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**SCHOOL BASED DRUG PREVENTION PROGRAMS:  
A REVIEW OF WHAT WORKS**

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## ABSTRACT

This paper examines the effectiveness of school-based drug prevention programs in preventing illicit drug use. Our paper reports the results of a systematic review of the evaluation literature to answer three fundamental questions: (1) do school-based drug prevention programs reduce rates of illicit drug use? (2) if they do, what features are characteristic of effective programs? and (3) do these effective program characteristics differ from those identified as effective in reviews of school-based drug prevention of licit substance use (such as alcohol and tobacco)? Using systematic review and meta-analytic techniques, we identify the characteristics of school-based drug prevention programs that have a significant and beneficial impact on ameliorating *illicit* substance use (i.e. narcotics) among young people. We find that successful intervention programs typically involve high levels of interactivity, time-intensity, and universal approaches that are delivered in the middle school years. These program characteristics aligned with many of the effective program elements found in previous reviews exploring the impact of school-based drug prevention on *licit* drug use (i.e. alcohol and tobacco). Contrary to these past reviews, however, our analysis suggests that the inclusion of booster sessions and multifaceted drug prevention programs have little impact on preventing illicit drug use among school-aged children. Limitations of the current review and policy implications are discussed.

**Keywords:** school-based drug prevention, illicit drugs, substance use, meta-analysis, systematic review.

## INTRODUCTION

Schools are a popular starting point for the delivery of many social education and prevention efforts, 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). School-based drug prevention (SBDP) programs are especially popular, with evidence suggesting their benefits to be twice that of costs (Caulkins, Pacula, Paddock & Chiesa, 2002). Schools are thus an appropriate and convenient “platform” from which to launch drug prevention efforts. Schools have the ability to reach large numbers of school-aged children, and programs delivered during school hours are relatively easy to implement compared to other types of non-institutionally based programs (such as family or community-based programs). Petrosino (2003) laments, however, that the large number of highly variable school-based programs creates confusion amongst policy-makers as to which strategies to implement.

A plethora of studies have assessed the effectiveness of SBDP efforts, most of which focus on the impact of these programs on reducing or preventing *licit* drug use<sup>1</sup> (Allott, Paxton & Leonard, 1999; Belcher & Shinitzky, 1998; Black, Tobler & Sciacca, 1998; Botvin & Griffin, 2003; 2004; Coggans, Cheyne & McKellar, 2003; Cuijpers, 2002; Dusenbury, Mathea & Lake, 1997; Ennett et al., 1994; Flay, 2000; Gottfredson & Wilson, 2003; McBride, 2003; Midford, 2000; Skara & Sussman, 2003; Tobler, et al., 2000). The focus in the literature on licit drug consumption, such as alcohol and tobacco, makes intuitive sense given that most SBDP programs are implemented at a developmental stage when illicit drug use rates among adolescents are low.

We know, however, that illicit substance use among school-aged children is a major and growing concern. In 2004, 28.5% of Australian adolescents aged 12 to 17 years had used an illicit drug during their life. More than one in five 12 to 17 year olds reported having tried marijuana (23.2%), 3.7% reported having tried amphetamines, 3.4% ecstasy, 1.0% cocaine, and 0.5% opiates (Australian Institute of Health and Welfare, 2005). In the US 36.8% of 8<sup>th</sup> through 12<sup>th</sup> graders reported having used an illicit substance during their lifetime (Johnston, O'Malley, Bachman & Schulenberg, 2005). To our knowledge there have been just two systematic reviews that have examined the impact of SBDP programs on *illicit* drug outcomes (see Tobler, Lessard, Marshall, Ochshorn & Roona, 1999; White & Pitts, 1998). Our research extends the body of literature around SBDP in two ways: first, we update these two past systematic reviews by accessing studies conducted *post* the late 1990s to assess the effectiveness of SBDP programs in reducing or preventing *illicit* substance use. Second, we compare and contrast our results with reviews of *licit* drug use outcomes.

Our paper addresses three fundamental research questions: (1) do school-based drug prevention programs reduce rates of illicit drug use? (2) if they do, what features are characteristic of effective programs? and (3) are these effective program characteristics similar to those identified as effective in reviews of school-based drug prevention of licit substance use? To answer these research questions our approach proceeds in three stages: first, we identify the key elements of program success that have been found in past reviews of SBDP programs that target *licit* drug use. Second, we update the two past reviews of SBDP that report results pertaining to *illicit* drug use outcomes using systematic and meta-analytic approaches to synthesize relevant recent literature. We then

compare and contrast the elements that we find to be components of successful SBDP programs that target *illicit drug use* with the successful elements found in the majority of the literature on the impact of SBDP programs on *licit* drug use outcomes. We conclude our paper with a discussion of the policy implications of our research findings.

### **SCHOOL BASED PROGRAMS: WHAT WE KNOW SO FAR**

School-based prevention programs encompass a very wide range of interventions. Some are structured and use peer learning as a way to engage young people in an interactive manner (see for example Black, Tobler, & Sciacca, 1998). Some seek to build highly specific resilience skills (see for example Hurry, Lloyd & McGurk, 2000). Others are more passive and merely seek to provide young people with educational information (see for example Forman, Linney & Brodino, 1990). School based prevention programs also vary by the grade at which the program is delivered, the level of intensity and interactivity, the type of attitude or behaviour that the program seeks to change.

The first stage of our review sought to conduct a synopsis of the range of systematic reviews already present in the literature to tease out the key components of successful school-based programs that target licit and illicit substance use. As such, the following section identifies the main components of school based prevention programs and highlights the key findings from past reviews in two key areas: licit drug outcomes and illicit drug outcomes.

