Preventing Adolescent Drug Use: Long-Term Results of a Junior High Program

ABSTRACT

Objectives. Although several studies have reported short-term gains for drug-use prevention programs targeted at young adolescents, few have assessed the long-term effects of such programs. Such information is essential for judging how long prevention benefits last. This paper reports results over a 6-year period for a multisite randomized trial that achieved reductions in drug use during the junior high school years.

Methods. The 11-lesson curriculum, which was tested in 30 schools in eight highly diverse West Coast communities, focused on helping 7th and 8th grade students develop the motivation and skills to resist drugs. Schools were randomly assigned to treatment and control conditions. About 4000 students were assessed in grade 7 and six times thereafter through grade 12. Program effects were adjusted for pretest covariates and school effects.

Results. Once the lessons stopped, the program's effects on drug use stopped. Effects on cognitive risk factors persisted for a longer time (many through grade 10), but were not sufficient to produce corresponding reductions in use.

Conclusions. It is unlikely that early prevention gains can be maintained without additional prevention efforts during high school. Future research is needed to develop and test such efforts. (*Am J Public Health.* 1993;83:856–861)

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Introduction

During the 1980s, efforts to delay or reduce adolescent drug use showed increasing success with middle school or junior high school students. Among the most promising programs are those based on the social influence model, which emphasizes strategies for identifying and resisting social pressures to use drugs. First used against smoking, this approach has delayed or reduced adolescent use of the gateway drugs.[1–4] Its impact, which has been more consistent against cigarettes and marijuana than against alcohol, has ranged from modest reductions in use to substantial reductions of 50% or more.

Do these early gains persist throughout the high school years, or do young people need continued prevention efforts as they mature? Long-term follow-ups have been restricted largely to grades 9 or 10 and have yielded ambiguous results—erosion of earlier gains,[5,6] delayed boomerang effects,[5] and maintenance of some gains at a reduced level.[7,8]

Although two antismoking studies have followed students to the end of high school,[9,10] this paper provides the first assessment of a broader drug prevention program that covers the 6-year period from grade 7 through grade 12. The results have added significance because the program, Project ALERT, received a rigorous experimental test across widely diverse school environments. Results during the junior high school years showed that the curriculum delayed or reduced cigarette and marijuana use and was equally effective in schools with high and low minority populations.[1] Evidence that those gains persisted over several years would provide important support for the long-term effectiveness of short-term programs; evidence that they decayed would bolster the argument for continued prevention efforts during high school.

The Project ALERT Experiment

The Project ALERT field trial took place in 30 California and Oregon schools drawn from eight urban, suburban, and rural communities. Nine of the 30 schools had minority populations of 50% or more. Schools were randomly assigned to two treatment groups and one control group: in 10 of the 20 treatment schools, students were taught by adult health educators; in the other 10, older teens assisted the adult teachers in half of the 7th-grade lessons. Students in the 10 control schools did not receive the Project ALERT curriculum, but these schools were allowed to deliver existing prevention programs that followed more traditional strategies (teaching drug information and/or general communication and problem solving skills). Four did so.

To enhance pretreatment equivalence among the three experimental conditions, we used three methods: blocking by district, restricted assignment, and randomized assignment of schools. By blocking, we mean that each experimental condition included at least one school from each district. We restricted allowable school assignments to a subset that produced minimal imbalance among experi-

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mental conditions on school test scores, language spoken at home, drug use among 8th-graders, and the ethnic and income composition of school catchment areas. From the eligible subset, we randomly selected final assignments to ensure that each school had a one-third probability of assignment to any particular condition.[11] These assignment procedures produced substantial pretreatment equivalence in school-level characteristics potentially related to future drug use.[12]

Students received eight lessons during grade 7 and three additional lessons in grade 8. Designed to build the motivation and the skills needed for effective resistance to prodrug pressures, the curriculum integrated strategies adapted from the health belief model[13] and the self-efficacy theory of behavior change.[14] The former emphasized increasing student recognition that drug use brings negative personal consequences, reducing barriers to resistance (e.g., inability to identify prodrug pressures, beliefs that "most kids" use, low resistance skills), and enhancing the perceived benefits of nonuse. The latter influenced the curriculum's focus on building resistance self-efficacy and the use of specific strategies for enhancing skill learning—modeling the desired behavior, practicing it, and receiving recognition for good performance.

