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School-Based Drug Prevention Among At-Risk Adolescents: Effects of ALERT Plus

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In a recent randomized field trial, Ellickson et al. found the Project ALERT drug prevention curriculum curbed alcohol misuse and tobacco and marijuana use among eighth-grade adolescents. This article reports effects among ninth-grade at-risk adolescents. Comparisons between at-risk girls in ALERT Plus schools (basic curriculum extended to ninth grade with five booster lessons) and at-risk girls in control schools showed the program curbed weekly alcohol and marijuana use, at-risk drinking, alcohol use resulting in negative consequences, and attitudinal and perceptual factors conducive to drug use. Program-induced changes in perceived social influences, one's ability to resist those influences, and beliefs about the consequences of drug use mediated the ALERT Plus effects on drug use. No significant effects emerged for at-risk boys or at-risk adolescents in schools where the basic ALERT curriculum (covering seventh and eighth grades only) was delivered. Possible reasons for gender differences and implications for prevention programming are discussed.

Keywords: *drug use prevention; gender; high-risk youth*

School-based drug prevention curricula, many of which focus on countering social influences to use drugs, have succeeded in delaying initial use of tobacco, alcohol, and other drugs in the general population of middle school adolescents (e.g., Botvin, Baker, Dusenbury, Botvin, & Diaz, 1995; Donaldson, Graham, & Hansen, 1994; Ellickson, McCaffrey, Ghosh-Dastidar, & Longshore, 2003). Some studies have also shown that drug prevention curricula geared to the general student population can have a positive impact on the critical subpopulation of adolescents at risk for escalating drug use

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(Eisen, Zellman, Massett, & Murray, 2002; Ellickson, McCaffrey, et al., 2003; Flay et al., 1985). However, other studies suggest that such curricula may in fact be counterproductive by leading at-risk adolescents to increased use rather than cessation or reduction of use (Donaldson et al., 1996; Ellickson & Bell, 1990; Gerstein & Green, 1993). In addition, despite the possibility that prevention effects might differ by gender, few studies have compared these effects between boys and girls. Finally, prevention programs in sixth or seventh grade are typically evaluated over a time frame that misses the critical transition from middle school to high school. It is especially important to gauge effects of prevention programs among at-risk adolescents making that transition because they are more liable than others to progress to regular use of alcohol, tobacco, and marijuana and to use of harder drugs (e.g., Lynskey et al., 2003).

In a field trial of the Project ALERT drug prevention curriculum (Ellickson, McCaffrey, et al., 2003), 45 South Dakota high schools and their middle school feeder(s) were randomized to an ALERT Only condition (basic Project ALERT curriculum delivered in seventh and eighth grade), an ALERT Plus condition (basic Project ALERT curriculum extended to ninth grade with five booster lessons), or a control condition. Adolescents in each condition completed a confidential self-report survey on drug use and related topics at baseline (before the curriculum began in seventh grade) and at annual follow-ups in the spring of each year. The basic ALERT Only curriculum succeeded in curbing alcohol, tobacco, and marijuana use among eighth graders (Ellickson, McCaffrey, et al., 2003).

This article reports effects of both ALERT Only and ALERT Plus on weekly use of alcohol, tobacco, and marijuana; consequences of alcohol and marijuana use; high-risk alcohol use; and drug-related attitudes and perceptions among ninth-grade at-risk adolescents. We defined at-risk youth as those who had already used either tobacco or marijuana before delivery of the curriculum began in seventh grade and thus were at substantial risk of deepening their involvement with drugs during both middle school and high school (DeWit, Adlaf, Offord, & Ogborne, 2000; Yamaguchi & Kandel, 1984). We also assessed the degree to which program-induced changes in drug-related perceptions mediated program effects on drug use. Effects were tested separately for at-risk boys and girls. We compared at-risk adolescents from ALERT Only and control schools to measure effects of the ALERT Only curriculum at ninth grade, namely, 1 year after completion of the basic curriculum. We compared at-risk adolescents in control and ALERT Plus schools to evaluate effects of the middle school curriculum combined with booster lessons in ninth grade.

BACKGROUND

Drug Prevention Among At-Risk Adolescents

There are several reasons for concern regarding the effectiveness of drug prevention among adolescents at risk for escalated drug use. First, early users of alcohol, tobacco, or other drugs are significantly more likely than nonusers to intensify their drug use, do poorly in school, and engage in multiple other problem behaviors as they mature (DuRant, Smith, Kreiter, & Krowchuk, 1999; Lynskey et al., 2003). Even youth who have tried alcohol or tobacco only once or twice by 7th grade have a substantially higher risk of these problems than those who have not tried either substance (Ellickson, Tucker, & Klein, 2001, 2003). The transition to 9th grade may be especially problematic for such youth because they have left a middle school environment in which they were the oldest

cohort and entered a new environment populated by 10th to 12th graders among whom substance use is likely to be more prevalent (Adger, 1992). Programs that can curb the escalating trajectory of use among at-risk youth may also help to prevent drug use sequelae such as drunk driving, unsafe sex, and violence, whereas programs ineffective with at-risk youth may yield benefits only for those adolescents who are least likely to experience drug-related harms.

Second, at-risk youth, who escalate use more quickly than their lower risk counterparts, may have greater need for lessons that build motivation against high-risk use and include skills for dealing with risky situations, coping with emotional distress, and quitting—activities that may be lacking in prevention programs designed for the general population (Sussman, Dent, Burton, Stacy, & Flay, 1995). Third, few studies of social influence curricula have employed rigorous experimental designs to examine effects among adolescents sorted by risk level, and findings from those studies are quite inconsistent. Dielman (1994) reported favorable effects of an alcohol prevention program on alcohol misuse and onset of use but only for at-risk adolescents, namely, those who already had unsupervised experience with alcohol before exposure to the program. Flay et al. (1985) found stronger effects on weekly smoking by youth who had already begun smoking at baseline than on those who had not done so. Similar findings for monthly tobacco use and onset of marijuana use were reported by Eisen et al. (2002). In contrast, Johnson et al. (1990) found no differences in rates of monthly tobacco, alcohol, or marijuana use when they compared outcomes in their overall samples and in at-risk subsamples, whereas Donaldson et al. (1994) reported no difference in substance use between at-risk and other adolescents in effects of a social influence curriculum.