#### **The Value of Interactivity on Licit Drug Outcomes**

According to Tobler et al. (2000), “[I]nteractive programs provide contact and communication opportunities for the exchange of ideas among participants and encourage learning drug refusal skills” (p. 287). The use of interactivity in school-based prevention

programs is an important feature across a range of different types of programs that address a variety of social issues, such as anti-bullying (see Bouhours, 2001) and life education (see Eisen, Zellman & Murray, 2003; Botvin, Baker Dusenbury, Tortu & Botvin, 1990). For drug prevention, research finds that the more interactivity in a SBDP program (i.e., the more that communication among teachers, students and peers is maximised), the more likely it is that a student will be prevented from using a licit substance. Tobler and her colleagues (2000) report that student involvement in the delivery of a program is associated with improved efficacy of drug prevention programs. They (see Tobler, et al., 2000; Tobler et al., 1999) also reported significant positive effects on self-reported licit and illicit drug use for approaches involving interactive teaching methods, such as social influence and competency enhancement.

Conversely, variants of non-interactive programs, such as knowledge dissemination (providing educational material on the harmful effects of drugs) and affective education (teaching students about the relationship between emotions and drug use and what strategies may help to keep emotions in check) were not found to have significant impacts on drug use. A multitude of reviews have since corroborated these findings (see Allott, Paxton & Leonard, 1999; Black, Tobler & Sciacca, 1998; Botvin & Griffin, 2003; Cuijpers, 2002; McBride, 2003).

### **The Importance of Program Intensity on Licit Drug Outcomes**

From a logical perspective, one would expect that more “intense” SBDP programs would generate more pro-social behavioural change among school-aged children than the less intense programs. Evidence suggests that there is indeed value in developing drug prevention programs that involve multiple sessions, with more intensive programs

associated with greater effectiveness (Botvin & Griffin, 2003; Gottfredson & Wilson, 2003; McBride, 2003; Tobler, et al., 2000; Tobler, et al., 1999; White & Pitts, 1998).

### **The Impact of Booster Sessions on Licit Drug Outcomes**

Similarly, the inclusion of booster sessions that are designed to reiterate and build upon original program content has been found to enhance the effectiveness of SBDP programs (Botvin & Griffin, 2003; Gottfredson & Wilson, 2003; McBride, 2003; Skara & Sussman, 2003; Tobler et al., 1999; White & Pitts, 1998). However, past reviews have found that the additional effectiveness of booster sessions may be contingent on other factors of the program, such as program interactivity (Cuijpers, 2002; Tobler et al., 1999).

### **The Role of Program Providers in Reducing Licit Drug Use**

A number of past reviews have also investigated the differential impact of various program providers on program effectiveness and have found mixed evidence. While some reviews report that drug prevention programs led by peers can be as effective as adult-led programs (Allott, et al., 1999; Black, et al., 1998; Cuijpers, 2002; Gottfredson & Wilson, 2003), others report that differences in effectiveness across the various types of providers are most likely mitigated by a number of other factors, such as program interactivity (Allott, et al., 1999; Black, et al., 1998; Cuijpers, 2002; McBride, 2003). 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 outperformed teachers.

### **A Focus on Multi-faceted Programs to Reduce Licit Drug Use**

Multifaceted programs do not focus solely on drug abuse but may also incorporate aspects such as personal development, general decision-making skills and stress



management. The evidence regarding the impact on licit drug use of multifaceted components in school-based drug prevention programs is also mixed. Some studies report an increase in effectiveness of multifaceted programs (Allott, et al., 1999; Cuijpers, 2002), while others report that programs that seek to reduce licit drug use are not materially enhanced through the adoption of a multi-faceted approach (Flay, 2000).

### **The Optimal Stage for Intervention to Reduce Licit Drug Use**

The evidence regarding the most appropriate developmental stage to implement drug prevention programs is also mixed. Tobler and her colleagues (2000) suggest that programs implemented later in the developmental cycle (e.g. high school), when drug abuse is more likely to be a problem, show greater evidence of effectiveness. Others argue that programs are more effective at preventing the onset of licit drug use if 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 (Botvin & Griffin, 2003; Gottfredson & Wilson, 2003). Botvin & Griffin (2003) argue that universal programs are more effective when implemented earlier in the developmental cycle, before licit drug use becomes severe and that selective or indicated programs are generally more effective later, when licit drug use has already been identified. In addition, a number of reviews have suggested that while younger children may benefit from multi-drug focused programs, older children and adolescents may benefit more from programs that target a single drug (see Botvin & Griffin, 2003; McBride, 2003).

**What we know so far in reducing licit drug use?**

Systematic reviews that have assessed the impact of SBDP programs on reducing or preventing licit substance use such as alcohol and tobacco (Allott, Paxton & Leonard, 1999; Botvin & Griffin, 2003; 2004; Flay, 2000; Gottfredson & Wilson, 2003; McBride, 2003; Midford, 2000; Tobler et al., 2000; White & Pitts, 1998) generally conclude that programs adopting interactive approaches (such as social influence or competency enhancement), intensive programs, and programs targeted at junior and middle school aged children tend to be the program elements that are crucial in reducing or preventing *licit* drug use (McBride, 2003).

**What we know so far about programs to reduce illicit drug use**

Our review of the SBDP literature (see Soole et al., 2005) located two prior reviews that specifically assessed the impact of SBDP programs on *illicit drug use* outcomes: one by American researcher, Nancy Tobler and her colleagues (1999) focusing on marijuana use in the short term and the other by British researchers David White and Marion Pitts (1998) who examined outcomes of illicit drug use over the short and long term.

Tobler and her colleagues (1999) reviewed 37 evaluated SBDP programs published between 1978 and 1991 and found that interactive programs that cultivated social competencies were significantly more effective than non-interactive programs in reducing marijuana use or delaying first-time use. Interactive programs were also found to significantly and positively affect a change in attitudes. Of the interactive programs, the most effective were those led by mental health counsellors (Tobler et al., 1999). After program interactivity, program size was the best predictor of program success. Tobler et

al. (1999) found that programs containing less than 400 participants demonstrated significantly more indicators of program success than those exceeding this size.

In assessing the effects of SBDP on the reported use of marijuana (and any illicit drug use, in one study), White and Pitts (1998) reviewed 55 SBDP programs published between 1980 and April 1997. They found that less than a third (27%) of reviewed programs affected positive change in illicit drug use outcomes. Short *and* long term impacts of SBDP programs were investigated. Significant short-term effects were found yet these were relatively minimal and diminished over time (White & Pitts, 1998). Effective components of the reviewed programs were varied and contingent on the type of program being run. Successful interventions were identified as providing general skills training alongside specific skills, such as culturally sensitive skills training and refusal skill straining (see White & Pitts, 1998). Booster sessions and increased curriculum time spent on the program were found to be effective elements of program implementation. Program intensity, however, was not a good predictor of program success (White & Pitts, 1998).