The highly participatory classroom lessons allowed teachers to adjust program content to classrooms with diverse drug experience and knowledge while ensuring that all students received the essential motivational and skill-building activities. Extensive classroom monitoring over the 2-year implementation period (950 of 2300 lessons) showed that the curriculum was delivered as intended: in 92% of the observed classes, all lesson activities were covered. Student evaluations of the lessons were highly favorable: over 85% liked the program and over 80% felt it would help them resist pressures to use drugs.[12]

Methods

Data Collection Procedures and Validity

Students filled out questionnaires about their drug use and related attitudes and behavior seven times between grades 7 and 12: before and after the 7th-grade curriculum (baseline and 3 months later); before and after the 8th-grade booster lessons (12 and 15 months after baseline); and once each during grades 9, 10, and 12 (24, 36 and 60 months after baseline). From grade 8 on, students who had moved out of Project ALERT schools or districts were tracked by mail and telephone follow-up.

For alcohol, cigarettes, and marijuana, the questionnaire asked about lifetime use, frequency of use within the past month and year, and amount used. Data on cognitive risk factors tapped perceptions that have been linked with subsequent use of the three drugs in previous studies: (1) short- and long-term consequences of use (both positive and negative); (2) normative beliefs about the prevalence of use and its acceptability to others; (3) resistance self-efficacy; and (4) expectations of use in the next 6 months.

We took several steps to motivate students to participate and to tell the truth. Before classroom administration, the data collectors described our procedures for ensuring data privacy (e.g., no names on questionnaires, no access by teachers or parents); informed students of their right not to participate; and, for those who gave consent, collected saliva samples that the students were told would be tested for drug use. These procedures, which have been found to improve participation rates and the accuracy of reports of drug use among adolescents,[15,16] appear to have achieved their goals. Fewer than 1% of the students refused to fill out a questionnaire at baseline and at each successive wave; saliva tests indicated that the great majority told the truth about tobacco use; and longitudinal consistency checks across the first four waves indicated that denial of use after an earlier admission averaged about 5% across all three target substances.[12] Retractions of reports of frequent use averaged substantially less than 1%.[17]

Analysis Sample and Methods

This paper describes the program's impact on cognitive risk factors and use of the target drugs (alcohol, cigarettes, and marijuana) at grades 10 and 12. It also provides 6-year trends for selected drug use outcomes. To assess whether the curriculum's effectiveness differed according to preprogram use, we divided the analysis sample into three baseline risk levels for each substance. For cigarettes and alcohol, these levels were nonusers (never tried), experimenters (tried once or twice but not in the past month) and users (tried three or more times in the past year or used in the past month). Because students who had not tried marijuana by grade 7 constituted a large and heterogeneous group, we subdivided them into two risk levels: those who had not smoked cigarettes by baseline and those who had. The third level included all students who had already tried marijuana.

For the 10th- and 12th-grade analyses, students in the analysis sample had to have filled out a questionnaire at baseline, stayed in a Project ALERT school long enough to begin the booster lessons, and provided data on the outcome of interest at grades 10 and 12. For each substance, we required complete, consistent data for all measures of use; for belief outcomes, sample sizes differ slightly across specific scales or items. At least 9% of the retained sample had already dropped out of school when they filled out the grade 12 survey.

Preliminary analysis showed that students with missing or inconsistent baseline use data most closely resembled the user group. Hence we included those students in risk level 3. The additional students were less than 3% of the total analysis sample and less than 9% of the sample in risk level 3.