Drug Use Prevention and Gender

Whether drug prevention programs are equally effective with both boys and girls remains unclear. Some studies have documented stronger effects for boys or for girls; others have reported no difference in outcomes across the two groups. Graham, Johnson, Hansen, Flay, and Gee (1990) found stronger effects of a school-based drug prevention curriculum on onset of tobacco and marijuana use (but not alcohol use) among girls than among boys, whereas Perry et al. (2003) found favorable effects of an enhanced Drug Abuse Resistance Education (DARE) middle school curriculum on past year and past month alcohol use and on current smoking for boys but not girls. Consistent with the nondifference in alcohol outcomes reported by Graham et al., Shope, Copeland, Marcoux, and Kamp (1996) reported no gender differences for a curriculum focusing on alcohol misuse. Similarly, no gender differences emerged for use of alcohol, tobacco, or marijuana in the Donaldson et al. (1994) study.

The Project ALERT and ALERT Plus Curricula

Based on the social influence model of prevention, the Project ALERT curriculum for middle school youth seeks to motivate youth against using drugs and help them build the skills they need to translate that motivation into effective resistance behavior. The lessons synthesize three theories of behavioral change: (1) the health belief model (Rosenstock, Strecher, & Becker, 1988), (2) the social learning model (Bandura, 1985), and (3) the self-efficacy theory of behavior change (Bandura, 1977). The health belief model informed the curriculum's emphasis on helping adolescents understand the salience and seriousness of consequences associated with drug use, reducing barriers to

effective drug resistance, and highlighting the benefits of nonuse. Self-efficacy theory fostered the curriculum's emphasis on building confidence in one's ability to resist pro-drug pressures, the lack of which is deemed an important barrier to effective drug resistance. The social learning model guided the curriculum's focus on helping students build norms against use, identify social pressures to use drugs, practice successful resistance to those pressures, and emulate role models for nonuse. Project ALERT lessons are led using interactive question-and-answer techniques and small group activities, which appear to be crucial elements in the effectiveness of prevention curricula (Tobler, 1997).

The ALERT Plus curriculum is designed as a set of booster lessons for high school youth who completed the Project ALERT curriculum as middle school students. The ALERT Plus curriculum has the same overall goals, theoretical underpinnings, and interactive teaching strategies as the middle school curriculum. It differs in that it takes into account developmental changes during the high school years that affect opportunities and motivations to use drugs. These include more diverse friendship networks and dating opportunities that increase the likelihood of exposure to more favorable norms about use, a broader array of drugs, and regular and high-risk use among one's peers (Sussman et al., 1995); acquisition of a driver's license, which increases the importance of addressing risky situations such as driving while impaired and riding with a driver who has been drinking or using drugs (Sussman et al., 1995); greater exposure to and awareness of advertising and other marketing techniques (Collins, Ellickson, McCaffrey, & Hambarsoomians, 2005); and an increasing tendency for alcohol, tobacco, and other drug (ATOD) use, especially regular use, to be more closely tied to emotional distress (Novacek, Robert, & Robert, 1991).

Hence the ALERT Plus curriculum seeks to strengthen norms against high-risk drug use (e.g., regular and polydrug use, drinking and driving), help students cope with risky drug situations and learn ways to quit, increase understanding of the consequences of high-risk use (e.g., binge drinking, polydrug use, use of illegal drugs like ecstasy and methamphetamine), develop healthy ways to cope with emotional distress, and identify and counter multiple marketing techniques. Consistent with studies that highlight the role of parents in curbing drug use (Spoth, Redmond, Trudeau, & Shin, 2002), ALERT Plus also seeks to include parents in the prevention process through parent/child involvement in planning drug-free parties and learning how knowledge and regulations about drugs have changed over time.

Previous Results for Middle School Program

The original Project ALERT curriculum (seventh and eighth grades) was found to prevent or reduce marijuana and tobacco use among eighth graders. However, the program did not help early smokers who tried cigarettes more than once or twice, and its effects on alcohol use were short-lived (Ellickson & Bell, 1990). In view of these findings, the middle school program was strengthened with the addition of two new lessons designed to improve the curriculum's impact on alcohol use and to overcome its ineffectiveness with early smokers, plus a series of home learning activities that encourage parental involvement in substance use prevention during seventh and eighth grades. A recent evaluation of the revised Project ALERT curriculum in 55 South Dakota schools showed that Project ALERT curbed alcohol misuse as well as regular and initial use of tobacco and marijuana among eighth-grade adolescents. Reductions in use were observed among adolescents at low, moderate, and high risk for future use (Ellickson, McCaffrey, et al., 2003). Favorable effects were also observed on drug-relevant cognitive factors such as perceived prevalence of use, resistance self-efficacy,

peer approval of use, beliefs about use, and intentions to use (Ghosh-Dastidar, Longshore, Ellickson, & McCaffrey, 2004; Orlando, Ellickson, McCaffrey, & Longshore, 2005).

In analyses of the overall South Dakota sample, effects on drug use and cognitive factors did not persist at ninth grade in either program condition—ALERT Only (where the curriculum ended in eighth grade) or ALERT Plus (booster lessons added in ninth grade). However, the ALERT Plus lessons, which were designed to combat escalating and risky drug use, may be particularly relevant to at-risk early users. This study asks if such youth benefited from receiving the ALERT Plus program after entry into Grade 9.

METHOD

The current study used data from the South Dakota evaluation to examine effects of ALERT Only and ALERT Plus on ninth-grade weekly drug use, consequences of use, and high-risk alcohol use among at-risk adolescents, namely, those who reported lifetime use of either tobacco or marijuana prior to the baseline survey in seventh grade. We chose this definition because several studies have shown that early initiation predicts escalating drug use and other problem behavior (DeWit et al., 2000; DuRant et al., 1999; Hingson, Heeren, Jamanka, & Howland, 2000), and even experimental use at this early age is associated with substantially increased risk for greater drug involvement in high school (Ellickson, Tucker, et al., 2001, 2003). We also assessed the program's impact on cognitive factors identified as mediators of ALERT's effects in prior research (Orlando et al., 2005)—beliefs about the consequences of drug use, perceived prevalence of use, friends' approval of use, resistance self-efficacy, and intentions to use. We compared adolescents in ALERT Only and control schools to measure effects of the middle school program 1 year after its completion in eighth grade. We compared adolescents in control and ALERT Plus schools to evaluate the effect of the combination of Project ALERT and booster lessons added in high school (ninth grade).

