiation and 0.56 (CI=0.29, 1.08) for regular use. The intervention led to greater reductions in rates of both marijuana initiation rates and regular use, compared to a school-based curriculum only condition	Pretest analyses of group equivalence revealed no significant baseline differences across conditions on demographic and substance use variables. Attrition analyses revealed that students who dropped out were significantly more likely to have reported drinking at baseline, negative self-esteem, less academic achievement, higher tolerance of deviance, greater sense of wrongdoing, feel unloved by their families, have more friends who use drugs, are less willing to try and stop friends using marijuana, and are older. There were no significant differential attrition effects however
Stevens, Freeman, Mott & Youells (1996)	HLAY 2000 is a drug education curriculum that focuses on "gateway" drugs. A "no drug use" message is delivered through such mediums as puppetry, books, videos, games, and posters. In addition, the curriculum teaches social skills and advocates the importance of self-esteem (children participate in activities that promote self-exploration), positive family relationships, and strong bonds to other prosocial institutions, such as the school. Drug information, particularly	The intervention did not have a significant impact on either initiation of marijuana (p=.37) or regular marijuana use (p=.31). However, the intervention did reduce initiation rates and rates of regular use, compared to controls. Risk ratios (adjusted for important variables) were 0.95 (CI=0.67, 1.35) for initiation and 0.84 (CI=0.51, 1.36) for regular use. The intervention did not produce reductions in rates of marijuana initiation rates and regular use as large	Pretest analyses of group equivalence revealed no significant baseline differences across conditions on demographic and substance use variables. Attrition analyses revealed that students who dropped out were significantly more likely to have reported drinking at baseline, negative self-esteem, less academic achievement, higher tolerance of deviance, greater sense of wrongdoing, feel

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	related to "gateway" substances and the negative consequences of drug use, is also disseminated. The curriculum also involves social skills training relating to assertiveness, peer relationships, refusal skills, and peer pressure	as a condition that added parenting and community drug prevention components to the school-based curriculum	unloved by their families, have more friends who use drugs, are less willing to try and stop friends using marijuana, and are older. There were no significant differential attrition effects however
Kim, McLeod & Shantzis (1993)	HLAY 2000 is a drug education curriculum that focuses on "gateway" drugs. A "no drug use" message is delivered through such mediums as puppetry, books, videos, games, and posters. In addition, the curriculum teaches social skills and advocates the importance of self-esteem (children participate in activities that promote self-exploration), positive family relationships, and strong bonds to other prosocial institutions, such as the school. Drug information, particularly related to "gateway" substances and the negative consequences of drug use, is also disseminated. The curriculum also involves social skills training relating to assertiveness, peer relationships, refusal skills, and peer pressure	Hard drug use rates increased only slightly in the experimental condition, and moderately in the control condition. The difference between groups was not statistically significant ($F = 3.85$ ($df = 1,226$), $p = .051$ - alpha set at .004 for significance given multiple tests)	No test for effects of attrition, or tests for baseline equivalence of groups
Graham, Johnson, Hansen, Flay & Gee (1990)	Project SMART involved two parts. One part involved social skills training aimed at increasing student awareness of the social pressures to use drugs (media, peers, adults, etc) and teaching a variety of skills used to resist such pressures. The second part involved affective education emphasising decision-making skills, values clarification and stress management techniques. Students in the current evaluation received one part or another but were grouped together to form the experimental condition	The intervention led to a reduction in reported marijuana use index scores among program students compared to control students, and this finding approached significance ($p = .08$). Female program students reported significantly lower rates of marijuana use then their control counterparts, but there were no differences between male program and control students	Pretest analyses for group equivalence revealed no significant differences on substance use outcomes, however no analysis of baseline equivalence on demographic variables was reported. No attrition analyses were conducted
Hansen, Johnson, Flay, Graham & Sobel (1988)	Project SMART involved two parts. One part involved social skills training aimed at increasing student awareness of the social pressures to use drugs (media, peers, adults, etc) and teaching a variety of skills used to resist such pressures. The second part involved affective education emphasising decision-making skills, values clarification and stress management techniques. Students in the current evaluation received the social skills training curriculum	The intervention had no significant impact on either marijuana incidence or prevalence rates, compared to controls. Incidence rates were largely equivalent at both posttest measurement periods. At the initial posttest however, there was a marginally significant reduction in prevalence rates ($F = 2.88$, $p = .09$), however this finding had disappeared by the follow-up. Overall, rates of marijuana use were slightly lower among program students compared to the control. Among baseline marijuana nonusers, there was a significant reduction in the number of program students beginning use at the initial posttest (p	Pretest analyses for group equivalence revealed a number of significant differences. Students in the social condition reported less drinking and smoking at baseline compared to the control students. Students in the affective condition also reported greater levels of baseline alcohol use. Attrition analyses revealed a number of significant differences. Males were more likely to drop out, as were black students, and those students reporting greater baseline drinking, smoking and marijuana use. There was more attrition among social

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
		<.05) compared to the control, but this finding dissipated at the follow-up. The program failed to have a significant impact on the proportion of students increasing their marijuana use or ceasing use	students then control students, and less attrition among affective students, however there were no significant condition x outcome differential attrition effects
Generic Skills Training Limited Interventions			
Hansen & Dusenbury (2004)	All Stars Core involves normative education, the teaching of generic skills such as communication and interpersonal skills to improve acceptance at school, and family relationships, as well as attempting to instil in adolescents a sense that drug use does not fit in with their life goals and that a commitment to abstain from drug use is thus necessary	From pretest to posttest, both Control and Core students experienced an increase in rates of marijuana use. Core students did not differ significantly from the control students ($F(2, 604) = 1.889$; $p = 0.15$), nor did Core students differ significantly from students who received the Plus curriculum. Core students reported less use than control students, but greater use than Plus students. Comparing marijuana use among Controls with Core students, the effect size was 0.054	Only significant difference between the three experimental conditions at pretest was for cigarette smoking (Core students smoked more than control or Plus students). The same pattern was observed for marijuana use and this approached significance ($p = .14$). Pretest use rates and a number of demographic variables used as covariates in subsequent analyses. No attrition analyses were conducted
Sussman, Sun, McCuller & Dent (2003)	Project Towards No Drug Abuse (TND) was designed as an indicated program to be used with at-risk youth at continuation and alternative high schools. The program also attempts to correct the cognitive misrepresentations many students have of themselves, in an effort to motivate students to not engage in substance use. In addition, students learn a variety of generic life and social skills such as decision-making, effective communication, and coping and self-control, in order to equip them with the skills to act on their motivations not to use drugs, and to help improve interaction with lower risk peers. The program also informs students of general drug information, such as the social and health consequences of drug use	The health educator-led condition reported significantly lower rates of hard drug use at the 2-year follow-up compared to control students ($p=.024$). While program students also reported less marijuana use this finding was not statistically significant. In addition, there was a significant interaction effect on marijuana use, with males in the health educator-led condition who reported not using marijuana at baseline, reporting significantly less use at 2-year follow-up ($p=.031$)	No pretest analyses of group equivalence were conducted. Attrition analyses revealed no evidence of significant differences in rates of attrition across conditions or of scores on demographic and substance use variables between students retained and those who were not retained
Sussman, Sun, McCuller & Dent (2003)	Project Towards No Drug Abuse (TND) was designed as an indicated program to be used with at-risk youth at continuation and alternative high schools. The program also attempts to correct the cognitive misrepresentations many students have of themselves, in an effort to motivate students to not engage in substance use. In addition, students learn a variety of generic life and social skills such as decision-making, effective communication, and coping and self-control, in order to equip them with the skills to act on their motivations not to use drugs, and to help improve interaction with lower risk peers.	The self-instruction condition did not result in significant main or interaction effects, for either marijuana or hard drug use	No pretest analyses of group equivalence were conducted. Attrition analyses revealed no evidence of significant differences in rates of attrition across conditions or of scores on demographic and substance use variables between students retained and those who were not retained

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	The program also informs students of general drug information, such as the social and health consequences of drug use		
Dent, Sussman & Stacy (2001)	Project Towards No Drug Abuse (TND) was originally designed as an indicated program to be used with at-risk youth at continuation and alternative high schools. In the present study the authors test the generalisability of the program to students attending general high schools. Lesson address such generic life skills as communication and listening skills, coping skills, self-control, and decision-making. Other features of the curriculum include normative education, and knowledge dissemination regarding both the immediate and long-term negative health and social consequences of drug use. The program attempts to instil in adolescents a sense that drug use does not fit in with their life goals and that a commitment to abstain from drug use is thus necessary	There were no significant intervention effect on rates of marijuana use ($F=1.48$ (1,24) $p=.49$). However, treatment students who had higher rates of hard drug use at baseline benefited significantly more from the intervention then those with lower rates of use ($F=21.31$ (1,24) $p<.001$). These findings are consistent with findings from previous evaluations of the program with at-risk adolescents	There was no evidence that the experimental and control groups differed significantly on any of the pretest measures. Attrition analyses revealed that those students who failed to provide data at posttest were not significantly different to those who did on any drug use or demographic variables. It is unclear whether there was differential attrition between groups (i.e. if one group was more heavily affected by attrition than the other group)
Aseltine, Dupre & Lamlein (2000)	Across Ages is an intergenerational approach to drug prevention involving a school-based life skills curriculum, mentoring, and community service activities. Mentoring is the primary component of the program and involves the pairing of youths with older adults, in an attempt to promote collaborative interactions, where adults provide ongoing support and encouragement to the youth, and participate in general social activities with the youth (such as going to the park, movies, etc). Mentors helped the students improve their self-esteem and self-awareness of their abilities, as well as helping the youths with their school-work. The school curriculum consisted of the PYDC, a life skills curriculum designed to promote social competence and problem solving skills, as well as decision-making, interpersonal communication, coping skills and stress management, self-esteem building, and provide general health and substance abuse information. The community service activities were designed to encourage youth to better understand, and become more involved, with the elderly	From pretest to immediate posttest there were no significant differences in mean changes for marijuana use across conditions. From pretest to immediate posttest the experimental condition had a lower rate of change (+1.05) then the control condition (+1.15), however this difference was not significant. From pretest to 6-month follow-up there was a significant difference between mean changes between the experimental and control conditions, with the experimental condition having a significantly lower rate of change (+1.10) than the control condition (+1.30) ($p < .05$). There were no significant differences between the mentor and the curriculum condition where students received only the PYDC and community service activities, however students in the mentor condition reported smaller rates of increase than PYDC students at both immediate posttest (+1.05 and +1.13, respectively) and 6-month follow-up (+1.10 and +1.18, respectively)	No test for effects of attrition, or tests for baseline equivalence of groups
Aseltine, Dupre & Lamlein (2000)	The PYDC, a life skills curriculum designed to promote social competence and problem solving skills, as well as decision-making, interpersonal communication, coping skills and stress	From pretest to immediate posttest there were no significant differences in mean changes for marijuana use across conditions. From pretest to immediate posttest the	No test for effects of attrition, or tests for baseline equivalence of groups