## METHOD

Our paper updates the findings from past reviews of SBDP programs, asking three basic research questions: (1) do school-based drug prevention programs reduce rates of illicit drug use? (2) if they do, what features are characteristic of effective programs? and (3) do these effective program characteristics differ from those identified as effective in reviews of school-based drug prevention of licit substance use? In this section we describe our methods for updating the two past reviews of SBDP pertaining to *illicit* drug use outcomes and describe our analytic method.

### **Inclusion/exclusion criteria**

Our review of the evaluation literature included any drug prevention intervention involving, in part, a school-based intervention component. Our selection criteria allowed for programs containing family-based, community-based, media-based or other multifaceted components, delivered in conjunction with a school-based component. The school-based component could vary from curriculum-based education to policy/structural change. For a study to be included, however, the evaluation was required to include an illicit drug use outcome measure. 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.).

Our review focused on behavioural change (i.e., self reported use) as opposed to changes in attitudes or perceptions of drugs mainly. Self-reported drug “use” tends not to be the outcome measure most often reported in past systematic reviews. Thus, to build

upon what we already knew from past systematic reviews, our review concentrated on studies that had a self-reported drug *use* outcome.

To be included in our review, the content of the prevention efforts was required to have a broader scope than the specific prevention or reduction of licit substance use only. This inclusion criterion eliminated the multitude of smoking and alcohol prevention programs that have been evaluated extensively in past reviews. That is, programs aimed at addressing gateway substance use (e.g., alcohol, tobacco and marijuana) were eligible for inclusion in the review on the prerequisite they included an illicit drug use outcome.<sup>2</sup> We restricted studies to journal articles written in English and published after 1990<sup>3</sup> due to time and resource constraints.

Included studies were required to have a pretest-posttest, comparison/control group design. This design criterion was imperative for a number of reasons. SBDP 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 pre- to posttest amongst both the experimental and control groups, and intervention success to be indicated by a significantly smaller rate of increase amongst treatment group participants. Thus, without a control group, evaluation of the impact of the intervention is problematic. Furthermore, it is common for experimental and control groups to differ significantly in rates of substance use and on other intermediate variables that may partially explain use rates reported at post-test. Thus, a pre-test measurement, and further a statistical comparison of pre-test group equivalence with appropriate adjustments for any existing baseline differences, helps strengthen the reliability of subsequent findings.<sup>4</sup>

### **Search for relevant studies**

Two research assistants received training from the third author and relevant studies were identified through a guided, iterative process using appropriate keyword searches of major databases from a number of disciplines.<sup>5</sup> Keywords included combinations of: school, prevention, intervention, evaluation, program, education, drug, substance, ATOD, cannabis, marijuana, heroin, cocaine, crack, amphetamine, ecstasy, affective education, knowledge dissemination, resistance skills training, generic skills training, social influence, competency enhancement, system-wide change, interactive, peer, teacher, and classroom. The reference lists of all relevant reviews and included studies, as well as key journals in the area of substance use<sup>6</sup>, were hand-searched for eligible studies. Two research assistants conducted the searches, retrieved relevant studies and coded the studies. To resolve discrepancies regarding eligibility the two researchers consulted with each other and the project leader.

This search process resulted in the identification of 149 studies evaluating SBDP programs that included an illicit drug use outcome measure. Of these retrieved studies, 58 studies were included in the narrative review. The remaining 91 studies either did not meet our study design criteria (e.g., did not have a control group or did not have a pre-test measurement period, N = 20), did not have self-reported use outcomes (e.g., had illicit drug attitude or knowledge outcomes only, N = 27), were non-English written papers of which we did not have the resources to translate (N = 5), or were published as reports that we were unable to retrieve (N = 39).

## The Narrative Review

The 58 studies in our review were coded using a 48-item codebook that recorded design, sample, setting, and intervention particulars. The methodological rigor score was based on the design of the study (e.g. random assignment versus statistical matching versus non-equivalent quasi-experiment) and also took into account such factors as non-equivalence of pre- and post-test measurement periods (which can lead to under- or overestimating the intervention effect) and whether the comparison group was receiving a lower level of the intervention or the standard treatment model (to account for dilution bias). The scale was adapted from Health Canada's (2004) review of treatment and rehabilitation interventions for driving while impaired offenders (see six point scale below).

<b>Ranking</b>	<b>Characteristics</b>
5	Randomised experimental design (groups comparable at pre-intervention)
4	Randomised experimental design (noticeable differences between groups at pre-intervention)
3	Matched comparison quasi-experimental design (groups comparable at pre-intervention)
2	Matched comparison quasi-experimental design (noticeable differences between groups at pre-intervention)
1	Non-equivalent comparison, quasi-experimental design (groups comparable at pre-intervention)
0	Non-equivalent comparison, quasi-experimental design (noticeable differences between groups at pre-intervention)

All studies were assessed based on this six-point scale. In addition, each study was examined for methodological flaws such as whether the post-intervention measurement

occurred while the intervention was still being implemented or if the post-intervention period was longer than the pre-intervention period leading to an underestimate of the impact of the intervention. We deducted a half a point from the scale score for each methodological shortcoming such that the rigor scale had a range from zero to 5 with intervals of 0.5, where 5 is the highest quality and 0 is the lowest quality. Essentially, studies scoring 3.5 or above on this scale used randomised experimental designs while studies scoring below 3.5 adopted quasi-experimental designs.

The 58 studies identified in our systematic review generated 61 unique treatment-comparison contrasts. For each of these contrasts, the intervention and study characteristics are detailed in Table 1 below.

