EFFECTIVENESS OF SCHOOL-BASED SMOKING PREVENTION PROGRAMS

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Researchers and others have developed many school-based tobacco prevention programs over the past 30 years. Approaches to smoking prevention went through several phases: informational, affective/motivational and psychosocial. As early as 1978 Thompson (Thompson, 1978), in a review of all English language papers on smoking prevention between 1960 and 1976, concluded that most methods used up to that point, i.e., informational and affective approaches, were not effective and this was echoed by Beattie (Beattie, 1984). Many programs can effectively change knowledge, but such change is not enough, by itself, to alter behavior (Goodstadt, 1978) and, in any case, quickly decays (Hwang, Yeagley, & Petosa, 2004). Sometimes, information can actually make behavior worse (Goodstadt, 1978, 1980) as can some affective programs (Petrosino, Turpin-Petrosino, & Finckenauer, 2000). During the late 1980’s and early 1990’s U.S. Government agencies concluded that traditional approaches (informational and affective) were largely ineffective and that the approaches based on social-psychological models (Evans, 1976; McGuire, 1964) were modestly effective across a variety of settings, times and populations (Glynn, 1989; U.S. Department of Health and Human Services, 1991).

Over 20 reviews of tobacco control or substance abuse prevention published since the early 1980’s have included school-based smoking prevention within their realm (Backinger, Fagan, Matthews, & Grana, 2003; Best, Thomson, Santi, Smith, & Brown, 1982; Burns, 1992; Buttross & Kastner, 2003; Centers for Disease Control and Prevention, 1994; Flay, 1985; Glasgow & McCaul, 1985; Hansen, 1992; Institute of Medicine, 1994; Krowchuk, 2005; Lantz et al., 2000; Moskowitz, 1983; Park, 2006; Pentz, 1999; Schaps, Churgen, Palley, Takata, & Cohen, 1980; Schaps, DiBartolo, Moskowitz, Palley, & Churgin, 1980; Skara & Sussman, 2003; Stead, Hastings, & Tudor-Smith, 1996; Sussman, 2001; Thomas & Perera, 2007; Thompson, 1978; Torre, Chiaradia, & Ricciardi, 2005; U. S. Department of Health and Human Services, 1994, 2000; U.S. Department of Health and Human Services, 1991; Vickers, Thomas, Patten, & Mrazek, 2002). Some of these reviews were broad-based and non-systematic, and some were very systematic, including the most recent Cochrane review (Thomas & Perera, 2007). In addition, almost a dozen meta-analyses of prevention programs, including school-based smoking prevention, have been published since the late 1980’s (Black, Tobler, & Sciacca, 1998; Bruvold, 1993; Hwang et al., 2004; Rooney & Murray, 1996; Rundall & Bruvold, 1988; Tingle, DeSimone, & Covington, 2003; Tobler, 1986, 1992; Tobler et al., 2000; Tobler & Stratton, 1997; Wiehe, Garrison, Christakis, Ebel, & Rivara, 2005).

These reviews and meta-analyses have repeatedly reinforced the fact that informational and affective programs do not work to change behavior. Furthermore, meta-analyses have further established the fact that some psychosocial programs and strategies, particularly those that are interactive programs based on the social influences approach (educating youth about social norms and influences and providing skills for resisting such influences), can be effective.

However, findings in the field are sometimes confusing to practitioners and policy makers because some early or short psychosocial programs reported promising short-term effects that did not last (Ellickson, Bell, & McGuigan, 1993; Flay, 1989; D. J. Hawkins, 1999; D. M. Murray, Pirie, Luepker, & Pallonen, 1989; Shean, de Klerk, Armstrong, & Walker, 1994; Shope, Copeland, Kamp, & Lang, 1998). In addition, some tested programs simply are not effective (Peterson, Kealey, Mann, & Marek, 2000). DARE is a prime example of a program that seems to be similar to many successful programs in many ways, yet it has been proven in multiple studies and two meta-analyses (Ennett, Rosenbaum et al., 1994; Peterson et al., 2000; West & O'Neal, 2004) to be ineffective. These mixed results have led some to question the overall value of
OBJECTIVES AND CONSIDERATIONS

The World Health Organization (WHO) Tobacco Free Initiative (TFI) wanted to develop an understanding of whether school-based prevention can be effective and, if so, what kinds of school-based prevention programs produce long-term effects, and which of these might be successful in less developed countries. Therefore, my objectives in this review were to:

1. Determine from past reviews whether or not school-based smoking prevention can be effective
2. Determine which kinds of school-based prevention can be effective over the long term
3. Assess the likely cost-effectiveness of effective programs
4. Discuss which approaches have promise in less developed countries
5. Make recommendations for developing countries

Before reviewing original research studies, I provide a review of findings from selected meta-analyses and prior reviews. This helps focus my review.

REVIEW OF META-ANALYSES AND THE COCHRANE REVIEW

The first objective is to determine, from past reviews, whether or not school-based smoking prevention can be effective. Meta-analyses of school-based prevention programs have used various criteria and so have varied in scope, from including 74 smoking prevention studies among 207 substance prevention studies (Tobler et al., 2000), including evaluations of 65 separate programs (Hwang et al., 2004), reviewing 94 randomized trials of school-based smoking prevention (Thomas & Perera, 2007), but reviewing only 23 of them in detail because of methodological limitations with the rest. Reviews of the long-term effects have also varied in scope from including 25 studies with at least 2-year follow-ups (Skara & Sussman, 2003), to including only 8 studies with grade 12 (or age 18) outcome data (Wiehe et al., 2005). The result has been a confusing array of findings, ranging from precise effect sizes for some types of programs (Hwang et al., 2004; Tobler et al., 2000) to a conclusion that most school-based prevention programs do not work (Glantz & Mandel, 2005; Wiehe et al., 2005).

Tobler et al 2000

Nan Tobler (Tobler, 2000) summarized her series of meta-analyses and suggested that programs that used interactive learning strategies and involved same- or similar-age peers as leaders or facilitators were most effective. Tobler and colleagues found that smoking prevention programs produced an average effect size of 0.16, with “interactive” programs producing a significantly larger effect size than non-interactive programs (0.17 versus 0.05) (Tobler et al., 2000). Tobler and colleagues (Tobler et al., 2000) also found that programs that address multiple substances were less effective at reducing tobacco use than programs that targeted only tobacco (ES = .10 vs. .17) -- but they had the added benefit of reducing alcohol and other substance use as well. They also found program effects to be larger in schools with predominantly special or high-risk (minority, high absenteeism or dropout, poor academic records) populations. This is an important finding for developed countries as it suggests that these programs can reduce the gap between low- and high-risk groups of adolescents; it is also potentially important for this review.
because it suggests a level of generalizability of effects of these programs.

**Hwang**

Hwang and colleagues (Hwang et al., 2004) estimated an average short-term effect size of .19 for smoking behavior outcomes from the 65 programs they reviewed. They reported effect sizes of .22 for attitudes and skill, and .53 for knowledge. They found that all effects were smaller at delayed follow-ups. Behavior barely decayed over 1-3 years (to .18) but without further programming decayed by half (.09) at follow-ups of 3 or more years. Knowledge decayed dramatically by 1 year follow-up (to .19), and attitudes and skills decayed to about half their original effects by 1 year follow-up (.10 and .09, respectively).

Hwang and colleagues (Hwang et al., 2004) also estimated the effects of different approaches to smoking prevention operationally defined as follows. Social Influence (SI) programs addressed immediate health, social, and cosmetic effects of smoking; peer and media influences; social norms, expectations, and acceptance; and other information; as well as social skills such as modeling, role-playing, and/or group practice. Cognitive-behavioral (CB) programs included the elements of the SI approach plus at least two cognitive skills such as problem-solving, decision-making, assertiveness, self-control, and/or other coping skills. Life Skills (LS) programs included the components of the SI and CB programs plus at least one affective skill such as self-confidence (self-efficacy), values clarification, and/or generic social skills. A second way of distinguishing programs was by their setting levels: exclusively school-based only or school plus community settings. The latter setting level was defined as including at least one of the following: community members (mass media, community key workers, parent/family members) and any community-involving activity such as homework assignments, awareness activities, organized campaigns, sports or cultural activities; efforts to develop and enforce a policy on tobacco use in schools or community; or volunteer work in the community.

Hwang et al. (Hwang et al., 2004) found that social influences approaches had average effect sizes for short-term, 1-3 years and > 3 years smoking prevention, respectively, of .12, .15 and .07; cognitive behavioral approaches had effect sizes of .21, .21 and NA; Life skills of .29, .16 and NA. I do not consider these differences in effect sizes between types of programs to be very meaningful because a) it is very difficult to categorize programs accurately and, in any case, many of the differences between types of programs have, in practice, been minimized over time as researchers interacted and mixed components, and b) some of the differences between categories may be due to single research groups conducting multiple studies of one program that obtained unusually large effect sizes, as Hwang et al pointed out. For example, Steve Schinke and Lew Gilchrist (University of Washington) published results from 7 different small-scale studies of programs that Hwang categorized as using the CB approach, in which students rather than schools were randomly assigned to conditions, with higher effect sizes than most other programs and few long-term follow-ups. Similarly Gilbert Botvin conducted 9 of the 12 studies classified in this meta-analysis as life skills, with an average effect size of .44, considerably larger than the others in that category.

Regarding setting, Hwang et al (Hwang et al., 2004) found that school-only programs reported effect sizes of .22, .16 and .06 at short-term, 1-3 years and > 3 years, respectively; and school plus community programs reported effect sizes of .16, .21, and NA. Again, I do not place much confidence in these estimates because a) the school plus community category includes such a wide range of different types of activities and b) the underlying school program varied greatly among them. In a previous systematic review of school and school plus community...
programs (Flay, 2000), I concluded that *school plus community programs produce about double the effect when the type of school program is held constant.*

**Rooney and Murray**

Rooney and Murray’s (Rooney & Murray, 1996) meta-analysis of 131 smoking prevention programs adjusted for studies with a unit of analysis error, although this had little or no effect on the overall effect sizes. The average effect size was around 0.10 at long-term follow-up. This would approximate to a 5% relative reduction in smoking. Using a modeling approach, the authors estimated that the impact could be increased if programs began around sixth grade as part of a multi-component health program, gave same-age peer leaders a role in program delivery, and used booster sessions. They estimated that this might achieve a relative reduction in smoking of between 19% and 29%.

**Thomas and Perera Cochrane review**

Thomas and Perera (Thomas & Perera, 2007) have completed the most thorough systematic (Cochrane) review of school-based smoking prevention studies to date with a minimum of 6 months follow-up after the completion of the intervention. They reviewed only randomized trials and found 94 of them (115 others identified as RTCs were eliminated because the reviewers determined that they were not really RCTs or because the follow-up was less than 6 months after the end of the intervention). They rated the methodological biases of each study and separated studies into those with minimal risk of bias (category 1), medium risk of bias (category 2) and high risk of bias (category 3). Six areas of possible bias were considered for their bias rating: 1) selection bias (baseline differences due to imperfect randomization or no report of exactly how randomization was conducted or whether it was concealed), 2) performance bias (due to problems with program implementation or contamination of the control group), 3) attrition bias (due to attrition rates of 20% or more or differential attrition by condition), 4) detection bias (due to differences in outcome assessment), 5) statistical power bias (due to inadequate power or no power analysis reported), and 6) statistical bias (due to inappropriate analysis such as not taking account of clustering or ICCs were not reported). Based on these ratings, they found and analyzed in detail only 23 studies of the highest quality (that suffered from the least bias). Of the remainder of the studies, 31 were rated to be in category 2 and 40 in category 3.

These are rather rigid criteria, and even many high-quality studies of school-based programs cannot meet them all, partly because many of the criteria are outside the control of researchers and partly because of editorial decisions by journals. For example, performance bias is likely in any school-based effectiveness trial (where regular school teachers or other providers deliver the program, compared with an efficacy trial, in which research staff deliver the intervention). However, this kind of bias is likely to lead to an underestimation rather than an overestimation of program efficacy, although potentially a true estimate of effectiveness under real-world conditions. The second kind of performance bias, contamination of the control group has become more likely historically, at least in most developed countries, as more and more schools already have some form of smoking prevention program, often derived from the same theoretical principles as the program being evaluated. Again, however, such bias is likely to lead to an underestimation of program effectiveness (because the control group is doing smoking education as usual rather than no smoking education).

Attrition is an issue that was more of a problem when the field considered the student as the unit of analysis. Now that we (correctly) take the school to be the unit of random assignment,
program delivery and analysis, the amount of attrition at the individual student level is less of an issue (as long as it is similar across conditions in both magnitude and type). In addition, attrition is likely to be high in schools with high turnover, the very schools many studies have deliberately selected for their studies because students in these schools are at highest risk for smoking. Non-differential attrition may reduce external validity (generalizability) of study results but not the internal validity (bias). Although attrition should be assessed and any differential attrition reported (and adjusted for in analyses if appropriate), studies should not automatically be penalized based on levels of student attrition. On the other hand, if one or more schools drops out of a study, that would be a great cause for concern.

Another consideration is that journals will not publish all of the details of studies. For example, they do not care to know whether randomization was concealed or not. They do not require that ICCs be reported, and only a few researchers have ever reported them. Analytical approaches have changed over time as statisticians have developed the methods to handle clustered data. Thomas and Perera determined statistical significance from their own analysis of odds ratios – the odds of baseline never smokers starting to smoke by posttest in the intervention group compared to the control group. When ICCs were not reported, they assumed an ICC of .097, the average found in a limited set of older studies (Siddiqui, Hedeker, Flay, & Hu, 1996). This approach probably has lower statistical power that necessary and, in many cases, led to a decision that a difference that was reported as significant by the original authors was judged to be non-significant by these reviewers. Thus, this approach leads to a bias against finding significant effects.

Another criterion that might be overly strict is requiring at least one assessment at least 6 months beyond the end of the intervention. As interventions have become more comprehensive and longer-lasting, it is becoming more difficult to meet this standard. For example, many programs include some type of follow-up sessions during high school. It is not clear that a study should be excluded from consideration in a review because the last posttest was less than 6 months after the last session, albeit at the end of high school, even though the bulk of the intervention may have occurred several years earlier.

It is not clear that eliminating many studies because of the types of issues discussed above is beneficial to the field. It leads to the omission from consideration of many important studies, at least just as many of which may be biased to an underestimate of effect size as are biased to an overestimate of effect size. The overwhelming focus on methods is also at the expense of an informed focus on the interventions. A better approach would be thorough meta-analyses that provide an analysis of the effects of these methodological issues as well as programmatic ones (Lipsey, Crosse, Dunkle, Pollard, & Stobart, 1985).

Regarding program types, Thomas and Perera assigned studies to the groups of information-only, social competence (the Good Behavior Game and the Seattle Social Development Program), social influences (56 trials, 13 of which met the criteria for category 1), combined social competence/influences (e.g., Life Skills Training, Towards No Tobacco, Child Development Project), and multimodal (i.e., including family or community components). As one who is very familiar with most of the programs evaluated in these studies, I question some of the assignments. One glaring question, for example, concerns why most of Gil Botvin’s studies of Life Skills Training were assigned to the combined social influences/competence category, yet one was assigned to the social influences group. The Ausems (Ausems, Mesters, van Breukelen, & De Vries, 2004) and Crone et al (Crone et al., 2003) interventions clearly included social influences components but were categorized in the information-only category. There are many
other examples of questionable assignment; as Thomas and Perera acknowledge (page 10), it is extraordinarily difficult for people not intimately involved in the field to determine how to group the different interventions. Most prior reviews and meta-analyses by people outside of prevention have had major problems with this. Nan Tobler probably has probably done the best job of overcoming this, particularly in her later papers as she learned more and more about the programs she was dealing with. In addition, over time, the programs have become more and more alike, in principle, as they incorporate ideas from each other. For example, there is no longer much that separates some of the programs assigned to the social competence and social influence groups.

