

## Testing the Generalizability of Intervening Mechanism Theories: Understanding the Effects of Adolescent Drug Use Prevention Interventions

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*Outcome research has shown that drug prevention programs based on theories of social influence often prevent the onset of adolescent drug use. However, little is known empirically about the processes through which they have their effects. The purpose of the present study was to evaluate intervening mechanism theories of two program models for preventing the onset of adolescent drug use. Analyses based on a total of 3077 fifth graders participating in the Adolescent Alcohol Prevention Trial revealed that both normative education and resistance training activated the causal processes they targeted. While beliefs about prevalence and acceptability significantly mediated the effects of normative education on subsequent adolescent drug use, resistance skills did not significantly predict subsequent drug use. More impressively, this pattern of results was virtually the same across sex, ethnicity, context (public versus private school students), drugs (alcohol, cigarettes, and marijuana) and levels of risk and was durable across time. These findings strongly suggest that successful social influence-based prevention programs may be driven primarily by their ability to foster social norms that reduce an adolescent's social motivation to begin using alcohol, cigarettes, and marijuana.*

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KEY WORDS: school-based drug prevention; normative education; resistance training; social influence; alcohol use; smoking; marijuana use.

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## INTRODUCTION

Alcohol, cigarette, and other drug use is destructive behavior routinely practiced by Americans. For example, tobacco use accounts for one of every six deaths in America annually, making it the most preventable cause of death [U.S. Department of Health and Human Services (DHHS), 1989]. Alcohol is a major risk factor for liver disease, and it is involved in approximately half of all homicides, suicides, and motor vehicle fatalities (DHHS, 1991). Early use of alcohol, tobacco, and marijuana is related to substance abuse in later adolescence and adulthood (Fleming *et al.*, 1982; Kandell, 1982; Rachael *et al.*, 1982; Robins and Pryzbeck, 1985). Interventions designed to prevent, or at least delay, the onset of adolescent substance use hold great promise for preventing disease and promoting public health and well-being.

Although there are many identified risk factors for adolescent substance use [e.g., extreme economic deprivation, family dysfunction, parental drug use, early and persistent behavioral problems, school failure (see Hawkins *et al.*, 1992)], association with drug-using peers is often found to be one of the strongest predictors of the onset of adolescent drug use (e.g., Brook *et al.*, 1990, Kandell, 1986; Levanthal and Cleary, 1980; Newcomb and Bentler, 1986). Consequently, adolescent drug use prevention programs most often attempt to develop effective social influence resistance strategies for their participants.

School-based adolescent drug prevention programs implemented in the 5th through the 10th grades are by far the most popular and heavily researched. A recent comprehensive review of the literature on the effects of school-based adolescent drug prevention programs revealed that programs based on social influence strategies demonstrated predominantly positive outcomes (63%), while 26% were neutral and 11% actually produced harmful outcomes (Hansen, 1992). Although drug prevention programs based on social psychological theories of social influence have been successful in preventing the onset of drug use (see Botvin and Wills, 1985; Ellickson and Bell, 1990; Flay, 1985; Graham *et al.*, 1990; Hansen and Graham, 1991; Hansen *et al.*, 1988b; Pentz *et al.*, 1989), evaluation researchers **have** not demonstrated the individual-level processes through which these programs have their effects. McCaul and Glasgow (1985) suggest that neglect of the assessment and analysis of mediating mechanisms in prevention research has impaired the ability to consistently design successful prevention programs.

Relatively recent reviews of the scientific literature point out that a number of research issues related to social influence focused drug prevention programs still need to be addressed (Bangert-Drowns, 1988; Bruvold

and Rundall, 1988; Hansen, 1992; Hawkins *et al.*, 1992; Mosokowitz, 1989; Tobler, 1986). Some of these issues include the following.