Effects of attrition. The analysis sample for grades 10 and 12 constitutes from 53% to 57% of the baseline sample. Approximately 18% were lost because they had moved; another 25% failed to take the 10th- or 12th-grade survey. Missing outcome data reduced the sample by up to 4% more. As in most studies of adolescent substance use,[18] students lost from the analysis tended to have baseline characteristics frequently linked with later drug use—early onset, low grades, and deviant behavior.[1,19] Thus, the reader should be cautious about interpreting estimates of the amount of use in high school or of the rates of increase.

For this evaluation, the key issue is whether attrition affected the experiment's internal validity. It did not. We found no evidence that treatment affected either the frequency of sample loss or the characteristics of those who were lost. Thus any bias in substance use estimates should have occurred equally across experimental conditions and should have been canceled out when program effects were estimated.

Adjustment for covariates. Drug use outcomes included a series of binary measures ranging from lifetime use to daily use for each target substance. Thus we used logistic regression to assess program impacts on drug use. For nonbinary cognitive outcomes, we used linear regression techniques. Each equation included a series of baseline covariates to control for differences among experimental groups that might have arisen after assignment.

TABLE 1—Program Effects on Grade 12 Substance Use: Differences from Control Group (C)

Substance Use in Grade 12	Alcohol			Cigarettes			Marijuana		
	Baseline Risk Level			Baseline Risk Level			Baseline Risk Level		
	1	2	3	1	2	3	1	2	3
Sample size	855	1569	1042	1869	1033	583	1874	1178	470
Lifetime, % in C	82.5	100	100	53.4	100	100	35.9	68.8	100
Teen-leader effect	.0	NA	NA	2.2	NA	NA	.1	1.0	NA
Adult-only effect	2.7	NA	NA	2.4	NA	NA	.5	−1.9	NA
In past year, % in C	54.0	80.5	91.3	25.0	46.8	67.3	22.3	40.3	54.1
Teen-leader effect	3.4	−.6	2.2	2.1	1.4	2.5	−1.2	1.6	6.1
Adult-only effect	.9	2.4	−.4	.6	3.8	6.0	−1.2	−3.3	8.7
In past month, % in C	34.1	56.2	70.2	15.1	29.8	49.0	11.0	19.2	37.8
Teen-leader effect	1.3	−3.3	4.6	.7	.9	6.5	−1.8	4.2	−.2
Adult-only effect	.2	.4	−4.1	−.4	3.3	9.2	−.7	−.4	4.9
Monthly, % in C	24.2	41.3	59.9	14.6	30.5	49.0	6.5	17.2	33.8
Teen-leader effect	−1.7	1.3	−1.0	−.7	.3	7.0	−.9	2.2	−2.9
Adult-only effect	−4.2	−1.9	−6.8	.8	1.9	7.7	.8	−2.6	−2.5
Weekly, % in C	8.3	10.2	13.9	9.7	21.3	38.6	2.2	6.8	13.5
Teen-leader effect	−1.1	−.3	1.3	−1.4	1.0	6.1	−.8	−.2	5.5
Adult-only effect	−4.4**	−.9	.0	−.6	1.9	10.5*	−.1	−.3	4.6
Daily, % in C	.4	.2	1.0	7.3	16.3	32.0	1.1	3.2	8.1
Teen-leader effect	NA	NA	NA	−.7	.5	6.9	NA	.2	−.4
Adult-only effect	NA	NA	NA	−1.0	2.3	5.0	NA	.3	3.8

Note. Table shows absolute amount above or below control group prevalence rates for different baseline risk levels. Risk levels are as follows: For alcohol and cigarettes, 1 = nonuser (never tried), 2 = experimenter, and 3 = user. For marijuana, 1 = used no marijuana or cigarettes, 2 = used no marijuana, tried cigarettes; and 3 = used marijuana. An adult-only effect of 2.7 for lifetime use of alcohol in risk level 1 means that 85.2% (82.5 + 2.7) of adult-only group students who had not used alcohol at baseline had done so by grade 12 (the percentage is adjusted for baseline differences between experimental groups). NA = Not analyzed because frequency was 100% or less than 2%.