Study Design

For the South Dakota evaluation, we randomly assigned 45 school clusters, namely, high schools and their associated middle school feeder(s), to two treatment conditions and one control condition.[1] As indicated earlier, the ALERT Only treatment condition consisted of prevention lessons in seventh and eighth grades. In the ALERT Plus treatment condition, students received the seventh- and eighth-grade lessons as well as booster lessons in ninth grade. Students in the control condition received other prevention curricula already in place at their schools but were not exposed to any part of the ALERT curriculum in any grade. To enhance pretreatment equivalence across conditions, we used blocking by geographic region and community size and restricted assignment when randomizing school clusters to conditions (Ellickson, McCaffrey, et al., 2003). After we completed randomization, two districts (each with one high school) recanted their decision to participate in the study. Schools in a similar region of the state and with a similar ethnic composition replaced the schools that dropped out.

For this study, analyses included 1,383 students from the 45 school clusters—457 from 16 clusters receiving ALERT Only, 370 students from 14 clusters receiving ALERT Plus, and 556 students from 15 control clusters. Of these, 4 school clusters were in cities with more than 50,000 residents, 12 were in towns of 5,000 to 25,000 residents, and the remaining clusters were in rural communities. Students in the analytic

sample were 44% female and 19.6% non-White (largely Native American); 57.7% lived with both biological parents. Prior to the study, 15.9% of this at-risk sample had tried marijuana and 99% had tried tobacco.

Data Collection

This analysis used data from the seventh-grade survey (administered just before program delivery) and the ninth-grade survey (administered approximately 30 months after baseline and after delivery of the ninth-grade boosters in ALERT Plus schools). Data collection procedures and instruments were approved by RAND's institutional review board. To motivate students to participate and to tell the truth, data collectors described the study's procedure for ensuring privacy, informed students of their right not to participate, and told students that saliva specimens collected from assenting students could be tested for drug use. To further improve participation rates, we used make-up sessions at school plus tracking by mail and telephone to request survey completion by students missed in class.

These procedures resulted in high rates of student participation. Of 5,412 students enrolled in the seventh grade in all schools, 4,689 (86.6%) completed the baseline survey. Nonrespondents included 549 (10.1%) whose parents refused consent and 174 (3.2%) who missed both the classroom survey and the make-up session or who refused to participate. Of the 1,772 at-risk students in the baseline sample, 389 (22.0%) were not surveyed at ninth grade, leaving an analytic sample of 1,383 at-risk students (1,274 surveyed in schools, 109 surveyed through mail or phone follow-up). Most (85.6%) of the 389 lost students had moved or were chronically absent and could not be tracked via phone or mail follow-up. Overall, students lost at ninth grade were more likely to be male, be non-White, have low grades, have parents with low educational attainment, live with a single parent or stepparent, and have used tobacco or marijuana as recently as the past month at baseline or report weekly use of these substances. However, when weighted to account for differential loss at follow-up, the analytic sample was nearly identical to the original baseline sample of at-risk students (Table 1, columns 1 and 4). Only family situation (single parent) and grades differed by more than a percentage point or two between the original and weighted samples. Attrition rates were very similar for the control and ALERT Only conditions (24.5% and 23.4%, respectively) and slightly lower for ALERT Plus (20.2%).

To assess the validity of self-reported drug use, we relied on physiological tests and the consistency of self-reports within and across surveys. Self-reported tobacco use was highly consistent with cotinine levels in a random sample of 654 saliva specimens submitted for testing. For 560 students reporting no current tobacco use, testing indicated only three false negatives. In addition, internal consistency of self-report data was quite high within and across waves of data collection (see Ellickson, McCaffrey, et al., 2003).

Data Imputation

Missing data for baseline covariates were imputed using a Bayesian model for the joint distribution of all baseline and eighth-grade follow-up variables. The model used a multivariate Gaussian distribution to approximate the joint distribution for the variables conditional on the unobserved parameter values. The imputed values are a random sample from the posterior distribution of the missing data and conditional on the observed data and the model. Using the NORM software (Schafer, 1999), we sampled

Table 1. Baseline Characteristics of At-Risk Adolescents by Attrition Status and Weighted for Loss at Follow-Up (%)

	Baseline Sample (Unweighted; $N = 1,772$)	Analytic Sample (Unweighted; $N = 1,383$)	Students Lost at Follow-Up (Unweighted; $N = 389$)	Analytic Sample (Weighted; $N = 1,383$)
Male	57.1	56.0	59.9	57.1
Non-White	24.1	19.6	40.3	23.8
Single parent or stepparent	47.3	42.3	65.9	43.5
Dad high school dropout	13.9	12.1	20.1	13.0
Mom high school dropout	11.2	9.3	18.0	10.3
Parental monitoring	1.4	1.4	1.4	1.4
Low grades (mostly Ds or Fs)	11.5	7.7	24.7	8.7
Weekly tobacco use	17.4	13.8	31.0	16.8
Used tobacco in past month	33.0	27.8	52.1	33.6
Weekly marijuana use	5.0	3.0	11.8	3.9
Used marijuana in past month	9.8	6.5	21.5	8.2
Weekly alcohol use	12.0	11.0	15.5	12.1
Used alcohol in past month	31.5	30.5	35.7	32.7

five sets of imputed values. Imputed values have been found to be robust to model misspecifications (Schafer, 1997). Results reported in this article synthesized analyses conducted on the five imputed data sets by averaging estimated coefficients and pooling within- and between-imputation variability to estimate standard errors (Schafer, 1997).

Outcome Measures

To capture frequency of use at a level appropriate to at-risk adolescents, we employed weekly use (3 or more days in the past month) of each drug. We measured alcohol consequences (marijuana consequences) as the sum of five (four) ninth-grade dichotomous items tapping past year experience of problems because of drinking or using marijuana (e.g., alcohol: getting sick, fighting, getting in trouble at school; marijuana: missing school or work, getting in trouble at school or home, finding it difficult to concentrate). To reduce skewness in these measures, we used the square root transformation of the summary score. To tap high-risk drinking, we took the square root of the sum of three dichotomous items (binge drinking in the past month, combined use of alcohol and marijuana in the past year, and weekly drinking).