The only outcome reported by Thomas and Perera was the prevalence of smoking among pretest never smokers. They did not include other possible outcomes, such as changes in the proportion of ever, weekly or monthly smokers. This also unnecessarily limited the studies that were considered.

Within all of the above constraints, Thomas and Perera concluded that:

1. There is little evidence that information alone is effective (only one study in this category met their inclusion criteria).
2. Nine (which they usually characterize as half in their text) of 13 studies of social influences that met their criteria demonstrated effects and 4 did not.
3. The most rigorous and long-lasting test (65 lessons over 8 years) of a social influences program (Hutchinson) was not effective (see further discussion of this study below).
4. There was limited evidence for the effectiveness of social competence programs (only two studies met criteria for inclusion).
5. Of only 3 high-quality studies of the combination of social competence and social influences, only one showed a significant effect and one showed a significant effect only for the health-educator led condition (but not the “self-instruction” condition).
6. Three of the 4 studies of multimodal approaches that met standards for inclusion produced positive effects (characterized in the text as providing limited evidence of effectiveness).
7. There is little evidence of the long-term effectiveness of smoking prevention programs.

The conclusions reached in this review are overly restrictive for several reasons. First, as pointed out above, too many studies were eliminated from consideration for suspicions of bias that are unreasonably strict. Second, evaluations of DARE, a program that is known to be ineffective from several RCTs and two prior meta-analyses were included with the social influences group. Although DARE is partly based on the social influence approach, it is clearly a very poor example of it (see further discussion below). Third, the focus on the Hutchinson study is unwarranted – it is an example of a preoccupation with methods leading to misleading conclusions – as no detailed information about the intervention and data on the short-term effects of the program have ever been reported (see further discussion below). There is no way to judge whether or not it was a good example of the social influences approach or another watered-down approach like the DARE program.

**Long-term effects (Wiehe et al.; Skara and Sussman)**

As noted above, Thomas and Perera concluded that there is little evidence of the long-term effectiveness of smoking prevention programs. Other recent reviews also raised questions about the long-term (high school or beyond) effects of school-based smoking prevention programs. Wiehe et al. (Wiehe et al., 2005) conducted a meta-analysis of the only 8 studies they could find
School-based smoking prevention with results reported at grade 12 or age 18. These included evaluations of programs of known ineffectiveness from prior studies (e.g., Hutchinson and DARE). Other studies included in the meta-analysis were early studies of the social influences approach (Flay, 1989; Shean et al., 1994) that, in retrospect, we should never have expected to have long-term, or even medium-term, effects. These programs were initial small-scale experimental tests of the social influences approach that included only 5-10 sessions in one or two grades without any boosters or programming in high school. Another was Project ALERT, which consisted of only 8 sessions in 7th grade and three booster sessions in 8th grade (Ellickson et al., 1993). Clearly, programs need to include more sessions, preferably with some in high school, to be effective in the long term. This is a conclusion that could have been proposed by Wiehe et al but wasn’t.

Of the studies reviewed by Wiehe et al., only the Life Skills Training (LST) program, which is an interactive program of 15 sessions in 7th grade, 10 in 9th grade, and 5 in 10th grade that incorporates the social influences approach as well as other general personal and social skills, was effective at long-term follow-up. Wiehe et al. concluded that “there is little evidence to suggest that existing programs produce medium-term decreases in smoking prevalence (page 168).” In an editorial comment, Glantz and Mandel (Glantz and Mandel, 2005) misleadingly stated that the Wiehe et al. review of long-term trials “convincingly shows that they are not effective (page 157).” They then discount the LST program evaluation because of the use of one-tailed t-tests and the failure to take account of multiple comparisons. However, it is perfectly appropriate to use one-tailed t-tests when a clear hypothesis is stated, and adjusting for multiple comparisons would not have eliminated the significant effects. In addition, the short-term effects of LST have been replicated in multiple studies (see below). Glantz and Mandel suggest that all aspects of smoking education should be integrated into regular core curriculum classes. This approach has not been shown to be effective. Furthermore, it is not likely to happen in the near future because of the current demands on schools, nor is it likely to be effective because one would expect much less adherence to the program components if the program was delivered by multiple teachers.

Skara and Sussman (Skara & Sussman, 2003) reviewed studies of 25 tobacco and other drug prevention programs that included long-term follow-ups (at least 24 months). They found that 18 of the 25 studies reported significant short-term effects and 15 of 25 reported significant long-term effects. Of 17 studies with pretest and posttest data, 11 (65%) reported significant long-term effects, with an average reduction in the percentage of baseline nonusers who initiated smoking in the program condition relative to control conditions of 11.4% (range 9 to 14.2%). Of the studies with significant short-term effects, 72% (13 of 18) were found to have significant long-term effects. Results also indicated that program effects were less likely to decay for programs with extended programming or booster sessions.

Summary of Review of Reviews

Although meta-analyses and systematic reviews provide some very useful information for scholars, they do not provide enough information of value to policy makers and practitioners. Indeed, meta-analyses can obscure some kinds of information, particularly when there are wide variations between the types of interventions being reviewed. Meta-analyses make more sense in medicine, where the effects of the same drug or procedure can be estimated from multiple trials. In a field like school-based smoking prevention, one is often comparing different kinds of programs with differing formats, theoretical orientation, targeted behaviors, and targeted populations and age groups. Furthermore, different programs were developed by different
researchers or practitioners with different theoretical or philosophical orientations (sometimes even when they claim to be the same), and implemented by different providers who, themselves, have different training and readiness for the work. There are also large differences among studies in research design and measurement of smoking. It really takes someone who is intimately familiar with a body of research and program development to conduct the most useful kind of in-depth review of a field like smoking prevention, where different programmers and programs have different training, theoretical bases and degree of understanding of children, youth and their families and other social settings, such as peer groups, schools and communities.

Despite the above short-comings, the meta-analyses by Tobler and Hwang provide clear directions on what types of programs are most effective. On the basis of a systematic review of reviews and individual studies of mediators, boosters, peer- versus adult-led, community components, Pim Cuijpers (Cuijpers, 2002) developed a nice summary of the effective ingredients of effective drug prevention programs. These include:

1. Interactive delivery methods
2. The use of the social influence model (defined more broadly than by Hwang – see below)
3. Including components on norms, commitment not to use, and intentions not to use
4. Adding community components
5. Including the use of peer leaders rather than relying totally on adult providers
6. Including training and practice in the use of refusal and other life skills

In addition, meta-analyses have established that programs that have more sessions, and that continue for multiple years are more effective.

Additional comments on reviews and meta-analyses

Some programs are not effective

Many smoking prevention programs and activities that have received lots of attention are not effective, especially in the long term, when evaluated fully. Examples include one-time visiting speakers, other one-day special events, poster competitions, lotteries, etc. A high-profile example in the literature is the “No Smoking Class” competition held throughout Europe, first established in Finland, where it has been carried out annually since 1989 (Vartiainen, Saukko, Paavola, & Vertio, 1996), and expended to seven countries in 1997/98 (Hanewinkel, Wiborg, Paavola, & Vartiainen, 1998). Each participating class has to decide if they want to be a “Smokefree Class” for the six-month period from fall to spring. Classes monitor their (non-)smoking behavior and report it to the teacher regularly. Classes in which pupils refrain from smoking for this period participate in a prize draw, where they can win a number of attractive prizes, including trips to other European countries. In addition, three lessons are provided by teachers. Nonrandomized studies with high rates of attrition of schools suggest that the program has immediate effects (Hanewinkel & Wiborg, 2002; Vartiainen et al., 1996; Wiborg & Hanewinkel, 2002). However, all three long-term (15-month, 18-month and 12-month) follow-up studies that I could find, two randomized trials and one not (Crone et al., 2003; Schulze, Mons, Edler, & Pötschke-Langer, 2006; Vartiainen et al., 1996), respectively, demonstrated that the small immediate effects were not maintained. From theory and other research, we would expect this.

The Hutchinson project (conducted at the Fred Hutchinson Cancer Center, University of Washington) is another ineffective program, the evaluation of which has received lots of attention because it was of such high quality and long term. The project was designed to be a
multiyear (grades 3-10) social influences tobacco prevention program. A large randomized trial (20 school groups per condition) produced no significant effects at the end of grade 12 or 2 years later (Peterson et al., 2000). These findings are impossible to interpret, because the investigators have never reported what effects there were or were not at any other time, including prior to entering high school (when most other programs report short-term results) or at the end of the program (grade 10). The effects of an intervention should be measured immediately or shortly after the program, and then the long-term measurement should serve to assess how permanent the effect is, or how quickly it decays.

Certainly, one cannot use the Peterson et al (Peterson et al., 2000) results to conclude that the social influences approach to smoking prevention is ineffective in the long-term deterrence of smoking among youth, as these authors did. These results must be interpreted in the context of the many other studies of the social influences approach in the literature (Botvin, Sussman, & Biglan, 2001; Sussman, Hansen, Flay, & Botvin, 2001).

The DARE (Drug Awareness and Resistance Education) Program was developed by the Los Angeles Police Department (LAPD) and the Los Angeles Unified School District (LAUSD) in the early 1980s. They essentially took the two variants of Project SMART (Self Management and Resistance Training) that were being tested with grade 7 students in LAUSD schools at the time (Graham, Johnson, Hansen, Flay, & Gee, 1990), combined them, and added a great deal of information about drugs (including, in some variants of the program as delivered, what they looked like, where to get them, and how to take them), for LAPD police officers to deliver to grade 5 and 6 students. The results of a randomized trial of the two SMART variants found that the resistance skills program was effective and the self-management program actually led to increased drug use relative to control group students (Graham et al., 1990; Hansen, Johnson, Flay, Graham, & Sobel, 1988). These results, combined with our knowledge that information usually does not influence behavior very much or actually makes things worse (Goodstadt, 1978, 1980) and the use of police officers who are not usually highly skilled teachers, make it no great surprise that DARE would not be effective.

Although early nonrandomized studies suggested that DARE sometimes had small effects for elementary school students, multiple randomized trials (Clayton, Cattarello, & Johnstone, 1996; Dukes, Ullman, & Stein, 1996; Ennett, Rosenbaum et al., 1994; Lynam et al., 1999; D. Rosenbaum, Flewelling, Bailey, Ringwalt, & Wilkinson, 1994; D. P. Rosenbaum & Hanson, 1998) and meta-analysis (Ennett, Tobler, Ringwalt, & Flewelling, 1994; West & O'Neal, 2004) have shown that DARE has little or no impact on drug use in the short term and none in the long term. In response, DARE has developed new programs for junior and senior high school students; the junior high program also has been shown to be ineffective (Perry et al., 2003; Perry, Komro, Veblen-Mortenson, & et. al, 2000) and evaluations of the high school program are not yet completed.

Many health education programs are promoted as being effective even without good evaluation data. One smoking prevention program in this category is the “Tar Wars” program for elementary students operated by the American Academy of Family Physicians (www.tarwars.org). Physicians or medical student volunteers go into 4th and 5th grade classrooms and provide one interactive 45-minute session that focuses on the short-term, image-based consequences of tobacco use. This is preceded by a lesson provided by the regular classroom teacher to teach students that, contrary to their perception, tobacco users are in the minority. The guest session is followed by a poster contest. A quasi-experimental evaluation suggests that this program produces short-term changes in knowledge (Cain et al., 2006). Despite the lack of
rigorous evaluation data, the AAFP claims that this program has reached 8 million children in 50 states and 13 countries (Cain et al., 2006), including developing countries such as Nepal (see http://www.tarwars.org/x1384.xml accessed January 18, 2008).

Another program that has been promoted as being an effective prevention program, but that had no long-term effects on smoking, is the Michigan Health Education Model. It consists of 30 lessons taught during grades 5-8, some of which include resistance skills training. Although it produced an 82% relative improvement (RI) in ever smoking at the end of the program (Shope et al., 1998; Shope, Copeland, Marcoux, & Kamp, 1996), no significant effects on smoking behavior remained by the end of grade 12 -- indeed, there was a negative effect for boys (Shope et al., 1998). It seems that the prevention content of this program was not intensive or long enough to produce permanent effects, that additional programming might have been needed when the students were adolescents, and/or that some content may even have had a negative effect as some older informational programs did.

Even programs of “proven effectiveness” do not always work

“Evidence-based practice” and other related terms have become common terms and standards in the U.S. and other countries in recent years. Multiple agencies have reviewed evaluation studies of substance abuse prevention programs and produced lists of “scientifically proven” or “evidence-based” programs.iii The stated purpose of these lists and guides is to help decision makers, at both the federal and local levels, choose programs that are supported by the best available evidence (Petrosino, 2003). These many lists have been confusing for practitioners because each uses different criteria and produces very different lists of “proven” programs (Flay et al., 2005; Gandhi, Murphy-Graham, Petrosino, Chrismer, & Weiss, 2007), yet they can have a profound influence on decision making. For example, after the U.S. Department of Education compiled one such list (of 9 “exemplary” and 33 “promising” programs) with the help of a panel of eminent prevention researchers, most school districts using Federal funds believed that they had to select a program from that list (Weiss, Murphy-Graham, & Birkeland, 2005).

Another difficulty with these lists is that some of the programs that appear on them have very limited evidence of effectiveness (Gandhi et al., 2007). Gandhi and colleagues analyzed the reported effects of five prominent programs that appeared on one or more of seven prominent lists of substance abuse prevention programs. They found limited evidence showing substantial impact on drug use behavior, even at immediate posttests for most programs, with the evidence for the effectiveness of most programs coming from only one or two studies, usually conducted by the program developers. In particular, they found very few studies showing substantial impact at longer follow-ups. Thus, even many of the programs that qualify for even the most rigorous of these lists do not yet have the kinds of data to meet rigorous standards of evidence required for being of proven efficacy, effectiveness or readiness for dissemination (Flay et al., 2005).

Policy makers and educators must be cautious about how they go about adopting and implementing smoking prevention programs, even those of “proven effectiveness.” Just because a program has been proven effective in a randomized trial does not mean that it will always be effective when delivered to different types of students (who may differ by age, culture or personality), by different providers (trained health educators, research staff, other types of visiting instructors, regular teachers), in different settings (e.g., community agencies, after-school programs). A clear example of this is the European Smoking prevention Framework Approach (ESFA)(De Vries, Mudde, Leijs et al., 2003). The ESFA was initiated in 1997 as a community intervention trial conducted in six countries (Denmark, Finland, the Netherlands, Portugal, Spain and the UK). It used an integral preventive approach to smoking prevention guided by best-
practice principles available at the time (Glynn, 1989). It targeted adolescents in and out of school as well as their parents and the schools themselves (De Vries, Mudde, Kremers et al., 2003; De Vries, Mudde, Leijis et al., 2003). Short-term effects 1 year after the pre-test (De Vries, Mudde, Kremers et al., 2003) were non-significant overall but significant effects were observed in Finland (smoking onset was 4.7% lower) and Spain (smoking onset was 3.1% lower); however, counter-productive trends were observed in Denmark and the UK. Long-term overall effects (De Vries et al., 2006) were small but significant (RI = 6.4%), with larger effects in Finland (RI=14.8% for weekly smoking, but no effect for ever smoking – see Vartiainen et al (Vartiainen et al., 2007) for more detail), Portugal (RI=36% for weekly smoking, 14.9% for ever smoking) and Spain (RI = 11.8% for weekly smoking and 6.3% forever smoking), and reverse effects in the Netherlands (except for non-natives). Effects were stronger in countries where more lessons were offered, teachers were trained longer, parents and community were more engaged, and the social influence content was taught well.