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	management, self-esteem building, and provide general health and substance abuse information. The community service activities were designed to encourage youth to better understand, and become more involved, with the elderly	experimental condition had a slightly lower rate of change (+1.13) then the control condition (+1.15), however this difference was not significant. From pretest to 6-month follow-up, similar nonsignificant, but positive findings were observed, with the experimental condition having a lower rate of change (+1.18) than the control condition (+1.30). There were no significant differences between the curriculum condition and a condition adding mentoring, however students in the mentor condition reported smaller rates of increase than PYDC students at both immediate posttest (+1.05 and +1.13, respectively) and 6-month follow-up (+1.10 and +1.18, respectively)	
Sussman, Dent, Stacy & Craig (1998)	Project Towards No Drug Abuse (TND) was designed as an indicated program to be used with at-risk youth at continuation and alternative high schools. The program also attempts to correct the cognitive misrepresentations many students have of themselves, in an effort to motivate students to not engage in substance use. In addition, students learn a variety of generic life and social skills such as decision-making, effective communication, and coping and self-control, in order to equip them with the skills to act on their motivations not to use drugs, and to help improve interaction with lower risk peers. The program also informs students of general drug information, such as the social and health consequences of drug use. The school-as-community component involved the establishment of a student body group, implementation of regular drug-free school events (such as job training, sports participation, drug-free parties, and a drug awareness week), as well as school newsletters and banners	The intervention failed to show any significant impact on 30-day marijuana use at one one-year follow-up ($F=0.07$ (2, 18), $p=.92$). In fact, follow-up means, adjusted for baseline use rates, suggested a greater frequency of marijuana use in the intervention condition ($M= 13.02$) compared to the control ($M= 11.21$). The intervention did have a significant impact on hard drug use rates at follow-up ($F=3.85$ (2, 18), $p=.04$). Adjusted follow-up means suggested less frequent use in of hard drugs in the intervention condition ($M= 2.87$) compared to the control ($M= 5.03$). An a priori contrast revealed that school-as-community condition did not differ significantly from a condition where only the TND curriculum was delivered ($t= -0.08$, $p =.93$). There was also a significant interaction between baseline use rates and condition for hard drug use, with students from the intervention condition who reported greater levels of use at baseline, reporting significantly less use at follow-up compared to control students. However, when considering those who reported less use at baseline, there was no significant difference between the intervention and control condition. There were no significant interaction effects between the two intervention conditions	Pretest analyses revealed no significant differences across study conditions at baseline. Attrition analyses revealed no significant differences between those reporting data at pretest and those reporting data at follow-up
Sussman, Dent, Stacy & Craig (1998)	Project Towards No Drug Abuse (TND) was designed as an indicated program to be used with at-risk youth at continuation and alternative high schools. The program also attempts to correct the cognitive misrepresentations many students have	The intervention failed to show any significant impact on 30-day marijuana use at one one-year follow-up ($F=0.07$ (2, 18), $p=.92$). In fact, follow-up means, adjusted for baseline use rates, suggested a greater frequency of marijuana use	Pretest analyses revealed no significant differences across study conditions at baseline. Attrition analyses revealed no significant differences between those reporting data at pretest and those

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	of themselves, in an effort to motivate students to not engage in substance use. In addition, students learn a variety of generic life and social skills such as decision-making, effective communication, and coping and self-control, in order to equip them with the skills to act on their motivations not to use drugs, and to help improve interaction with lower risk peers. The program also informs students of general drug information, such as the social and health consequences of drug use	in the intervention condition (M=12.31) compared to the control (M= 11.21). The intervention did have a significant impact on hard drug use rates at follow-up (F=3.85 (2, 18), p=.04). Adjusted follow-up means suggested less frequent use in of hard drugs in the intervention condition (M=2.74) compared to the control (M= 5.03). A priori contrasts revealed that the intervention condition differed significantly from the control (t= 1.78, p <.05), however there were no significant differences between the curriculum condition and a condition receiving an additional school-as-community component (t= -0.08, p =.93). There was also a significant interaction between baseline use rates and condition for hard drug use, with students from the intervention condition who reported greater levels of use at baseline, reporting significantly less use at follow-up compared to control students. This finding also occurred when considering those who reported less use at baseline. There were no significant interaction effects between the two intervention conditions	reporting data at follow-up
Snow, Tebes & Ayers (1997)	The ADM Program focused on teaching students the fundamental skills related to effective decision-making. The program also taught group process skills to aid students in recognising peer pressure, and effectively handling such drug-related situations of peer pressure and conflict resolution by implementing their learnt decision-making skills. In addition, the program attempted to improve student role ambiguities, and encourage students to develop strong social networks and to regularly utilise these networks to help with decision-making, obtain information and generate alternatives to drug use	The intervention failed to have a significant impact on past year use rates of either marijuana or hard drugs, at either the 3- or 4-year follow-ups	No analyses for pretest group equivalence were conducted. Attrition analyses revealed that males (at both 9th and 10th grade) and students from single parent families (at the 10th grade only) were more likely to drop out. There was no evidence of differential attrition
Snow, Tebes & Ayers (1997)	The ADM Program focused on teaching students the fundamental skills related to effective decision-making. The program also taught group process skills to aid students in recognising peer pressure, and effectively handling such drug-related situations of peer pressure and conflict resolution by implementing their learnt decision-making skills. In addition, the program attempted to improve student role ambiguities, and encourage students to develop strong social networks	The intervention failed to have a significant impact on past year use rates of either marijuana or hard drugs at immediate posttest. There was also no significant impact on past year marijuana use at 1-year follow-up. The intervention had a marginally significant impact on hard drug use at the one-year follow-up, with program students reporting less use than control students (F = 3.04 (1, 623), p <.09)	No analyses for pretest group equivalence were conducted. Attrition analyses revealed that males (at both 9th and 10th grade) and students from single parent families (at the 10th grade only) were more likely to drop out. There was no evidence of differential attrition

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	and to regularly utilise these networks to help with decision-making, obtain information and generate alternatives to drug use. There was an added emphasis on teaching resistance skills in an age-appropriate context of substance use situations likely to be experienced by the involved students		
Social Influence Interventions			
Eischens, Komro, Perry, Bosma & Farbakhsh (2004)	The DARE Plus intervention adds to the original DARE curriculum by including community actions teams designed to address community/school related problems of drug use and violent behaviour, a parent program ("On the VERGE"), and supervised extracurricular activities, devised by the youth themselves, including social/recreational, educational, and community service opportunities. Project DARE in its original form, focuses on teaching resistance skills and general drug education regarding the effects of drugs. The drug message advocated by this program is for total abstinence. The program emphasises social influence approaches through the improvement of students' awareness of the influence of the media on drug use, as well as normative education through presentation of more accurate accounts of the prevalence of adolescent drug use. While there are a number of generic skills training components (decision making, assertiveness, communication skills training), these are only a slight focus of the program. There is also an affective component (self-esteem building, coping skills training)	There was no significant effects on marijuana use behaviours and intentions (F=0.35, ns). However, participating students did report slightly lower mean rates of use and intention to use then non-participating students. The same results were observed when analysing females only (F=1.09, ns), with participating females reporting slightly less use and intention to use than non-participating females. Participating and non-participating males reported no differences in follow-up use rates (F=0.25, ns)	Pretest analyses for group equivalence revealed no significant differences between the two groups on any of the substance use or psychosocial variables. There was no attrition analysis conducted
Ellickson, McCafferey, Ghosh-Dastidar & Longshore (2003)	Project ALERT is drug prevention curriculum that aims to improve the normative beliefs students hold pertaining to drug use and the social, emotional, and physical consequences of using drugs. The program also attempts to help them identify and resist pro-drug pressures from parents, peers, and from social influences such as the media. The program aims to teach resistance skills and improve self-efficacy, the belief that one can successfully resist pro-drug influences. The program also involves a small parent/family component, that involves improving adolescent communication with parents about their knowledge of, experiences with, and responses to peer pressure to use drugs	The intervention had a significant positive effect on marijuana initiation, reducing the proportion of new marijuana users by 24% (P<.01), with initiation rates almost 17% in the control schools compared with 13% in the program schools. The program also had positive effects on current and regular marijuana use (15% and 18%, respectively) although neither finding was significant. The program had significant positive effects on marijuana initiation for program students identified as low- or moderate-risk at baseline (reductions of 38% and 26%, respectively). Program effects on current and regular marijuana use among low-, moderate-, and high- risk	Pretest analyses of group equivalence found that students in the control condition were significantly more likely to be White and to have used marijuana then students in the treatment condition. To control for this these variables were used as covariates in subsequent analyses. Attrition analyses revealed that students who dropped out of the sample were significantly more likely to be male, to be non-White, to have low grades, to have fathers with low educational attainment, to live in a single parent household, and to have used alcohol, cigarettes, or marijuana. There were however, no differential

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
		students suggested in almost all cases positive effects of the intervention (except for high-risk current use), however none of these findings were statistically significant	attrition effects between groups
Lynam, Milich, Zimmerman, Novak, Logan, Martin, Leukefeld & Clayton (1999)	Project DARE focuses on teaching resistance skills and general drug education regarding the effects of drugs. The drug message advocated by this program is for total abstinence. The program also involved social influence approaches through the improvement of students' awareness of the influence of the media on drug use, as well as normative education through presentation of more accurate accounts of the prevalence of adolescent drug use. While there are a number of generic skills training components (decision making, assertiveness, communication skills training), these are only a slight focus of the program. There is also an affective component (self-esteem building, coping skills training)	The intervention failed to have a significant impact on either frequency of past-month marijuana use (beta coefficient = -.044) or past year illicit drug use (for which pre-test levels were estimated; beta coefficient = .080). That is, levels of past-month marijuana use were higher among program students at the 10-year follow-up then their control group counterparts. While illicit drug use was lower among program participants this result was not significant	No tests for initial group equivalence were reported. Attrition analyses revealed that students who dropped out tended to be older males who reported using cigarettes at baseline. Differential attrition between groups was not explored, however authors claim that attrition seemed to have little effect on the results that were reported
Clayton, Cattarello & Johnstone (1996)	Project DARE focuses on teaching resistance skills and general drug education regarding the effects of drugs. The drug message advocated by this program is for total abstinence. The program also involved social influence approaches through the improvement of students' awareness of the influence of the media on drug use, as well as normative education through presentation of more accurate accounts of the prevalence of adolescent drug use. While there are a number of generic skills training components (decision making, assertiveness, communication skills training), these are only a slight focus of the program. There is also an affective component (self-esteem building, coping skills training)	The intervention had no significant impact on past year marijuana use among program participants at either immediate posttest or any of the corresponding four follow-up measurement points. In comparing the rates of marijuana use across conditions over time, there are no distinguishable differences in use trajectories between the program and comparison students	Pretest analyses of group equivalence revealed no significant differences between control and treatment students on demographic variables. The only significant baseline difference between groups in drug use was for alcohol use, with treatment students reporting higher rates. Attrition analyses revealed a number of significant differences between students who dropped out and who remained. At 9th grade follow-up males were more likely to drop out and at 8th grade follow-up students of other race/ethnicity were more likely to drop out. At all follow-ups except immediate posttest students who used cigarettes and marijuana were more likely to drop out, and those who used alcohol were also more likely to drop out, however this was only significant at 9th and 10th grade follow-ups. The only significant differential attrition between conditions occurred at the 8th and 9th grade follow-ups where treatment students using alcohol were more likely to drop out
Clayton, Cattarello & Waldren (1991)	Project DARE focuses on teaching resistance skills and general drug education regarding the effects of drugs. The	The intervention failed to significantly reduce past year marijuana use at either immediate posttest, 7th grade	Pretest analyses of group equivalence revealed a number of significant differences, with the treatment