We also created seven outcome measures for cognitive factors, which are parallel across drugs and constructed so that higher scores correspond to increased risk. We assessed use intentions by asking whether "you think you will smoke any cigarettes

(drink any alcohol, use marijuana) in the next six months?" (range = 1 to 4, from *definitely yes* to *definitely no*). Each of the resistance self-efficacy scales (one each for alcohol, tobacco, and marijuana) averaged four reverse-scored items that asked students to rate their ability to resist an offer of the specific drug in different situations: when bored at a party or when a best friend, a date, or all friends at a party are using (item range = 1 to 4, from *definitely would* to *definitely would not*; alphas = .96, .95, and .98 for alcohol, tobacco, and marijuana, respectively). To assess positive beliefs about the consequences of use, we averaged agreement with three positive statements for each drug (range = 1 to 4; alpha = .82, .66, and .88 for alcohol, tobacco, and marijuana, respectively). For all three drugs, these statements included "It relaxes you" and "It helps you get away from your problems." For alcohol and marijuana, the third statement was "It lets you have more fun"; for tobacco, it was "It helps you stay thin." Negative beliefs about the consequences of use were measured similarly, averaging agreement with four negative statements for each drug: likelihood of becoming dependent (all drugs); doing things you might regret, getting into trouble, slowing down reaction time (alcohol); making it hard to remember things, doing poorly in school, doing things you might regret (marijuana); doing poorly in sports, getting into trouble, making other people not want to be around you (tobacco). The items were reverse-scored so that higher values indicate students with lower negative beliefs and greater risk for drug use (alphas = .73, .68, and .80 for alcohol, tobacco, and marijuana, respectively). We assessed friends' approval of use by asking how your friends would feel if they found out that you smoked cigarettes (drank alcohol, used marijuana) sometimes and friends' respect for refusing to use drugs by extent of agreement with the statements that kids actually respect you more if you refuse to smoke cigarettes, drink alcohol, and use marijuana (4-point response scales). Perceived prevalence of use was the student's estimate of the percentage of ninth-grade students in their school who used tobacco, alcohol, or marijuana one or more times in the last month.

Outcome Analyses

To analyze the effects of ALERT Only and ALERT Plus on substance use and cognitive outcomes, we estimated a regression model for each outcome that included an indicator (0, 1) variable for ALERT Only, a separate indicator variable for ALERT Plus, and baseline covariates. The inclusion of individual- and school-level baseline covariates allowed us to remove imbalance between treatment and control groups at baseline and reduce the risk of spurious results due to chance differences in groups. For dichotomous outcomes (weekly tobacco, alcohol, and marijuana use), we used logistic regression; for all other outcomes, we used linear regression. Because of the large number of outcomes considered in this study, we do not present the regression models, instead providing estimates of each treatment's effect relative to control. For continuous variables, we present the estimated treatment effects as effect sizes (dividing the estimated difference between mean outcomes for the treatment and control groups by the standard deviation for the control group). For dichotomous outcomes, we follow the standard practice of reporting the estimated effects of treatment on the probability of the outcomes (cf. Ellickson & Bell, 1990; Wells et al., 2000), using logistic regression models to predict the expected rates of weekly use for each group as outlined in Graubard and Korn (1999). The resulting estimates provided the expected rates of use for each treatment condition that are presented in Table 2.

Table 2. Effects of ALERT Plus and ALERT Only on Expected Rates of Weekly Drug Use Among At-Risk Adolescents

	Girls			Boys		
Grade 9 Drug Use	Control $N = 251$ %	ALERT Plus $N = 163$ %	ALERT Only $N = 191$ %	Control $N = 305$ %	ALERT Plus $N = 208$ %	ALERT Only $N = 266$ %
Weekly alcohol use	39.6	26.8*	37.7	44.6	39.7	43.6
Weekly tobacco use	46.6	39.1	45.0	44.2	46.3	46.0
Weekly marijuana use	22.3	11.4*	20.3	23.6	19.1	26.1

NOTE: For each outcome, expected rates of use (in percentages) are estimated from a logistic regression model that included indicator variables for ALERT Plus and ALERT Only, plus baseline characteristics.
*significantly different from control group at $p < .05$.

Baseline Covariates. To choose relevant baseline covariates for inclusion in the models, we used backwards deletion (i.e., starting with a large set of covariates and including in the final model only those that substantially improved model fit) to identify predictors of difference between ALERT Plus and ALERT Only schools in the change in student outcomes from Grade 7 to Grade 8. Because students in those two groups received the same curriculum but diverged on some outcomes at Grade 8 (which reflected differences in propensity to use, not in program received), we paid special attention to variables that helped predict those differences and thus facilitated adjusting for imbalance across the two conditions. Models for tobacco outcomes (use and cognitions) included weekly smoking, lifetime marijuana use, parental education, friends' approval of tobacco use, and three school-level means among at-risk students—weekly smokers, inhalant users, and friends' respect for not using drugs. Those for alcohol outcomes included the baseline value of the outcome, lifetime inhalant use, and beliefs about friends' respect for not using. Models for marijuana outcomes included baseline value of the outcome,[2] friends' approval of tobacco use, parent education, deviance, and two school means—friends' respect for not using among at-risk students and inhalant users among at-risk students. To account for blocking, all models included covariates for school location (region of the state) and enrollment size, which was highly correlated with community size. For use outcomes, we also tested models that included additional demographic covariates, but these models did not alter our conclusions regarding program effects.

Accounting for Within-School Correlation and Attrition. To account for the clustering of students within schools (which can lead to inaccurate significance tests for program effects), our regression models used bias-reduced linearization with generalized estimating equation methods (McCaffrey & Bell, 2006). These methods are designed to yield standard errors and statistical tests that are unbiased in the presence of intracluster correlation. To account for attrition after baseline, we weighted the data when estimating model parameters. Attrition weights equaled the reciprocal of the probability of responding to the ninth-grade survey. The model for estimating response probability included main effects for gender, race/ethnicity, and monthly smoking at baseline, along with all two- and

three-way interactions among these variables. The model also included an indicator of positive beliefs about drugs and the average of the student's estimates of the percentages of tobacco, alcohol, and marijuana users in his or her class.

Mediation Analyses

To assess the potential mediation of drug use outcomes by cognitions, we first selected only those outcomes for which the program (either ALERT Only or ALERT Plus) had shown an effect at Grade 9. Next we identified the cognitive measures that were also predicted by the relevant program and assessed whether that measure predicted the use outcome as well. If yes, we used the methods of Baron and Kenny (1986) to estimate the mediation effect (described for one outcome, weekly use of alcohol):

1. We ran the basic regression model (Model 1) for estimating ALERT Plus (or ALERT Only) effects on weekly alcohol use.
2. For each Grade 9 cognitive measure that was significantly affected by treatment, we estimated a separate regression model (Models 2a through 2n) for weekly alcohol use that added the single measure to the basic model.
3. We then compared the program coefficient from each new model with that from the basic model without the cognition, asking whether its size and/or significance had been reduced.
4. If yes, we also conducted the Sobel (1982) test for mediation.