The details of the ESFA programs varied considerably across countries. Such variations may have accounted for the differences in outcomes, and prior research may be informative. For example, some studies have found programs to be ineffective (or even harmful) when delivered by regular classroom teachers (R. M. Bell & et. al, 1993; Botvin, Baker, Filazzola, & Botvin, 1990). The use of peer leaders has been found to improve effectiveness (Cuypers, 2002; Klepp, Halper, & Perry, 1986; Tobler, 1992), but they were not used in the ESFA. Some studies have reported effectiveness only when programs were delivered with high fidelity (Botvin, Baker, Dusenbury, Botvin, & Diaz, 1995; Botvin, Baker, Dusenbury, Tortu, & Botvin, 1990; Botvin, Baker, Filazzola et al., 1990; Botvin et al., 1989; Pentz et al., 1990).

Programs with replicated findings are more likely that programs for which there is no prior evaluation to be effective in different settings, but only if those replications showed effectiveness in many different types of students, providers and settings in evaluations by different investigators. Unfortunately, no program has yet been sufficiently replicated across different types of students, providers and settings. The program with the most replications is Life Skills Training (to be reviewed below), but most of these have been conducted by the program’s developer in the U.S; though I review replications in Spain and Europe below.

Gandhi et al (Gandhi et al., 2007) found that only two of the programs on the lists they reviewed had studies of long-term follow-up, (Botvin, Baker et al., 1995; Pentz, MacKinnon et al., 1989). I will include those in this review.

Cultural sensitivity

Cultural sensitivity is believed to be important in public health (Resnicow, Baranowski, Ahluwalia, & Braithwaite, 1999) and for effective prevention (Chen Jr, 2004; Ferketch, 2007; Flay et al., 2004; Hecht & Krieger, 2006; Klonoff & Landrine, 1999; LaFromboise, Coleman, & Gerton, 1993; Litrownik et al., 2000; Lynagh, 1997; Miranda et al., 2005; Schinke, Botvin, Orlandi, & et. al, 1990; Schinke, Gilchrist, Schilling, Walker, & Dale, 1987; Schinke et al., 1988; Shelley et al., 2004; Sussman, Yang, Baezconde-Garbanati, & Dent, 2003; Velez, 2001). Many studies have evaluated the effectiveness of untargeted or targeted prevention curricula in white, minority, or diverse samples, but few studies have directly compared culturally relevant smoking prevention curricula with curricula that do not address cultural issues (Johnson et al., 2005). Botvin et al (Botvin, Schinke, Epstein, & et. al, 1995) have found that culturally targeted and non-targeted versions of their Life Skills Program were both more effective than a control condition in preventing smoking among African American and Hispanic adolescents. Another group (Gosin, Marsiglia, & Hecht, 2003; Hecht, Graham, & Elek, 2006; Hecht & Krieger, 2006;
Hecht et al., 2003; J. R. Warren et al., 2006) compared prevention curricula targeted to the values of several cultural groups: a Mexican American curriculum, a Black/White curriculum, and a multicultural curriculum. All three curricula were more effective than a control condition, with the Mexican American and multicultural curricula affecting more outcome variables (regardless of the students’ ethnic characteristics) than the Black/White curriculum.

In a study in ethnically diverse schools (Hispanic, Asian-American, Caucasian) in Southern California, Johnson et al. (Johnson et al., 2007; Johnson et al., 2005) compared two 8-session, social-influence based curricula. One was an individualist-framed program, a version of the SMART program (Hansen, Johnson et al., 1988) with highly individualized content that emphasized “looking after yourself” (Project CHIPS – Choosing Healthy Influences for a Positive Self). The other was a collectivist-framed program that included cultural values from Hispanic and Asian cultures that emphasized collectivist objectives, interdependence of family members, respect for ancestors, and harmonious interpersonal relations (Project FLAVOR, Fun Learning about Vitality, Origins and Respect). They found that only the culturally sensitive curriculum (Project FLAVOR) significantly effected smoking initiation. The effects were larger for schools with large proportions of Hispanic students, and especially among the Hispanic students within those schools. Indeed, the multicultural program was effective only for Hispanic students in mostly-Hispanic schools. In contrast, the individualist-framed curriculum was effective only for Asian students in Asian/multicultural schools.

The kinds of results reported above suggest great caution is needed when implementing programs in different cultures. On the one hand, some programs seem to be equally effective with many different groups but, on the other hand, some studies suggest that making programs culturally relevant might be very important. Clearly, we need more research on this issue. In the mean time, any group or country adopting a program will need to evaluate it rigorously to determine its effectiveness in the new setting or culture.

Conclusion from Review of Reviews

In summary, findings from various reviews and meta-analyses suggest that:

School-based smoking prevention programs can have significant long-term effects if they:
(1) are interactive social influences or social skills programs that
(2) involve 15 or more sessions, including some up to at least ninth grade, that
(3) produce substantial short-term effects.

However, it is not easy to adopt and adapt programs for use contexts different from those in which it was tested, especially in other cultures and countries, and great care must be taken to implement with integrity and monitor implementation and outcomes.

These findings also suggest that many more programs that have reported short-term effects might also have medium- and long-term effects if they were evaluated. Unfortunately, long-term studies are relatively rare, mostly due to lack of funding.

METHODS FOR THIS REVIEW OF LONG-TERM EFFECTS

The second objective is to determine which kinds of school-based prevention can be effective over the long term. The World Health Organization (WHO) Tobacco Free Initiative (TFI)
wanted to develop an understanding of what kinds of school-based prevention programs produce long-term effects, and which of these might be successful in less developed countries. This required a focus on studies of programs that both were successful in reducing smoking in the short term and also included follow-up data into high school (grades 10–12) or beyond. The general protocol of locating studies was through multiple sources. I compiled searches of PsycINFO, MedINFO, the Google Scholar search engine (using the terms “school,” “prevent*,” “tobacco,” “smok*,” and “program*”), and word of mouth. The duration of that search was from January, 1970 through December 2007. I included any article or report in the English language that included data regarding the evaluation of school-based smoking prevention programs. Only studies with a control condition were included.

Since the purpose was to determine the size of the effects that could be obtained by the best programs that have been tested, the decision was made, based on my review of past reviews above, to limit this review to programs that included 15 or more sessions (preferably including some in high school) and that had demonstrated effects at both short term and medium term. Only three school-based programs and four school+ (plus small media, mass media, and family or community components) programs fulfilled these criteria. These two sets of studies are labeled Category I studies of school-based and school+ programs, respectively. For Category I studies, I included only studies that included follow-up into high school. Few studies have included follow-up beyond high school, but for those that did, the reported effects are of interest.

Given the small number of Category I studies, I also review evaluations of other programs with the promise of medium- and long-term effectiveness. These Category II studies consist of school-based and school+ programs that had large effects and were of a large enough scope and sequence to suggest likely medium- and long-term effects. Ten studies of 8 programs met these criteria.

All of the studies reviewed in these two sections are from developed countries (the U.S., Finland and the Netherlands). In view of this, I include a review of all studies I could find (n = 10) from developing countries (Category III).

Table 1 summarizes the categories and types of studies and programs in this review.

**Effect size**

Percent relative improvement (RI) is used as the indicator of effect size in this review for two reasons. First, it is readily available for all programs, whereas the detailed statistics needed to calculate an effect size are sometimes incompletely reported. Second, RI is readily understood and utilized in cost and benefit calculations. For randomized trials, pretest levels of smoking should be the same in both program and control groups, and RI would be the difference between posttest control (C) and program (P) groups divided by the control group level [i.e., (%C - %P)/%C]. However, pretest levels were not always the same, and these should be adjusted for; thus, in cases where pretest data were reported, RI is the posttest difference between groups minus the pretest difference between groups, divided by the control group posttest level, that is, (%change in C – %change in P)%Post C, expressed as a percentage.

One may ask how to compare the effect sizes reported in meta-analyses and RIs. An approach commonly used by meta-analysts (Rosenthal, 1984) is to translate the effect size into a percentage reduction (RI) based on the area under the curve in the Z distribution. This approach translates an effect size of .20 into a 10% relative reduction in smoking. In this report, I consider programs with effects 2 to 15 times as great as this, that is, with RIs of 20-140% or corresponding effect sizes of between .4 and 2.8.
Another complication in determining effect sizes is that different studies reported different levels of smoking as their outcome variable. For both short- and long-term effects, the most commonly used outcomes were ever (lifetime) use, use in the past month, or use in the past week. When studies reported more than one of these, I report them all in the tables. An additional level of complication is that some researchers report outcomes only for the subset of their sample who were nonsmokers at baseline/pretest. I noted reports on only those students who were nonsmokers at baseline in the text but not the tables. While relatively few studies reported more than one outcome measure, when they did so, the RIs were remarkably consistent across outcomes (with some exceptions). On the assumption that investigators reporting only one outcome may have chosen to report the measure with the largest effect size, the estimates are likely to be on the generous side.

**REVIEW OF CATEGORY I STUDIES AND FINDINGS**

To recap, Category I includes high-quality studies of programs that both were successful in reducing smoking in the short term and also reported significant follow-up effects into high school (grades 10–12) or beyond. For each of these programs, Table 2 shows the research design; the number of sessions, duration, and grade levels of the program, the grade of the last follow-up and the short and long-term program effects.

**Category I School-Based Programs**

Reviews of evaluations of three school-based programs are included in this section.

**The Tobacco and Alcohol Prevention Project (TAPP)**

The Tobacco and Alcohol Prevention Project, developed by Bill Hansen and colleagues at UCLA in the early 1980s (Hansen, Malotte, & Fielding, 1988) was a 15-session social influences-oriented program. The core components of the social influences approach have been employed in many evaluated programs, including those reviewed here. Hansen (Hansen, 1988) provides a good description of the theory and content of this approach. It has two main core elements: (1) resistance skills training to teach skills to resist the specific and general social pressures to smoke, and (2) normative education to correct student misperceptions of prevalence and acceptability of use. Programs using this approach also often involve active learning or the use of the Socratic or dialectic teaching approaches, open discussion, the use of peers or older admired youth as instructors, and behavioral rehearsals to ensure that skills are learned well (subsequently called interactive approaches). TAPP included the above core elements plus inoculation against mass media messages, information about parental influences, information about the consequences of use, and making a public commitment not to smoke. Peer opinion leaders were used to assist teachers with program delivery.

TAPP was evaluated in two cohorts of seventh grade classes in a nonrandomized study in Los Angeles County. Only cohort 1, conducted in two moderately sized school districts, was followed into grade 10. Health education and social studies teachers received 2 days of training prior to delivering the program. As shown in Table 2, by the end of eighth grade the RI in past-month smoking was 26.2%. By the end of grade 10 there was a 19.1% RI in past-month smoking and 18.3% RI in ever smoking. In a secondary analysis of only those students present at all waves of the study, the RI in past-month smoking was 43%.
This was an early study of the social influences approach, and it demonstrated that the approach can be very effective. The use of peer leaders probably enhanced what program effects would have occurred with teacher-only delivery (Cuijpers, 2002; Klepp et al., 1986; Tobler, 1992). The whole-sample result is preferred as the initial estimate of program effects because it provides a more realistic assessment of what would happen under real-world conditions; however, note that the larger effect obtained for students present throughout the study could be obtained if all schools were to implement the program.

Life Skills Training (LST)

Life Skills Training is one of the most researched school-based substance use (including smoking) prevention programs. Developed by Gil Botvin (Botvin & Eng, 1982), originally at the American Health Foundation and then at Cornell, LST consists of 30 classroom sessions with 15 delivered in grade 7, 10 in grade 8 and 5 in grade 9 (usually the first year of high school)vi The program was designed to teach students a wide array of personal and social skills. These include content similar to other smoking prevention programs that focus on social influences (Glynn, 1989; Hansen, 1988), including learning and practicing refusal and other assertion skills, information about the short- and long-term consequences of smoking, correction of misperceptions of the prevalence of use by same-age peers, and information about the decreasing acceptability of smoking in society. Other generic program content addresses the development of communication skills and ways to develop personal relationships.

Multiple studies over 25 years have demonstrated the effectiveness of the program when delivered by different providers, in different kinds of schools, and for different kinds of students (see (Botvin, 2000) and (Botvin & Griffin, 2002) for reviews). Only one study has included long-term follow-up through high school (Botvin, Baker et al., 1995). This was a follow-up of the largest single trial, conducted in 56 suburban and rural schools serving largely (91%) white students in three geographical regions of New York State (Botvin, Baker, Dusenbury et al., 1990). Schools were assigned randomly to two experimental conditions (one day or video-taped teacher training) or a control condition. Level of implementation ranged from 27 to 97% by teacher reports, with about 75% of the students receiving 60% or more of the intervention. Six program schools and 18% of the students were excluded from the analysis of program effects because of poor implementation.

As shown in Table 2, at the end of grade 9 the RI was a relatively small 8.9% (1.63% versus 1.48%) for weekly smoking, partly reflecting the low prevalence of weekly smoking at this age. At the end of twelfth grade, the RIs were 19.7% (33% versus 26.5%) and 20.4% (27% versus 22%) for monthly and weekly smoking, respectively.vii For the high-implementation group, the long-term RIs were both 28%. However, the RIs for the (almost) complete sample provide the most appropriate estimate of what effects could be obtained under real-world conditions -- indeed, they may still be an overestimate of the effects that might be obtained when the program developer is not involved -- although larger effects might be obtained with full, high-quality, implementation.

Independent evaluations of LST have found similar short-term effects. In a nonrandomized trial in Spain, where the program was delivered by teachers to grade 9 students, a 21% RI in average monthly smoking at the end of grade 10 reduced to 11% by the end of grade 12 (Fraguera, Martin, & Trinares, 2003). Independent evaluations of LST in Midwestern states found a short-term RI of 22% in a randomized trial in rural Iow (Spoth, Redmond, Trudeau, & Shin, 2002; Trudeau, Spoth, Lillehoj, Redmond, & Wickrama, 2003) and short-term RIs of 43%
in current smoking Indianapolis (Zollinger et al., 2003). Another small-scale (three schools per condition) randomized evaluation in Pennsylvania found small immediate effects for girls only, and these had decayed by the end of grade 7 and were no longer apparent by the end of grades 8-10 (Smith et al., 2004). In a nonrandomized trial of a German adaptation of the life skills approach in 106 German-speaking elementary schools in Austria, Denmark, Luxembourg, and Germany, a 10% RI in ever smoking and less than 1% RI in past-month smoking were reported (Hanewinkel & Asshauer, 2004).

**Project SHOUT**

John Elder and colleagues at San Diego State University (Eckhardt, Woodruff, & Elder, 1997; Elder et al., 1993) developed and evaluated Project SHOUT (Students Understanding Others Understand Tobacco), which used trained college undergraduates to teach 18 sessions to seventh and eighth graders that included information on the health consequences of smoking, celebrity endorsements on nonuse, the antecedents and social consequences of tobacco use, decision making, resistance skills advocacy (writing letters to tobacco companies, magazines, and film producers; participating in community action projects designed to mobilize them as anti-tobacco activists), a public commitment to not use tobacco, and positive approaches to encouraging others to avoid tobacco or quit. In ninth grade, five newsletters were mailed to students and two to their parents, and each student received four phone calls from trained undergraduate counselors that were individually tailored to their tobacco use status at the end of eighth grade or the prior phone call. During eleventh grade, approximately half of the students received two more newsletters that focused on tobacco company tactics to recruit new smokers’, information on recent city, state, or national legislation regarding tobacco, cessation advice, and second-hand smoke; and one phone call that focused on eliminating smoking in restaurants and other public places, and the rights of customers and employees in those places affected by the potential ban.

The program was evaluated in 22 schools with ethnically diverse populations in the San Diego, California area, some suburban and some rural. Schools were assigned randomly to program and control conditions after matching on pretest levels of tobacco use. Effects observed at the end of 8th grade (14.6% versus 10.8%, RI = 22%) were not statistically significant. However, as shown in Table 2, by the end of grade 9 the intervention produced a relative reduction in tobacco use in the past month of 30.3% (19.8% versus 13.2%). By the eleventh grade, the average RI was 44.1% (12.6% versus 7%). For the group that did not receive the grade 11 intervention, the RI decayed to only 9.5%.