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	drug message advocated by this program is for total abstinence. The program also involved social influence approaches through the improvement of students' awareness of the influence of the media on drug use, as well as normative education through presentation of more accurate accounts of the prevalence of adolescent drug use. While there are a number of generic skills training components (decision making, assertiveness, communication skills training), these are only a slight focus of the program. There is also an affective component (self-esteem building, coping skills training)	follow-up, or 8th grade follow-up. In fact, at all three follow-up measurements treatment students reported higher rates of use compared to the control students (3.3% and 2.8%, respectively at immediate posttest; 9.0% and 5.6%, respectively at 7th grade follow-up; and 12.6% and 10.2%, respectively at 8th grade follow-up). In addition, the difference observed at 7th grade follow-up was significant. Analysis of the results using students identified as high- or low-sensation seekers (top and bottom quintiles on sensation seeking scale) failed to reveal significant differences either, however reported rates of use were lower among treatment students, compared to control students, among both high- and low sensation seekers	group reporting higher proportions of white students and lower proportions of black students, more baseline alcohol use, and less negative attitudes towards drugs. Attrition analyses revealed that there was no difference in the amount of attrition from either condition. No data on differential attrition effects related to outcome variables was reported
Chou, Montgomery, Pentz, Rohrbach, Johnson, Flay & MacKinnon (1998)	The Midwestern Prevention Program (MPP) is a multi-component intervention involving a school-based curriculum; a parent organisation program for reviewing school drug prevention policy; parenting programs to improve parenting skills and parent-child communication; mobilisation of community leaders to organise a community drug taskforce; and mass media coverage. The classroom-based curriculum component focused on the social influence of media, peers, adults and the community on drug use, resistance skills training to combat such pressures, normative education, the teaching of assertiveness skills, and problem-solving skills, information dissemination regarding the psychosocial consequences of drug use, and encouraging students to make a public commitment against substance use. Students in the control condition had equal access to the community and media components	Without controlling for covariates students in the program condition decreased their past-month marijuana use relative to control condition students at immediate posttest (marginally significant), as well as 1- and 2-year follow-up. At 3-year follow-up, control students reported more positive decreases relative to the program students. Odds-ratios controlling for covariates suggested similar results, with program students reporting more positive trends in use, relative to control students, at all follow-up periods except for the 3-year follow-up period. None of these findings approached significance	Pretest analyses for group equivalence revealed only one significant difference, with control students comprising of more 7th graders from private schools and less from public schools than the program condition. Attrition analyses revealed only one significant difference, with greater attrition amongst control students, who reported baseline alcohol use, at the 1-year follow-up
Harmon (1993)	Project DARE focuses on teaching resistance skills and general drug education regarding the effects of drugs. The drug message advocated by this program is for total abstinence. The program also involved social influence approaches through the improvement of students' awareness of the influence of the media on drug use, as well as normative education through presentation of more accurate accounts of the prevalence of adolescent drug use. While there are a number of generic skills training components	The intervention failed to significantly impact on either past year or past month marijuana use, however reduced the rate of increase in both outcomes among program students compared to control students	Pretest analyses for group equivalence revealed a number of significant differences. The program group consisted of more females, white students, students reported baseline smoking, less attachment to school, and less belief in prosocial norms. No attrition analyses were conducted

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	(decision making, assertiveness, communication skills training), these are only a slight focus of the program. There is also an affective component (self-esteem building, coping skills training)		
Ellickson, Bell & McGuigan (1993)	Project ALERT is a social influence program focused on reducing gateway drug use. The program helps students identify pro-drug pressures from the media, peers, and other adults (as well as internal pressures to use drugs), encourages students to be motivated to not use drugs, and teaches them a variety of resistance skills, and healthier alternatives, to help them refrain from drug use. General information regarding the short-term consequences of drugs on health and social relationships is also disseminated. There is also normative education, emphasising that the majority of youths do not use drugs	Analyses were conducted comparing the adjusted proportions of students using marijuana, with students categorised by condition as well as baseline risk level (low = marijuana and cigarette nonusers; medium = marijuana nonusers but cigarette users; high = marijuana users). The intervention failed to significantly impact lifetime, past year, past month, weekly or daily marijuana use (irrespective of baseline risk-status). By 12th grade rates of use among program students were largely equivalent to those of control students, with an equal number of group x baseline risk-level comparisons showing greater use as those showing less use	Pretest analyses of group equivalence suggested that control students yielded slightly higher propensity-to-use drugs scores. This difference was controlled for in subsequent analyses. Attrition analyses revealed were significantly more likely to report baseline risk factors such as low grades, family disruption, and early drug use. However, there was no evidence of differential attrition across conditions
Bell, Ellickson & Harrison (1993)	Project ALERT is a social influence program focused on reducing gateway drug use. The program helps students identify pro-drug pressures from the media, peers, and other adults (as well as internal pressures to use drugs), encourages students to be motivated to not use drugs, and teaches them a variety of resistance skills, and healthier alternatives, to help them refrain from drug use. General information regarding the short-term consequences of drugs on health and social relationships is also disseminated. There is also normative education, emphasising that the majority of youths do not use drugs	Analyses were conducted comparing the adjusted proportions of students using marijuana, with students categorised by condition as well as baseline risk level (low = marijuana and cigarette nonusers; medium = marijuana nonusers but cigarette users; high = marijuana users). The intervention failed to have a significant impact on lifetime, past year, past month, or weekly marijuana use rates. In fact, in most cases, program students among all risk categories actually reported greater rates of use compared to control students. In all cases students who received the intervention delivered by health educators reported lower rates of use then students who received the intervention delivered by teen leaders	Pretest analyses of group equivalence suggested that control students yielded slightly higher propensity-to-use drugs scores. This difference was controlled for in subsequent analyses. Attrition analyses revealed were significantly more likely to report baseline risk factors such as low grades, family disruption, and early drug use. However, there was no evidence of differential attrition across conditions
Ellickson & Bell (1990)	Project ALERT is a social influence program focused on reducing gateway drug use. The program helps students identify pro-drug pressures from the media, peers, and other adults (as well as internal pressures to use drugs), encourages students to be motivated to not use drugs, and teaches them a variety of resistance skills, and healthier alternatives, to help them refrain from drug use. General information regarding the short-term consequences of drugs on health and social relationships is also disseminated. There	Analyses were conducted comparing the adjusted proportions of students using marijuana, with students categorised by condition as well as baseline risk level (low = marijuana and cigarette nonusers; medium = marijuana nonusers but cigarette users; high = marijuana users). The intervention significantly reduced the initiation of marijuana use among low-risk program students compared to students at the 1-year follow-up ($p < .05$). This finding was only marginally significant at the 9-month follow-up ($p < .10$)	Pretest analyses of group equivalence suggested that control students yielded slightly higher propensity-to-use drugs scores. This difference was controlled for in subsequent analyses. Attrition analyses revealed were significantly more likely to report baseline risk factors such as low grades, family disruption, and early drug use. However, there was no evidence of differential attrition across conditions

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	is also normative education, emphasising that the majority of youths do not use drugs	suggesting an added effect of the booster sessions. The intervention had no significant impact on initiation with medium-risk program students who reported higher rates of initiation at all follow-ups except immediate posttest. There was no significant intervention impact on monthly rates of marijuana use, irrespective of baseline risk-status, although in almost all cases the program students reported lower rates of use at all time points. Weekly use was significantly reduced among high-risk program students at immediate posttest ($p < .05$) however, the significance of this effect dissipated at subsequent follow-ups (while remaining positive). Rates of marijuana use cessation were also improved among high-risk students at both 9-month and 1-year follow-ups, however this finding was not significant	
Ellickson, Bell & McGuigan (1993)	Project ALERT is a social influence program focused on reducing gateway drug use. The program helps students identify pro-drug pressures from the media, peers, and other adults (as well as internal pressures to use drugs), encourages students to be motivated to not use drugs, and teaches them a variety of resistance skills, and healthier alternatives, to help them refrain from drug use. General information regarding the short-term consequences of drugs on health and social relationships is also disseminated. There is also normative education, emphasising that the majority of youths do not use drugs	Analyses were conducted comparing the adjusted proportions of students using marijuana, with students categorised by condition as well as baseline risk level (low = marijuana and cigarette nonusers; medium = marijuana nonusers but cigarette users; high = marijuana users). The intervention (adult leader only) failed to significantly impact lifetime, past year, past month, weekly or daily marijuana use (irrespective of baseline risk-status). By 12th grade rates of use among program students were largely equivalent to those of control students, however observations across the group x baseline risk-level comparisons suggested slightly more reductions in rates of use	Pretest analyses of group equivalence suggested that control students yielded slightly higher propensity-to-use drugs scores. This difference was controlled for in subsequent analyses. Attrition analyses revealed were significantly more likely to report baseline risk factors such as low grades, family disruption, and early drug use. However, there was no evidence of differential attrition across conditions
Bell, Ellickson & Harrison (1993)	Project ALERT is a social influence program focused on reducing gateway drug use. The program helps students identify pro-drug pressures from the media, peers, and other adults (as well as internal pressures to use drugs), encourages students to be motivated to not use drugs, and teaches them a variety of resistance skills, and healthier alternatives, to help them refrain from drug use. General information regarding the short-term consequences of drugs on health and social relationships is also disseminated. There is also normative education, emphasising that the majority of youths do not use drugs	Analyses were conducted comparing the adjusted proportions of students using marijuana, with students categorised by condition as well as baseline risk level (low = marijuana and cigarette nonusers; medium = marijuana nonusers but cigarette users; high = marijuana users). The intervention failed to have a significant impact on lifetime, past year, past month, or weekly marijuana use rates. In most cases however, program students among all risk categories reported lower rates of use compared to control students (except for monthly use among low-risk students, and past month and weekly use among high-risk students). In all cases students who received the intervention	Pretest analyses of group equivalence suggested that control students yielded slightly higher propensity-to-use drugs scores. This difference was controlled for in subsequent analyses. Attrition analyses revealed were significantly more likely to report baseline risk factors such as low grades, family disruption, and early drug use. However, there was no evidence of differential attrition across conditions

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
		delivered by teen leaders reported lower rates of use then students who received the intervention delivered by health educators	
Ellickson & Bell (1990)	Project ALERT is a social influence program focused on reducing gateway drug use. The program helps students identify pro-drug pressures from the media, peers, and other adults (as well as internal pressures to use drugs), encourages students to be motivated to not use drugs, and teaches them a variety of resistance skills, and healthier alternatives, to help them refrain from drug use. General information regarding the short-term consequences of drugs on health and social relationships is also disseminated. There is also normative education, emphasising that the majority of youths do not use drugs	Analyses were conducted comparing the adjusted proportions of students using marijuana, with students categorised by condition as well as baseline risk level (low = marijuana and cigarette nonusers; medium = marijuana nonusers but cigarette users; high = marijuana users). The intervention significantly reduced the initiation of marijuana use among low-risk program students compared to students at the 9-month and 1-year follow-ups (both $p < .05$). The intervention significantly reduced the rate of monthly marijuana use among low-risk program students compared to students at the 1-year follow-up ($p < .01$). This finding was only marginally significant at the 9-month follow-up ($p < .10$) suggesting an added effect of the booster sessions. The intervention also produced significantly less frequent monthly marijuana use among medium-risk students at the 9-month follow-up ($p < .05$), however the significance of this finding dissipated at the 1-year follow-up (while remaining positive). There were no other significant differences between program and control students in the medium- and high-risk categories for monthly use, although in almost all cases the program students reported lower rates of use at all time points. There were no significant effects on weekly use rates however; reported rates were lower for program students. Rates of marijuana use cessation were also improved among high-risk students, but only at the 1-year follow-ups, however this finding was not significant	Pretest analyses of group equivalence suggested that control students yielded slightly higher propensity-to-use drugs scores. This difference was controlled for in subsequent analyses. Attrition analyses revealed were significantly more likely to report baseline risk factors such as low grades, family disruption, and early drug use. However, there was no evidence of differential attrition across conditions
Becker, Agopian & Yeh (1992)	Project DARE focuses on teaching resistance skills and general drug education regarding the effects of drugs. The drug message advocated by this program is for total abstinence. The program also involved social influence approaches through the improvement of students' awareness of the influence of the media on drug use, as well as normative education through presentation of more accurate accounts of the prevalence of adolescent drug use. While	There were no significant differences in rates of change in drug use between experimental and control students. There were increases in rates of use from baseline to posttest for all illicit drug outcomes, in both conditions, however rates of change in marijuana use were lower among intervention students compared to control students (+0.01 and +0.05, respectively). Rates of change for pills, dust and cocaine were almost identical	No test for effects of attrition, or tests for baseline equivalence of groups