<Insert Table 1 about here>

Table 1 summarizes the key characteristics of the 61 treatment-comparison contrasts in our review. As Table 1 shows, 23 (37.7%) of the treatment-comparison contrasts scored 5 and 16 (26.25%) scored between 3.0 and 4.5 on our methodological rigor scale. The remaining 22 treatment-comparison contrasts scored between 0.5 and 2.0 on our methodological rigor scale. The table also shows that a greater number of contrasts were included that evaluated intervention approaches described as being more interactive, with social influence and competency enhancement programs evaluations accounting for 39.3% and 19.7%, respectively (see below for a detailed explanation of the various types of intervention approaches). Most contrasts were implemented universally (69.4%), did not include multifaceted components (67.7%), had high (extreme or considerable) interaction (71%), and consisted of between 10 and 19 sessions (50%). Booster sessions were included in only 20 (32.3%) of the treatment-comparison contrasts. Teachers were



the most common provider (41.9%), followed by professionals (25.8%). The contrasts included in our review involve programs most commonly delivered during middle school (72.6%), rather than elementary school (16.1%) or high/secondary school (11.3%). The samples used in the majority of contrasts 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.<sup>7</sup>

### **The Meta-Analytic Approach**

Of the 58 studies included in our review, 12 studies provided sufficient data to examine 16 treatment-comparison contrasts and to enable calculation of an effect size. These were included in the meta-analysis. The remaining 46 studies were excluded for a variety of reasons: twenty-eight studies were excluded because they did not present enough raw data (i.e., pre-treatment and/or sample size data) to calculate effect sizes while two studies were excluded as they did not present data on the variances of the groups. For the variances of the effect sizes to be calculated, one needs specific sample sizes of treatment and control groups for both before and after treatment. The nature of attrition in substance abuse research meant that the lack of specific sample size data was the primary reason for study exclusion. Eight studies were excluded as they only presented proportions of users. Five studies were excluded because they used pre-treatment scores as covariates (and failed to report the raw data) and/or presented statistics comparing post-treatment to follow-up and/or presented F statistics involving three or more groups without presenting raw data. Two studies were excluded because the sample overlapped with studies already included in the meta-analysis and one study

was excluded because the operationalization of ‘use’ was significantly different from pre to post treatment<sup>8</sup>.

Meta-analysis is a range of systematic, quantitative methods used to synthesise research findings from multiple studies investigating similar outcome variables. The key to meta-analysis is the calculation of an effect size. Calculating an effect size enables one to compare individual research findings from a number of studies using a common metric (see Lipsey & Wilson, 2001 for a detailed explanation). Cohen’s *d*, also known as the standardised mean difference, was the effect size of choice in the current meta-analysis.<sup>9</sup> A Microsoft Excel program was created that allowed for the calculation of effect sizes, variances and confidence intervals for each of the individual treatment-comparison contrasts. SPSS for Windows version 12.0.1 was used to combine effect sizes and conduct the moderator analyses.<sup>10</sup>

The meta-analyses were conducted using a random effects model. The random effects model calculates variance considering both between study variance and within study variance, whereas only within study variance is used to compute variance under the fixed effects model. If no between-study variability exists amongst the included studies, the computations from the fixed and random effects models will not differ. The random effects model was chosen for a number of reasons. First, the random effects model is a more conservative estimate of variance and reduces the likelihood of overestimating the effect of an intervention. The confidence intervals computed using the random effects model are generally wider and the resulting *p*-value is therefore less likely to be significant. Second, random differences between the studies were hypothesized, and thus the fixed effects model would have served to underestimate the variance, and in turn

overestimate the effect. Finally, the fixed effects model is not considered to be reliable when only a small number of effect sizes contribute to the meta-analysis, as was the case in the current study (Song, Sheldon, Sutton, Abrams, & Jones, 2001).

Moderator analyses were conducted using analysis of variance tests (see Lipsey & Wilson, 2001) to assess the impact of categorical variables on the obtained effect size distributions. This approach compares the effect size distributions corresponding to different levels of a given categorical moderator variable. The moderator analysis therefore allowed a more systematic statistical evaluation of those variables that may have influenced the obtained effect sizes. The moderator variables examined included intervention approach, implementation year, level of intervention, multifaceted nature of the program, interactivity, number of sessions and inclusion of boosters, type of provider, grade of targeted students, and methodological rigor scores (high quality studies were categorised as scoring 3.5 or above while low quality studies scored below this on the methodological rigor scale).

A number of meta-analyses were conducted for different types of drug outcomes (e.g., marijuana, other illicit drugs<sup>11</sup>, all drugs<sup>12</sup>) and post-test measurement period (e.g., short-term<sup>13</sup> and long-term<sup>14</sup>). Thus, a total of six meta-analyses were conducted, of which four are reported in detail in this paper.<sup>15</sup> Nine treatment-comparison contrasts were included in the meta-analyses for short-term marijuana outcomes, long-term marijuana outcomes, and long-term all drug outcomes. Ten treatment-comparison contrasts were included in the short-term all drug outcome meta-analysis, while only two treatment-comparison contrasts were included in the short-term other illicit drug outcome and long-term other illicit drug outcome meta-analyses. Multiple effect sizes calculated

from a single treatment-comparison contrast were combined to calculate a mean effect size for the contrast, with that effect used in subsequent analyses. This occurred in instances when there were multiple short- or long-term outcomes or multiple marijuana or other illicit drug outcomes, or multiple sub-samples receiving the same level of treatment.

## **META-ANALYSIS RESULTS**

Our first research question sought to answer whether or not school-based drug prevention programs reduce rates of self-reported illicit drug use. A number of meta-analyses were conducted to assess the effectiveness of SBDP programs on illicit drug outcomes. Table 2 presents the results of the six meta-analyses conducted<sup>16, 17</sup> and we present the forest plots and statistics for each of the six meta-analyses conducted in Figures 1 through 4.