Presentation of Results. Because program coefficients from linear and logistic regression models do not easily lend themselves to comparing treatment effects across studies, we present the results as (1) the expected rates of use for ALERT Only, ALERT Plus, and control students (for the dichotomous weekly use variables) or (2) standardized effect sizes (all other outcomes). The expected rates allow us to compare the percentage of weekly users across the three groups; they can be translated into treatment effects by subtracting the control percentage from the treatment percentage. The standardized effect sizes provide treatment effect estimates that are measured in standard deviation units and can also be compared across studies. All treatment effects were measured on an intent-to-treat basis. For the mediation analyses, we present the results in terms of the model coefficient for the treatment variable from the model, thereby facilitating coefficient comparisons before and after the potential mediator was added.

RESULTS

Curriculum Implementation

In the ALERT Plus schools, 28 trained teachers delivered the ninth-grade program. Teacher reports for 357 lessons indicated they covered all or some of each activity in 93% of the lessons and all of each activity except the wrap-up in 80% of the lessons. One or more of the activities was rushed in one third of the lessons, with teachers having more difficulty covering all the material in Lesson 2 (covering consequences of use). Overall, only 8% of the lessons were interrupted by external events such as fire drills, school announcements, or shortened class periods. Thus, the great majority of the lessons were completed and students participated in most of the requisite activities.

Table 3. Effects of ALERT Plus and ALERT Only on High-Risk Drinking and Consequences of Using Alcohol and Marijuana Among At-Risk Adolescents

	Effect Size[a]			
	Girls		Boys	
Grade 9 Drug Use	ALERT Plus $N = 163$	ALERT Only $N = 191$	ALERT Plus $N = 208$	ALERT Only $N = 266$
High-risk alcohol use	–.28***	–.05	–.07	–.04
Alcohol consequences	–.31**	–.05	.03	.09
Marijuana consequences	–.20	.16	–.04	.07

a. Effect sizes are calculated as the difference in the mean outcomes in the treatment group (ALERT Plus or ALERT Only) and the control group, divided by the standard deviation for the control group. Mean outcomes for each group are estimated from a linear regression model that included indicator variables for both ALERT Only and ALERT Plus and baseline covariates. Because of missing responses, sample sizes vary across outcomes from 97% to 100% of analytic sample.
**$p < .01$. ***$p < .005$.

Drug Use Outcomes

Tables 2 and 3 provide program effects on drug use for students who were exposed to ALERT Plus (the middle school program plus the ninth-grade high school curriculum) and those exposed only to the middle school program (ALERT Only). Comparisons of students in ALERT Plus and control schools indicate a consistent pattern of favorable effects for at-risk girls in the enhanced program. As Table 2 shows, at-risk girls in ALERT Plus schools reported significantly lower rates of weekly alcohol use (32% reduction compared to control girls; 26.8% vs. 39.6%) and weekly marijuana use (49% reduction compared to control girls; 11.4% vs. 22.3%). They also reported significantly lower scores on alcohol consequences and high-risk alcohol use (Table 3). Differences between control and ALERT Plus girls on weekly tobacco use and marijuana consequences were not large enough to reach statistical significance but were consistent with the other outcomes in showing lower drug involvement for girls in the ALERT Plus condition.

In contrast, ALERT Plus had no significant effects on drug use among at-risk boys (although these boys did exhibit modest reductions in weekly alcohol and marijuana use compared to boys in the control condition). In addition, comparisons between ALERT Only and control students showed no significant differences for either at-risk girls or at-risk boys, indicating that the previous effects of the middle school program did not persist through ninth grade in the absence of additional prevention lessons.

Cognitive Outcomes

Table 4 presents the results for cognitive outcomes, all scored so that lower values indicate lower risk. Consistent with the results for drug use, there were no statistically significant differences among boys for any of the cognitive outcomes. Also consistent with the results for drug use, girls in the enhanced ALERT Plus condition tended to have lower values for both marijuana and alcohol than girls in the control group. For marijuana, differences between ALERT Plus and control girls were statistically significant for five of the seven cognitive outcomes, with effects ranging from –.25 to –.50 of

Table 4. Effects of ALERT Plus and ALERT Only on Cognitive Outcomes Among At-Risk Adolescents

	Effect Size[a]			
	Girls		Boys	
Grade 9 Cognitive Outcomes[b]	ALERT Plus $N = 163$	ALERT Only $N = 191$	ALERT Plus $N = 208$	ALERT Only $N = 266$
Alcohol				
Intention to use	–.15	–.08	.00	–.04
Low resistance self-efficacy	–.07	–.06	.13	.06
Positive beliefs	–.25*	–.13	–.13	–.28
Low negative beliefs	–.33*	–.23	.00	–.13
Friends' approval	–.11	.00	.00	–.02
Friends' respect	–.29**	–.08	–.05	.00
Perceived prevalence	–.36	–.02	–.09	–.09
Marijuana				
Intention to use	–.30*	–.08	–.08	.00
Low resistance self-efficacy	–.29*	.10	–.01	.03
Positive beliefs	–.25*	–.09	–.12	–.10
Low negative beliefs	–.15	–.20*	–.07	–.10
Friends' approval	–.32**	–.05	–.03	.14
Friends' respect	–.14	.01	.03	–.05
Perceived prevalence	–.50**	.00	–.10	–.06
Tobacco				
Intention to use	–.06	–.17	–.04	–.06
Low resistance self-efficacy	.09	.02	.04	.11
Positive beliefs	–.07	–.21	.07	–.12
Low negative beliefs	–.12	–.12	–.07	–.11
Friends' approval	–.04	.00	.04	–.09
Friends' respect	–.12	.04	.14	.01
Perceived prevalence	–.21	–.13	–.01	–.14

a. Effect sizes are calculated as the difference in the mean outcomes between treatment group (ALERT Plus or ALERT Only) and control, divided by the standard deviation for the control. Mean outcomes for each group are estimated from a linear regression model that included indicator variables for both ALERT Only and ALERT Plus and baseline covariates. Because of missing responses, sample sizes vary across outcomes from 93% to 100% of analytic sample.
b. All cognitive outcomes are scored so that lower values indicate lower risk.
*significantly different from control group at $p < .05$; **$p < .01$.

a standard deviation unit. For alcohol, differences between ALERT Plus and control girls were statistically significant for both positive and negative beliefs and for friends' respect. Only one significant effect showed up for girls in the ALERT Only condition (negative beliefs about marijuana), and neither group exhibited significant differences for tobacco cognitions.