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	there are a number of generic skills training components (decision making, assertiveness, communication skills training), these are only a slight focus of the program. There is also an affective component (self-esteem building, coping skills training)		
Mackinnon, Johnson, Pentz, Dwyer, Hansen, Flay & Wang (1991)	The Midwestern Prevention Project (MPP) is a multifaceted community based-drug prevention program involving school, mass media, parent, community, and policy programming components. The school-based component adopts a social influence approach, focusing on normative education (teaching accurate information regarding drug use prevalence), teaching students to recognise the social influences on drug use (media, peers, other adults) as well as a variety of refusal skills to resist such pressures. Assertiveness and problem solving skills are also taught and students are encouraged to adopt public commitments against drug use. The mass media programming involved news clips, commercials, talk shows, press conferences, and a student video contest	The intervention had a significant effect on past month marijuana use, significantly reducing the rate of increase from pretest to posttest among program students ($F = 10.46$ (1, 36), $p < .01$ and $F = 6.56$ (1, 36), $p < .01$, for the conditional and unconditional analyses, respectively). The program also had a significant positive impact on intentions to use marijuana in the following two months ($F = 6.63$ (1, 36), $p < .01$ and $F = 2.95$ (1, 36), $p < .05$, for the conditional and unconditional analyses, respectively)	Pretest analyses of group equivalence revealed no significant differences between conditions on any drug use or demographic variables. Attrition analyses revealed no evidence of differential attrition by condition, and baseline drug users were not significantly more likely to drop out than nonusers
Pentz, Trebow, Hansen, MacKinnon, Dwyer, Johnson, Flay, Daniels & Cormack (1990)	The Midwestern Prevention Project (MPP) is a multifaceted community based-drug prevention program involving school, mass media, parent, community, and policy programming components. The school-based component adopts a social influence approach, focusing on normative education (teaching accurate information regarding drug use prevalence), teaching students to recognise the social influences on drug use (media, peers, other adults) as well as a variety of refusal skills to resist such pressures. Assertiveness and problem solving skills are also taught and students are encouraged to adopt public commitments against drug use. The mass media programming involved news clips, commercials, talk shows, press conferences, and a student video contest	Program effects were analysed in relation to implementation fidelity with control schools assigned as no implementation and program schools split into high and low implementation categories using the median of implementation scores as a cutting point. Significant program effects were found for the high implementation group compared to the control group, for both last month and last week marijuana use (both $p < .05$), with programs schools reporting significantly less increase in rates of use. No such significant effects were reported for the low implementation group, however for both use variables increases in rates of use were less than that reported among control schools	Pretest analyses of group equivalence revealed no significant differences between conditions on any drug use or demographic variables. Attrition analyses revealed no evidence of differential attrition by condition, and baseline drug users were not significantly more likely to drop out than nonusers
Wragg (1990)	The Illawarra program is a drug education program designed to help children identify the social pressures to use drugs, and teach them skills to resist such pressures. The curriculum also involves a strong knowledge dissemination component focused on the negative consequences of drug use and	At baseline there were no significant differences between experimental and control students in marijuana use rates (2% and 3%, respectively, ns). However, experimental students reported significantly less marijuana use than comparison students at each of the follow-up periods; 7th	Pretest analyses of group equivalence found no significant differences between the experimental and control group subjects. No attrition analyses were conducted

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	healthier alternatives to drug use. Only a limited focus is placed on generic skills training, with some teaching of decision-making skills and assertiveness training. This is one of the less comprehensive social influence interventions given the lack of normative education	grade (6% and 13%, respectively, $p < .05$); 8th grade (12% and 31%, respectively, $p < .001$); 9th grade (23% and 40%, respectively, $p < .001$); and, 10th grade (27% and 41%, respectively, $p < .01$). A trend analysis of use by status and time also revealed significant program effects ($F = 5.00$ (3, 229), $p = .002$). Among users however, there was only a significant between-groups difference at 7th grade ($p = .017$) which became non-significant in the years after	
Moberg & Piper (1990)	PMH is an intensive, integrated, multifaceted health promotion program aimed at reducing risk behavior amongst adolescents. The program focused on marijuana and tobacco use, as well as other health issues including nutrition, sexual behaviour, and drinking and driving. PMH intended to prevent marijuana use in those who had not begun experimentation, and reduce or cease use in those already experimenting. The project sought to achieve its objectives through the use of positive role models as instructors, teaching youth the social influence of media messages in relation to the targeted behaviors, refusal skills training, normative education, an emphasis on short term effects of risky health behaviours, attempting to instil a sense of commitment in adolescents to change any risky behaviors, and having students promote the healthy behaviors	Rates of marijuana use increased dramatically in both groups (8.7-16.5% in the experimental condition and 12.2-28% in the control condition). The between group changes were marginally significant ($p=.08$). There is some confusion regarding this as the table p-value is .17	Attrition analysis at follow-up indicated no significant differences between those who continued participation and those who dropped out. The only significant baseline differences between the experimental and control groups were for residence and parent education
Johnson, Pentz, Weber, Dwyer, Baer, MacKinnon, Hansen & Flay (1990)	The Midwestern Prevention Program (MPP) is a multi-component intervention involving a school-based curriculum; a parent organisation program for reviewing school drug prevention policy; parenting programs to improve parenting skills and parent-child communication; mobilisation of community leaders to organise a community drug taskforce; and mass media coverage. The classroom-based curriculum component focused on the social influence of media, peers, adults and the community on drug use, resistance skills training to combat such pressures, normative education, the teaching of assertiveness skills, and problem-solving skills, information dissemination regarding the psychosocial consequences of drug use, and encouraging students to make a public commitment against substance use. Students in the control condition had equal access to the community and	There was an increase in past-month marijuana use rates among both the experimental and control conditions from baseline to follow-up. The intervention significantly reduce the rate of this increase amongst program students ($p=.0405$), with rates increasing among program students from 2.3% at baseline to 12.3% at follow-up (+10%) compared to an increase among control students from 0.7% at baseline to 19.7% at follow-up (+19%)	Analyses for pretest group equivalence revealed no significant differences. Attrition analyses revealed that baseline drug users were significantly more likely to be missing at follow-up, however there were no significant differential attrition effects

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	media components		
Competency Enhancement Interventions			
Smith, Swisher, Vicary, Bechtel, Minner, Henry & Palmer (2004)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	Data was analysed by gender. For program males there were no significant effects on marijuana use at either immediate posttest or 1 year follow-up compared to the control males. At immediate posttest, rates of use were largely unaffected with slightly higher rates of use amongst program males. At follow-up program males reported slightly lower levels of use. For females, rates of reported marijuana use were lower than control females at both immediate posttest and follow-up. These differences were significant at immediate posttest, however differences were no longer significant at 1-year follow-up. There was a significant gender by treatment interaction, with females having significantly more beneficial outcomes at immediate posttest than their male counterparts	Pretest analyses for group equivalence revealed significant differences in free-lunch eligibility, substance use and incidence of problem behaviours, across the three conditions. Thus, these variables were controlled for in subsequent analyses. No analyses of the effects of attrition were conducted
Smith, Swisher, Vicary, Bechtel, Minner, Henry & Palmer (2004)	The I-LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects. This version of the program differs from the standard LST program given it is delivered in an innovative way, infused into regular classroom lessons by teachers. For example, normative beliefs may be addressed in mathematics classes where students graph the actual rates of youth substance	Data was analysed by gender. For males there were no significant effects on marijuana use at either immediate posttest or 1 year follow-up compared to the control males. At immediate posttest, rates of use were largely unaffected with equivalent rates amongst program and control males. At follow-up program males reported slightly higher rates of use. For females, rates of reported marijuana use were lower than control females at both immediate posttest and follow-up. These differences were significant at immediate posttest, however differences were no longer significant at 1-year follow-up. There were no significant gender by treatment interactions	Pretest analyses for group equivalence revealed significant differences in free-lunch eligibility, substance use and incidence of problem behaviours, across the three conditions. Thus, these variables were controlled for in subsequent analyses. No analyses of the effects of attrition were conducted

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	abuse		
McNeal, Hansen, Harrington & Giles (2004)	The All Stars intervention addresses four fundamental mediating factors of substance use and problem behaviour: (1) normative beliefs, (2) lifestyle incongruence, (3) commitment to use drugs, and (4) bonding to school. That is, normative education is employed to address misconceptions regarding drug use, an attempt is made to highlight the incongruence between a commitment to avoid drugs and actual substance use, and teachers/professionals provide one-on-one support for students identified as social isolates, in an attempt to increase their attachment to school and improve their integration into the school social milieu	Overall, there were no significant effects of the intervention on marijuana use, when teacher-delivered. Analysing 30-day prevalence rates of marijuana use, control students reported an increase in rates of use from pretest to posttest (5% to 8.7%), while the teacher condition stunted the growth rate of use altogether (3.2% at both measurement points)	Pretest analyses of group equivalence revealed a number of significant differences, with intervention students being older and reporting higher levels of minority status, alcohol use, sexual activity, norms, and commitment. These variables were used as covariates in subsequent analyses. Taken together, this information suggests a more conservative estimate of the interventions effectiveness. Attrition analyses revealed those students who dropped out were significantly more likely to be male, older, and of minority status, and to have scored worse on all behavioural mediators except sensation seeking. However, there was no differential attrition across conditions
McNeal, Hansen, Harrington & Giles (2004)	The All Stars intervention addresses four fundamental mediating factors of substance use and problem behaviour: (1) normative beliefs, (2) lifestyle incongruence, (3) commitment to use drugs, and (4) bonding to school. That is, normative education is employed to address misconceptions regarding drug use, an attempt is made to highlight the incongruence between a commitment to avoid drugs and actual substance use, and teachers/professionals provide one-on-one support for students identified as social isolates, in an attempt to increase their attachment to school and improve their integration into the school social milieu	Overall, there were no significant effects of the intervention on marijuana use, when professional-delivered. Analysing 30-day prevalence rates of marijuana use, control students reported a larger increase in rates of use from pretest to posttest (5% to 8.7%) than that reported by the professional-delivered condition (3.2% to 4.1%)	Pretest analyses of group equivalence revealed a number of significant differences, with intervention students being older and reporting higher levels of minority status, alcohol use, sexual activity, norms, and commitment. These variables were used as covariates in subsequent analyses. Taken together, this information suggests a more conservative estimate of the interventions effectiveness. Attrition analyses revealed those students who dropped out were significantly more likely to be male, older, and of minority status, and to have scored worse on all behavioural mediators except sensation seeking. However, there was no differential attrition across conditions
Hansen & Dusenbury (2004)	All Stars Plus was recently developed with the goal of expanding the Core program to include the development of other key protective competencies, namely, goal setting, decision making, and resistance skills. That is, these skills are added to normative education, the teaching of generic skills such as communication and interpersonal skills to improve acceptance at school, and family relationships, as well as attempting to instil in adolescents a sense that drug use does not fit in with their life goals and that a commitment to abstain	From pretest to posttest Control students experienced an increase in rates of marijuana use, while students who received the Plus curriculum experienced a slight decline. This difference was not significant however ($F(2, 604) = 1.889$; $p = 0.15$). Also, Plus students did not differ significantly from students who received the Core curriculum. Nonetheless, marijuana use outcomes for Plus students were in a positive direction. Plus students reported the lowest levels of marijuana use, followed by	Only significant difference between the three experimental conditions at pretest was for cigarette smoking (Core students smoked more than control or Plus students). The same pattern was observed for marijuana use and this approached significance ($p = .14$). Pretest use rates and a number of demographic variables used as covariates in subsequent analyses. No attrition analyses were conducted