The pattern of effects observed suggest that much of the long-term effect was due to personal attention via newsletters and phone calls in grades 9 and 11. Indeed, one has to wonder if the personal attention set up a response bias among respondents such that those who received personalized newsletters and phone calls were motivated to tell the researchers what they wanted to hear; however, lack of a differential response rate to the surveys by condition speaks against this, at least in part. Considerable research suggests that the power of similar-age peers and the power of college-age counselors for high school students should not be underestimated. Although the cost of the intervention as studied was kept down by the use of volunteer students, it is not clear how easily this model can be disseminated. The results also strongly suggest, however, that even a brief intervention during high school was enough to actually increase the effect observed at the end of grade 9.
Category I School+ Programs

The North Karelia Project

Erkki Vartiainen and colleagues at the National Public Health Institute of Finland (Vartiainen, Fallonen, McAlister, & Puska, 1990; Vartiainen, Paavola, McAlister, & Puska, 1998; Vartiainen, Pallonen, McAlister, Koskela, & Puska, 1983; Vartiainen, Pallonen, McAlister, Koskela, & Puska, 1986) tested a 10-session social influences program delivered by trained health education teachers and peer leaders in the province of North Karelia, Finland. A community-wide heart disease prevention program and mass media campaign modeled on the Stanford three-cities project (Farquhar et al., 1977) was going on throughout North Karelia at the same time. Two schools received the 10-session program from the project health educator and trained peer leaders and two schools received a 5-session version from regular teachers. Two schools from another province, where there was no prevention program, were used as controls. As shown in Table 2, at the end of grade 9 the RI (average of lifetime, monthly, and weekly) was 44.6% (for both program conditions), which decayed to 38.7% by grade 11. By 3 years beyond the end of high school, the RI had decayed to 22.9% in the health educator condition and 37.3% in the teacher condition; by 10 years beyond high school, the average RI was 20% with the two conditions not significantly different.

The results reported here can only be interpreted as the joint effects of the school-based smoking prevention program and the community-wide heart disease prevention campaign (which had a reduction of smoking as one of its targets). Thus, these results suggest effects that are larger than those of the school-based programs reviewed above. The larger effects obtained by regular teachers suggests that programs might be more effective when delivered by regular classroom teachers than when delivered by visitors to classrooms, possibly because of the ongoing relationships that teachers establish with students. However, at the long-term follow-up, teachers and visitors produced similar effects.

Minnesota Class of 89

This project, conducted by Cheryl Perry and colleagues at the University of Minnesota (Perry, Klepp, & Sillers, 1989), was another in which a school-based prevention curriculum was tested in the context of a community-wide heart disease prevention program. The community program consisted of community education, including mass media, and organization activities, including screening, cessation clinics, and workplace education, designed to reduce three cardiovascular risk factors -- smoking, cholesterol levels, and blood pressure (Luepker, Murray, Jacobs, & et. al, 1994; Mittelmark et al., 1986). The school-based smoking prevention program (Perry, Kelder, & Klepp, 1994; Perry, Kelder, Murray, & Klepp, 1992) was based on the Minnesota Smoking Prevention Program (Arkin, 1981; D. M. Murray, Luepker, Johnson, & Mittelmark, 1984), one of the early social influences programs, and included material on diet and exercise as well as tobacco. Seven sessions on smoking prevention were delivered by peer leaders assisted by teachers in seventh grade. In eighth and ninth grades an additional 10 sessions concerning tobacco use were delivered by teachers. The classroom components were supplemented by the development of health councils through which students participated in other cardiovascular risk reduction projects.

The smoking prevention program was evaluated with a design in which students in all of the schools in one community received both the community-wide cardiovascular intervention and
the school-based smoking prevention program, and students in all the schools in another
community did not. All students in one cohort were surveyed every year from grade 6 to grade
12. As in all school-based studies, attrition occurred continuously over the 6 years and, by grade
12 only 45% of the original participants were surveyed. There were no differences in smoking
rates at sixth grade. By the end of seventh grade, after the core smoking prevention content had
been delivered, weekly smoking prevalence was about 40% lower in the program condition, and
this effect was maintained through twelfth grade (Table 2), 3 years after the end of direct
smoking prevention instruction and a year after the end of general community education.

Like the North Karelia project, this study demonstrates that school-plus-community
programming can have substantial effects that are maintained to a large extent through the end of
high school.

**Midwestern Prevention Project (MPP)**

The Midwestern Prevention Project (also known as Project STAR, Students Taught
Awareness and Resistance), developed by Mary Ann Pentz and colleagues at the University of
Southern California, tested a school-plus-community (and mass media) version of the social
influences approach in eight communities in the Kansas City metropolitan area. The school-
based component consisted of 10 sessions delivered by classroom teachers to sixth or seventh
grade students (depending on the year of transition to middle school) and 5 sessions delivered the
following year (when a parent involvement component was also implemented). Of these schools,
8 were assigned randomly to conditions, 24 other schools elected to deliver the program and 18
others elected to wait till after the project. Mass media programming was available to all
communities every year. Other community-based programming started in the third year and
likewise was available in all communities.

At the 2-year follow-up, the RI was 37.5% (Table 2; (Pentz, Dwyer et al., 1989)). By grades
9-10, it was 18% (Table 2; (Johnson et al., 1990)). These results are difficult to interpret because
all students were exposed to the mass media and community components. The mass media
programming, in particular, would be expected to reduce the difference between groups because
control group would no longer be a real control, and it might have reduced students’ rate of onset
relative to if they had not been exposed to the community program. This might explain the
relatively fast “decay” that was observed.

**Vermont Mass Media Project**

The Vermont project tested the effectiveness of a mass media social influences smoking
prevention program when delivered in the context of a school-based program. Kim Worden and
colleagues, of the University of Vermont (Flynn et al., 1992; Worden et al., 1988), undertook a
very careful development process to develop television and radio spots that would discourage
cigarette smoking by adolescents. They randomly assigned two communities to the program
(mass media plus school) condition and two matched communities to a school-only condition.
There was no true control group. In the program communities, they purchased the time for airing
the spots (734 TV spots in year 1 decreasing to 348 by year 4, and 248 radio spots in year 1
increasing to 450 by year 4) and provided schools with the school-based program (four sessions
in each of grades 5-8 and three sessions in each of grades 9 and 10 -- each student in the study
cohort was exposed to 4 years of program during grades 5-8, 6-9, or 7-10) and teacher training to
deliver them. Neither schools nor students were told about the media programming, and the mass
media programming never mentioned the school program. Thus, as far as students were concerned, there was no linkage between the two programs.

As shown in Table 2, the RIs in weekly smoking among the school plus mass media program group compared to the school-only program group were 36.6% (14.8% versus 9.1%) at the end of the program (grades 9-11) and 28.8% 2 years later at grades 10-12 (Flynn, Worden, Secker-Walker, Badger, & Geller, 1995; Flynn et al., 1992; Flynn et al., 1994). Larger effects were observed for daily smoking -- 44% RI at the end of the program and 36% a year later. It is difficult to estimate what the effects of the school-only program might have been, and, therefore, the relative contributions of the school and mass media programming. Nevertheless, this study demonstrates that well-designed media programming can produce large effects above those of the school-only program, about 80% of which are maintained for at least 2 years.

**Summary of Findings from Category I Programs**

Results from three social influence and social competence programs with 15 or more sessions over 2–4 years, preferably with some content in high school, had significant long-term effects (i.e., at grades 10-12): an average of a 27.6% (range 18.7–44.1) relative reduction in smoking. The extraordinary effects of Project SHOUT may have been due to the added content on tobacco industry activities, the teaching and encouragement of advocacy skills, and the personal attention. These results need to be replicated. The long-term effects suggest that a minimal personal contact intervention of this kind in high school could increase the effects of any other program delivered in middle school. On the basis of these studies, I conclude that social influences oriented programs of proven effectiveness, if well implemented, can produce a long-term RI of between 25 and 30%.

The school+ studies produced short-term RIs of about 40%, almost twice as high as the school-only programs, consistent with my prior review (Flay, 2000). These effects decayed over time an average of 22% to about 31% RI. Because the effects of school-only programs tended to increase rather than decay over time, the long-term effects of school plus community or mass media programs were only about 12% better than school-only programs. Note, however, that program effects were maintained at a higher level (almost 40%, or 31% better than school-only programs) for those programs that included a high school component (North Karelia and Minnesota Class of 89); reinforcing the conclusion above that high school programming reduces the decay of effects.

The use of multiple delivery modalities increases effectiveness over those obtained from school-only programs (Flay, 2000). This is consistent with theories about the influences on behavior existing across multiple domains of life (Bronfenbrenner, 1977, 1979, 1986; Flay & Petrakis, 1994; Petrakis, Flay, & Miller, 1995). It helps if students receive consistent messages across community contexts and over time.

Thus, I conclude that ongoing school plus mass media or community programs can produce a long-term RI of between 35 and 40%.

**REVIEW OF CATEGORY II STUDIES AND FINDINGS**

This section provides a brief review of 10 studies of 8 programs that show exceptional promise or provide other important insights to help estimate the potential and likely relative
reduction in smoking onset if prevention programs were widely implemented. These results are summarized in Table 3.

The Adolescent Alcohol Prevention Trial (AAPT)

William Hansen and John Graham of the University of Southern California (Hansen & Graham, 1991) tested two variants of early social influences programming (nine sessions delivered to grade 7 students) targeted to alcohol use. They contrasted information plus resistance skill training, information plus normative education alone, or both of these combined. Schools were assigned randomly to one of these three conditions or to a control. Although the program focused mostly on alcohol, it also produced effects on cigarette smoking. The normative education and combined programs produced the largest effects. As shown in Table 3, the RIs at the end of the program were 21.4% for lifetime smoking and 26.2% for monthly smoking. At eleventh grade follow-up, the RI in lifetime smoking was 13.9% (Taylor, Graham, Cumsille, & Hansen, 2000).

Although this program focused mostly on alcohol, it also produced effects for cigarette smoking. These effects were not too different in magnitude from those reported earlier from TAPP (developed by the same principal investigator), although, as might be expected because the program was not focused on smoking, these effects were not maintained as well.

Towards No Tobacco (TNT)

Steve Sussman and colleagues, also at the University of Southern California (Dent et al., 1995; Sussman, Dent, Stacy, Hodgson et al., 1993; Sussman, Dent, Stacy, Sun et al., 1993), developed the TNT program as a more intensive approach to tobacco prevention that incorporated the social influences approach and new approaches to altering normative beliefs and social skills training. In a large randomized trial, they found RIs in ever smoking of 34% at the end of the program (grade 8) and 30% at grade 9, and RIs in weekly smoking of 64% at the end of the program and 56% at the end of grade 9 (see Table 3). These effects are larger than those found in other programs, so one would expect that the long-term effects might also be larger.

Know Your Body (KYB).

Investigators at the American Health Foundation developed the Know Your Body program in the early 1980s as a comprehensive health education program that included social influences and competence prevention components. It consisted of 384 lessons delivered during grades 4 through 9. In a randomized trial in two New York State communities, Walter and colleagues (Walter, 1989; Walter, Hofman, Connelly, Barrett, & Kost, 1985; Walter, Hofman, Connelly, & et. al, 1986; Walter, Hofman, Vaughan, & Wynder, 1988; Walter, Vaughan, & Wynder, 1989; Walter & Wynder, 1989) found an 11.5% RI in thiocyanate (a biological marker of smoking) at grade 8. In one community, they found a 73.3% RI in lifetime smoking at the end of grade 9 (entered at half this value in Table 3, since it was not replicated in the second community).

In a second randomized trial with Washington DC black students, Bush and colleagues (Bush, Zuckerman, Taggart et al., 1989; Bush, Zuckerman, Theiss et al., 1989) obtained very similar results, 49.5% RI after one year and 80.8% RI after 3 years (at the end of grades 7-9). Again, these were based on saliva thiocyanate.

These are exceptionally large effects. Without long-term follow-up data we cannot be sure
how well they would have been maintained, but these studies show that strong prevention effects can be obtained by comprehensive health education programs that also include proven approaches to prevention.

**The Good Behavior Game (GBG)**

Shepard Kellam and colleagues at The Johns Hopkins University (Kellam & Anthony, 1998) applied the Good Behavior Game (Barrish, Saunders, & Wolfe, 1969) to improving elementary student behavior in the expectation that it would prevent subsequent adolescent problem behavior. In a trial where grade 1 students were assigned randomly to classrooms and classrooms or teachers were assigned randomly to the GBG, another intervention, or control conditions, students received three 10-minute sessions per day at the beginning of grade 1, increasing in frequency and duration during grades 1 and 2. Ialongo and colleagues (Ialongo, Werthamer, Kellam, & et. al, 1999), Werthamer, Kellam, et al (1999) reported a 24% RI in problem behavior at the end of grade 2 and Fur-Holden and colleagues (Furr-Holden, Ialongo, & Anthony, 2004) reported a 26.3% RI in lifetime smoking at grade 8 (Table 3).

A second trial tested the effects of only one year of the GBG in grade 1 on smoking behavior 6 years later (Storr, Ialongo, Kellam, & Anthony, 2002). At the follow-up, students who had participated in the GBG were 21% less likely to have started smoking, a result remarkably similar to that obtained in the earlier study (Table 3).

These studies demonstrate that important changes in life course trajectories of behavior brought about early in life can lead to important changes in adolescent behavior, including smoking. Other school-based programs that improve elementary school children’s behavior also have this kind of potential, for example, Fast Track (Conduct Problems Prevention Research Group, 2002a), the Seattle Social Development Group program (D. J. Hawkins, Catalano, Kosterman, Abbott, & Hill, 1999; J. Hawkins & et. al, 1992; O'Donnell, Hawkins, Catalano, Abbott, & Day, 1995) and the Positive Action program (see below). Some non-school interventions that improve the behavioral trajectory of young children -- for example, preschool maternal counseling (Cullen & Cullen, 1996) and home nursing visitation (David L. Olds, Eckenrode, Henderson, & et. al, 1997; D. L. Olds et al., 2004) -- also have this potential.

**The Positive Action (PA) Program**

The Positive Action program was developed by Carol Gerber Allred, an educational psychologist who had also been a classroom teacher in the late 1970’s and early 1980’s, as a comprehensive character education program designed to improve character, pro-social and other positive behaviors and school performance as well as negative (problem or unhealthy) behaviors, including smoking. The program consists of 15-minute lessons up to four days per week for grades K-12, delivered by trained teachers. In addition, the school principal and PA coordinator/committee implement school-wide climate change activities to encourage and support positive behaviors by students. School counselors can provide additional lessons to high-risk students and parents can conduct weekly lessons with their children that parallel the school lessons. A community involvement component is also available. The program makes students (and their teachers and parents) aware of how they feel good about themselves when they do positive actions, how that good feeling can lead to further positive thoughts and actions, and that there is always a positive way to do everything. Students are taught what actions are positive in the physical (including engaging in health-promoting behaviors and avoiding harmful
substances), intellectual (including motivation to learn, decision-making and problem-solving), emotional (including empathy, self-control, self-management and responsibility) and social (including getting on with others, refusal and other communication skills, and other prosocial behaviors) areas of their lives. Students learn the skills they need to perform all of these behaviors through lessons, discussion, role-play and practice. The program is very interactive (Sussman, Rohrbach, Patel, & Holiday, 2003; Tobler et al., 2000); interaction between teacher and student is encouraged through the use of structured class discussions and activities, and interaction between students is encouraged through structured or semi-structured small group activities, including games, role plays and practice of skills.

Three quasi-experimental evaluations used archival school-level data from Hawaii, Nevada and a large south-eastern school district in matched controlled designs (Flay & Allred, 2003; Flay, Allred, & Ordway, 2001) to estimate the impact of PA on school disciplinary reports and student test scores. Large effects were found for both kinds of data in all three studies.