Table 5 presents the results of mediation analyses for the four drug use outcomes that ALERT Plus reduced among at-risk girls—weekly marijuana use, weekly alcohol use, high-risk drinking, and drinking that resulted in negative consequences. It shows the ALERT Plus coefficients for the basic regression model with no Grade 9 mediators

Table 5. Mediation Effects of Cognitive Factors on Ninth-Grade Drug Use Outcomes Among At-Risk Girls Receiving ALERT Plus

	ALERT Plus (At-Risk Girls)	
Grade 9 Cognitive Measures Included in the Model[a]	Coefficient	*p* Value
Weekly marijuana use models		
Model 1. None	–.91	.03
Model 2a. Intention to use[b]	–.58	.15
Model 2b. Low-resistance self-efficacy[b]	–.62	.16
Model 2c. Positive beliefs[b]	–.73	.19
Model 2d. Friends' approval[b]	–.77	.08
Model 2e. Perceived prevalence[b]	–.64	.07
Weekly alcohol use models		
Model 1. None	–.62	.01
Model 2a. Positive beliefs[b]	–.42	.15
Model 2b. Negative beliefs[b]	–.48	.03
Model 2c. Friends' respect[b]	–.49	.04
Alcohol consequences models		
Model 1. None	–.23	.00
Model 2a. Positive beliefs[b]	–.12	.14
Model 2b. Negative beliefs[b]	–.19	.02
Model 2c. Friends' respect[b]	–.18	.01
High-risk alcohol use models		
Model 1. None	–.21	.00
Model 2a. Positive beliefs[b]	–.11	.12
Model 2b. Negative beliefs[b]	–.15	.03
Model 2c. Friends' respect[b]	–.14	.04

a. Cognitive measures are scored so that lower values indicate lower risk.
b. Significant mediator for ALERT Plus ($p = .05$).

(Model 1) and for models in which each of the Grade 9 mediators that ALERT Plus modified were added to the basic model (Models 2a through 2n).

For weekly marijuana use, we added each of five cognitive factors—intentions to use marijuana, positive beliefs about its consequences, low-resistance self-efficacy, friends' approval of use, and friends' respect for not using marijuana—to the basic model. Models 2a through 2e show that including each factor yielded a substantially reduced coefficient for ALERT Plus so that it was no longer significant at the .05 level. Each of these cognitive factors also met the Sobel test for mediation.

For all three alcohol outcomes (weekly alcohol use, drinking that resulted in negative consequences, and high-risk drinking), we added each of three cognitive factors to the basic model. The potential mediators included positive beliefs about the consequences of drinking (Model 2a), negative beliefs about those consequences (Model 2b), and friends' respect for not drinking (Model 2c). Adding positive beliefs to the basic model reduced the ALERT Plus coefficient, making it no longer significant at the .05 level for all three outcomes. Moreover, the Sobel test for mediation indicated that favorable beliefs about the consequences of drinking mediated the effects of ALERT Plus on each measure of drinking behavior. Sobel tests also confirmed that negative beliefs

about drinking and friends' respect for not using alcohol mediated the effects of ALERT Plus on the three alcohol use outcomes (and in each case, adding the specific cognition to the basic model substantially reduced the size of the ALERT Plus coefficient but did not change the significance at the .05 level).

DISCUSSION

These findings indicate that extending the time of exposure to a social influence prevention curriculum beyond seventh and eighth grade by means of booster lessons in ninth grade can reduce progression to regular (weekly) drug use, stem the adverse sequelae of use, and produce favorable change in drug-relevant attitudinal and perceptual factors among at-risk girls. As noted earlier, ninth grade may be especially problematic for at-risk adolescents because they have left a school environment in which they were the oldest cohort and entered a new environment where substance use is likely to be more prevalent. Hence, the effects of ALERT Plus on at-risk youth may be partly attributable to the ninth-grade curriculum's emphasis on minimizing the kind of drug use that these youth are particularly likely to engage in. It may not be reasonable to expect strong effects among low-risk youth, fewer of whom are likely to make the transition to regular use and misuse.

In addition, the ALERT Plus focus on reinforcing social norms against at-risk use, increasing the salience of its harmful consequences, and reducing perceptions of its favorable consequences may be particularly relevant for at-risk youth—who start using as young adolescents, are more likely to be exposed to other drug users, especially as they make the transition to high school, and are more likely to incur drug-related harms as they mature. This interpretation is supported by the mediation analyses, which show that all three types of cognitions (those that tap perceived social influences and the ability to resist them, beliefs about negative consequences, and beliefs about positive consequences) mediated the effects of ALERT Plus on drug use.

Studies examining curriculum effects by risk level have not specified effects by gender within the at-risk group. We did so and found differences. Thus, it is possible that effects shown in other studies for at-risk adolescents overall were specific to girls or stronger for girls than for boys. Why would this be so? There are several plausible hypotheses that are consistent with the curriculum's substantive focus in ninth grade. The first, which ties in with the curriculum's social learning and self-efficacy underpinnings, suggests that girls are more susceptible to social influences than boys (Griffin, Botvin, Doyle, Diaz, & Epstein, 1999) and thus more responsive to a program that builds social norms against high-risk use and skills to deal with social situations in which high-risk use is likely (parties, riding with a driver who has been drinking, or using other drugs). Rohrbach and Milam (2003) noted that girls may be more readily influenced than boys by peer approval of drinking; others have found that boyfriends in particular influence girls' ATOD use (Amaro, Blake, Schwartz, & Flinchbaugh, 2001). Girls may also be more responsive to parental disapproval of use than boys (Griffin et al., 1999) and thus more responsive to ALERT Plus activities aimed at getting parents positively involved in the prevention process.

Our results provide some support for the hypothesis of differential gender responsiveness to prodrug social influences. ALERT Plus modified several cognitive outcomes that tap social influences for drinking and marijuana use among at-risk girls but not among at-risk boys. It increased perceptions that friends would respect one for not

drinking, and for marijuana, it increased perceptions that one could successfully resist social pressures to use while decreasing perceptions that use is prevalent and approved of by one's friends. Moreover, each of these cognitions mediated the effects of ALERT Plus on at-risk girls' drinking or marijuana use, suggesting that the program's greater success with girls is partly attributable to its greater effectiveness in modifying their beliefs about prodrug social influences and their ability to resist them.

The second explanation reflects the health belief model's emphasis on seriousness and salience of consequences. One strand of research suggests that girls are more concerned than boys are about losing control under the influence of drugs and doing something they might later regret (Simons-Morton et al., 1999); hence girls may be more responsive to information about the consequences of risky drug use and ways to avoid those consequences. ALERT Plus highlighted risks associated with loss of control (e.g., engaging in unprotected sex, looking foolish, getting in accidents, losing one's "reputation"). Consistent with this focus, the program increased perceptions that drinking has negative consequences (including the perception that drinking can cause you to do something you later regret). But it did so for girls, not for boys. And these negative beliefs did in fact mediate ALERT Plus effects on weekly drinking, high-risk alcohol use, and drinking that resulted in negative consequences. Another strand of research suggests that girls, who are more subject to depression than boys (Hankin & Abramson, 2001), may be more susceptible to beliefs that drug use can help one get away from one's problems. ALERT Plus also modified positive beliefs about drinking and marijuana use among at-risk girls, beliefs that included the perception that drug use helps one get away from one's problems. These positive beliefs in turn mediated the program's effect on weekly marijuana use and all three alcohol outcomes. Hence, the program's greater effectiveness with at-risk girls may also be partly attributable to its greater success in modifying their beliefs about positive and negative consequences of use.