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	from drug use is thus necessary	Core students, while control students reported the most use. Comparing marijuana use among Controls with Plus students, the effect size was 0.194	
Griffin, Botvin, Nichols & Doyle (2003)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	There was no significant intervention effect on marijuana use. While the control group did report higher rates of marijuana use at posttest (1.87 vs. 1.69), the difference was not statistically significant ($\chi 2 = 1.3$ (1), GEE p=.126)	A series of t-tests revealed no significant baseline differences between the experimental and control groups on substance use outcomes or demographic variables. There were no differences in attrition across conditions, however, overall, those who reported lifetime smoking, marijuana use, and polydrug use at baseline were more likely to drop out than those who did not
Botvin, Griffin, Diaz & Ifill-Williams (2001)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	There were no significant effects of the intervention on marijuana use at the immediate posttest. At one year follow-up a significant effect of the intervention was observed using GLM ANCOVA methods, with students in the experimental condition reporting less marijuana use then their control student counterparts. However, when within school intracluster correlations were controlled for this difference became non-significant	Pretest analyses of group equivalence revealed a number of significant differences between the experimental and control conditions. The experimental condition had a higher proportion of African-American students, while the control condition had a higher proportion of Hispanic students and students receiving free lunches. These demographic variables were used as covariates in subsequent analyses. There were no significant between-group differences in drug use at baseline. Attrition analyses revealed that students who dropped out were more likely to have reported smoking, drinking and using marijuana at baseline. Moreover, experimental students who used marijuana were more likely to drop out than their control group marijuana using counterparts
Hecht, Marsiglia, Elek, Wagstaff, Kulis, Dustman & Miller-Day (2003)	The "keepin' it REAL" curriculum was delivered in three formats (Mexican American, Black/White, Multicultural), each designed to be culturally grounded. In each case the curriculum stressed teaching students a variety of resistance skills such as refusing pressures to use drugs, explaining why	Marijuana use increased in all four conditions across the evaluation periods. A number of analyses were conducted to assess the affect of the intervention on marijuana use. The first set of analyses combined all three versions of the curricula to create an overall intervention condition, and	Pretest analyses of group equivalence revealed a significant difference in ethnic composition of students across the four conditions. Attrition analyses revealed no significant differences in rates of dropout among students of different ethnic status

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	one wishes to not use drugs, avoiding situations in which drug pressures may arise, and leaving situations where drug pressures exist (hence R.E.A.L). Each strategy was discussed but in greater or lesser detail depending on the cultural version of the curricula. In addition, students were also informed of the social influences to use drugs, were presented with information to improve normative misconceptions, and were taught a number of generic life and social skills such as effective communication and decision-making. Each version of the curricula involved cultural narratives designed to make the program more culturally relevant and enhance student identification with the prevention message. Booster sessions involved school assemblies, poster projects, murals, neighbourhood nights out, and essay contests. A series of television and radio public service announcements (PSAs) and a billboard campaign ran concurrently with the curriculum component of the intervention and was designed to reinforce the anti-drug messages being emphasised in the curricula	found a significant effect on marijuana use, with intervention youth reporting less use at the 1-year follow-up ($p < .001$). Use rates were essentially equal at immediate posttest, and slightly lower amongst intervention youth at 6-month follow-up (ns). The second set of analyses compared each of the 3 versions of the curricula with the control condition. At immediate posttest and 6-month follow-up there were no significant differences. However, at both posttest periods the Mexican American curriculum students reported lower levels of use, while both the Black/white, and Multicultural curriculum students reported slightly higher use at immediate posttest and lower levels at 6-month follow-up. At 1-year follow-up all conditions reported lower levels of use, with both the Mexican American curriculum and Multicultural curriculum students reporting significantly less use ($p < .01$ and $p < .05$, respectively). The authors note that the versions reflect the cultural grounding of the content and emphasis of the curriculum, and not the students targeted by the intervention. A final set of analyses assessed whether students matched to a culturally relevant version of the curriculum had more positive changes in substance use then mismatched students. These analyses failed to yield significant differences and thus, provide little support for a cultural matching hypothesis.	
Eisen, Zellman & Murray (2003)	The SFA intervention emphasises the social influences involved with drug use, and teaches a variety of resistance strategies to negate such influences. A cognitive-behavioural approach is adopted to teach a variety of generic life and social skills including decision-making skills, resistance skills, assertiveness, effective communication, and ways to improve peer relationships. Affective components also aid students to build self-esteem, enhance personal responsibility, improve self-confidence, and manage emotions more effectively. General drug use knowledge, consequences of use, the difficulty of transitioning into the teen years, and the benefits of living a healthy and drug-free life are also taught. The SFA by design advocates a zero-tolerance approach to drug use, and does not address the normative beliefs of students	There were statistically significant increases in marijuana use rates among both program and control students from baseline to 1-year follow-up. Significant intervention effects were found for both lifetime ($p=.05$) and 30-day ($p=.03$) marijuana use, with treatment students reporting less of each. Specifically, 27.24% of program students reported lifetime marijuana use compared to 30.5% of control students, and 11.32% of program students reported lifetime marijuana use compared to 13.79% of control students. No significant differences in the behavioural intentions to use marijuana or cocaine/crack were observed between program and control students	Pretest analyses revealed no significant baseline differences between conditions on substance use outcomes. Attrition analyses revealed a number of significant differences between retained students and attrition students, with those dropping out more likely to have reported baseline marijuana use, being from the Detroit and Wayne County districts, being African American, coming from a single parent home, having a greater proportion of friends who smoke cigarettes, and reporting less parental monitoring of activities and school work

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Eisen, Zellman, Massett & Murray (2002)	The SFA intervention emphasises the social influences involved with drug use, and teaches a variety of resistance strategies to negate such influences. A cognitive-behavioural approach is adopted to teach a variety of generic life and social skills including decision-making skills, resistance skills, assertiveness, effective communication, and ways to improve peer relationships. Affective components also aid students to build self-esteem, enhance personal responsibility, improve self-confidence, and manage emotions more effectively. General drug use knowledge, consequences of use, the difficulty of transitioning into the teen years, and the benefits of living a healthy and drug-free life are also taught. The SFA by design advocates a zero-tolerance approach to drug use, and does not address the normative beliefs of students	The intervention had a marginally significant effect on marijuana initiation use rates among baseline nonusers ($F=3.93$, $p=.056$) with a smaller proportion of program students initiating use than control students (9.43% and 11.76%, respectively). However, rates of marijuana use among baseline nonusers were not significantly impacted upon by the program with a slightly smaller proportion of treatment students reporting past 30-day use than control students (4.28% and 5.44%, respectively; $p=.2$). There were no significant differences between treatment and control students who reported marijuana use at baseline. There was some evidence of a positive intervention effect on progression of drug use, with significantly less treatment students progressing from binge drinking to marijuana use (21.11% and 37.57%, respectively; $F=6.25$, $p=.019$) and a marginally significant effect on progression from 30-day alcohol use to marijuana use (16.81% and 23.52%, respectively; $F=3.89$, $p=.059$)	Pretest analyses revealed no significant baseline differences between conditions on substance use outcomes. Attrition analyses revealed a number of significant differences between retained students and attrition students, with those dropping out more likely to have reported baseline marijuana use, Hispanic ethnic origin, come from a single parent home, taken a make-up survey, and a greater number of friends who smoke cigarettes
Spoth, Redmond, Trudeau & Shin (2002)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use. The goal of the SFP is to improve parental skills in nurturing, limit setting, and communication, and by teaching youth prosocial behaviour and resistance skills	At one-year follow-up lower rates of marijuana use initiation were reported amongst experimental students (4.1%) compared to control students (7.9%). The experimental group had significantly less new users than the control group ($F=4.84$ (1, 21), $p<.05$). The relative reduction rate (the proportion of new users in the intervention group relative to the control group) was 48.1. There were no significant differences in marijuana initiation between the LST + SFP condition and a condition in which students received only the LST curriculum ($F=0.01$ (1, 21), ns), however rates were slightly lower among LST + SFP students than LST only students (4.1% and 4.3%, respectively)	The only significant baseline difference across experimental conditions on demographic and substance use outcomes was for single parent households, with control students were more likely to live with both parents. Pretest use rates and parental living status were used as covariates in subsequent analyses. No significant differential attrition was found from pre- to posttest, or posttest to follow-up, on any of the demographic or use outcomes
Spoth, Redmond, Trudeau & Shin (2002)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic	At one-year follow-up lower rates of marijuana use initiation were reported amongst experimental students (4.3%) compared to control students (7.9%). The experimental	The only significant baseline difference across experimental conditions on demographic and substance use outcomes was for single parent

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use	group had significantly less new users than the control group ($F=4.57$ (1, 21), $p < .05$). The relative reduction rate (the proportion of new users in the intervention group relative to the control group) was 45.6. There were no significant differences in marijuana initiation between the LST only condition and a condition in which students received both the LST curriculum and a parenting program ($F=0.01$ (1, 21), ns), however rates were slightly lower among LST + SFP students than LST only students (4.1% and 4.3%, respectively)	households, with control students were more likely to live with both parents. Pretest use rates and parental living status were used as covariates in subsequent analyses. No significant differential attrition was found from pre- to posttest, or posttest to follow-up, on any of the demographic or use outcomes
Scheier, Botvin & Griffin (2001)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	Marijuana use rates were equivalent at pretest (experimental = 1.06; control = 1.09 - no significant differences), and at posttest (both in the 9th and 10th grades) the control group had higher rates of use (9th grade - experimental = 1.46; control = 1.56; 10th grade - experimental = 1.75; control = 1.83). These findings were not significant however	Only significant difference at pretest between experimental and control groups were that control students reported more frequent and intense drinking and more drunkenness and more assertiveness. Attrition analyses revealed that those who dropped out were significantly more likely to be using alcohol, tobacco, and marijuana. The dropout rates were also significantly greater for males than females. Despite this, there were no differential attrition across conditions
Schinke, Tepavac & Cole (2000)	The intervention was a culturally adapted model of life skills training. The program utilised cognitive-behavioural strategies to inform Native American adolescents of the social influences to use drugs, such as peer pressure and the role of advertising and the media. Strategies to resist such pressure (refusal skills) are also taught, as are healthier lifestyle alternatives. A number of generic life and social skills, including problem-solving, personal coping and effective interpersonal communication are also taught. Normative education was addressed through the provision of culturally relevant information emphasising that Native American traditions run counter to substance use. Culturally relevant narratives also aid discussion regarding the perceived benefits	There were no significant intervention effects for the skills training plus community component condition on weekly marijuana use. At immediate follow-up and 2-year follow-up students from the intervention condition reported greater rates of use than the control students, however this finding was reversed at the 1- and 3-year follow-ups. At all follow-up measurements there were no significant differences between students from the skills training plus community component condition and students that received the skills training curriculum only	Pretest analyses for group equivalence suggested no significant differences in substance use rates across conditions. Attrition analyses revealed no significant differential attrition across conditions or between retained and attrition students