- Why do prevention programs achieve or fail to achieve their objectives?
- In what grade(s) should drug prevention interventions be implemented?
- Is there a generalizable effect across drugs? For example, do alcohol prevention programs, with curricula emphasizing mainly alcohol use prevention, prevent the onset of cigarette and marijuana use as well?
- How durable are the effects of drug prevention programs? That is, how well do prevention effects hold up over time?
- How do contextual factors influence the effectiveness of programs? For example, do they work the same in public versus private schools?
- In what ways do participant characteristics influence the effectiveness of drug prevention programs? Do they work equally well for males versus females, across ethnic groups, and across adolescents with various levels of risk?

Theory-driven evaluation approaches are well suited to address these issues.

### **Theory-Driven Evaluation**

In recent years there has been much discussion about moving beyond traditional “atheoretical” or “black-box” outcome program evaluations to theory-driven or process analyses (see Bickman, 1987; Chen and Rossi, 1983, 1987; Lipsey, 1993, 1988; Lipsey and Pollard, 1989). Advantages of the theory-driven approach are numerous. For example, program theory can (1) help identify pertinent variables and how, when, and on whom they should be measured, (2) permit sources of extraneous variance to be identified and controlled, (3) alert the researcher to potentially important or intrusive interactions (e.g., differential subject response to treatment), (4) help distinguish between the validity of the program implementation and the validity of the program theory, (5) dictate the proper statistical model for data analysis and the tenability of the assumptions required in that model, and, maybe most importantly, (6) help develop a cumulative knowledge base about how programs work and when they work (Bickman, 1987; Lipsey, 1993; Lipsey and Pollard, 1989). In the current investigation we concentrated our efforts on evaluating the generalizability of intervening mechanism theories (Chen, 1990).

Unlike traditional outcome evaluations, which assess mainly input-output relationships, the evaluation of intervening mechanism theories involves identifying the underlying causal processes that link a program with its outcomes. If a program is unsuccessful, intervening mechanism evaluation determines whether failure is due to the inability of the program to activate the causal processes that the theory predicts ("program failure") or an invalid program theory ["theory failure" (Chen, 1990)]. Stated another way, a program may disappoint because a flawed theory was implemented or because a good theory was poorly implemented (Lipsey and Pollard, 1989). The specific purpose of the present study was (1) to assess the validity of intervening mechanism theories of two school-based adolescent drug use prevention interventions and (2) to evaluate the generalizability of each intervening mechanism theory.

### Adolescent Alcohol Prevention Trial

The present investigation is part of the evaluation of the Adolescent Alcohol Prevention Trial (AAPT), a longitudinal drug prevention intervention assessing the effectiveness of two social psychology-based strategies for preventing the onset of adolescent drug use. The first strategy, Resistance Skills Training (RT), was designed to give adolescents the behavioral skills necessary to refuse explicit drug offers. This strategy is based on the assumption that the reason many adolescents begin using drugs is that they lack the appropriate social skills to refuse drug offers made by their peers, older siblings, and others (i.e., they don't know how to "just say no").

Research has shown that adolescents frequently overestimate the prevalence and acceptability of drug use among their peers (see Hansen, 1992). Prevalence and acceptability beliefs have been shown to be important risk factors for the onset of adolescent drug use. The second strategy, Normative Education (NORM), was designed specifically to combat the influence of **these** passive social pressures [i.e., social modeling and overestimation of friend's use (see Graham *et al.*, 1991)]. The normative education program focused on correcting erroneous perceptions about the prevalence and acceptability of adolescent substance use and on establishing conservative group norms.

In addition, both programs included instruction about the social and health consequences of adolescent drug use. This component was called Information About Consequences of Use (ICU).

While other researchers have looked at the effectiveness of drug prevention programs that target both active and passive forms of social

influence, a unique feature of the **AAPT** design is that it allows for the examination of the effects of each program component separately (all components are usually combined into one program). That is, **AAPT** was designed to examine the “active ingredient(s)” in social influence-based adolescent drug prevention programs. This was accomplished by randomly assigning school units into one of four experimental conditions: (1) **RT** (Resistance Skills Training + **ICU**), (2) **NORM** (Normative Education + **ICU**), (3) **COMBINED** (Resistance Skills Training + Normative Education + **ICU**), and (4) **ICU** (**ICU** only). A summary of this 2 x 2 factorial design is given in Table I.