Two randomized trials of PA have recently been completed, one in 10 matched pairs of Hawaii elementary schools (Flay, Acock, Vuchinich, & Beets, 2006) and one in 7 matched pairs of Chicago elementary schools (Flay, DuBois, & Ji, 2007). After 3 years of PA, 5th graders were 30% and 29% less likely to have started smoking than 5th graders in control schools in Hawaii and Chicago, respectively (Table 3).

The south-eastern quasi-experimental study (Flay & Allred, 2003) provided the only opportunity to date to examine the long-term effects of PA. We were able to obtain school-level archival data from the middle and high schools that students from the studied elementary schools later attended. The middle and high schools had not implemented the program. Compared to middle schools with less than 65% PA graduates, schools with 65-75% PA graduates reported 16% fewer smoking incidents, and schools with more than 75% PA graduates reported 32% fewer smoking indigents (Table 3). Compared to high schools with less than 15% PA graduates, high schools with 15-27% PA graduates reported 10% fewer incidents of tobacco use, and schools with more than 27-50% PA graduates reported 20% fewer incidents.

These data establish that the effects of 4-6 years of PA in elementary school are maintained at high levels through middle and high school. It seems likely that effects would be even greater if students also were exposed to PA during middle and high school.

**School plus computer-tailored letters**

Marlein Ausems and colleagues at Maastricht University in the Netherlands (Ausems, Mesters, van Breukelen, & De Vries, 2004) tested the effects of a short (93 sessions) social-influence school-based program and 3 computer-tailored letters. The researchers developed a computer program to produce tailored letters to students using their baseline data on smoking-related attitudes, social normative beliefs and self-efficacy. The letters were mailed to students 3 weeks apart. Some schools provided the letters without the school curriculum.

Students in the letter-only and school plus letter conditions were 30% and 27% less likely, respectively, to initiate smoking by the 6-month posttest. By the 18-month posttest, students in the letter-only condition were 43% less likely to have initiated smoking (Table 3), but students in the school plus letter were only 14% less likely. The authors speculated that the simultaneous combinations of interventions might have caused an overload of information. However, it seems more likely that the school-based program was just not strong enough to produce the kinds of effects that longer school-based programs have produced. Perhaps a stronger school-based program followed by personalized letters would have produced larger effects like those reported.
Project 16

Project 16, developed by Tony Biglan and colleagues at the Oregon Research Institute (Biglan, Ary, Smolkowski, Duncan, & Black, 2000) was a randomized, multiple cross-sectional design to test the effects of a comprehensive community-based intervention designed to reduce smoking by seventh and ninth graders. Sixteen communities were assigned randomly to two conditions, a five-session social influences school-based program and the school program plus the community program. The community program included media advocacy, youth anti-tobacco activities, family communications about tobacco use, and reduction of youth access to tobacco. At the end of 2 years of intervention, the covariate adjusted prevalence of smoking among seventh and ninth graders in the community program communities had increased 0.9% (from 10.7% to 11.6%) while prevalence had increased 3.3% (from 8.1% to 11.4%) in the school-based only communities – leading to a RI of 21.1% (Table 3). One year later, the parallel rates were 5.9% (from 7.9% to 13.8%) and 2.1% (from 10.3 to 12.4%), respectively, or a RI of 27.5% (Table 3).

The RIs obtained by this intervention suggest that well-designed community-based interventions can have effects that seem likely to grow over time. The lack of a true control group makes estimating the true effect difficult. However, the results of this study suggest that significant medium- and long-term effects can be expected from well-designed and implemented school-plus-community programs. Perhaps a stronger school-based program accompanied by a strong community-based program could produce results that increase over time (Flay, 2000).

Summary of Category II Programs

Although these programs are not strictly comparable, the average effect size of these 9 projects was 29% for short-term effects and 36% for medium-term effects (usually grade 8 or 9), but with large variation (12-50% for short term and 14-81% for medium term). The medium-term effects of these programs were larger than the long-term effects of Category I programs. Given that Category I programs actually had increased effects over time, these results suggest that long-term effects considerably higher than those derived from Category I programs may be possible with more comprehensive or newer school-based programs.

The results of the Good Behavior Game and Positive Action programs are particularly intriguing because they demonstrate the power of changing the trajectories of behavior early in life. A prevention program provided to these students in middle and high school might have much larger medium- and long-term effects on smoking and other health-related behaviors – but no evaluations of such combinations are available to date.

SUMMARY OF FINDINGS AND CONCLUSIONS

School-only Programs

This review suggests that interactive social influences smoking prevention programs that provide 15 or more lessons, start in upper elementary or middle school, and continue into high school can produce solid long-term effects. Other conditions that appear to improve the effectiveness of school-only programs relate to content (social influences and general social competence are of critical importance), how well they are delivered (related to how well teachers are motivated and trained), and the involvement of older peers. The findings are consistent with
the 13 components of effective programs for elaborated by Nan Tobler as a result of her multiple meta-analyses (Tobler, 2000).

Results from three social influence and social competence programs with 15 or more sessions over 2-4 years, preferably with some content in high school, had significant short-term effects of about 22% RI in monthly or weekly smoking that increased during high school in two of the studies to an estimated average of 28% RI. Some other programs (Category II) provided further evidence that (1) the social influence approach can affect tobacco use even when alcohol use was the main focus, (2) comprehensive health education programs that include strong social influence content can be effective, possibly even more effective than stand-alone social influence programs, and (3) programs early in life can alter developmental pathways for the better, including less tobacco use in adolescence.

Based on an average of the long-term effects of Category I studies, and supported by the estimated medium-term effects of Category II studies, I estimate that the possible long-term (end of high school or age 18) effects of a national program of well-implemented, school-based smoking prevention programs of proven effectiveness could be as high as 25-30%.

School-plus-Community and/or Mass Media Programs

The four Category I school-plus-community studies produced short-term RIs of about 40%, decaying to long-term effects of about 31%. As noted earlier, program effects were maintained at a higher level (almost 40%, or 31% better than school-only programs) for those programs that included a high school component (North Karelia and Minnesota Class of 89). Thus, I estimate that the possible long-term effects of a national program of well-implemented school-plus-community and/or mass media smoking prevention programs of proven effectiveness could be as high as 35-40%.

Expected Effects into Young Adulthood

Program effects are likely to decay beyond high school. Unfortunately, few studies are available to guide us in how large or small this decay might be. National U.S. data may allow for an estimate, though it is unclear how applicable it will be in other countries. The U.S. National Household survey on Drug Abuse data suggest that about 3.012% (average for 1989-1999, range = 2.63-3.46) of 18 year-olds who are not smoking daily become daily smokers by the time they are 25 (Giovino, 2004). The Monitoring the Future 2003 data provide a national estimate of the percentage of grade 12 students that smoke daily at 15.8%, meaning that 84.2% of twelfth graders were not smoking daily. For school-only programs, this would represent a 24.9% RI in daily smoking by age 25 (see Table 4 for calculations), with a decay in RI of (30 - 24.9)/30 = 16.9%. For school plus ongoing community or media programs, the comparable figures would be a 33.2% RI in daily smoking by age 25 (see Table 4), with a decay in RI of (30-33.2)/30 = 16.9% (coincidently the same as for school-only programs). In reality, I expect that the decay of school-only programs might be greater than this estimate, perhaps closer to 20%, and the decay of school plus ongoing community or mass media programs might be less, say 15% because the messages remain in the larger environment to influence or reinforce behavior. Of course, it is very difficult to draw any conclusions about long-term decay in developing countries.

Expected Effects under Real-World Conditions

There are at least two other factors that could reduce the effects of even the best programs in real-world implementations (1) rate of adoption by schools and communities, and (2) level and
quality of implementation or delivery.

Active adoption of a program does not necessarily translate into high implementation of it. For example, among Oregon schools who obtained funding to implement smoking prevention in 2001 (from Master Settlement funds), 37% implemented at a very low level and produced less than 1% RI in student smoking when compared with control schools (who did not obtain smoking prevention funding); another 39% implemented at a medium level, producing an 11.5% RI; and 24% implemented at a high level, producing a 48% RI in student smoking (MMWR, 2001). These figures would lead to about a 25% RI overall if one combined the medium and high implementation results, or only 16% RI if one averaged over all schools who obtained funding. Clearly, less-than-complete implementation could dramatically reduce the expected effect size of any national effort.

Experience in the USA suggest that getting effective prevention programs adopted (and used) by schools is not easy (Ennett et al., 2003; Ringwalt et al., 2002; U. S. Department of Health and Human Services, 2000). Estimates of effects often come from efficacy trials where adoption is not as large an issue because only those schools or communities willing to adopt the program have been entered into the study, and where implementation quantity and quality may not be major issues because the implementers are trained and monitored by the researchers. Nevertheless, it would be helpful to have an estimate of the proportion of schools that would be willing to implement an effective tobacco prevention program; however, we know of few such estimates. As an example, the Conduct Problems Prevention Research Group (Conduct Problems Prevention Research Group, 2002) reported that seven of eight school districts that were offered the Fast Track program accepted, and 52 of the 54 schools asked agreed to participate.

In actuality, not even all schools entered into studies always carry through with their willingness to implement the program. For example, we noted above how 6 program schools were dropped from the LST analysis because of lack of implementation (Botvin, Baker, Dusenbury et al., 1990). In another example, Battistich, et al. (Battistich, Schaps, Watson, Solomon, & Lewis, 2000) reported that only 5 of 12 schools recruited into the program arm of a nonrandomized project based on faculty interest and perceived likelihood of being able to implement the program actually implemented the program moderately well to very well during the 3-year study.

In these days of high demands on schools, they are unlikely to address prevention unless they have to, or unless it can be shown to also improve achievement, and they are unlikely to adopt a program unless they have the funding for it. Adoption probably would not be 100% even with a clear mandate and earmarked funding, although it might increase over time, following the standard S-shaped adoption curve as successes are publicized (Rogers, 2003). A clear mandate to include tobacco prevention in the curriculum together with earmarked funding and monitoring of adoption should help obtain rates of adoption of evidence-based school-based programs of 75% or more.

Getting comprehensive programs implemented fully and with integrity, even when they are adopted with full information and commitments, also is no small task, and the level and quality of implementation are clearly related to program effectiveness (Kam, Greenberg, & Walls, 2003). Factors believed to influence program implementation have been identified, and they are related not only to the program itself (e.g., program complexity, provision of technical assistance, user-friendly materials) but also to the environment in which the program is implemented (i.e., district, school, teacher, and participant characteristics) (Durlak, 1998).

For some programs with high levels of monitoring, levels of implementation might be high.
For example, the Conduct Problems Prevention Research Group (Conduct Problems Prevention Research Group, 2002) reported that participating teachers taught an average of 85% of the lessons in the first year of the program, 91% of parents participated in the program, and 79% of them attended at least 50% of the parent sessions.

Without ongoing monitoring, implementation might be much more uneven. Uneven implementation of a national program could reduce the effect size substantially -- but by how much? The effect sizes reported for LST already took incomplete implementation into account. The authors reported that about 76% of the students received 60% or more of the program from trained teachers in schools who had signed onto the study (Botvin, Baker et al., 1995). The 20% long-term RI reported was for the whole sample (for the high-fidelity sample, the long-term RI was 28%). Independent evaluations of the LST program have reported a wide range of effects. However, none of these studies provided data on levels or integrity of implementation.

The tobacco industry has sponsored adoption, implementation, and evaluation of LST (Interactive International, 2000, 2001). During the first 2 years, teachers who provided implementation data (73%) taught 80% of the units, met 75% of the objectives, and covered at least 69% of the activities. If one assumes that the 27% who did not provide implementation reports did not teach LST, then the average implementation level would be between 50 and 60%. Some teachers noted that the only reason they implemented LST at all, especially in year 2, was because it was being monitored or evaluated. Thus, one could conclude that under conditions of ongoing monitoring or evaluation a high level of implementation (60% or more) could be achieved.

There may be less compromise in the delivery of a community or mass media campaign than of school programs because they are of larger scale. A 75% implementation level might be a reasonable expectation for well designed and fully funded (including purchase of time on television and radio) campaigns.

**COST-EFFECTIVENESS**

The third objective of this review is to estimate the costs and cost-effectiveness of school-based smoking prevention. It is difficult to estimate the costs and the value of benefits of successful prevention programs and, therefore the benefit/cost ratio (Caulkins, Rydell, Everingham, Chiesa, & Bushway, 1999; Foster, Dodge, & Jones, 2003). There are at least two reasons for this: 1) the costs and benefits are so variable and 2) the long-term effectiveness of prevention programs has been so variable (Tengs, 1996). Nevertheless, several scholars have provided estimates.

One analysis estimated the cost of an effective 30-session prevention program in the U.S. at $US150 per student for program materials, training, teacher time and other costs (Caulkins et al., 1999). However, the estimated savings due to the benefits of preventing significant numbers of students from starting to smoke, and delaying the start date (and therefore the lifetime consumption) for others, are significant (Čauklins, Pacula, Paddock, & Chiesa, 2004). For example, the estimated social benefits of smoking prevention alone are about $US300 per student, a benefit/cost ration of 2.0, and the estimated total benefits are about $US840, a benefit/cost ration of 5.6.

The cost of an effective smoking prevention program in Canada has been estimated at $CAN67 (1996 dollars) (Stephens, Kaiserman, McCall, & Sutherland-Brown, 2000). Assuming a modest 4% long-term effectiveness, benefits of smoking prevention were estimated to be lifetime savings on health care of $CAN3,400 per person and on productivity of almost
$CAN14,000 (Stephens et al., 2000), a benefit/cost ration of 15.4.

Scholars disagree on whether lives saved actually save money or add costs for society. According to Hodgson (Hodgson, 1992), smokers incur about $9,379 more in lifetime health costs than nonsmokers. Using this information, Wang and colleagues (Wang, Crossett, Lowry, Sussman, & Dent, 2001) estimated the cost-effectiveness of LST to be about $US13,316 per life saved and $US8,482 per QALY (with the program costing only $US13.29 per student).

Another group estimated the costs of Project TNT at $US48 per student and that TNT would cost about $US20,000 per quality-adjusted life-year (QALY) gained (Tengs, Osgood, & Chen, 2001). While not cost saving, they concluded that smoking prevention offers gains in both survival and health-related quality of life that make it worth the cost. This latter statement is based on citizens’ “willingness to pay” for gains on the order of several hundred thousand dollars per QALY saved. In addition, another analyses found that the median cost of 587 medical and public health interventions is $US42,000 per year of life saved (Tengs, Adams, Pliskin, & al., 1995), so they conclude that smoking prevention is more efficient than most health/medical interventions.

The social benefits of even broader behavior improvement programs could be considerably greater. Steve Aos and his colleagues at the Washington State Institute for Public Policy conducted an analysis of the cost-effectiveness of about 70 different prevention programs (Aos, Lieb, Mayfield, Miller, & Pennucci, 2004). They estimated that LST costs $US29 per student and leads to benefits of $US746 (due to both smoking and drug prevention), a benefit of over $US25.61 per $ spent or a benefit/cost (b/c) ratio of 25.61. They estimated that TNT costs only $US5 per student and produces a benefit of $US279, a b/c ratio of 55.84. Other programs included in both that review and the current one include the Good Behavior Game (b/c = 25.92), the Midwestern Prevention Project (5.29), the Minnesota smoking prevention program (102.29) and a category of “other social influence/skills building substance prevention programs” (70.34).

Clearly, from a societal perspective, the costs of effective prevention are well worth it both to the individual students and to society as a whole, at least in developed countries. In developed countries, cost-benefit estimates ranged from 2 to over 100. It is difficult to determine the likely cost-benefit in developing countries, but the high costs of program delivery in developed countries combined with the high social and health costs of not preventing tobacco use in developing countries, suggest that prevention will also be cost-effective in many developing countries.