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	and consequences of substance use. The community component involved efforts to increase the participation of key community members, such as elders, parents/families, teachers, law enforcement officials, neighbourhood residents, and commercial establishments, in reinforcing the drug prevention message through activities, newsletters, etc		
Schinke, Tepavac & Cole (2000)	The intervention was a culturally adapted model of life skills training. The program utilised cognitive-behavioural strategies to inform Native American adolescents of the social influences to use drugs, such as peer pressure and the role of advertising and the media. Strategies to resist such pressure (refusal skills) are also taught, as are healthier lifestyle alternatives. A number of generic life and social skills, including problem-solving, personal coping and effective interpersonal communication are also taught. Normative education was addressed through the provision of culturally relevant information emphasising that Native American traditions run counter to substance use. Culturally relevant narratives also aid discussion regarding the perceived benefits and consequences of substance use	There were no significant intervention effects for the skills training curriculum condition on weekly marijuana use at immediate posttest, 1-year follow-up, or 2-year follow-up. At immediate follow-up students from the intervention condition reported greater rates of use than the control students, however this finding was reversed at the 1-, 2-, and 3-year follow-ups. At the 3-year follow-up, the skills training students reported significantly less use than the control students ($F=7.63$ (2, 1186), $p < .0001$). At all follow-up measurements there were no significant differences between students from the skills training plus community component condition and students that received the skills training curriculum only	Pretest analyses for group equivalence suggested no significant differences in substance use rates across conditions. Attrition analyses revealed no significant differential attrition across conditions or between retained and attrition students
Piper, Moberg & King (2000)	The HLF intervention utilised a number of strategies including social inoculation in which youth are encouraged to identify and acknowledge the impact of social influences of peers, the media, and other social forces on drug use. Moreover, youths are taught resistance skills to negate such social pressures. Normative education, through the provision of more accurate data on the health behaviours of adolescents, is also a key component of the program. Students are encouraged to make a personal commitment against drug use. Drug education is limited to the short-term impacts and consequences of drug use, rather than the long-term effects. Same age peers delivered approximately one-third of the curriculum. A parent component also featured in the program, with homework assignments, parent meetings, and weekly mail-outs to parents, helping to aid communication between the students and their parents and encouraging support and involvement of the parents, as well as a community component involving a community organizer sponsoring health event and addressing	Unadjusted prevalence rates of past month marijuana use suggested no significant differences between conditions. Students who received the intensive version of the curriculum however, reported more positive rates of use at the 10th grade follow-up (8%) compared to control students (10%) or students receiving the age-appropriate version (12%). Logistic regression analyses, controlling for covariates, revealed a significant effect of the intensive version on past month marijuana use at 10th grade follow-up ($p < .05$), with less use reported. Conversely, students who received the age-appropriate version reported greater rates of use (ns) at 10th grade. At ninth grade, both versions reported non-significant, but positive, effects on marijuana use	Pretest analyses of group equivalence revealed a number of significant differences, with age-appropriate students having less educated parents, and control students having more mothers working outside of the home and living in two-parent families. These variables were controlled for in subsequent analyses. Attrition analyses revealed that retention of students by condition was not significantly different at 9th grade follow-up, however significantly fewer intensive condition students were retained at 10th grade follow-up. No attrition analyses on demographic or substance use variables reported

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	health-related policy issues		
DeWit, Steep, Silverman, Stevens-Lavigne, Ellis, Smythe, Rye, Braun & Wood (2000)	The Opening Doors program aims to prevent or reduce drug use and other deviant behaviour, such as delinquency, truancy, school behaviour problems and poor performance, school dropout, and improve students school, family and social functioning by targeting intermediate factors such as self-esteem, self-concept, coping skills, peer refusal, social skills, and improving attitudes towards social institutions (such as the school and family). Utilises the social competence skills training approach and focuses on teaching generic skills (e.g., social skills, communication skills) designed to enhance personal and interpersonal effectiveness. Normative education also features in the program with adolescents routinely exposed to pro-social and health enhancing beliefs and values. A parent program runs concurrently with the school-based component, and is aims to promote an actively supportive home environment and teach parents to reinforce their children's school experience and efforts to make positive lifestyle changes	There was a significant effect of the intervention on marijuana use frequency ($F=10.85$ (1,143), $p< .001$; $F=6.74$ (1,143), $p< .01$ when adjusting for pretest use and demographic variables). Significantly less program students reporting use at posttest than control students ($p <.01$). While program students still reported less use at follow-up than control students, this difference had diminished and was no longer significant	No test for effects of attrition, or tests for baseline equivalence of groups
Botvin, Griffin, Diaz, Scheier, Williams & Epstein (2000)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	GLM ANCOVA analyses were conducted to identify the effect of the intervention. In all cases, the intervention group reported less illicit drug use than the control group (except for nonmedical pill use, where use rates were equivalent). There were a number of significant intervention effects. Treatment youth reported significantly less marijuana use than the control group ($F=4.81$ (1, 416), $p=.029$), as well as less use of heroin and other narcotics ($F=4.58$ (1, 417), $p=.033$), hallucinogens ($F=5.95$ (1, 417), $p=.015$), and the combined illicit drug use outcomes (total illicit substance use - $F=6.56$ (1, 418), $p=.011$; total illicit drug use other than marijuana - $F=3.56$ (1, 418), $p=.017$). Additional analyses were conducted to control for intracluster correlations (ICCs) among students within schools (due to assignment at the school unit of analysis). GEE ANCOVA analyses had very little effect on the findings suggested by the GLM analyses, except for marijuana use, where the p-value became marginally significant ($p=.071$)	The only difference between experimental and control students at pretest was significantly higher reporting of drinking frequency among control students. This variable was used as a covariate in subsequent analyses. No attrition analyses were conducted

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Botvin, Baker, Dusenbury, Botvin & Diaz (1995)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	For the full sample: there were no significant effects of the intervention on prevalence of either monthly or weekly of marijuana use, although the experimental group reported a lower rate of use. There were however, some significant impacts on cigarette smoking and getting drunk, as well as weekly prevalence of polydrug use that included marijuana (cigarettes and marijuana; alcohol, cigarettes and marijuana). For the high-fidelity sample: there was significantly less prevalence of weekly marijuana use in the experimental condition (p=<.05). There were also numerous significant impacts on cigarette and alcohol use, as well as weekly prevalence of polydrug use that included marijuana (cigarettes and marijuana; alcohol, cigarettes and marijuana)	No significant pretest differences were found for either the full sample or the high fidelity sample. No differential attrition effects were found for any of the drug use variables in either the full sample or the high-fidelity sample
Botvin, Baker, Dusenbury, Tortu & Botvin (1990)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	At 3-year follow-up, the experimental condition reported significantly lower levels of marijuana use than the control group (F = 4.04 (2, 3678), p = .0176). The minimal provider training condition (videotape training) was compared to a condition where teachers received considerable training (training workshop and feedback condition). As hypothesised the considerable training condition reported lower levels of use at follow-up than the minimal training condition (1.51 and 1.54, respectively), however this difference was not significant	Tests of baseline equivalence revealed no significant differences across the conditions in behavioural outcomes. No information provided regarding equivalence on demographic variables. Attrition analyses revealed that significantly more smokers and marijuana users dropped out of the sample than non-smokers and non-users. There was significantly greater attrition of pretest marijuana users from the control condition than the experimental condition leading to a more conservative test of the effect of the intervention
Botvin, Epstein, Baker, Diaz & Ifill-Williams (1997)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the	The intervention had a significant impact on rates of marijuana use (F=2.79 (1, 703), p=.0477), with intervention students reporting lower rates of use then their control counterparts. There were also impacts on behavioural intentions, with intervention students reporting significantly less intention to smoke marijuana (F=2.81 (1, 687), p=.0471) than control students. There was also a marginally significant impact on intention to use cocaine (F=2.53 (1, 689), p=.0562), with results favouring the intervention group	Pretest analyses of group equivalence revealed no significant differences in substance use rates. The only significant difference among demographic variables was for ethnicity, with a greater proportion of African-American youth, and a lower proportion of Hispanic youth in the experimental group. No attrition analyses were conducted

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	normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects		
Botvin, Schinke, Epstein, Diaz & Botvin (1995)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	The standard LST curriculum failed to have a significant impact on current marijuana use at posttest, with similar proportions of intervention and control students reporting use (18% and 19%, respectively). The intervention also failed to have an effect on future intentions to use marijuana	Pretest analyses of group equivalence revealed a number of significant differences. There were a greater proportion of Latino students, a lower proportion of African American students, and a greater percentage of students reporting living in a two-parent home in the control condition than the experimental condition. There were also more positive outcomes for alcohol variables amongst control students. These variables were controlled in subsequent analyses. Attrition analyses revealed that amongst baseline marijuana users there was significantly higher attrition in the control condition compared to the experimental condition. There were no other differential attrition effects
Botvin, Schinke, Epstein, Diaz & Botvin (1995)	The culturally focused LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects. This version differs from the standard program in its delivery and teaching methods, using a group counselling format and storytelling, videos, and peers as culturally relevant mediums of program content	The culturally focused LST curriculum failed to have a significant impact on current marijuana use at posttest, with similar proportions of intervention and control students reporting use (20% and 19%, respectively). The intervention also failed to have an effect on future intentions to use marijuana	Pretest analyses of group equivalence revealed a number of significant differences. There were a greater proportion of Latino students, a lower proportion of African American students, and a greater percentage of students reporting living in a two-parent home in the control condition than the experimental condition. There were also more positive outcomes for alcohol variables amongst control students. These variables were controlled in subsequent analyses. Attrition analyses revealed that amongst baseline marijuana users there was higher attrition in the control condition compared to the experimental condition (marginally significant). There were no other differential attrition effects
Botvin, Baker, Dusenbury, Botvin & Diaz	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social	For the full sample: there were no significant effects of the intervention on prevalence of either monthly or weekly of	No significant pretest differences were found for either the full sample or the high fidelity sample. No