< Insert Table Two here >

As Table 2 shows there were a number of significant findings, with four of the six meta-analyses conducted producing significant mean effect sizes<sup>18</sup>. Further, all analyses produced mean effect sizes in the desired direction, suggesting overall program effectiveness. The meta-analyses assessing the impact of SBDP programs on marijuana use, provided significant results both in the short-term ( $d = .136$ , 95% CI = .035-.237,  $p < .01$ ) (see Figure 1) and the long-term ( $d = .219$ , 95% CI = .071-.367,  $p < .01$ ) (see Figure 2). There was no significant heterogeneity in effect sizes for short-term marijuana outcomes ( $Q = 3.69$ ,  $ns$ ) or long-term marijuana outcomes ( $Q = .95$ ,  $ns$ ). For short-term marijuana outcomes, lower quality studies (Mean ES = .14, SE = .07, N = 4) produced significantly higher effect sizes than higher quality studies (Mean ES = .13, SE = .08, N =

5,  $Z = 2.09$ ,  $p = .04$ ). However, for long-term marijuana outcomes, high quality studies (Mean ES = .25, SE = .10, N = 4) produced significantly higher effect sizes than lower quality studies (Mean ES = .19, SE = .11, N = 5,  $Z = 2.43$ ,  $p = .02$ ). Overall, these results suggest that in the short term around 54% of control participants performed worse than treatment participants while in the long term around 58% of participants performed worse than treatment participants (Coe, 2002).

< Insert Figures 1 and 2 here >

Similarly, the meta-analyses assessing the impact of SBDP programs on all drug use also provided significant results both in the short-term ( $d = .141$ , 95% CI = .042-.24,  $p = <.01$ ) (see Figure 3) and the long-term ( $d = .208$ , 95% CI = .087-.329,  $p = <.001$ ) (see Figure 4).<sup>19</sup> In both the marijuana and all drug analyses, results suggest that SBDP programs not only have an immediate impact on self-reported drug use, but that this impact persists into the long-term. Furthermore, this positive effect actually strengthens, as made evident by the larger and more significant mean effect sizes. There was no significant heterogeneity in the effect sizes for short-term all drug use outcomes ( $Q = 3.93$ , *ns*) or for long-term all drug use outcomes ( $Q = 8.52$ , *ns*). For short term all drug outcomes, high quality studies (Mean ES = .22, SE = .10, N = 8) produced significantly higher effect sizes than lower quality studies (Mean ES = .11, SE = .06, N = 2,  $Z = 2.22$ ,  $p = .03$ ). Similarly, for long term all drug outcomes, high quality studies (Mean ES = .19, SE = .05, N = 4) produced significantly higher effect sizes than low quality studies (Mean ES = .18, SE = .11, N = 5,  $Z = 4.1$ ,  $p = .00$ ). Overall, these results suggest that around 56% of control participants performed worse in terms of short term drug use than

treatment participants while around 58% of control participants performed worse in terms of long term drug use compared to treatment participants (Coe, 2002).

< Insert Figures 3 and 4 here >

We also explored the self-reported drug use outcomes for other categories of illicit drugs including cocaine and amphetamines. The two treatment-comparison contrasts contributing to each meta-analysis produced non-significant findings both for short-term other illicit drug outcomes ( $d. = .237$ , 95% CI =  $-.208-.682$ , *ns*) as well as for long-term other illicit drug outcomes ( $d. = .918$ , 95% CI =  $-.7 -2.536$ , *ns*). There was not significant heterogeneity in the effect sizes for short-term other illicit drug outcomes ( $Q = .16$ , *ns*) yet significant heterogeneity existed in the effect size distributions for long-term other illicit drug outcomes ( $Q = 12.49$ ,  $p < .001$ ). Moderator analyses on rigor scores for these outcomes were not conducted due to the low number of studies. Essentially, the results suggest that in the short term around 60% of control participants performed worse than treatment participants on the outcome of short-term illicit drug use. Moreover, it appears that approximately 82% of control participants performed worse on long term illicit drug use outcomes than treatment participants (Coe, 2002).

### **NARRATIVE REVIEW RESULTS**

Our second research question sought to disentangle the characteristics of SBDP programs that are found to be effective from those that are found to be ineffective in reducing self-reported illicit drug use. In this section we provide a qualitative analysis of the full sample of 58 retrieved studies contributing 61 treatment-comparison contrasts (see Table 1).

*Affective Education*

Affective education programs focus on interpersonal development such as self-esteem enhancement, improving coping and stress management skills, and improving personal decision-making through self-reflection. One study in our review involved evaluations of affective education programs, which scored very low (ie zero) on our methodological rigor scale.

Our review of the evaluation literature suggests that these programs are unlikely to reduce self-reported illicit drug use (see Hansen, Johnson, Flay, Graham & Sobel, 1988). Knowledge-based programs (that include passive information dissemination) that augment these affective education programs similarly tend not to be effective in reducing illicit drug use (see Forman, Linney & Brodino, 1990).

#### *Resistance Skills Training*

Resistance skills training typically involve a strong knowledge dissemination component and emphasize refusal and resistance skills training, but do not emphasize social influence, normative education, and generic skills training. Six studies in our review involved evaluations of resistance skills training programs, which scored a mean of 2 (Mdn = 1, Mo = 0) on our methodological rigor scale. The methodologically more rigorous studies found significant reductions mainly in initiation of drug use. The less rigorous studies found mixed results with half reporting significant reductions in drug use.

Overall, our review suggests that girls benefit from these types of programs more than boys, and that there may be an immediate preventive effect on reducing marijuana initiation rates among baseline non-users (Graham, Johnson, Hansen, Flay & Gee, 1990; Hurry, Lloyd & McGurk, 2000; Kim, McLeod & Shantzis, 1993; Shope, Copeland,

Kamp & Lang, 1998; Shope, Copeland, Marcoux & Kamp, 1996; Stevens, Freeman, Mott & Youells, 1996).

### *Generic Skills Training*

Generic skills training programs typically include a knowledge dissemination component as well as a focus on teaching generic life skills such as decision-making, problem solving, communication, assertiveness and coping skills. Eight studies in our review involved evaluations of generic skills training programs, which scored a mean of 3.25 (Mdn = 4, Mo = 4) on our methodological rigor scale. The methodologically more rigorous studies found mixed results with two studies reporting significant reductions in hard drug use and one study finding significant reductions in marijuana use. The less rigorous studies found no significant effects.