CATEGORIES III: SMOKING PREVENTION STUDIES FROM DEVELOPING COUNTRIES

The fourth objective of this review is to discuss which approaches have promise in less developed countries. I first review published reviews and then I review individual studies in order of the World Bank income categories (World Bank, 2008) (summarized in Table 5).

Reviews

I found two reviews of smoking prevention efforts in less developed countries. One of these was conducted by researchers at University of Southern California Institute for Health Promotion and Disease Prevention as part of their Pacific Rim Transdisciplinary Tobacco Use Research Center (PR-TTURC). The third was a review of smoking prevention research from the Department of Nursing at Cheju National University in Korea.
The Pacific Rim (Tanzania, Nepal, China and Thailand)

At a 2006 conference sponsored by the PR-TTURC (Unger, Palmer, & Johnson, 2007), Sussman and Pacific Rim colleagues (Sussman et al., 2007) described tobacco control activities in the Pacific Rim countries of Tanzania, Nepal, China and Thailand. They used the Framework Convention on Tobacco Control (FCTC), an internationally based agreement that would commit countries to adopt strong tobacco-control policies since February 27, 2005, as their framework. The FCTC, which contains 38 articles (World Health Organization, 2003), has raised the profile of tobacco control internationally to a level not previously seen. However, the treaty is very weak when it comes to prevention, and none of the articles directly addresses school-based smoking prevention. At a stretch, it could be included in Article 12, “Education, communication, training and awareness” in Section d, “effective and appropriate training or sensitization and awareness programmes on tobacco control addressed to persons such as ..... educators ....” or in Section f, “public awareness of and access to information regarding the adverse health, economic, and environmental consequences of tobacco production and consumption.” ((World Health Organization, 2003), page 11). According to Sussman and colleagues (Sussman et al., 2007) Tanzania and Nepal are implementing 7 of the 11 anti-tobacco strategies laid out in the framework, while China was judged to have implemented 9 of them and Thailand 10 of them.

In Tanzania, anti-tobacco educational campaigns have had considerable effects on spreading anti-tobacco knowledge, especially among youth. Among city youth, 59%–71% reported that during the past year they had been taught about the dangers of smoking in class. In Nepal, local NGOs and medical organizations, in collaboration with the Ministry of Health, are reported to be involved in providing anti-tobacco health education at the school level; 77.7% of youth said they had been taught about the dangers of tobacco use in the past year; and 55% reported discussing, in class, the negative consequences of tobacco use in the past year. In China there was no report of school-based prevention efforts, and only 18%–21% of youth reported that they had been taught in class about the dangers of smoking during the past year. Thailand has an extensive public educational campaign, but no report of any school-based prevention efforts, although youth activism against tobacco use has surfaced as a prominent aspect of tobacco control efforts, including public youth demonstrations against the Philip Morris ASEAN Art Awards in 2004 and against convenience stores’ resistance to the Ministry of Health’s restrictions on tobacco point-of-sale advertising in 2005.

It seems that almost no smoking prevention programs are available in most developing countries. Yet regular adolescent tobacco use is an increasing problem in these countries which is likely to worsen (B. Bell, 2000; C. W. Warren et al., 2000). Tobacco industry documents indicate a desire for global penetration in markets throughout Europe, Asia, and Africa (Yach & Battcher, 2000). Increasing exports of tobacco products by developed countries (increased 42% from 1993 to 1996) and increased international consumption (increased 5% during the same period) provide hard evidence of their success at this (Chaloupka & Nair, 2000).

Sussman and colleagues speculate that tobacco control in developing countries progresses in three general steps: 1) awareness - assessment, awareness, and beginnings of tobacco control often involving public warnings; 2) growth - enactment of several policies but with equivocal national government and local support; and 3) maturity - enactment and enforcement of a number of policies that take a relatively strong tobacco control stance and demonstrate national government and local activism support. “According to our evaluation, Tanzania is at the end of the first step or beginning of the second step, and Nepal and China are at the second step. In the third step, as illustrated by Thailand, a mature stance toward tobacco control is established; the
cigarette tax is used efficiently to reduce cigarette demand and provide a secure funding base for health promotion, cessation is included in national programs, and anti-tobacco activism is encouraged.” (pages S443-455).

**Park (Korea)**

Park (Park, 2006) reviewed 11 smoking prevention programs that had been evaluated in Korea. Most consisted of only 4-6 sessions and none included booster sessions. All included information, 9 taught something about refusal skills, 6 taught communication and/or assertiveness skills, 3 contained something about stress management, and 3 included affective components aimed at enhancing self-esteem. Most were delivered didactically. Seven of the programs took place in middle schools, usually in 7th grade, and 4 in high schools. Random assignment was used in only two studies. As one would expect, given the program content, most programs produce significant effects on knowledge, about half on attitudes, and no study produced a significant effect on behavior (of 5 that measured it).

Clearly, smoking prevention efforts in Korea are not yet effective. *Future developments should build on the knowledge contained in this and prior reviews.*

**Smoking Prevention Research in Upper Middle Income Countries**

I found one study of school-based smoking prevention in only one upper-middle income country, South Africa.

**South Africa**

The National Health Promotion Research and Development Group, Medical Research Council, South Africa, has conducted a study of adolescent preferences for the setting, timing, delivery format, provider and key elements of tobacco control program (Swart, Panday, Reddy, Bergstrom, & de Vries, 2006). Although adolescents were unaware of smoking prevention programs, they reported a willingness to participate in such programs. They thought that programs should include school-based activities that are supported by out-of-school activities, held over weekends and holidays, taught by non-judgmental and empathetic teachers and peers, and are exciting, fun filled and integrated into their daily lives.

P. Reddy and colleagues evaluated two school-based prevention curricula adapted for use in 8th and 9th grade classes in racially mixed South African schools -- Life Skills Training and a harm minimization model called Keep Left -- in a randomized trial in 36 schools (Reddy, James, Rajpaul, Omardien, & Resnicow, 2007). The baseline data were collected in January 2005 and the intervention delivered during the 2005 and 2006 school years, and posttest data collected in November 2006. At posttest, students in program schools (both LST and KL) were 16.6% less likely to have smoked than students in control schools (see Table 5). However, LST had no effect for males and a 20% RI for females. On the other hand, KL had a 14% RI for males and a 13% RI for females. With respect to ethnicity, LST produced a 24% RI for coloreds, while KL produced only a 5% RI. For blacks, the KL program was very effective, reducing smoking by 55% while LST produced no effect. Both programs had negative effects on whites and Indians (analyzed as one group), increasing their smoking relative to controls by 20% and 50% for LST and KL, respectively. Both programs reduced 30-day smoking by 20% overall, again with significant interactions involving gender and ethnicity.

The large number of interactions with gender and ethnicity found in this study in South
Africa, together with mixed results found with different ethnic groups in the US, suggest that great care will need to be taken when adopting and adapting smoking prevention programs from developed countries for use in developing countries.

### Smoking Prevention Research in Lower Middle Income Countries

I found four studies of smoking prevention from China, one from Thailand and one from Taiwan.

#### China

Zheng et al (Zheng et al., 2005) (only the abstract available in English) evaluated the effectiveness of a school-based smoking prevention intervention program among 4th and 5th grade students in two elementary schools, one intervention and one control. A one-year “comprehensive smoking intervention” was delivered to the intervention group. Students in the intervention group significantly improved their knowledge and attitudes related to tobacco use and, as shown in Table 5, the program reduced the likelihood of attempting smoking by 67% (2.6% vs. 7.8%). However, some of this effect had decayed at 6-month follow up; how much is not reported in the English abstract.

Xinguang Chen and colleagues from Wayne State University (Michigan, USA) and Beijing Normal University in China (Chen, Fang, Li, Stanton, & Lin, 2006) conducted a quasi-experimental pilot study of a smoking prevention program for students in grades 7-11. The program, Stay Away From Tobacco (SAFT), developed by the researchers using ideas from TNT and the Minnesota smoking Prevention Project (both reviewed earlier), consisted of 7 sessions dealing with the health consequences of smoking, how to say “No,” the popularity of smokers and nonsmokers, does smoking mean maturity?, does smoking help control negative emotions?, and skills against pro-tobacco media. The research design compared classrooms of the program taught by research staff, the program taught by teachers and a control condition. At 6-months posttest, the percentage of the control group reporting smoking increased from 3.9% to 9.7% while the program groups decreased from 8.9 or 10.5% to 0.8% or 5.9% for researcher-led and teacher-led classrooms, respectively, or RIs of 143% and 107% (Table 5). These results are difficult to interpret because of the non-randomization to program or control conditions and the large differences between conditions in baseline smoking rates. Nevertheless, this pilot study produced promising results suggesting that social influence approaches to smoking prevention can be effective in China.

Chih-Ping Chou and colleagues from the University of Southern California and the Wuhan Center for Disease Control and Prevention in China (Chou et al., 2006) conducted a school-based randomized trial of a 13-session smoking prevention program for 7th graders in 7 matched pairs of schools. The program was a translated and adapted version of Project SMART (Graham et al., 1990; Hansen, Johnson et al., 1988). Changes were made to accommodate Chinese culture (e.g., session content specific to national smoking prevalence rates, anti-tobacco policies, and pictures of cigarette advertisements was replaced with similar information about China). Several other changes were made to make the program more appealing and memorable to Chinese adolescents (for example, a baseball trivia game was changed to basketball because the students were more familiar with basketball). Students also make public commitments in front of their classmates not to smoke and discuss the negative social and physical consequences of smoking to establish a social norm among the students that smoking is unacceptable among their peers. Additional
emphasis was placed on avoiding household exposure to tobacco smoke. At the 1-year follow-up, smoking had increased more rapidly in the control schools than in the program schools, but this effect occurred only among students who had tried smoking before baseline. Among baseline never smokers the preventive effect was only 7% (not significant); among baseline triers, the reduction in further smoking was 17.5% (Table 5), 39% among males and 20% among females, with the percentage of recent smokers remaining about the same between baseline and posttest in the control condition and decreasing in the program condition. The results are a little difficult to interpret because, despite randomization, baseline rates of smoking were significantly higher in the program than the control schools. Nevertheless, this study also suggests that careful adaptation of a prevention program developed in the U.S. can be successful with Chinese students.

Wen and colleagues at Sun Yat-sen University in Guangzhou (Wen et al., 2003) (only the abstract available in English) evaluated the process of smoking prevention among Chinese junior high school students. The program included 18 activities implemented among students, teachers, parents and cigarette retailers over the course of one year. The activities included: a nicotine toxicity experiment, agreement of families to be smoke-free, a letter to parents, no-smoking signs, blackboard information about health and smoking, and signature on World Day of No Smoking. Fifty two percent of students reported general satisfaction with the program. The biggest perceived shortcoming for the intervention plan was the low participation of students. The authors concluded that some intervention measures had not been fully carried out among the students. The abstract says that a cluster-randomized, schooled-based trial was conducted, but no outcome data were reported.

**Thailand**

Nuananong Seal from the University of North Dakota (Seal, 2006) reported on the evaluation of the effectiveness of a life skills training (LST) program to reduce tobacco and drug use among Thai high school students. Grade 7-12 students in two high schools were randomly assigned to the program or control condition. The students in the control group received the tobacco and drug education curriculum normally provided; the intervention group received a 10-session LST program adapted for the Thai context. LST students reported statistically significant positive effects regarding knowledge, attitudes, and the development of refusal, decision-making, and problem solving skills. The results showed that the LST program was effective for preventing tobacco and drug use -- 19% RI in ever used, 32% RI in use during the past week, and a 60% RI in use more than once a week, average RI = 37% (see Table 5).

**Taiwan**

Pi-Hsia Lee and colleagues in Taiwan (Lee, Wu, Lai, & Chu, 2007) evaluated a school-wide no smoking strategy and a classroom-based smoking prevention curriculum on smoking-related knowledge, attitude, behavior, and skill of junior high school students. Using a quasi-experimental design, 469 7th to 9th grade students at four junior high schools in Taiwan were selected and separated into three groups by classroom. Experimental group A experienced a school-wide no smoking policy and a six-session smoking prevention curriculum. Experimental group B experienced only the school-wide no smoking strategy. The control group experienced no intervention. After the program, group A exhibited a better understanding than either group B or the control group of the dangers of smoking, of techniques for refusing cigarettes, and
reported better attitudes toward resisting smoking and lower intentions to smoke. However, the intervention had no demonstrable effect on the smoking behavior of students. The results seem to suggest that policy plus curriculum was better than curriculum alone, at least on knowledge and attitudinal outcomes.

**Smoking Prevention Research in Lower Income Countries**

I found two studies of smoking prevention from India and one from Pakistan

**India**

K. S. Reddy and colleagues from the India Institute of Medical Sciences in New Delhi, together with Cheryl Perry and colleagues from the University of Minnesota (now at Texas University, Austin) designed and evaluated a school-based program and a school plus family involvement program for preventing tobacco and alcohol use with 7th grade students in New Delhi. The school-based program was based on CATCH (Luepker et al., 1996) a cardiovascular disease prevention program that included posters, booklets, classroom activities, debates, and a signature campaign delivered during the course of one school year. Three of the 20 classroom session concerned the influences to use tobacco, ways to refuse offers to smoke, and passive smoking. Students practiced ways to identify and refuse tobacco if a cigarette were offered to them by older students. Students were also involved in signing a memorandum for a comprehensive government ban on tobacco advertising, which was presented by student representatives to the Prime Minister of India. For the family involvement program, students took home 6 booklets of information and activities to share with their families. These were based on prior research with “home-team programs” in the U. S. (Perry, Luepker, Murray, & et. al, 1988).

Thirty elementary schools, selected to represent all schools in New Delhi (public and private, boys or girls or mixed, were randomly assigned to the two program conditions or a control condition. At (short-term) posttest, the school-only program reduced smoking onset by 42% and the school plus family condition reduced smoking onset by 55% (see Table 5); whereas smoking increased among the control group, it remained basically steady in the program conditions. The program also reduced intentions to use tobacco in the future and alcohol use. No long-term follow-up has yet been reported, but the research group has initiated a second project in India (see next paragraphs).

Cheryl Perry and colleagues in New Delhi (Mishra et al., 2005; Perry, Stigler, Arora, & Reddy, 2006) described the development of a second program to test in India. This 7-session program focuses on prevention of tobacco use, and includes peer-led activities, family involvement and other activities from Perry’s prior work. The intervention targets two cohorts of students who were in the 6th and 8th grade when the study started.

Stigler et al (Stigler et al., 2007) report on the short-term outcomes of a randomized trial of the new program. Thirty two schools in Delhi (north India) and Chennai (south India) were randomized to receive the intervention (n = 16) or serve as a delayed intervention control (n = 16). Students in these schools were surveyed before the intervention began and at an intermediate point, 1 year into the 2-year intervention. Compared with the control, students in the intervention condition (a) had better knowledge about the health effects of tobacco; (b) believed that there were more negative social consequences to using tobacco; (c) had fewer reasons to use tobacco; (d) had more reasons not to use tobacco; (e) were less socially susceptible to chewing
and smoking tobacco; (f) perceived fewer peers and adults around them smoked or chewed tobacco; (g) felt that tobacco use was not acceptable, especially among their peers; (h) were more confident in their ability to advocate for tobacco control; (i) were more knowledgeable about tobacco control policies; and (j) supported these policies, too. Fewer students in the intervention condition reported having intentions to smoke tobacco in the next year or chew tobacco when they reached college. No changes in actual tobacco use were observed at this stage of the study. Nevertheless, the number and magnitude of these results, together with the very positive results of the prior study, suggest that this group may have developed a very powerful program for the prevention of tobacco use in India.