The third explanation for the ALERT Plus program's greater effectiveness with at-risk girls focuses on the persuasiveness of the messenger, suggesting that girls may be more amenable to messages that come from female teachers. Differential effectiveness of same-gender teachers was cited by Graham et al. (1990), who found that girls were more favorably affected than boys by the curriculum they tested. They noted that the health educators who taught their curriculum were women. Similarly, the great majority of ALERT Plus teachers were women. Consistent with this interpretation, Perry et al. (2003) found favorable effects for boys but not girls of an enhanced DARE middle school curriculum taught primarily by male police officers. Thus, it is possible that curriculum effects for the general population of adolescents or for at-risk adolescents depend in part on gender of the instructors.

The lack of effects for at-risk boys highlights differences among at-risk boys and girls in this age group. Although successful with females, ALERT Plus failed to modify such theoretically relevant mediators as intentions to use, resistance self-efficacy, beliefs about the positive and negative consequences of use, and perceptions of social norms among their male counterparts. As noted earlier, there are several reasons why curricula like ALERT Plus might be more effective with at-risk girls. Additional studies are needed to identify program modifications that might better address mediators of drug use among at-risk boys and ascertain whether male teachers are more persuasive with these youth than are female teachers.

Three limitations of this analysis should be noted. First, it was based on self-report data. We sought to ensure data validity by collecting a saliva specimen from all students (except those who declined) and indicating that specimens might be tested to detect

recent use. For a random sample of 654 specimens actually tested, self-reported tobacco use was highly consistent with cotinine levels. In addition, internal consistency of self-report data on drug use was quite high within and across waves of data collection. Hence we believe that the findings based on these data were not significantly affected by error or deliberate underreporting. Second, although we were able to maintain contact with most students across multiple years of data collection, attrition was neither negligible nor random. Although weighting the sample sharply reduced the known bias attributable to attrition, we cannot be sure that all such effects were eliminated. Third, as in other studies, we defined risk on the basis of drug use occurring prior to baseline data collection. It is possible that our findings might be different if based on alternative indicators of risk such as socioeconomic status.

Implications for Prevention Practice

This study shows that drug prevention during high school can be effective with at-risk youth, who are particularly likely to escalate drug use and experience drug-related harms. The findings counter arguments that prevention programs help those that need them least, providing evidence that prevention can actually work with precisely those adolescents who need help most. Such evidence bolsters the rationale for prevention and argues for including a focus on mitigating high-risk use in high school prevention programs. Such a focus would likely enhance program effectiveness with vulnerable youth, particularly girls who start smoking or using marijuana at an early age. At the same time, the finding that ALERT Plus did not help at-risk boys points out how much we still need to learn about what works for boys and girls at varying levels of risk. At the very least, practitioners need data on program effectiveness for both males and females. Future research should be attentive to gender differences in the effectiveness of drug prevention programs and should elucidate the reasons for such differences if they consistently emerge. Although aspects of curriculum delivery (e.g., gender of the instructors) may be relevant, it seems especially important to focus on identifying risk factors affecting onset of use, progression to regular and high-risk use, and negative consequences of use for adolescents overall and for at-risk girls and boys in particular. Curricula might then be revised to emphasize risk factors of primary importance.

Notes

1. The full study design randomized 48 clusters. However, assignment of 3 clusters was restricted to the ALERT or ALERT Plus conditions. Those clusters were not included in this analysis.

2. Because we did not measure consequences of marijuana use at baseline, we used baseline marijuana use as a covariate in this model.

References

Adger, H. (1992). Alcohol and other drug use and abuse by adolescents. In D. E. Rogers & E. Ginzberg (Eds.), *Adolescents at risk: Medical and social perspectives* (pp. 80-95). Boulder, CO: Westview.

Amaro, H., Blake, S. M., Schwartz, P. M., & Flinchbaugh, L. J. (2001). Developing theory-based substance abuse prevention programs for young adolescent girls. *Journal of Early Adolescence*, *21*, 256-293.

Bandura, A. (1977). Self efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*, 191-215.

Bandura, A. (1985). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice Hall.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182.

Botvin, G. J., Baker, E., Dusenbury, L., Botvin, E., & Diaz, T. (1995). Long-term follow-up results of a randomized drug abuse prevention trial in a White middle-class population. *Journal of the American Medical Association*, *273*, 1106-1112.

Collins, R. L., Ellickson, P. L., McCaffrey, D., & Hambarsoomians, K. (2005). Saturated in beer: Awareness of beer advertising in late childhood adolescence. *Journal of Adolescent Health*, *37*, 29-36.

DeWit, D. J., Adlaf, E. M., Offord, D. R., & Ogborne, A. C. (2000). Age at first alcohol use: A risk factor for the development of alcohol disorders. *American Journal of Psychiatry*, *157*, 745-750.

Dielman, T. E. (1994). School-based research on the prevention of adolescent alcohol use and misuse: Methodological issues and advances. *Journal of Research on Adolescence*, *4*, 271-293.

Donaldson, S. I., Graham, J. W., & Hansen, W. B. (1994). Testing the generalizability of intervening mechanism theories: Understanding the effects of adolescent drug use prevention interventions. *Journal of Behavioral Medicine*, *17*, 195-216.

Donaldson, S. I., Sussman, S., MacKinnon, D. P., Severson, H. H., Glynn, T., Murray, D. M., et al. (1996). Drug abuse prevention programming. *American Behavioral Scientist*, *39*, 868-883.

DuRant, R. H., Smith, J. A., Kreiter, S. R., & Krowchuk, D. P. (1999). The relationship between early age of onset of initial substance use and engaging in multiple health risk behaviors among young adolescents. *Archives of Pediatrics and Adolescent Medicine*, *153*, 286-291.

Eisen, M., Zellman, G. L., Massett, H. A., & Murray, D. M. (2002). Evaluating the lions-quest "skills for adolescence" drug education program: First-year behavior outcomes. *Addictive Behaviors*, *27*, 619-632.