### Hypotheses

The purpose of the present study was to test the theoretical underpinnings of each program model. Specifically, **we tested** the following hypotheses.

- **Adolescents** who receive Resistance Skills Training will have significantly better resistance skills than adolescents who do not receive Resistance Skills Training, and resistance skills will significantly predict subsequent adolescent drug use.
- **Adolescents** who receive Normative Education will provide significantly lower estimates of the prevalence of drug offers in their school than adolescents who do not receive Normative Education, and prevalence estimates will significantly predict subsequent adolescent drug use.
- **Adolescents** who receive Normative Education will believe that drug use is less acceptable than adolescents who do not receive Normative Education, and beliefs about acceptability will significantly predict subsequent adolescent drug use.

A conceptual process model summarizing the hypotheses appears in Fig. 1.

Table 1. Adolescent Alcohol Prevention Trial Research Design

Resistance training	Normative education	
	No	Yes
No	<b>ICU</b>	<b>NORM (+ ICU)</b>
Yes	<b>RT (+ ICU)</b>	<b>COMBINED (RT + NORM + ICU)</b>

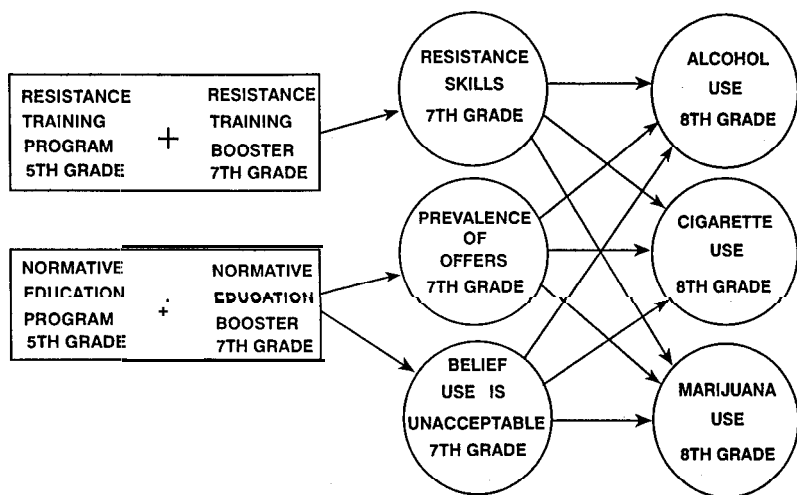


Fig. 1. Conceptual process model.

## METHOD

### Participants

Participants were students from 229 classrooms from 124 elementary schools in Los Angeles or San Diego County who received one of four Adolescent Alcohol Prevention Trial (AAPT) curricula. The analyses presented in this paper are based on students who completed a fifth-grade pretest and program, a seventh-grade booster program and process questionnaire, and an eighth-grade posttest (described below). A total of 3077 students (53% females and 47% males; 57% whites, 27% Hispanics, 10% Asians, 3% African-Americans, and 4% other ethnic groups; 62% attending public schools and 38% attending private schools) met these criteria, approximately 62% of the original sample of students who had completed the pretest and presumably received the main program in fifth grade.

### Experimental Design

Based on junior high school feeder patterns and geographical considerations, the 124 elementary schools were divided into 48 independent school units. Using a procedure designed to maximize pretest comparability

on relevant measures (Graham et al., 1984a), the 48 school units were randomly assigned to one of four experimental conditions. Fifth-grade students attending these schools received a main version of one of the programs (conditions) in fifth grade and a follow-up booster program in seventh grade (all seventh-grade booster programs were condensed versions of the original program that emphasized the main issues). The main programs are described below.