*$P \leq .10$, compared with control group.

**$P \leq .05$, compared with control group.

Hence the reported results may be interpreted as if the control group and the two treatment groups were identical on the baseline measures used in the regressions.

For the models predicting use, covariates included district, dummy variables for Black race and Asian race, and a composite propensity-to-use variable that weighted 64 baseline items equally. The latter variable covered peer and family use of and beliefs about the target substances, personal beliefs about them, and several background variables. For each specific substance, we also included expectations of future use, offers, and a substance-specific scale of other items. Baseline use of the target substances was included when there was sufficient variation within a risk level. Regressions predicting cognitive risk factors controlled for baseline values of the corresponding cognitive variable, use of the associated substance, district, gender, race/ethnicity, deviance, grades, and family background variables.

To avoid reducing the analysis sample when one or more covariates were missing, we imputed values for incomplete covariates. Typically, we imputed the mean value for all students with the same amount of baseline use of the substance most highly correlated with the variable being imputed. The regressions also included dummy variables to account for imputation of key covariates and for survey administration (in school or by mail).

Adjustments for within-school correlations. Our evaluation of program effects during junior high found that individual-level analyses permitted more precise controls for possible pre- and postprogram differences among the experimental groups than did a school-level assessment.[1] The student-level analysis also produced more conservative estimates of program results. Hence we use individuals as the unit of analysis. However, within-school correlations among the outcome variables increase standard errors for school-level variables such as treatment, leading to overly liberal significance tests.[18] To overcome this problem, we estimated within-school correlations for each dependent variable and used those estimates to adjust the treatment t statistics downward.[20] To improve precision in estimating those factors and the resulting standard errors, we combined information across samples and outcomes.[21] At grades 10 and 12, the adjustment factors ranged between 1.00 and 1.25 for the use outcomes. For cognitive risk outcomes, they ranged from 1.24 to 1.38 at grade 10 and from 1.08 to 1.20 at grade 12.

To facilitate understanding of the pattern of effects across outcomes and risk groups, we distinguish three levels of statistical significance based on two-tailed tests ($P \leq .10$, .05, and .01).

Results

Early Results

Project ALERT's results during the junior high school years provided strong evidence that the social influence approach to prevention can curb both cigarette and marijuana use. The program worked equally well in schools with high and low minority populations, and it had a significant impact on both high- and low-risk adolescents.

For marijuana use and beliefs, the program produced generally positive effects across all three risk levels, yielding the best results for students who had not used either cigarettes or marijuana before baseline (a one-third reduction in initiation). For cigarettes, the program significantly reduced current, weekly, and daily smoking during 8th grade among previous experimenters. However, although it curbed prosmoking beliefs among baseline nonsmokers and the more committed users, the program did not reduce tobacco use for the first group, and it had a negative (boomerang) effect on the smoking behavior of early users. Program effects for alcohol use and beliefs were the smallest; early reductions in drinking during grade 7 eroded by the 8th grade. Using older teens to assist teachers in the classroom produced comparatively larger reductions in the prodrug beliefs, but not in actual use.[22,23]

These findings clearly undercut criticisms that prevention programs work only in middle-class suburban communities and curtail only trivial levels of use. They also suggest that prevention programs work best for children who have limited prior experience with drugs and for substances (e.g., cigarettes and marijuana) that are spurned by most adults.

Long-Term Results

Outcomes at grades 10 and 12. Table 1 presents the program's effects on use of alcohol, cigarettes, and marijuana when the students were scheduled to be in 12th grade. It shows control group prevalence rates in the baseline risk groups for several drug use outcomes, ranging from lifetime use to daily use. The teen-leader and adult-only effects are depicted as absolute increases or decreases relative to the control group.