**Pakistan**

Ishaq et al (Ishaq & Khan, 2004) report on a quasi-experimental evaluation of two smoking cessation/prevention programs in two schools compared to a control school in Nowshera, Pakistan. The program was targeted to 13-19 year old boys, 27% of whom were already smoking in the school that received a school plus mass media program, and 23% of whom were already smoking in the school that received the school-only program, and 29% of whom were already smoking in the control school. After 3 years, both program conditions produced RIs of 19% (Table 5). The results are difficult to interpret because of the nature of the design and pretest differences in smoking rates.

**Summary of Research from Developing Countries**

The 10 studies reviewed varied greatly in sophistication, ranging from small-scale quasi-experiments with only one school per condition to large-scale school-based randomized trials. The programming also appeared to vary greatly, with little information about some of them to judge their likely effectiveness. Most programs were, however, derived from models previously developed and tested in the U.S. The average short-term effect size is remarkably high (RI = 46%), but varied between zero and 143%.

As a group, these studies demonstrate that approaches to smoking prevention can be adopted and adapted to be effective in developing countries. The best example of how to do this well is Cheryl Perry’s collaborative work in India (Mishra et al., 2005; Perry et al., 2006). She and her colleagues from the University of Texas have worked closely and intensively with their New Delhi colleagues, and engaged the community as well, to create a culturally sensitive (Resnicow et al., 1999) program. This process is an exemplary one that should be followed in other countries.

It is disappointing, and somewhat surprising that only 10 studies of smoking prevention programs in developing countries have been published to date. The relative dearth of research in developing countries needs to be overcome so that the benefits of effective school-based smoking prevention can be experienced by all.

**DISCUSSION**

**Limitations**

There are at least 10 limitations to the studies that met the criteria for this review.

1. Many prevention studies -- including some of those reviewed here -- did not use randomization, but instead used matched controls or other designs. Some so-called quasi-
experimental designs (Shadish, Cook, & Campbell, 2002) may be acceptable under certain conditions (Flay et al., 2005), but most of the quasi-experimental studies reviewed here were seriously flawed. The most appropriate design for evaluating school-based prevention programs is the school-based randomized trial, where schools are assigned to conditions and data are analyzed taking into account the nesting of students in schools (Flay & Collins, 2005; Murray, 1998; Murray, Hannan, & Zucker, 1989).

2. Although more than one program has reported significant long-term effects, none of the individual programs has more than two evaluations of long-term effects. Thus, although we can conclude that comprehensive, interactive programs, using the social influences approach, with 15 or more sessions, including in high school, can have long-term effects, we do not yet know whether the long-term effects of any one of the programs meeting these criteria can be replicated. Replication studies, especially in different countries, are urgently needed.

3. There is a reliance on self-report measures of tobacco use. For many years, the validity of self-reports of sensitive behaviors was questioned. After a series of studies of the use of biochemical validation or the collection of biochemical samples for use in a “bogus pipeline” procedure (Aguinis, Pierce, & Quigley, 1993; Presti, Ary, & Lichtenstein, 1992; Roese & Jamieson, 1993), methods for surveying adolescents that ensure confidentiality were developed that seem to ensure the validity of self-reports of sensitive behaviors (Graham et al., 1984; David M. Murray, O'Connell, Schmid, & Perry, 1987; Patrick et al., 1994; Stacy et al., 1990). Although multiple studies suggest that students do report their substance use honestly when asked under conditions of confidentiality, these studies were limited to middle school students in developed countries, so it would be wise to have some studies in developing countries use biochemical verification of self reports of smoking with high school students and young adults.

4. The available long-term evaluations do not allow determination of the relative effectiveness of these programs for different populations. However, indications from meta-analyses that these types of programs have larger effects in schools with a predominantly special or high-risk (minority, high absenteeism or dropout, poor academic records) populations are promising. We need more replication studies with different populations, within both developed and developing countries.

5. The last time of data collection in most of these studies was while youth were still in high schools. We need many more truly long-term studies of the ongoing effects of smoking prevention programs, preferably up to age 25.

6. There is great variability in the way researchers and evaluators assess outcomes. Researchers have used ever smoking, smoking in the past month or week, and other indicators of youth smoking. Some researchers included only baseline never smokers in their analyses. Fortunately, there was reasonable consistency in estimates of prevention effectiveness across measures in most of the reviewed studies. Nevertheless, it would help future reviewers if researchers could settle on consistent measures. In addition, however, future research needs to include assessment of multiple short-term effects (or mediating variables) in addition to tobacco use. For example, programs are designed to improve knowledge of the influences on behavior (including tobacco industry promotions); knowledge of the physical, economic, environmental and social consequences of tobacco use; perceptions of risk; normative estimates or beliefs; decision-making, peer pressure resistance, and coping skills; and possibly student’s activism against smoking in their environment. All of these mediating variables need to be measured in future research, and their mediating effects on tobacco use behavior demonstrated.

7. There was large variation across studies in program content, which affects the validity of
some prior reviews of this literature. Conducting meta-analyses of these studies seems like comparing apples with oranges, or even with yams (instead of comparing multiple crops of Gala apples or even different breeds of apples). The variation makes it difficult to compare programs. In other disciplines, one would not conduct a meta-analysis or review of such different kinds of programs and draw a conclusion for all programs as a group. One would not, for example, conduct a meta-analysis of all treatments for breast cancer and conclude that breast cancer treatment does not work. Rather, one would attempt to determine which kinds of treatments work the best (and for whom and under what conditions), and then adopt the best treatment as the standard of practice. Unfortunately, some meta-analysts of various smoking prevention programs have treated them as a homogeneous group and concluded that they are not very effective, and that they do not have medium- or long-term effects. It would be more appropriate to try to find which kinds of programs produce significant effects, or the largest effects (as well as for which kinds of people and under what conditions), as Tobler et al., Hwang et al., and this author have attempted.

8. We still lack consistency and continuity across developmental stages (preschool through college), and this clearly is an area where continued research is desirable. At the preschool and elementary school levels, implementation of more general and promising approaches such as the Good Behavior Game or the Positive Action program should be used to prepare students to adopt tobacco-free lifestyles. Increasing evidence suggests that behavior improvement or positive youth development programs can have pervasive effects on behavior, including reducing tobacco use, and also can improve school performance. However, the lack of replicated findings regarding specific effects on tobacco use to date suggests that they should be accompanied by rigorous evaluations. Such evaluations of general behavior-improvement and youth development programs will contribute to the knowledge base of smoking prevention as well as youth development.

9. Program developers were involved in all of the evaluations reported. It is quite probable that the effect sizes reported by program developers are larger that those that will be obtained under other conditions. The field is urgently in need of independent replications of the findings summarized in this paper (Flay et al., 2005).

10. There is a relative dearth of rigorous research on school-based smoking prevention in developing countries. However, several countries are making progress with the help of researchers from more developed countries. Much more research on school-based smoking prevention in developing countries is urgently needed.

Despite, or maybe because of, the above limitations, there are multiple reasons to suspect that estimates of effect sizes derived from the small number of studies from developed countries reviewed here (RI of 25-30% for school-only programs or 35-40% for those that add on-going community activities or mass media campaigns) might be conservative (underestimates) estimates of effects that might be observed in at least some developing countries. First, some of the effect sizes were derived from studies that already included less than optimal implementation. Second, if a program was implemented nationwide, for multiple years, there might be increasing effects for a while as new generations of students passed through the program. For example, as fewer young adults become smokers, there will be less social support for smoking and fewer adolescents will be tempted to try smoking. Third, the possibility of larger effect sizes were suggested by the larger short-term effects of the Towards No Tobacco and Know Your Body projects, the promising effects of general behavior improvement programs such as the Good Behavior Game and the Positive Action program, and the extraordinarily large
effects of Project SHOUT with minimal high school boosters. Fourth, some of the studies in developing countries reported larger effect sizes than most studies in developed countries.

On the other hand, the effect sizes reported by the few studies conducted in developing countries to date (average RI of 46%, range as high as 143%) might provide an overestimate of what could be expected with large-scale dissemination. Small-scale quasi-experiments are known to produce overestimates of effects (Wilson & Lipsey, 2001). Indeed, characteristics of evaluations (size, design, sampling, measures, and analysis) explain about half of the variance between effect sizes, while program characteristics (type, dosage, delivery, etc.) explain only about 21% of the variance in 300 meta-analyses of educational, behavioral, and mental health interventions. On another hand, one might expect larger effects in some developing countries because they have not yet been exposed to much tobacco control and prevention activity. The current research based in developed countries demonstrates a phenomenon of decreasing effect sizes over time (see (Tobler et al., 2000) Figure 9). For example the average effect size decreased from .18 in the 1997 report (Tobler & Stratton, 1997) to .15 in the 2000 report (Tobler et al., 2000). One reason for this might be that as more and more tobacco control activities occurred, having a true control group became less and less likely.

**Recommendations**

Given that school-based prevention could produce significant and practical reductions in youth smoking initiation and levels, the following recommendations seem appropriate.

**Recommendation 1:** Every country should implement an evidence-based smoking prevention program (or a similar substance-abuse prevention program that has been shown to reduce smoking) at all grade levels. As a corollary, they should be discouraged from using programs for which there is evidence of ineffectiveness (e.g., DARE). The evidence presented in this review suggests that we know of multiple programs that should be effective in preventing or reducing the use of tobacco by youth worldwide. Care needs to be taken in translating and adapting programs for use in other countries, but early evaluations from developing countries clearly suggest that this can be done successfully. It is also clear that school-based smoking prevention can be cost-effective.

**Recommendation 2:** Governments, communities, or school districts should provide funding for evidence-based prevention programs for every school in their jurisdiction. Given the availability of evidence-based smoking and substance abuse prevention programs, funds should be made available to support comprehensive school-based prevention programming. Some environments might be more supportive of general substance abuse prevention programs or more general behavior improvement programs than tobacco-specific programs. However, smoking prevention programs can also lead to lower levels of initiation of alcohol and other drugs. Increasing evidence also suggests that more general behavior improvement programs not only have more effects, but have larger effects on each of the behaviors, and these effects are more likely to be maintained because they support each other. More general programs also are more likely to include elements that change the climate of entire schools (or other locations in which they are implemented), thus providing more generalized support for the positive behaviors encouraged by the programs (Catalano, Berglund, Ryan, Lonczak, & Hawkins, 2004; Eccles & Gootman, 2002; Flay, 2002).

**Recommendation 3:** Governments, communities, or schools also should provide funding to develop and deliver comprehensive community or mass media programs that complement school-based programs. School-plus-community or mass media programs have been shown to
have effects that are 25-50% larger than school-only programs. Conversely, school-based programs can provide the normative change that is needed to support community programs or policy changes regarding smoking in public places or the pricing of tobacco in the community.

**Recommendation 4:** Schools and communities must take steps to ensure that adopted programs are implemented with high fidelity. Programs implemented with higher fidelity produce larger effects, and larger effects are more likely to be maintained through high school and into adulthood. Schools will need to provide the resources and support for every teacher and staff person to be trained in proper implementation. This also requires ongoing monitoring of implementation as well as ultimate effects on student behavior. These tasks are somewhat technical and require highly qualified people. However, it is critical that such research be conducted in developing countries as the implement school-based smoking prevention to 1) assure their own policy-makers and populations that the programs are, indeed, effective, and 2) provide replication studies to the world-wide literature on which kinds of programs work in various cultures and conditions of delivery.

**Recommendation 5:** Prevention programs must be sustained over time. It is not sufficient to deliver a prevention program, whether school only, community only, mass media only, or school plus mass media or community, for only a few years. Any program must be sustained for a meaningful length of time (a generation) to be effective at the population level in the long term. Sustained programs may have greater effects in the long term; however, effects over an extended period are hard to estimate. Rather than just reducing young adult smoking by 10–20% for the first cohort, a sustained program could potentially cut the population prevalence of smoking in half in about two decades.

**Recommendation 6:** Developing nations should find the funding to make the above recommendations a reality. The costs of the above recommendations are likely to be less than $10 per student for the first year and dramatically less in future years in most countries. Subsequent years would cost as little as one-fifth of these amounts. One approach to obtaining the funding is taxation to tobacco products, which also has preventive effects in its own right.

### Establishing Smoking/Tobacco Prevention Programs in Developing countries

Establishing effective smoking/tobacco prevention programs in schools in developing countries will take a high level of commitment and effort. The first step will be to convince officials that tobacco use is a serious problem in their country. To this end, the Global Youth Tobacco Survey (GYTS), developed by WHO in collaboration with CDC, will be useful (Strong & Bonita, 2003).

The second step will be to identify the resources that it will take to adopt, adapt implement and monitor the implementation and effectiveness of smoking/tobacco prevention programs. The costs will have to be determined and then the resources obtained.

A related issue concerns identifying and removing barriers to doing prevention in the school setting. Many barriers to delivering health programming in schools exist, including lack of understanding of the importance of school health programs, inadequate coordination, lack of a sense of responsibility for student health among school staff, and lack of resources (The Global School Health Initiative and Health and Human Development Programs, 1999).

A fourth step involves the actual adoption and adaptation of an evidence-based program. This will require working closely with program developers and researchers who have worked on effective approaches. The types of changes Johnson and colleagues made to their Project SMART for use in China provide a good example of the initial types of changes that might be
necessary. Cheryl Perry and her colleagues in India provide a good example of a more intensive approach.

The fifth step involves actual implementation. This will require careful training of teachers or others who will deliver the program to ensure that they understand the theoretical principles underlying it and the practical skills necessary to deliver it in a dialectic or Socratic manner (rather than the traditional didactic manner) with many opportunities for student involvement. Some of these skills will be foreign to many teachers.

The sixth step is monitoring of implementation. As suggested and emphasized multiple times in this review, monitoring of implementation is critical whenever a program is used in a new setting or country. Monitoring of implementation is necessary to ensure that an adequate amount of the program is delivered and that it is delivered with integrity. A breakdown in either of these can lead to program failure.

A sixth step is the evaluation of effectiveness. This is necessary because, as we have seen, a program proven effective in one context with one type of student and provider may not be as effective, or even effective at all, in a different context with a different type of student and provider. Only careful evaluation can provide assurance that the program is having (or not having) the desired effects.

A final step is institutionalization or ensuring that the program is sustained over many years. It is not sufficient to deliver a program to students in one grade and expect the effects to last throughout their lives. As was clear in many places in this review, only those programs that involve multiple years of intervention will likely be effective in the long term. At the school or community levels, only those programs that stay in place for multiple generations will have long-lasting benefit to the community.

CONCLUSIONS

This review makes it clear that effective school-based smoking prevention programs exist and can be adopted, adapted and deployed in developing countries with success. Developing countries should invest only in these research-proven programs and avoid spending money on programs where there is little or no prior evidence of program effectiveness. When implementing programs, they must pay attention to “program fidelity” (quality control). They should evaluate currently-funded programs to determine if benefits occur and if they exceed costs. They should develop the specialized knowledge needed to keep abreast of the latest research from around the world.

It is time for the world to face up to the fact that preventing as many children and youth as possible from starting to smoke cigarettes is feasible and worthwhile, both economically and in terms of improved health of the population.
### Table 1: Categories of Studies and Programs in this Review

**Category I**

High quality studies of

- Programs that were successful in reducing smoking in the short term, and
- Included significant effects into high school (grades 10–12) or beyond.