The first condition, Information About Consequences of Use (ICU), consisted of four 45-min lessons about the health and social consequences of using alcohol and other drugs. The second condition, Resistance Skills Training (RT), consisted of four lessons about consequences of using substances and five lessons that helped students to identify and resist peer and advertising **pressure** to use alcohol and other substances. The third condition, Normative Education (NORM), included four lessons about consequences and five lessons that corrected erroneous perceptions of prevalence and acceptability of alcohol and drug use among peers and established a conservative normative school climate regarding substance use. The fourth condition (COMBINED) included three lessons about consequences, three and one-half lessons teaching resistance skills, and three and one-half lessons establishing conservative norms (for details of program content, see Hansen and Graham, 1991; Hansen et al., 1988a, 1991).

To define these four groups, two program-group membership variables were dummy coded as follows. Participants receiving the resistance training lessons in the fifth and seventh (booster) grades were given a "1" for the variable **RT**<sub>57</sub>. Participants receiving normative education in the fifth and **seventh** (Booster) grades received a "1" for the variable **NORM**<sub>57</sub>. Those not receiving normative education received a "-1" for **NORM**<sub>57</sub>.

## Measures

**Drug Use.** The main dependent variables for this study were alcohol, cigarette, and marijuana use. An alcohol use index was created that consisted of three items: "How many drinks of alcohol have you had in your whole life?" ". . . in the past month?" and ". . . in the past week?" Response categories for each of the alcohol use items were 1 = "none" or "only sips FOR RELIGIOUS SERVICE"; 2 = "only sips (NOT for religious service)"; 3 = "part or all of one drink"; 4 = "2 to 4"; 5 = "5 to 10"; 6 = "11 to 20"; 7 = "21 to 100"; and 8 = "more than 100." Cigarette use was measured by three similar items: "How many cigarettes have you smoked in your whole life?" ". . . in the past month?" and ". . . in the past week?" The response categories were similar to the alcohol items **de-**

scribed above. Marijuana use was measured by two dichotomous (yes/no) items: "Have you ever used marijuana in your whole life?" and ". . . in the past month?" The items for each substance were standardized (mean = 0, SD = 1) and averaged separately for each grade. Nine behavioral measures were completed. These include alcohol use at fifth ( $ALC_5$ ), eighth ( $ALC_8$ ), and ninth ( $ALC_9$ ) grades, smoking at fifth ( $SMK_5$ ), eighth ( $SMK_8$ ), and ninth ( $SMK_9$ ) grades, and marijuana use at fifth ( $MAR_5$ ), eighth ( $MAR_8$ ), and ninth ( $MAR_9$ ) grades.

**Resistance Skills.** Resistance skills (RESIST) were measured by a behavioral assessment procedure described in some detail by Graham et al. (1989) and Rohrbach et al. (1987). Briefly, participants were removed from their classrooms one at a time. A same-sex classmate (previously trained) then made a persistent role play alcohol offer to the participant. The participant's response was observed by (1) two classmates (the offerer and another student observer of the opposite sex), (2) two adult data collectors, and (3) the participant him- or herself. After the role play each of these people completed a questionnaire pertaining to the participant's performance. Several items assessed the skill with which the offer was rejected. These items included ratings of amount of eye contact, loudness of voice, and posture. There were also two general items asking how well the student stood up for him- or herself and how well he or she resisted the alcohol offer. Each of the observers was also asked about the likelihood that the subject would use alcohol in the near-future. In the present study, resistance skills in seventh grade ( $RESIST_7$ ) were measured by the standardized average of (1) the standardized average of the classmates' ratings, (2) the standardized average of the adult data collectors' ratings, and (3) the standardized average of the self-reports, collected after the booster program in seventh grade.