By the end of high school, the treatment program no longer had a significant effect on behavior. Its earlier positive impact on cigarette and marijuana use had completely disappeared, as had the boomerang effect for baseline cigarette users. Although a slight negative trend showed up for students whose preprogram exposure to cigarettes had placed them in the highest risk level, the differences are not statistically significant.

Results on use at grade 10 (not shown) were similar, with the following exception: For alcohol, two negative effects showed up in the teen-leader schools. Although these boomerang results occurred only for risk level 3 students and only for relatively infrequent drinking (any use in the past year or month), they were statistically significant ($P \leq .05$). Two years later, this difference had faded away.

In contrast, program effects on cognitive risk factors lasted considerably longer (Table 2). As late as grade 10, Project ALERT students in both treatment groups were more likely to believe that drug use would have negative personal consequences and that resistance would bring respect from one's friends. These effects were stronger in the teen-leader schools ($P \leq .01$) than in the adult-only schools ($P \leq .10$). Students taught by adults only were also more likely than those in the control group to believe that they could become dependent on drugs ($P \leq .10$), whereas those taught by teens were more likely to provide lower estimates of alcohol, cigarette, and marijuana use among their peers ($P \leq .01$) and less likely to think their friends would approve if they used drugs ($P \leq .05$). In general, these results also applied to each substance (alcohol, cigarettes, and marijuana) and were stronger among students in risk levels 1 and 2 (not shown).

However, program effects on resistance self-efficacy and personal expectations of using in the future—each of which had been significant and substantial during grades 7, 8, or 9—disappeared by grade 10. By grade 12, Project ALERT's impact on beliefs about the social consequences of drug use, peer reactions to use, and the benefits of resistance had been further reduced, although significant effects showed up for dependency in the teen-leader schools. Only one significant difference, lower estimates of peer drug use, applied to each of the three substances ($P \leq .05$).

Program impacts over time. To illustrate the decay in program effects on behavior, Figures 1 through 3 show year-by-year trends for specific results that were significant during junior high. For low- and moderate-risk students, the program's early impact on cigarette and marijuana use disappeared by grade 9 and did not resurface in later years. At 24, 36, and 60 months, marijuana onset rates among the three experimental groups were not significantly different at risk level 1 (Figure 1); the same conclusion applies to regular (weekly) smoking among higher-risk baseline experimenters (Figure 2) and to current and daily smoking in the same group (not shown).

For students at the highest risk level, program results for regular use—whether positive or negative—eroded as well, sometimes even earlier than grade 9. Among baseline marijuana users in the teen-leader schools, we saw a reduction of nearly 50% in weekly marijuana use immediately after the 7th grade lessons; 12 months later, the difference between teen-leader and control group students had

TABLE 2—Program Effects on Cognitive Risk Factors at Grades 10 and 12, across Baseline Risk Level

Cognitive Risk Factor	Grade 10 (n ≈ 3685)			Grade 12 (n ≈ 3640)		
	Teen Leader	Adult Only	Control	Teen Leader	Adult Only	Control
Consequences of use						
Risk of dependency	.733	.721*	.797	.702**	.750	.789
Social consequences	.695***	.755*	.808	.736*	.770	.781
Normative perceptions						
Prevalence of peer use	1.199***	1.288	1.300	1.389***	1.436	1.460
Friends approve of use	1.417**	1.513	1.487	1.531	1.565**	1.498
Friends do not respect refusal	.942***	1.014*	1.095	.898	.946	.931
Resistance self-efficacy	.758	.789	.764	.694	.736	.735
Expectations of using	.958	1.006	.966	.947	.957	.961

Note. All outcomes range from 0 (antidrug) to 3 (prodrug).
*$P \leq .10$, compared with control group.
**$P \leq .05$, compared with control group.
***$P \leq .01$, compared with control group.