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(1995)	influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	marijuana use, although the experimental group reported a lower rate of use. There were however, some significant impacts on cigarette smoking and getting drunk, as well as weekly prevalence of polydrug use that included marijuana (cigarettes and marijuana; alcohol, cigarettes and marijuana). For the high-fidelity sample: there was significantly less prevalence of weekly and monthly marijuana use in the experimental condition (both $p<.05$). There were also numerous significant impacts on cigarette and alcohol use, as well as weekly prevalence of polydrug use that included marijuana (cigarettes and marijuana; alcohol, cigarettes and marijuana)	differential attrition effects were found for any of the drug use variables in either the full sample or the high-fidelity sample
Botvin, Baker, Dusenbury, Tortu & Botvin (1990)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	At 3-year follow-up, the experimental condition reported significantly lower levels of marijuana use than the control group ($F = 4.04$ (2, 3678), $p = .0176$). The considerable provider training condition (training workshop and feedback condition) was compared to a condition where teachers received minimal training (videotape training). As hypothesised the considerable training condition reported lower levels of use at follow-up than the minimal training condition (1.51 and 1.54, respectively), however this difference was not significant	Tests of baseline equivalence revealed no significant differences across the conditions in behavioural outcomes. No information provided regarding equivalence on demographic variables. Attrition analyses revealed that significantly more smokers and marijuana users dropped out of the sample than non-smokers and non-users. There was significantly greater attrition of pretest marijuana users from the control condition than the experimental condition leading to a more conservative test of the effect of the intervention
Botvin, Baker, Filazzola & Botvin (1990)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this	At the one-year follow-up the intervention (teacher-led plus boosters) failed to impact significantly on rates of lifetime, past month, past week, or past day marijuana use, or on marijuana use index scores, compared to the control. In fact, in all outcomes reported rates of use among program youth were greater than those reported by control youth. In addition, the program (when delivered by regular classroom teachers and including booster sessions) resulted in significantly greater marijuana index scores ($p <.05$), compared to a condition in which the program was delivered by older peer leaders and did not involve booster sessions. Further, compared to a condition where the	Pretest analyses for group equivalence were not conducted, however baseline response frequencies were used as covariates in all subsequent analyses of the data. Attrition analyses revealed that while students who dropped out were significantly more likely to have reported drinking and having smoked marijuana at baseline, there were no differential attrition effects across conditions

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	program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	program was delivered by older peers and included booster sessions, significantly greater past month ($p < .003$), past week ($p < .03$), and marijuana index scores ($p < .0007$) were reported. There were no other significant differences between this condition and others	
Botvin, Baker, Filazzola & Botvin (1990)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	At the one-year follow-up the intervention (peer-led plus boosters) significantly reduced rates of past month marijuana use ($p < .03$) and scores on the marijuana use index ($p < .03$), compared to the control group. While the program failed to impact significantly on rates of lifetime, past week, or past day marijuana use in comparison to the control group, in all cases reported use rates were lower among program students. The intervention (when delivered by older peers and including booster sessions) also resulted in significantly reduced past month ($p < .003$), past week ($p < .03$), and marijuana index scores ($p < .0007$), compared to a condition in which the program and booster sessions were delivered by regular classroom teachers. There were no other significant differences between this condition and others	Pretest analyses for group equivalence were not conducted, however baseline response frequencies were used as covariates in all subsequent analyses of the data. Attrition analyses revealed that while students who dropped out were significantly more likely to have reported drinking and having smoked marijuana at baseline, there were no differential attrition effects across conditions
Botvin, Baker, Filazzola & Botvin (1990)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	At the one-year follow-up the intervention (teacher-led) failed to impact significantly on rates of lifetime, past month, past week, or past day marijuana use, or on marijuana use index scores, compared to the control. Use rates for program students were almost equivalent to those reported by control students. There were also no significant differences between this condition and others	Pretest analyses for group equivalence were not conducted, however baseline response frequencies were used as covariates in all subsequent analyses of the data. Attrition analyses revealed that while students who dropped out were significantly more likely to have reported drinking and having smoked marijuana at baseline, there were no differential attrition effects across conditions
Botvin, Baker, Renick, Filazzola & Botvin (1984)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social	The intervention failed to have a significant impact on either monthly or weekly marijuana use rates, when compared to the control condition. Furthermore, students in the teacher-led intervention condition reported significantly more	Pretest analyses for group equivalence were not conducted; however baseline response frequencies were used as covariates in all subsequent analyses of the data. No attrition analysis was conducted

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	monthly and weekly marijuana use than students in a condition where the same curriculum was delivered by older aged peers ($p < .003$ and $p < .01$, respectively)	
Botvin, Baker, Filazzola & Botvin (1990)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	At the one-year follow-up the intervention (peer-led) failed to impact significantly on rates of lifetime, past month, past week, or past day marijuana use, or on marijuana use index scores, compared to the control. However, rates of reported use were lower than that of the control group for all outcomes except lifetime use. The program (when delivered by older peers but not including booster sessions) did result in significantly reduced marijuana index scores ($p < .05$), compared to a condition in which the program and booster sessions were delivered by regular classroom teachers. There were no other significant differences between this condition and others	Pretest analyses for group equivalence were not conducted, however baseline response frequencies were used as covariates in all subsequent analyses of the data. Attrition analyses revealed that while students who dropped out were significantly more likely to have reported drinking and having smoked marijuana at baseline, there were no differential attrition effects across conditions
Botvin, Baker, Renick, Filazzola & Botvin (1984)	The LST curriculum focuses on teaching information and skills related to understanding, interpreting and resisting social influences that promote drug use, as well as teaching generic personal and social skills that aim to improve social competence. The program also promotes the development of characteristics associated with decreased risk for using drugs. Cognitive-behavioral skills training in the areas of self-esteem, peer pressure, social influence, coping skills, communication, interpersonal relationships, and assertiveness is the impetus of this program. There is also attempt to improve the normative perception of drug use amongst youth. Knowledge dissemination regarding drug use also features in this program, however the emphasis is on the immediate negative consequences of drug use, rather than the long-term effects	The intervention had a significant main effect on both monthly marijuana use ($F = 4.86$ (2, 1100), $p < .008$) and weekly marijuana use ($F = 5.11$ (2, 1097), $p < .006$). Planned post hoc comparisons showed that students in the peer-led intervention, compared to control students, reported significantly less posttest monthly and weekly marijuana use ($p < .001$ and $p < .002$, respectively). Students in the peer-led intervention condition also reported significantly less monthly and weekly marijuana use than students in a condition where the same curriculum was delivered by regular classroom teachers ($p < .003$ and $p < .01$, respectively)	Pretest analyses for group equivalence were not conducted; however baseline response frequencies were used as covariates in all subsequent analyses of the data. No attrition analysis was conducted

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
System-Wide Change Interventions			
Zavela, Battistich, Gosselink & Dean (2004)	SYF is an comprehensive, multifaceted, and culturally sensitive approach. School-based health promotion curricula focused on substance abuse avoidance, building resiliency through improvements in self-acceptance and problem-solving, and promoting healthy behaviours. The academic improvement/enhancement component involved tutoring and mentoring of students referred by teachers and project staff. A variety of parent and family programs were also available that focused on substance-abuse education, parenting skills and family communication. Alternative, drug-free activities included school and extracurricular activities that reinforced the drug-nonuse message by engaging youth in non-competitive, health promoting alternative sporting and recreational activities. Youth leadership training was also utilised to aid adolescents' development. Finally, high-risk students were referred to case managers who worked with the student and their family to improve individual behaviour, family environments, and to make appropriate referrals to community resources	Program students reported lower levels of lifetime, past 30-day, and frequency of marijuana use, and less 30-day illicit drug use, than comparison students. However, the only difference that approached statistical significance was for lifetime marijuana use ($F(1, 247) = 2.97$, $p < .09$, ES = -.22), with fewer program (35%) than comparison students (46%) reporting that they had ever used marijuana	No test for effects of attrition, or tests for baseline equivalence of groups. However, a number of demographic variables were used as covariates in subsequent analyses
Zavela, Battistich, Dean, Flores, Barton & Delaney (1997)	SYF is an comprehensive, multifaceted, and culturally sensitive approach. School-based health promotion curricula focused on substance abuse avoidance, building resiliency through improvements in self-acceptance and problem-solving, and promoting healthy behaviours. The academic improvement/enhancement component involved tutoring and mentoring of students referred by teachers and project staff. A variety of parent and family programs were also available that focused on substance-abuse education, parenting skills and family communication. Alternative, drug-free activities included school and extracurricular activities that reinforced the drug-nonuse message by engaging youth in non-competitive, health promoting alternative sporting and recreational activities. Youth leadership training was also utilised to aid adolescents' development. Finally, high-risk students were referred to case managers who worked with the student and their family to improve individual behaviour, family	There were no significant differences between program and comparison students in either lifetime (22% and 18%, respectively) or past 30-day (13% and 12%, respectively) use of marijuana, however as can be seen program students reported higher rates of use. No significant difference was observed for lifetime prevalence of cocaine/crack use (8% in the program group and 6% in the comparison group), however the program group reported significantly less past 30-day cocaine/crack use (4% for the program group and 7% for the comparison group, $p < .001$). There was a significant impact among program participants of baseline risk on both lifetime and 30-day marijuana use, with students identified as higher risk reporting higher levels of use ($p < .05$). There were no significant effects of levels of program participation on rates of lifetime or 30-day marijuana use	No test for effects of attrition, or tests for baseline equivalence of groups

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
	environments, and to make appropriate referrals to community resources		
Furr-Holden, Ialongo, Anthony, Petras & Kellman (2004)	The FSP involved 3 components: (1) enhancement of parent-school communication, through training of teachers and school mental health professionals in facilitating increased parental involvement in school activities; (2) weekly home-school learning and communication activities; and (3) series of parent workshops covering issues such as the importance of parent-school communication and collaboration, parent teaching skills, the importance of parental support of a child's academic achievement, and improving child discipline and behaviour management	The intervention had no significant impact on marijuana use, with intervention youth actually reporting higher levels of use than their control youth counterparts (21% and 19%, respectively). The intervention also failed to have a significant effect on other illicit drug use (cocaine, crack, heroin), with only slightly fewer treatment youth reporting use of such substances than control youth (6% and 7%, respectively). These findings remained unchanged when covariate adjustments, and adjustments for intraclass correlations, were made	There was no evidence of differential attrition across groups. It was unclear as to whether pretest analyses of group equivalence were conducted
Bond, Thomas, Coffey, Glover, Butler, Carlin & Patton (2004)	The Gatehouse Project was designed to prevent or reduce the onset of mental health problems by creating a more positive school social environment. The intervention included both institutional and individual components. The individual component involved a curriculum-based approach that emphasised positive emotional and behavioural development, through the teaching of cognitive-behavioural strategies such as interpersonal skills. This component of the intervention did not involve drug specific education or the teaching of resistance skills. The institutional component involved creating school-wide change through the promotion of a safe, secure, and trustworthy school social and learning environment which addresses risk and protective factors. Key elements in achieving this included the establishment of school liaison team	The intervention failed to have a significant impact on marijuana use prevalence or incidence rates among the intervention group, for either past six month use, or weekly or greater use. However, in all instances the intervention group did report lower rates of use or initiation then their control counterparts. There was evidence to suggest that intervention youth reporting not smoking or using marijuana at baseline were significantly less likely to report weekly or greater use at 10th grade follow-up, then intervention youth who had used cigarettes but not marijuana at baseline	No test for effects of attrition, or tests for baseline equivalence of groups
Morris, Parker & Aldridge (2002)	Integrated Programme (IP) involved exposing youth to a variety of drug educational inputs, such as drama workshops, a teacher delivered curriculum, educational talks by invited guests, and drug information packs. In addition, an outreach program, conducted outside of school hours, provided extra assistance for students identified as high-risk. Parental involvement was also encouraged through parent meetings focusing on drug use and ways to effectively communicate with their children, and a number of community drugs awareness programs were run, intended for small groups of students	The findings suggest a more positive effect of the intervention on program students from the younger cohort, especially in West Yorkshire. At this site, use rates were lower among program participants on all individual drug use measures (amphetamines, cannabis, cocaine, ecstasy, heroin, LSD, mushrooms). Rates were significantly lower for amphetamine, ecstasy, and mushroom use. At Northumbria, results were slightly less promising with no significant differences and lower rates of use for amphetamines and ecstasy only (cannabis use rates largely equivalent, and LSD and mushroom use rates	Pretest analyses of group differences revealed a number of significant differences in background characteristics, including single-parent status, unemployment of mother/father, and smoking and drinking rates. These variables were used as covariates in subsequent analyses. Attrition analyses revealed a number of significant differences. Those dropping out tended to be older, male, have unemployed mothers and/or fathers, come from single-parent homes, had been exposed to more drug offer situations, and used more