**Prevalence of Offers.** A process questionnaire was administered immediately following the implementation of the fifth-grade program and the seventh-grade booster. The process questionnaire also contained questions that assessed the participants' beliefs about the prevalence of alcohol, cigarette, and marijuana offers at their school. Three items answered in seventh grade were used to measure the participants' beliefs about the prevalence of offers at their school: "A lot of people in my school offer alcoholic drinks to their friends," "A lot of people who go to my school offer cigarettes to their friends," and "A lot of people who go to my school offer marijuana to their friends." Response categories for the items were 1 = "strongly disagree"; 2 = "disagree"; 3 = "agree"; and 4 = "strongly agree." The three items answered after the booster program in seventh grade were standardized and averaged ( $OFFER_7$ ).

*Use Is Not Acceptable.* The process questionnaire also contained two adolescent alcohol use scenarios (the user was 14 in the first scenario and 17 years old in the second). Beliefs that use is not acceptable were measured by two items (beliefs that friends think use is not acceptable and own belief that use is not acceptable) about the appropriateness of adolescent alcohol use in each scenario (a total of four items). The questions answered in the seventh grade were standardized, averaged, and then used in the main analyses of this study (NA<sub>7</sub>).

### Reliability and Validity

Reliability and factor analytic techniques confirmed the adequacy of the measures used in this sample. For example, the internal consistency (coefficient alpha) of the measures was reasonable. Coefficient alphas were as follows: fifth-grade alcohol use (.74), fifth-grade smoking (.65), fifth-grade marijuana use (.46), seventh-grade resistance skills (.68), seventh-grade prevalence of offers estimate (.77), seventh-grade beliefs about the unacceptability of alcohol use (.87), eighth-grade alcohol use (.82), eighth-grade smoking (.87), eighth-grade marijuana use (.70), ninth-grade alcohol use (.85), ninth-grade smoking (.88), and ninth-grade marijuana use (.76). Further, Graham *et al.*, (1989) reported considerable convergent validity of ratings of resistance skills using the behavioral assessment procedure described above, and reliability for a very similar set of items used in a comparable sample has been reported elsewhere to be very good (Graham *et al.*, 1984b).

### Data Analysis

To assure the quality of the covariance matrices analyzed, the distribution of each variable was inspected for accuracy, missing data problems, and skewness, and appropriate adjustments were made. For example, the distributions of all of the substance use variables deviated substantially from normality. Logarithmic transformations were employed on the substance use variables to reduce skew.

Preliminary analyses revealed that there were significant differences between adolescent subgroups on some of the main variables. For example, adolescents attending public school had significantly higher levels of eighth-grade smoking and marijuana use, seventh-grade offers, and had weaker beliefs about the unacceptability of alcohol use than adolescents attending private schools. Males reported significantly more eighth-grade alcohol use, smoking, and marijuana use and had poorer seventh-grade resistance skills

and weaker beliefs about the unacceptability of alcohol use than females. White students reported more eighth-grade alcohol and marijuana use, had better seventh-grade resistance skills, and gave higher prevalence of offers estimates and lower ratings of beliefs about the unacceptability of alcohol use than **nonwhites**.<sup>4</sup> The most meaningful way to account for these differences was to include sex, ethnicity, and school type (public versus private) as covariates in all analyses. A summary of the differences between subgroups is given in Table II.

The main purpose of this study was to understand why adolescent drug use onset was or was not affected by the interventions. That is, we were interested in understanding the robustness of intervening mechanism theories at the individual level of analysis. The randomized experimental unit is the **school**. Therefore, to understand the causal paths in our models (i.e., program to mediator), we first conducted ANCOVAs controlling for fifth-grade use ( $ALC_5$ ,  $SMK_5$ ,  $MAR_5$ ), sex, ethnicity, and type of school to examine the effects of the interventions on the proximal program factors (mediating variables) at the school, classroom, and individual levels of analysis.