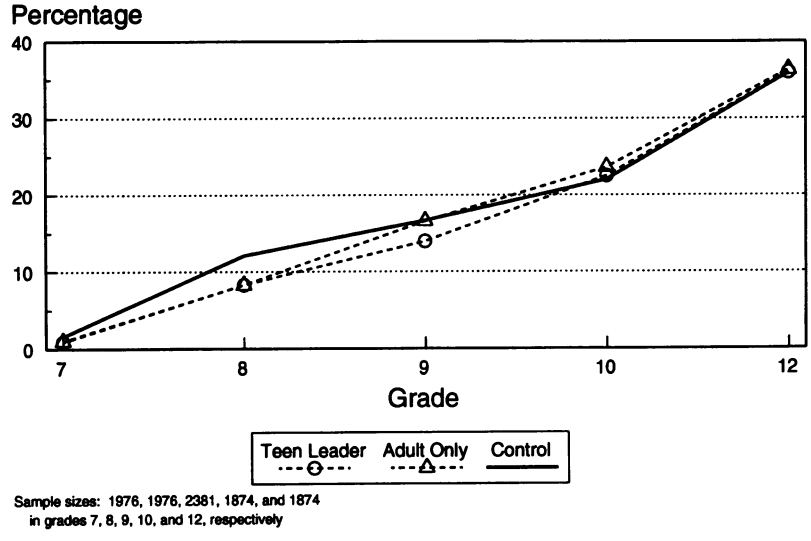

FIGURE 1—Program effects on marijuana initiation in risk level 1 (baseline nonusers of marijuana and cigarettes).

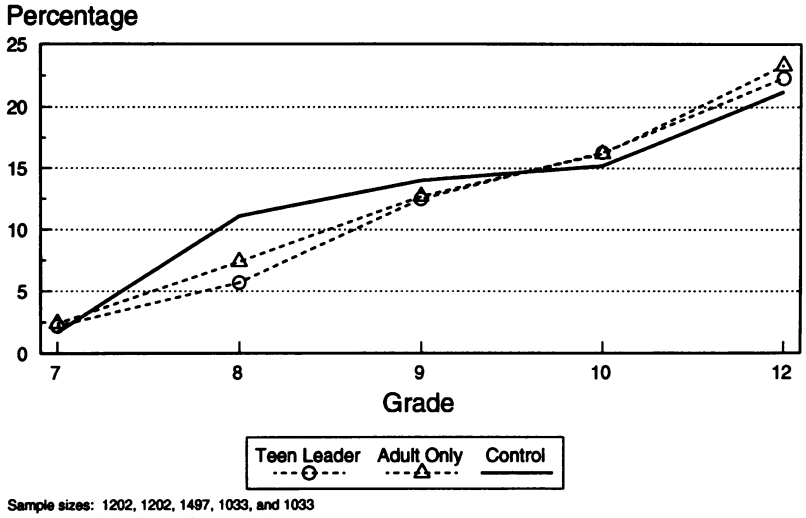

FIGURE 2—Program effects on weekly cigarette use in risk level 2 (baseline cigarette experimenters).