Overall, our review of included evaluation studies suggest that generic skills training programs tend to have more impact on reducing or preventing harder drug use, rather than marijuana use, and its effectiveness may be restricted to low-risk youths (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). A self-instruction component tends not to lead to main or interaction effects on either marijuana or hard drug use. By contrast, inclusion of a mentoring component slightly increased the effectiveness of generic skills training programs.

### *Social Influence*

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, 2003: 46). That is, youths are educated about the influence of the media, peers, and adults on subsequent drug use, and a variety of refusal skills are taught to aid the young person’s ability to abstain from use. Misconceptions regarding drug use amongst youth are corrected and replaced with more accurate information. Eleven studies in our review involved evaluations of social influence programs, which scored a mean of 3.06 (Mdn = 4, Mo = 5) on our methodological rigor scale. The methodologically more rigorous studies produced mixed results with half of the studies reporting significant reductions in marijuana use and initiation of marijuana use. The less rigorous studies found similar results with half of the studies reporting significant reductions in marijuana use.

Overall, as with previous reviews of the DARE family of SBDP programs, no significant impact was observed in our review for marijuana or other self-reported 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 was also very little evidence to suggest favourable impacts of the program on marijuana use trajectories. Overall, evidence suggests that social influence programs are, at best, only effective in the short-term and that those identified as low- to moderate-risk for use at baseline benefit more from these types of programs (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).

A number of school-based social influence evaluations also investigated the effect of peer involvement in the delivery of the program, and the inclusion of booster sessions, on self reported illicit drug use outcomes (Bell, et al., 1993; Ellickson & Bell, 1990; Ellickson, et al., 1993). While both of these features seemed to somewhat strengthen the positive effect of the program, these findings failed to reach statistical significance.

### *Competency Enhancement*

Competency enhancement programs emphasize 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. Competency enhancement was the most empirical evaluated intervention approach of the reviewed studies. 25 treatment-comparison contrasts were reviewed under this intervention approach (Botvin, Baker, Dusenbury, Botvin & Diaz, 1995; Botvin et al., 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 et al., 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). The competency enhancement programs in our review had a mean score of 3.7, median of 5 and mode of 5 on our

methodological rigor scale. The methodologically more rigorous studies found mixed results with two thirds finding non-significant results. The less rigorous studies also reported mixed results with half finding significant reductions in marijuana use.

Overall, Botvin, et al. (1990) and Botvin, et al. (1984)<sup>20</sup> found that peer delivery of competency enhancement programs is significantly more effective in reducing self-reported marijuana use rates compared to delivery by teachers, irrespective of the inclusion of booster sessions (methodological rigor scores were 5 and 1 respectively). In fact, the teacher-led condition was not found to significantly impact marijuana use rates. Booster sessions had no significant impact on program effectiveness.

Spoth, et al. (2002) has reported significant positive effects of life skills training (LST) programs on marijuana use initiation, irrespective of the inclusion of a multifaceted family component (methodological rigor score was 5). 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 these types of programs. Botvin, Schinke, et al. (1995) (methodological rigor score was 0.5) 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, no significant impact on rates of marijuana use was observed in a number of other evaluations of the program (Botvin, et al., 2001 – rigor score of 5; Griffin, et al, 2003 – rigor score of 5; Scheier, et al., 2001 – rigor score of 4). There is evidence to suggest that females benefit more from the

program than males (Smith, et al., 2004 – rigor score of 5), however no evidence to suggest that infusing the curriculum content into normal school classes improves the effectiveness of the program.

### *System-wide change*

System-wide change programs consist of two types. 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). Five studies in our review involved evaluations of system-wide change programs and scored a mean of 2 on our methodological rigor scale. The methodologically more rigorous studies found mixed results with only one significant effect reported for reductions in amphetamine/ecstasy use. Similarly, the less rigorous studies also reported only one significant effect for cocaine/crack use.

Overall, our review of the evaluation evidence suggests that students identified as higher-risk at baseline benefited less from these types of programs than those of lesser initial risk of self-reported illicit drug use. The success of these programs, it seems, may be largely a function of the characteristics of the students involved, such as age, socio-economic status and race (see Bond, et al., 2004; Cuijpers, Jonkers, de Weerd & de Jong, 2002; Furr-Holden, Ialongo, Anthony, Petras & Kellman, 2004; Morris, Parker & Aldridge, 2002; Zavela, et al., 1997; Zavela, Battistich, Gosselink & Dean, 2004). 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 (see for example, Cuijpers, et al., 2002; Furr-Holden, et al., 2004).

### *Other*

Other SBDP programs include counselling, sporting and recreational activities programs, and theatre and drama based drug education. Two evaluations (rigor scores 1 and 0.5) suggested negative effects on rates of marijuana use, with program students reporting greater levels of use (see Valentine, Gottlieb, Keel, Griffith & Ruthazer, 1998; Valentine, Griffith, Ruthazer, Gottlieb & Keel, 1998).

## **COMPARING PROGRAM EFFECTIVENESS FOR LICIT VERSUS ILLICIT OUTCOMES**

Our third research question sought to examine whether or not SBDP programs vary in terms of success when contrasting *illicit* drug use outcomes with *licit* substance use. In this section we compare and contrast findings from our narrative and meta-analytic reviews of self-reported illicit drug use outcomes to our literature review of previous reviews reporting results for licit drug use outcomes. Table 3 (below) summarizes the results of our comparison across eight dimensions including intervention type, whether booster sessions were provided or not, the number of sessions provided, the grade target of the program, whether or not the program involved any type of interactivity, the type of program provider, whether or not the program was multifaceted, and whether the program was universal or selective in nature.

<Insert Table 3 about here>

As Table 3 shows, there were a number of consistencies between prior research reporting on licit drug use outcomes and our review that focuses on illicit drug use outcomes. First, improved effectiveness was observed for programs adopting a more interactive approach. This finding has been empirically established in previous reviews (see Tobler, et al, 2000) and was again reiterated in our research. Second, and consistent with this first finding, approaches adopting more interactive methods, such as social influence or competency enhancement, were also found to increase program effectiveness for both licit and illicit drug outcomes. Third, programs involving a greater number of sessions were shown to positively impact on both licit and illicit drug use. Finally, programs adopting a universal approach also appear to improve program effectiveness in addressing both licit and illicit drug use.