The main analyses for this study consisted of a series of path analyses. The first analysis examined the indirect effects of Resistance Skills Training<sub>57</sub> and Normative Education<sub>57</sub> on  $ALC_8$ ,  $SMK_8$ , and  $MAR_8$ , controlling for  $ALC_5$ ,  $SMK_5$ ,  $MAR_5$ , sex, ethnicity, and type of school ( $N = 3077$ ). To test the generalizability of the intervening mechanism theories, we subsequently examined the theoretical models for females, males, whites, Hispanics, nonwhites, adolescents attending public schools, adolescents attending **private** schools, adolescents at elevated risk (i.e., adolescents that had used at least one of the substances before the programs were implemented in the fifth grade), and ninth-grade use separately.

Only a third of the students were randomly selected to complete the behavioral assessment procedure. Since two-thirds of the behavioral assessment data were missing completely at random for all of the analyses (see Graham and Donaldson, 1993; Little and Rubin, 1989), the data were analyzed with a multiple-group procedure using LISREL (Jöreskog and Sörbom, 1987) recently described by Allison (1987) and by Muthen *et al.* (1987). This maximum-likelihood procedure produces unbiased estimates of model parameters with missing data when the data are missing completely at random or when the cause of missingness is included in the

<sup>4</sup>Approximately 43% of the participants were nonwhite. The majority of the nonwhite category was Hispanic (27% of the entire sample). As a covariate, it seemed most appropriate to define ethnicity as a dichotomy (57% white, 43% nonwhite). However, Hispanics were analyzed separately in the main analyses. The sample sizes for the other ethnic categories were too small to permit meaningful analyses.

Table II. Mean Differences Between Subgroups on Pretests, Mediators, and Posttests

	Type of school			Sex			Ethnicity		
	Public	Private	<i>p</i>	Males	Females	<i>p</i>	Whites	Nonwhites	<i>p</i>
Alcohol use									
N	1908	1169		1446	1631		1754	1323	
5th grade	.07 (.14)	.09 (.17)	**	.09 (.16)	.07 (.14)	**	.09 (.16)	.06 (.14)	**
8th grade	.15 (.18)	.14 (.16)	ns	.15 (.18)	.14 (.16)	**	.15 (.18)	.13 (.17)	**
Smoking									
N	1908	1169		1446	1631		1754	1323	
5th grade	.04 (.12)	.04 (.12)	ns	.05 (.13)	.03 (.10)	**	.04 (.12)	.04 (.12)	ns
8th grade	.11 (.18)	.09 (.14)	**	.11 (.18)	.09 (.16)	**	.10 (.18)	.09 (.15)	ns
Marijuana use									
N	1908	1169		1446	1631		1754	1323	
5th grade	.01 (.09)	.01 (.07)	ns	.01 (.10)	.01 (.07)	*	.01 (.08)	.01 (.09)	ns
8th grade	.05 (.17)	.02 (.10)	**	.05 (.17)	.03 (.13)	**	.05 (.17)	.03 (.12)	**
Resistance skills									
N	599	412		509	502		579	432	
	.03 (.83)	-.06 (.71)	ns	-.07 (.79)	.07 (.77)	**	.11 (.77)	-.15 (.78)	**
Prevalence of offers									
N	1908	1169		1446	1631		1754	1323	
	-.24 (.87)	.39 (.61)	**	-.01 (.86)	.00 (.80)	ns	-.07 (.85)	.10 (.80)	**
Use is unacceptable									
N	1908	1169		1446	1631		1754	1323	
	-.04 (.89)	.07 (.79)	**	-.05 (.91)	.04 (.80)	**	-.03 (.89)	.04 (.80)	*

Note. Means (standard deviations).

\**p* < .05.\*\**p* < .01.

model. Analyses conducted using this procedure are much more accurate than the alternative strategies of mean substitution, single imputation, pairwise deletion, or listwise deletion (Graham et al., 1993c; Little and Rubin, 1987, 1989; Rubin, 1987).