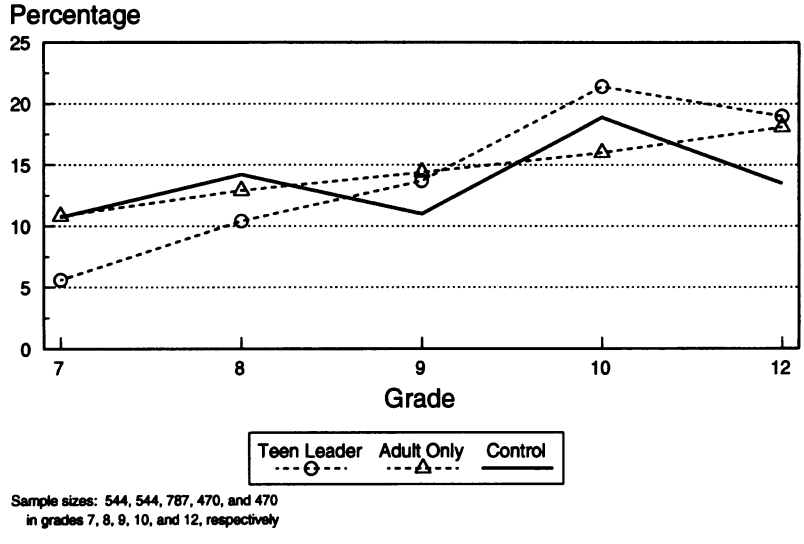

FIGURE 3—Program effects on weekly marijuana use in risk level 3 (baseline marijuana users).

shrunk to 25% and was no longer statistically significant (Figure 3). Similarly, the negative effect on daily smoking that appeared during grade 7 faded to statistical nonsignificance by grade 8. Previous boomerang effects on less frequent smoking by these early users also faded by grade 9.

Discussion

Our analysis of Project ALERT's results over 6 years yields two major conclusions: (1) Once the lessons stopped, the program's impact on drug use stopped as well; and (2) the curriculum's effect on cognitive risk factors lasted considerably longer. Attrition is unlikely to have affected the validity of these conclusions for three reasons: (1) Our analysis uncovered no evidence of differential attrition across experimental groups; (2) if anything, one might expect the loss of the highest risk students to slow the estimates of erosion; and (3) the decay of program effects on cognitive risk factors between grades 10 and 12 was observed in a common sample of students.

This erosion of behavioral effects during high school is consistent with the two evaluations of smoking prevention programs that cover a similar span of years.[9,10] That this erosion occurred despite the persistence of many cognitive effects indicates that these cognitive effects were insufficient to affect behavior, either because key cognitive links were no longer affected by the program or because the remaining reductions in prodrug beliefs were comparatively small. We suspect that both explanations apply.

During their sophomore year, treatment group students were more likely than control group students to believe that drinking, smoking, and using marijuana could have negative personal consequences, that their friends would disapprove if they used, and that the act of resisting would bring peer respect. But they were no longer less inclined to anticipate using in the future, nor did they feel more capable of resisting than their counterparts in control schools. Expectations of future use have typically been stronger predictors of drug use behavior than other cognitive risk factors; hence the disappearance of program reductions in this key motivating variable may have been critical.

In addition, program-induced increases in resistance self-efficacy faded by grade 9, just after students had entered the more pressured high school environment. By grade 10, 95% of the control students had tried alcohol, 75% had tried cigarettes, and 50% had tried marijuana. The small cognitive effects that still persisted were simply not enough to change behavior in the face of these increased pressures.

We conclude that teenagers need continued and strong reinforcement to resist drugs (or other high-risk behavior) during the high school years, a conclusion that echoes the National Cancer Institute's recommendations for antismoking programs.[3] Drug prevention research has demonstrated that programs for junior high school students can make a difference in the short run. Evidence that increasing the number of program sessions produces larger reductions in high-risk sexual behavior suggests that follow-on programs aimed at drug use might also have a positive effect.[24] However, we still know very little about whether supplementary efforts during high school can sustain—or increase—early reductions in drug use. Hence we need to try out different approaches and to assess how well they work with older teens.

Delaying or reducing drug use during early adolescence clearly yields immediate benefits—reduced risk of accidents, of unsafe sexual activity, of early dependency, and of other health-threatening be-

haviors. Nevertheless, the value of drug prevention would be greatly enhanced if we could maintain those benefits after the transition to high school. Making the effort to do so becomes even more important when we consider the difficulty of achieving and sustaining behavior change once a habit has set in. Very few adults are able to quit smoking on the first try; even successful quitters typically try to stop at least three times over a period of several years.[25] The same pattern applies for drug treatment.[26] In contrast, prevention programs have curbed drug use among young adolescents with as few as 11 50-minute lessons. We should give high priority to finding out whether programs designed for older teenagers can sustain those gains through high school. □

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