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
		larger). Among the older cohort, West Yorkshire intervention students experienced no significant differences compared to the control group, and reported lower levels of cannabis and mushroom use only. However, at Northumbria, program students reported lower rates of use on all individual drug measures, with significantly lower rates of cannabis use. Across both sites and age cohorts there was evidence to suggest that the program may have had an impact by minimising hard drug use rates, with program students reporting softer drug use repertoires. The intervention appeared to have little impact on initiation rates	alcohol, tobacco, and other drugs
Cuijpers, Jonkers, de Weerdt & de Jong (2002)	The Healthy Schools and Drugs program is a multi-componential intervention involving 5 main elements: (1) a curriculum-based component, in which children are taught general drug information, refusal skills, decision-making skills, skills to increase self-esteem, and the development of healthy attitudes towards drugs; (2) establishment of a school committee responsible for coordinating all drug prevention efforts within the school; (3) formulation of school regulations on drug use; (4) development of a system to identify students with drug problems and appropriately refer them to support and counselling services; and (5) involving parents through parent evenings, explanatory program brochures, and newsletters	The intervention did not significantly reduce the proportion of students reporting ever having used marijuana at immediate posttest (16.5% in the intervention group and 18.5% in the control group). Given that proportions on this outcome were almost identical at baseline for the intervention and control groups (2.5% and 2.4%, respectively) the intervention appears to have had little immediate impact on reducing initiation. Contrary to expectation, a greater proportion of intervention students reported monthly marijuana use at immediate posttest, compared to their control counterparts (58.5% and 50.8%, respectively). This finding approached significance ($p = <0.1$)	Pretest analyses of group equivalence found that control students, relative to their experimental counterparts, were more likely to have smoked cigarettes, and to have greater knowledge of, and differing attitudes towards, substance use. These variables were fund to be not significantly related to the dependent variables. There were no significant differences on substance use outcomes at baseline. There were no tests for the effects of attrition, but observed rates suggest greater attrition amongst intervention group compared to the control group (32% and 20%, respectively)
Other Interventions			
Furr-Holden, Ialongo, Anthony, Petras & Kellman (2004)	The CC involved 3 components: (1) curriculum designed to enhance academic achievement, such as interactive activities targeting listening and comprehension skills, composition skills, critical thinking skills, and mathematic skills; (2) behaviour management strategies for teachers, designed to improve the classroom behaviour of students and reduce inattentive and disruptive behaviour amongst students; and (3) supplementary strategies for students performing below standard, including tutoring and adaptations to the curriculum to facilitate individual learning styles.	The intervention had no significant impact on marijuana use, with intervention youth actually reporting higher levels of use than their control youth counterparts (21% and 19%, respectively). The intervention did however have a marginally significant effect ($p = .051$) on other illicit drug use (cocaine, crack, heroin), with treatment youth reporting less use than control youth (3% and 7%, respectively). Looking at relative risk ratios intervention students were significantly less likely have used illicit drugs compared to control youth ($p <.05$), and this finding remained unchanged when covariate adjustments, and adjustments	There was no evidence of differential attrition across groups. It was unclear as to whether pretest analyses of group equivalence were conducted

Authors & Publication Year	Summary of intervention	Summary of results pertaining to illicit drug outcomes	Attrition Analysis & Pretest Group Equivalence
		for intraclass correlations, were made	
Valentine, Griffith, Ruthazer, Gottlieb & Keel (1998)	Very limited information regarding the intervention was reported. The Urban Youth Connection involved individual, pair or group counselling. In this sense, it was markedly different to the typical curriculum-based programs	Assessing the crude, unadjusted follow-up substance use prevalence rates, at the middle school, there were no statistically significant differences between treatment and comparison group students for 30-day marijuana or cocaine use, with treatment students reporting more marijuana use, but less cocaine use. Among high school students, the treatment group were significantly more likely to report 30-day marijuana use (38.5% vs. 20.2%, p=.001), and also reported more cocaine use (nonsignificant). The authors explain the higher rates of use among treatment students as evidence that the intervention correctly served high-risk students, with the comparison group representing a students with a lower level of risk. Adjusting for baseline differences, the differences between middle school treatment and comparison student's marijuana and cocaine use remained nonsignificant. Marijuana use was again higher amongst treatment students in this cohort. Amongst high school students there was again, significantly more marijuana use amongst treatment students	Of students who reported data at both pre- and posttest, there were significantly more males than females at the high schools, and at the middle school there were significantly fewer Hispanics and more African-Americans in the treatment group, as well as significantly more treatment students living in single-parent homes. The treatment group (in both middle and high school) also scored significantly higher on pretest outcome measures including substance use and other problem behaviours. Baseline differences were controlled for in subsequent analyses. No attrition analyses were conducted
Valentine, Gottlieb, Keel, Griffith & Ruthazer (1998)	Very limited information regarding the intervention was reported. The Urban Youth Connection involved individual, pair or group counselling. In this sense, it was markedly different to the typical curriculum-based programs	While there are few significant results the authors stress the importance of analysing the trends of the data given that the low sample size reduced the ability to find statistically significant results. Unadjusted amount of change in marijuana use suggested that although rates of change tended to be better for treatment students, there were no statistically significant differences. When changes in use were adjusted for pretest marijuana use, results tended to remain nonsignificant, although the higher proportion of new marijuana users in the treatment group approached significance (p = .07). When analysing trends, both middle and high school treatment students had higher rates of marijuana use. In both middle and high school, there was a greater percentage of new users among treatment group students, however less continuing users	Of students who reported data at both pre- and posttest, there were no significant differences between groups at the high schools, however at the middle school there were significantly fewer Hispanics and more African-Americans in the treatment group. There were no significant differences in either middle or high school in drug outcome variables, except for more tobacco use among the middle school treatment group (p = .003). Baseline differences controlled for in subsequent analyses. No attrition analyses were conducted

APPENDIX B: FORMULAS USED TO CALCULATE EFFECT SIZES FOR THE META-ANALYSIS

To calculate an effect size for studies with pretest and posttest means and standard deviations the following formula was used:

$$d = \frac{(M_{post,\,E} - M_{pre,\,E})}{SD_{pooled}} - \frac{(M_{post,\,C} - M_{pre,\,C})}{SD_{pooled}} \qquad \text{Eq. 1}$$

The overall pooled within standard deviation was calculated by first calculating the pooled within standard deviation for the experimental and control groups separately, using the following formula:

$$\mathrm{SD}_{pooled,\,w} = \sqrt{\frac{(N_{E/C} - 1)(SD_{E/C})^2 + (N_{E/C} - 1)(SD_{E/C})^2}{N_{E/C} - 1 + N_{E/C} - 1}} \qquad \text{Eq. 2}$$

The results of these two calculations were then used to calculate the overall pooled within standard deviation using the following formula:

$$\mathrm{SD}_{pooled} = \sqrt{\frac{(N_E - 1)(SD_E)^2 + (N_C - 1)(SD_C)^2}{N_E - 1 + N_C - 1}} \qquad \text{Eq. 3}$$

The following formula was employed to calculate the variance of the effect size calculated from Equation 1. The variance was calculated separately for the experimental and control groups.

$$\mathrm{Var\,(d)}_{E/C} = \left[\frac{2(1-p)}{n}\right]\left(\frac{n-1}{n-3}\right)\left[1 + \left(\frac{n}{2(1-p)}\mathrm{d}^2\right)\right] - \frac{\mathrm{d}^2}{[c(n-1)]^2} \qquad \text{Eq. 4}$$

where: n = number of paired observations in a single-group pretest-posttest design; p is estimated to be .5 or .25; d = effect size for each group

$$\mathrm{c(df)} = 1 - \frac{3}{(4df) - 1}$$

where: $df = n - 1$

The overall variance of the effect size was calculated by simply adding the variance of both groups, as described in the following formula:

$$\mathrm{Var\,(d)} = \mathrm{Var\,(d)}_E + \mathrm{Var\,(d)}_C \qquad \text{Eq. 5}$$

The following formula was used to calculate the effect size when pretest means and standard deviations were not available:

$$d = \frac{(M_{post,E} - M_{post,C})}{SD_{pooled}} \quad \text{Eq. 6}$$

The pooled within standard deviation was calculated using Equation 3. The variance of the effect size was calculated using the following formula:

$$\text{Var (d)} = \left[\frac{N_E + N_C}{N_E N_C} + \frac{d^2}{2(N_E + N_C)}\right] \quad \text{Eq. 7}$$

The following formula was used to calculate the effect size from pretest-posttest proportions:

$$\text{d} = \left[\frac{\sqrt{3}}{\pi}[\ln(\frac{p_a p_d}{p_b p_c})]\right] - \left[\frac{\sqrt{3}}{\pi}[\ln(\frac{p_a p_d}{p_b p_c})]\right] \quad \text{Eq. 8}$$

where: $\sqrt{3}/\pi = .55133$; ln is the natural logarithm

The variance of the effect size was calculated using the following formula:

$$\text{Var (d)} = \frac{2\pi l_E(1-l_E)e^{(lE)}}{n} + \frac{2\pi l_C(1-l_C)e^{(lC)}}{n} \quad \text{Eq. 9}$$

Likewise, effect sizes where also able to be calculated from the following data using the following formulas:

From *t*-values:

$$d = t\sqrt{\frac{1}{N_E} + \frac{1}{N_C}} \quad \text{Eq. 10}$$

From *F*-values:

$$d = \sqrt{\frac{F(N_E + N_C)}{N_E N_C}} \quad \text{Eq. 11}$$

From χ^2 values:

$$d = 2\sqrt{\frac{\chi^2}{N - \chi^2}} \quad \text{Eq. 12}$$

Irrespective of the effect size calculation method the following formula was used to calculate the 95% confidence intervals (95% CI):

$$95\%\text{CI} = d \pm 1.96\sqrt{Var(d)}$$

Eq. 13

Similarly, the following formula was used in all instances to calculate the inverse variance of all effect sizes:

$$\text{inverse variance} = \frac{1}{\text{variance of d}} \quad \text{Eq. 14}$$

The following formula was used to combine multiple effect sizes and calculate a mean effect size:

$$\text{d.} = \left(\sum_{i-1}^{k} w_i d_i\right) / \left(\sum_{i-1}^{k} w_i\right) \quad \text{Eq. 15}$$

where: *k* = number of studies; *di* = individual study effect size statistic; *wi* = individual study inverse variance weight

The variance of the mean effect size is calculated using the following formula:

$$\text{Var(d.)} = 1 / \left(\sum_{i-1}^{k} w_i\right) \quad \text{Eq. 16}$$

where: *k* = number of studies; *wi* = individual study inverse variance weight

The 95% CI of the mean effect size is calculated using a formula synonymous to Equation 13:

$$95\%\text{CI} = d. \pm 1.96\sqrt{Var(d.)} \quad \text{Eq. 17}$$

The Q-statistic, exploring heterogeneity of the effect sizes included in a meta-analysis is calculated using the following formula:

$$\text{Q} = \sum_{i-1}^{k} w_i \left(d_i - d.\right) \quad \text{Eq. 18}$$

where: *k* = number of studies; *di* = individual study effect size statistic; *wi* = individual study inverse variance weight