Table 3 also reveals a number of important differences between effective program characteristics of SBDP programs observed in our review of illicit drug use outcomes and findings from past reviews investigating the impact of SBDP programs on licit substance use. Specifically, our review found evidence of effectiveness for programs implemented during the middle school years only, when experimentation with illicit drugs is most prominent. Reviews of the effect of SBDP programs on licit drug use have suggested evidence among programs implemented across elementary, middle school *and* high school years. Our review, however, could not differentiate the most appropriate program provider, failing to find improved effectiveness to be associated with professionals, teachers, or peer involvement. In contrast, all program provider types have been found to produce some evidence of effectiveness on licit drug use outcomes.

Other program characteristics that appear to have contrasting effects on illicit and licit drug use outcomes include the inclusion of multifaceted program components and booster sessions. Both of these elements have been shown to improve program effectiveness in addressing licit substance use in the past. However, these findings were not mirrored in our review. In fact, multifaceted programs and programs with booster sessions consistently showed no evidence of increasing program effectiveness, and in a number of instances actually appeared to have an unintended negative impact on program effectiveness.

### **CONCLUSION AND POLICY IMPLICATIONS**

Our review adds to the plethora of evaluative research conducted previously that have summarized the effectiveness of SBDP programs. Past reviews have been largely concerned with deciphering the impact of SBDP on self-reported *licit* drug use (e.g. alcohol and tobacco) as well as better understanding the impact of SBDPs on young people's *attitudes and perceptions* of illicit drug use. Our review fills several gaps in the literature: first, we update reviews from the late 1990s and thereby assess the more recent impact of SBDP programs on reducing or preventing self-reported *illicit drug use* (e.g., marijuana, cocaine, and heroin). Second, we focus on self-reported illicit drug use as opposed to licit drug use and/or perceptions and attitudes towards licit or illicit drug use. Third, we compare and contrast our findings with past systematic reviews to uncover the programmatic factors that distinguish success between licit and illicit drug outcomes.

Taking the findings of our narrative and meta-analysis reviews together, our study found some consistent findings with past reviews investigating the impact of SBDP on licit substance use (McBride, 2003; Tobler, et al.; 2000; see also Table 3). Consistent

with prior research regarding the impact of SBDP programs on licit substance use, our review found that interactive programs adopting either social influence or competency enhancement components appear to be the most effective approach to school-based drug prevention. Further, more intensive programs appear to increase program effectiveness, and universal programs may be slightly more effective. However, this research does little to resolve the debate regarding the most appropriate program provider.

Using the policy decision-making model offered by Weiss and her colleagues (2005) our study suggests that policy makers should focus their school-based drug prevention initiatives around interactive programs that are delivered during the middle school years. Our review also highlights the importance of policy makers developing programs that specifically target licit drug use (as opposed to those programs that together focus on licit and illicit drug use). This may be especially important given the small, yet significant growth in young people experimenting with illicit substances. Our study also suggests that there is probably no additional benefit in funding multifaceted programs or booster sessions. These two strategies may be more effective for preventing licit drug use, but may be of limited benefit in preventing illicit drug use. Finally, in terms of what *not* to recommend: our findings suggest that SBDP programs that lack interactivity and are aimed at children outside of the middle school years are unlikely to yield many benefits. Policy makers should take general note of the ongoing importance of funding scientifically rigorous evaluations of drug prevention programs.

There are a number of limitations to the current review. First, base rates of illicit drug use are often low at the time that SBDP programs are implemented. The majority of



programs reviewed were implemented during the middle school years when adolescent experimentation with illicit drugs is typically just beginning. Thus, self reported rates of illicit drug use are generally low, making identifying changes in this behaviour very difficult to detect.

The second limitation stems from the fact our review was intentionally restricted to assessing the impact of SBDP programs on self-reported illicit drug *use*. Most of the studies we uncovered in our search included perceptions and attitudes to drug use, but very few reported actual self reported use. This failure to ask questions about actual use of illicit substances is likely a reflection of the conditions imposed by ethics committees on asking questions about illegal behaviour of children under 18. These limitations served to restrict the number of eligible studies included in the meta-analysis, and subsequently the number of treatment-comparison contrasts contributing to any of the analyses conducted. However, this fact reiterates the importance of our study in combining both the narrative review and meta-analytic findings to build a picture of the effectiveness of SBDP programs.

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Table 1. Characteristics of the 61 treatment-comparison contrasts included in the systematic review

	<i>n</i> of treatment-comparison contrasts	% of treatment-comparison contrasts
<b>Intervention Characteristics</b>		
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 focused	6	9.80
Generic skills training focused	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
<i>Family</i>	7	11.48
<i>Community</i>	3	4.92
<i>Media</i>	2	3.28
<i>Mix</i>	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
<i>Health educator</i>	4	6.56
<i>Trained professional</i>	3	4.92
<i>Project staff</i>	3	4.92
<i>Police officer</i>	4	6.56
<i>Counsellor</i>	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
<b>Sample Characteristics</b>		
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
<b>Design Characteristics</b>		
Methodological Rigor Scores		
0 - .9	13	21.3
1 - 1.99	9	14.75
2 - 2.99	0	0
3 - 3.99	7	11.5
4 - 4.99	9	14.75
5	23	37.7
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

Table 2. Summary results of the meta-analyses

Meta-Analysis	k	d.	95% CI Lower	95% CI Upper	p
Marijuana outcomes (short-term)	9	0.14	0.04	0.24	0.009
Marijuana outcomes (long-term)	9	0.22	0.07	0.37	0.003
All drug outcomes (short-term)	10	0.14	0.04	0.24	0.005
All drug outcomes (long-term)	9	0.21	0.09	0.33	0.001
Other illicit drug outcomes (short-term)	2	0.24	-0.21	0.68	0.296
Other illicit drug outcomes (long-term)	2	0.92	-0.7	2.54	0.266



Table 3. Comparison of findings of the impact of school-based drug prevention programs on licit and illicit drug use (N = 58 studies)