*Two groups:*

- School-based only
- School plus community or mass media

**Category II**

High quality studies of

- Programs that were very successful in reducing smoking in the short term, and were
- Of a large enough scope and sequence to suggest likely medium- and long-term effects

*Two groups:*

- School-based only
- School plus community or mass media

**Category III**

Any studies of

- Effects of smoking prevention in developing countries
Table 2: Short and Long-term Effects of Seven Selected Social Influence Programs with Follow-up Into High School

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Project name</th>
<th>Design</th>
<th>N classes</th>
<th>Length</th>
<th>Type</th>
<th>Grades</th>
<th>Grade at last follow-up</th>
<th>Short-term effect size (%)&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Long-term effect size (%)&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hansen&lt;sup&gt;e&lt;/sup&gt;</td>
<td>TAPP (Cohort 1)</td>
<td>NR-S</td>
<td>15</td>
<td>1 yr</td>
<td>S</td>
<td>7</td>
<td>10</td>
<td>26.2%</td>
<td>26.2%</td>
</tr>
<tr>
<td>Botvin&lt;sup&gt;f&lt;/sup&gt;</td>
<td>Life Skills Training</td>
<td>R-S</td>
<td>30</td>
<td>3 yrs</td>
<td>S</td>
<td>7-9</td>
<td>12</td>
<td>8.9%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Elder&lt;sup&gt;g&lt;/sup&gt;</td>
<td>Project SHOUT</td>
<td>R-S</td>
<td>18+</td>
<td>3 yrs</td>
<td>S+</td>
<td>7-9+</td>
<td>11</td>
<td>30.3%</td>
<td>30.3%</td>
</tr>
</tbody>
</table>

**MEANS for school programs**

<table>
<thead>
<tr>
<th></th>
<th>Life</th>
<th>Month</th>
<th>Week</th>
<th>Av ES</th>
<th>Life</th>
<th>Month</th>
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<td>School only programs</td>
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<td></td>
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</tr>
<tr>
<td>Hansen&lt;sup&gt;e&lt;/sup&gt;</td>
<td>28.2%</td>
<td>8.9%</td>
<td><strong>21.8%</strong></td>
<td>18.3%</td>
<td>27.6%</td>
<td>20.4%</td>
<td><strong>27.6%</strong></td>
<td></td>
</tr>
</tbody>
</table>

**School plus community or mass media programs**

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Project name</th>
<th>Design</th>
<th>N classes</th>
<th>Length</th>
<th>Type</th>
<th>Grades</th>
<th>Grade at last follow-up</th>
<th>Short-term effect size (%)&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Long-term effect size (%)&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vartiainen&lt;sup&gt;h&lt;/sup&gt;</td>
<td>N Karelia</td>
<td>NR-C</td>
<td>10+</td>
<td>2 yrs</td>
<td>S+C</td>
<td>7-8</td>
<td>11</td>
<td>44.8%</td>
<td>43.7%</td>
</tr>
<tr>
<td>Perry</td>
<td>Minnesota Class of 89</td>
<td>NR-C</td>
<td>17+</td>
<td></td>
<td>S+C</td>
<td>6-10</td>
<td>12</td>
<td>40.0%</td>
<td>40.0%</td>
</tr>
<tr>
<td>Pentz&lt;sup&gt;i&lt;/sup&gt;</td>
<td>MPP</td>
<td>PR-S</td>
<td>15+</td>
<td>2 yrs</td>
<td>S+C</td>
<td>6-7/7-8</td>
<td>9-10</td>
<td>40.9%</td>
<td>34.1%</td>
</tr>
<tr>
<td>Flynn&lt;sup&gt;j&lt;/sup&gt;</td>
<td>Vermont Mass Media</td>
<td>R-C</td>
<td>22+</td>
<td>4 yrs</td>
<td>S+M</td>
<td>5-8, 6-9 or 7-10</td>
<td>10-12</td>
<td>36.6%</td>
<td>36.6%</td>
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</table>

**MEANS for School + Community or Media Programs**

<table>
<thead>
<tr>
<th></th>
<th>Life</th>
<th>Month</th>
<th>Week</th>
<th>Av ES</th>
<th>Life</th>
<th>Month</th>
<th>Week</th>
<th>Av ES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>44.8%</strong></td>
<td>42.3%</td>
<td>39.0%</td>
<td><strong>39.7%</strong></td>
<td>40.3%</td>
<td>28.6%</td>
<td>35.0%</td>
<td><strong>31.2%</strong></td>
<td></td>
</tr>
</tbody>
</table>

**OVERALL MEANS for all programs**

<table>
<thead>
<tr>
<th></th>
<th>Life</th>
<th>Month</th>
<th>Week</th>
<th>Av ES</th>
<th>Life</th>
<th>Month</th>
<th>Week</th>
<th>Av ES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>44.8%</strong></td>
<td>35.3%</td>
<td>33.0%</td>
<td><strong>32.0%</strong></td>
<td>29.3%</td>
<td>28.0%</td>
<td>31.3%</td>
<td><strong>29.7%</strong></td>
<td></td>
</tr>
</tbody>
</table>

---

*a*: All studies except Vartiainen (North Karelia, Finland) took place in the USA.

*b*: R = Random, NR = nonrandom, PR = partial random, S = School, C = Community
c: S = School only, S+ = School plus small media or family outreach, M = Mass Media, C = Community

d: Percent relative improvement (RI) as either (% change in C - % change in P)/%C or (%C-%P)/%C, where P = Program condition and C = Control. Short-term effects are generally at the end of grade 8 or 9.

e: Tobacco and Alcohol Prevention Project. The long-term effect for smoking in the past month was larger (42.9%) for students present at all waves of the study.

f: Randomization was originally complete, but 6 program schools were dropped from analysis because of low implementation. The RI for high-implementation students at 12th grade was 37%.

g: The effect reported is with half the high school students receiving a high-school intervention (2 newsletters and 1 phone call during grade 1), without it, effect size is only 17.1%, with it for all students, the effect size is 71.4%.

h: At 3 years post HS the effect was 22.0% for the health educator (HE) condition and 37.3% for the teacher condition; at 10 years post HS the effect was 20% for the HE condition and 19.5% for the teacher condition.

i: Midwestern Prevention Project.

j: This study tests the difference between school plus mass media and school-only (there was no control group).
Table 3: Other Programs of Interest

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Project name</th>
<th>Design</th>
<th>N</th>
<th>Length</th>
<th>Type</th>
<th>Grades</th>
<th>Grade at last follow-up</th>
<th>Short-term effect size (%)</th>
<th>Medium-term effect size (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Life</td>
<td>Month</td>
</tr>
<tr>
<td>Graham &amp; Hansen</td>
<td>AAPT</td>
<td>NR-S</td>
<td>9</td>
<td>S</td>
<td>7</td>
<td>11</td>
<td>21.4%</td>
<td>26.2%</td>
<td>23.8%</td>
</tr>
<tr>
<td>Sussman</td>
<td>TNT</td>
<td>R-S</td>
<td>12</td>
<td>S</td>
<td>7-8</td>
<td>9</td>
<td>34.4%</td>
<td>64.3%</td>
<td>49.3%</td>
</tr>
<tr>
<td>Walter</td>
<td>KYB</td>
<td>R-S</td>
<td>384</td>
<td>S+</td>
<td>4-9</td>
<td>9</td>
<td>11.5%</td>
<td>36.6%</td>
<td>36.6%</td>
</tr>
<tr>
<td>Bush</td>
<td>KYB</td>
<td>R-S</td>
<td>250</td>
<td>S+</td>
<td>4-7, 5-8 or 6-9</td>
<td>7-9</td>
<td>49.5%</td>
<td>80.8%</td>
<td></td>
</tr>
<tr>
<td>Kellam</td>
<td>GBG</td>
<td>R-K</td>
<td>120</td>
<td>S</td>
<td>1</td>
<td>8</td>
<td>24.4%</td>
<td>20.07%</td>
<td>20.07%</td>
</tr>
<tr>
<td>Storr/ Fur-Holden</td>
<td>GBG +ML</td>
<td>R-K</td>
<td>1 yr</td>
<td>S</td>
<td>1</td>
<td>8</td>
<td>22.2%</td>
<td>22.2%</td>
<td>26.3%</td>
</tr>
<tr>
<td>Flay</td>
<td>PA - Hawai‘i</td>
<td>R-S</td>
<td>560</td>
<td>S+</td>
<td>2-5 or 3-6</td>
<td>5 or 6</td>
<td>30.0%</td>
<td>32.0%</td>
<td></td>
</tr>
<tr>
<td>Flay</td>
<td>PA - Chicago</td>
<td>R-S</td>
<td>420</td>
<td>S+</td>
<td>3-5</td>
<td>5</td>
<td>29.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ausems</td>
<td>PR-S</td>
<td>3-3mo</td>
<td>S+</td>
<td>7</td>
<td>9</td>
<td>30.0%</td>
<td>30.0%</td>
<td>43.2%</td>
<td>43.2%</td>
</tr>
<tr>
<td>Biglan</td>
<td>Project 16</td>
<td>R-C</td>
<td>5+</td>
<td>S+C</td>
<td>7-9</td>
<td>7-9</td>
<td>21.1%</td>
<td>21.1%</td>
<td>27.5%</td>
</tr>
</tbody>
</table>

**MEAN EFFECT SIZES**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Life</td>
<td>Month</td>
<td>Week</td>
<td>Av ES</td>
<td>Life</td>
<td>Week</td>
</tr>
<tr>
<td>25.8%</td>
<td>26.2%</td>
<td>64.3%</td>
<td><strong>29.1%</strong></td>
<td>28.3%</td>
<td>55.6%</td>
</tr>
</tbody>
</table>

a: All studies except Ausems (Netherlands) took place in the USA.
b: R = Random, NR = nonrandom, PR = partial random, K = Student, S = School, C = Community
c: S = School only, S+ = School plus small media or family outreach, M = Mass Media, C = Community
d: Percent relative improvement (RI) as either (%change in C - %change in P)/% change in C or (%C-%P)/%C, where P = Program condition and C = Control. Short-term effects are generally at the end of grade 8 or 9.
e: Adolescent Alcohol Prevention Trial
f: Towards No Tobacco

g: Know Your Body. Included parent communications. Effects are for saliva thiocyanate, a biological indicator of tobacco use. Long-term effects were reported only for one site (so value shown is half value reported at that site) and significant only for males (0% vs. 12%).

h: A replication of KYB in Washington DC area schools. Results are saliva thiocyanate, short-term after 1 yr of intervention, long-term after 3 years.

i: Good Behavior Game. Initially 3 10-minute classes per week in grade 1, increasing in duration and frequency during grades 1 and 2. Short-term effects are for "Problem behavior" at the end of grade 2. Smoking effects were significant only for boys.

k: Good Behavior Game plus Mastery Learning in grade 1 only. Very similar results were obtained in a condition that added family partnerships. Short term results are at the end of grade 7.

k: Consists of about 140 15-minute classes per elementary grade. The medium-term effect entered in the table is the effect in middle school for students exposed to PA in elementary school estimated from a different (quasi-experimental) study (see text).

l: Three computer-tailored letters based on the stages of change model (TTM). A classroom plus letters condition produced similar or worse results. Reported results are for baseline never smokers. Results were similar for baseline smokers.

m: Multiple cross-sectional design, where successive cohorts of 7th and 9th grade students were surveyed.
<table>
<thead>
<tr>
<th>Without the prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average proportion not smoking in high school who will start by age 25 (SAMHSA Household Survey 1989-99)</td>
</tr>
<tr>
<td>Average high-school daily smoking without intervention (Monitoring the Future, 2003)</td>
</tr>
<tr>
<td>Proportion of new smokers by age 25</td>
</tr>
<tr>
<td>Therefore, total proportion smoking by age 25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>With school-based prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion smoking after school-based prevention</td>
</tr>
<tr>
<td>Therefore, proportion not smoking</td>
</tr>
<tr>
<td>Therefore, proportion new smokers by 25</td>
</tr>
<tr>
<td>Therefore, total proportion smoking by age 25</td>
</tr>
<tr>
<td>Therefore, new RI</td>
</tr>
<tr>
<td>Decay in RI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>With school + community/media prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion smoking after school-based prevention</td>
</tr>
<tr>
<td>Therefore, proportion not smoking</td>
</tr>
<tr>
<td>Therefore, proportion new smokers by 25</td>
</tr>
<tr>
<td>Therefore, total proportion smoking by age 25</td>
</tr>
<tr>
<td>Therefore, new RI</td>
</tr>
<tr>
<td>Decay in RI</td>
</tr>
<tr>
<td>Investigator</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>P. Reddy(^f)</td>
</tr>
<tr>
<td>Zheng</td>
</tr>
<tr>
<td>Chen(^g)</td>
</tr>
<tr>
<td>Chou(^h)</td>
</tr>
<tr>
<td>Wen(^i)</td>
</tr>
<tr>
<td>Seal(^j)</td>
</tr>
<tr>
<td>Lee(^k)</td>
</tr>
<tr>
<td>KS Reddy(^l)</td>
</tr>
<tr>
<td>Stigler(^m)</td>
</tr>
<tr>
<td>Ishaq(^n)</td>
</tr>
</tbody>
</table>

**MEAN for all programs**  
46.1%

\(^a\): Divided by income level according to World Bank income categories.
\(^b\): R = Random, NR = nonrandom, PR = partial random, K = Student, S = School, C = Community
\(^c\): S = School only, S+ = School plus small media or family outreach, M = Mass Media, C = Community
\(^d\): Smoking ever or in the last week or month
\(^e\): Percent relative improvement (RI) as either (%change in C - %change in P)/% change in C or (%C-%P)/%C, where P = Program condition and C = Control.
\(^f\): Tested two programs, Keep Right (harm minimization approach) and LST (and control). The ES was the same for both programs, but there were many interactions involving sex and race (see text).
\(^g\): Program developed following TNT and Minnesota programs. ES is for research staff led. For teacher led, the ES was 107%.
| h | Outcome was smoked since pretest among those who have smoked prior to pretest. RI was 39% for males and 20% for females. RI for smoking initiation among pretest never smokers was 7% (not significant). |
| i | Although it is stated that an outcome evaluation was conducted, only process data are reported. |
| j | Tested LST adapted for Thailand. ES is average of 19% RI in ever used, 32% RI in use during the past week, and a 60% RI in use more than once a week. |
| k | Compared a classroom curriculum with classroom curriculum plus school-wide non-smoking policy (and control). The more intensive program produced significant improvements in knowledge, attitudes and intentions. |
| l | Program developed with aid of Cheryl Perry based on CATCH. Three sessions specifically related to smoking in a 20-session cardiovascular health. Study compared school-only and school+family (and control). |
| m | Extensive program development activities with Cheryl Perry. Results reported here are after 1 year of the 2-year program. The program produced improvements in an extensive list of attitudinal outcomes (see text). |
| n | Study compared school-only, school plus mass media and control. Both programs produced the same ES. |
REFERENCES


Interactive International. (2000). Evaluation of the life Life Skills Training program: Year 1 (Prepared for Philip Morris, USA and Brown & Williamson), [http://legacy.library.ucsf.edu/tid/acb29c00](http://legacy.library.ucsf.edu/tid/acb29c00).


MMWR. (2001). Effectiveness of school-based programs as a component of statewide tobacco control initiative - Oregon 1999-2000. (No. 50(31)).


Endnotes

i One meta-analysis focused only on the quality of eleven evaluations and not their outcomes (Tingle et al., 2003).

ii As well as some misleading information sometimes.


iv This review is not limited to randomized trials, though most studies included were.

v All seven Category I programs were included in the 25 studies with at least 2 years of follow-up reviewed by Skara and Sussman (Skara & Sussman, 2003). The other studies in their review did not meet one or more of the criteria for inclusion. For many, the last follow-up was earlier than grade 10 (and some of these are in my Category II). For some, there were no demonstrable short-term program effects (e.g., (Peterson et al., 2000)).

vi This is the number of lessons for the version tested in the studies reported here. Different versions of the program have different numbers of lessons per grade.

vii Note that the RI of 21% [(33 - 27)/33] reported by Skara and Sussman (Skara and Sussman, 2003) was based on the method that used only posttest results. Our RI is based on the method that includes pretest results.

viii Unfortunately, the design of this evaluation (unmatched control group, for which date are not reported) does not allow for any interpretation regarding program effectiveness.

ix The South African study, where local researchers worked with US and Australian experts might be another example of an effective process, but less information was available on the process in the Powerpoint presentation I viewed.