Ellickson, P. L., & Bell, R. M. (1990). Drug prevention in junior high: A multi-site longitudinal test. *Science*, *247*, 1299-1305.

Ellickson, P. L., McCaffrey, D. F., Ghosh-Dastidar, B., & Longshore, D. L. (2003). New inroads in preventing adolescent drug use: Results from a large-scale trial of Project ALERT in middle schools. *American Journal of Public Health*, *93*, 1830-1836.

Ellickson, P. L., Tucker, J. S., & Klein, D. J. (2001). High-risk behaviors associated with early smoking: Results from a 5-year follow-up. *Journal of Adolescent Health*, *28*, 465-473.

Ellickson, P. L., Tucker, J. S., & Klein, D. J. (2003). Ten-year prospective study of public health problems associated with early drinking. *Pediatrics*, *111*, 949-955.

Flay, B. R., Ryan, K. B., Best, J. A., Brown, K. S., Kersell, M. W., D'Avernas, J. R., et al. (1985). Are social-psychological smoking prevention programs effective? The Waterloo study. *Journal of Behavioral Medicine*, *8*, 37-59.

Gerstein, D. R., & Green, L. W. (1993). *Preventing drug abuse: What do we know?* Washington, DC: National Academy of Sciences.

Ghosh-Dastidar, B., Longshore, D., Ellickson, P. L., & McCaffrey, D. F. (2004). Modifying pro-drug risk factors in adolescents: Results from Project ALERT. *Health Education & Behavior*, *31*, 318-334.

Graham, J. W., Johnson, C. A., Hansen, W. B., Flay, B. R., & Gee, M. (1990). Drug use prevention programs, gender, and ethnicity: Evaluation of three seventh-grade project SMART cohorts. *Preventive Medicine*, *19*, 305-313.

Graubard, B. I., & Korn, E. L. (1999). Predictive margins with survey data. *Biometrics*, *55*, 652-659.

Griffin, K. W., Botvin, G. J., Doyle, M. M., Diaz, T., & Epstein J. A. (1999). A six-year follow-up study of determinants of heavy cigarette smoking among high-school seniors. *Journal of Behavioral Medicine*, *22*, 271-284.

Hankin, B. L., & Abramson, L. Y. (2001). Development of gender differences in depression: An elaborated cognitive vulnerability-transactional stress theory. *Psychological Bulletin*, *127*, 773-796.

Hingson, R. W., Heeren, T., Jamanka, A., & Howland, J. (2000). Age of drinking onset and unintentional injury involvement after drinking. *Journal of the American Medical Association*, *284*, 1527-1533.

Johnson, C. A., Pentz, M. A., Weber, M. D., Dwyer, J. H., Baer, N., MacKinnon, D. P., et al. (1990). Relative effectiveness of comprehensive community programming for drug abuse prevention with high-risk and low-risk adolescents. *Journal of Consulting and Clinical Psychology*, *58*(4), 1-10.

Lynskey, M. T., Heath, A. C., Bucholz, K. K., Slustke, W. S., Madden, P. A., Nelson, E. C., et al. (2003). Escalation of drug use in early-onset cannabis users vs. co-twin controls. *Journal of the American Medical Association*, *289*, 427-433.

McCaffrey, D. F., & Bell, R. M. (2006). Improved hypothesis testing for coefficients in generalized estimating equations with small samples of clusters [Electronic version]. *Statistics in Medicine*, *25*, 4081-4098.

Novacek, J., Robert, R., & Robert, H. (1991). Why do adolescents use drugs? Age, sex and user differences. *Journal of Youth and Adolescence*, *20*, 475-492.

Orlando, M., Ellickson, P. L., McCaffrey, D. F., & Longshore, D. (2005). Understanding the impact of a school-based drug prevention program: The role of program-targeted intervening variables. *Prevention Science*, *6*, 35-46.

Perry, C. L., Komro, K. A., Veblen-Mortenson, S., Bosma, L. M., Farbakhsh, K., Munson, K. A., et al. (2003). A randomized controlled trial of the middle and junior high school D.A.R.E. and D.A.R.E. plus programs. *Archives of Pediatrics and Adolescent Medicine*, *157*, 178-184.

Rohrbach, L. A., & Milam, J. (2003). Gender issues in substance abuse prevention. In W. J. Bukoski & Z. Sloboda (Eds.), *Handbook of drug abuse theory, science, and practice* (pp. 343-355). New York: Plenum.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education Quarterly*, *15*, 175-183.

Schafer, J. L. (Ed.). (1997). *Analysis of incomplete multivariate data*. London: Chapman & Hill.

Schafer, J. L. (1999). *Software for multiple imputation*. Retrieved September 13, 2001, from www.stat.psu.edu/~jls/misoftwa.html#win

Shope, J. T., Copeland, L. A., Marcoux, B. C., & Kamp, M. E. (1996). Effectiveness of a school-based substance abuse prevention. *Journal of Drug Education*, *26*, 323-337.

Simons-Morton, B., Haynie, D. L., Crump, A. D., Saylor, K. E., Eitel, P., & Yu, K. (1999). Expectancies and other psychosocial factors associated with recent smoking among early adolescent boys and girls. *Addictive Behaviors*, *24*, 229-238.

Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equation models. In S. Leinhart (Ed.), *Sociological methodology 1982* (pp. 290-312). San Francisco: Jossey-Bass.

Spoth, R. L., Redmond, C., Trudeau, L., & Shin, C. (2002). Longitudinal substance initiation outcomes for a universal preventive intervention combining family and school programs. *Psychology of Addictive Behaviors*, *16*, 129-134.

Sussman, S., Dent, C. W., Burton, D., Stacy, A. W., & Flay, B. R. (1995). *Developing school-based tobacco use prevention and cessation programs*. Thousand Oaks, CA: Sage.

Tobler, N. S. (1997). Meta-analysis of adolescent drug prevention programs: Results of the 1993 meta-analysis. In W. J. Bukoski (Ed.), *Meta-analysis of drug abuse prevention programs, National Institute on Drug Abuse Monograph 170* (pp. 5-68). Rockville, MD: NIDA.

Wells, K. B., Sherbourne, C., Schoenbaum, M., Duan, N., Meredith, L., Unutzer, J., et al. (2000). Impact of disseminating quality improvement programs for depression in managed primary care: A randomized controlled trial. *Journal of the American Medical Association*, *283*, 212-220.

Yamaguchi, K., & Kandel, D. (1984). Patterns of drug use from adolescence to young adulthood: II. Sequences of progression. *American Journal of Public Health*, *74*, 668-672