Variable	Impact on:	
	Illicit drugs <sup>a</sup>	Licit drugs <sup>b</sup>
<i>Type of intervention</i>		
Affective Education	–	X
Knowledge & Affective Education	+	X
Resistance Skills Training Limited	+/-	N/A <sup>c</sup>
Generic Skills Training Limited	+/-	N/A <sup>c</sup>
Social Influence	+	++
Competency Enhancement	++	++
Systems Change	+/-	++
<i>Interactivity</i>		
High	++	++
Low	x	X
<i>Number of sessions</i>		
More intensive	++	++
Less intensive	x	X
<i>Booster sessions</i>		
Yes	x	+
No	x	X
<i>Program provider</i>		
Teacher	x	+
Professional	x	+
Peer	x	+
<i>Multifaceted components</i>		
Yes	x	+ <sup>d</sup>
No	x	X
<i>Grade of targeted students</i>		
Primary	x	+
Middle	+	+
High	x	+
<i>Level of intervention</i>		
Universal	++	+ <sup>e</sup>
Selective/indicated	x	+ <sup>e</sup>

Note: ++ = predominately or significantly positive findings; + = some positive findings; +/- = mixed evidence; – = negative findings; and x = no impact observed. These were assigned as a count of cases based on their effect size or based on the findings from prior research.

<sup>a</sup> Based on findings from both the meta-analysis and narrative review.

<sup>b</sup> Based on findings from the reviews outlined in the background literature section of this paper.

<sup>c</sup> These intervention classifications were unique to this paper.

<sup>d</sup> Typically found to be contingent upon other factors such as program interactivity.

<sup>e</sup> Universal programs typically found to be more effective for younger children and selective/indicated programs more effective among older children.

## Endnotes

<sup>1</sup> Predominately, reviews, and to a large extent, program evaluations, have been concerned with what many refer to as licit drugs, such as alcohol and tobacco. Occasionally, program effects on marijuana use rates have been evaluated, but very rarely have harder drugs been included in outcome evaluations (typically due to the low rates of use of these drugs among school-children). While it could be argued that alcohol and tobacco are illicit substances among adolescents, we see this as an issue of semantics, and are concerned with identifying the impact of school-based drug prevention on drugs routinely defined as illicit.

<sup>2</sup> 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.

<sup>3</sup> With the exception of studies published prior to 1990 that analysed the exact same sample of participants as studies published post-1990. This exception was for the narrative review only. There were no instances where multiple studies evaluating the same treatment-comparison contrast were included in a meta-analysis.

<sup>4</sup> The decision was also made to include only studies conducting significance testing. This sought to avoid inappropriate conclusions regarding the effectiveness of a program if results were nonsignificant but in a positive direction. 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, which occurred in one instance only (Forman, Linney & Bordino, 1990).

<sup>5</sup> Disciplines covered included psychology, education, health, criminology, law, politics and government. Databases searched within these disciplines included: Blackwell Synergy, Expanded Academic ASAP Plus, Kluwer On-Line e-Journals, Proquest, PsycINFO, PsycArticles, SciELO, ScienceDirect, Web of Knowledge (Social Sciences Citation Index), SwetsWise, Kinetica, Public Affairs Information Service International (PAIS), Sociological Abstracts, Informit Search, Oxford University Press Journals, Rehabdata, Wiley e-journals, Criminal Justice Abstracts, Sage Fulltext Databases, and Dissertation Abstracts.

<sup>6</sup> A total of 30 journals were hand-searched including *Addiction*, *Addictive Behaviors*, *American Journal of Criminal Justice*, *American Journal of Drug and Alcohol Abuse*, *Annals of the American Academy of Political and Social Science*, *Australian and New Zealand Journal of Criminology*, *British Journal of Criminology*, *Crime and Delinquency*, *Criminal Justice*, *Criminal Justice and Behavior*, *Criminology*, *Current Issues in Criminal Justice*, *Drug and Alcohol Dependence*, *Drug and Alcohol Review*, *Drugs: Education, Prevention and Policy*, *European Journal on Criminology*, *Evaluation*, *Evaluation Review*, *Health Education and Behavior*, *International Journal of Drug Policy*, *International Journal of Offender Therapy and Comparative Criminology*, *Journal of Addictive Diseases*, *Journal of Alcohol and Drug Education*, *Journal of Drug Issues*, *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*.

<sup>7</sup> There was missing data on a number of important variables such as implementation date, number of sessions, and interaction, suggesting a need for authors of program evaluations to increase reporting validity.

<sup>8</sup> A table of excluded studies was compiled and can be made available to interested persons upon request to the second named author, Professor Lorraine Mazerolle.

<sup>9</sup> Effect sizes were computed from various forms of data including: pretest-posttest means and standard deviations; *F*-values; *t*-values; and, pretest-posttest frequencies. For a summary of calculations used see Soole, et al. (2005).

<sup>10</sup> Using macros provided by David Wilson (<http://mason.gmu.edu/~dwilsonb/ma.html>).

<sup>11</sup> Other illicit drugs included cocaine/crack, heroin/opiates, stimulants, depressants, party drugs, hallucinogens, and so forth.

<sup>12</sup> All drug outcomes were a combination of the "marijuana" and "other illicit drug" outcome categories.

<sup>13</sup> Short-term outcomes were defined as posttest measurements less than one-year after completion of program.

<sup>14</sup> Long-term outcomes were defined as posttest measurements one year or more after completion of the program.

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<sup>15</sup> 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.

<sup>16</sup> The meta-analyses were conducted both with each of the treatment-comparison contrasts (treatment-comparison contrast as unit of analysis) and with each study contributing only one effect size (study as unit of analysis). 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.

<sup>17</sup> 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.

<sup>18</sup> Fail safe N was calculated using the formula  $k_0 = k [(ES_k/ES_c)-1]$ . In all four meta-analyses more than 15 studies with null findings were required to reduce the significance of the findings to a point of non-significance. While, this traditional formula has since given way to the trim-and-fill method, the program used to calculate effect sizes did not allow for funnel plots to be produced, and thus negated our ability to use this method.

<sup>19</sup> Obviously, the “all drug use” analyses were largely driven by the marijuana use analyses.

<sup>20</sup> 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.