## RESULTS

### Effects of Programs on Mediators

As predicted, Resistance Skills Training<sub>57</sub> significantly improved RESIST<sub>7</sub> at the individual ( $F = 38.56, p < .01$ ), classroom ( $F = 20.76, p < .01$ ), and school ( $F = 14.12, p < .01$ ) levels (Table III). Normative Education<sub>57</sub> significantly improved RESIST<sub>7</sub>, OFFERS<sub>7</sub>, and NA<sub>7</sub> at the individual (RESIST<sub>7</sub>  $F = 10.22, p < .01$ ; OFFERS<sub>7</sub>  $F = 51.96, p < .01$ ; NA<sub>7</sub>  $F = 35.94, p < .01$ ), classroom (RESIST<sub>7</sub>  $F = 10.09, p < .01$ ; OFFERS<sub>7</sub>  $F = 17.27, p < .05$ ; NA<sub>7</sub>  $F = 13.09, p < .01$ ), and school (RESIST<sub>7</sub>  $F = 9.02, p < .01$ ; OFFERS<sub>7</sub>  $F = 8.55, p < .05$ ; NA<sub>7</sub>  $F = 6.01, p < .05$ ) levels.<sup>5</sup> The Resistance Skills Training<sub>57</sub> X Normative Education<sub>57</sub> interaction term was significantly related to OFFERS<sub>7</sub> at the individual ( $F = 8.69, p < .01$ ) and classroom ( $F = 4.24, p < .01$ ) levels.<sup>6</sup>

### Main Process Analyses

Using the multiple-group procedure described above, unstandardized regression weights ( $b$ ), standard errors (SE), and probability values ( $p$ ) were computed for the paths of interest in each of the models. This information was also used to compute the indirect effects (IE) and the standard errors of the indirect effects (SE<sub>IE</sub>) of the interventions on the drug use variables (see Baron and Kenny, 1986; Bollen, 1987; MacKinnon et al., 1991; Sobel, 1986).

Path analysis controlling for ALC<sub>5</sub>, SMK<sub>5</sub>, MAR<sub>5</sub>, sex, ethnicity, and type of school was conducted for the overall model predicting eighth-grade

<sup>5</sup>These analyses demonstrate that the interventions significantly affect proximal program factors (mediators) in the same way at all three levels of analysis. Multilevel analysis or hierarchical linear modeling that corrects for the intraclass correlation without a substantial loss of power could also be used to demonstrate the causal effect of the interventions (e.g., see Aitkin and Longford, 1986; Bryk and Raudenbush, 1992; Kreft, 1993). However, the results reported here are even more impressive because we have found the effects under the most conservative analysis (i.e., school-level analysis).

<sup>6</sup>The purpose of this study was to understand the main effects of RT<sub>57</sub> and NORM<sub>57</sub>. Although we address the implications of the interaction term (RT<sub>57</sub> X NORM<sub>57</sub>) in the Discussion, it was not of interest (or included) in the main analysis.

**Table III.** Effects of Interventions on Mediators at Three Levels of Analysis

	Resistance skills (RESIST <sub>7</sub> )	Prevalence of offers (OFFERS <sub>7</sub> )	Use is not acceptable (NA <sub>7</sub> )
Individuals ( <i>N</i> = 3077)			
RT <sub>57</sub>	38.56**	2.58	2.27
NORM <sub>57</sub>	10.22**	51.96**	35.94**
RT <sub>57</sub> X NORM <sub>57</sub>	.82	8.69**	.05
Classrooms ( <i>N</i> = 229)			
RT <sub>57</sub>	20.76**	3.90	3.75
NORM <sub>57</sub>	10.09**	17.27'	13.09**
RT <sub>57</sub> X NORM <sub>57</sub>	.60	4.24**	.53
Schools ( <i>N</i> = 48)			
RT <sub>57</sub>	14.12**	3.60	2.71
NORM <sub>57</sub>	9.02**	8.55*	6.01*
RT <sub>57</sub> X NORM <sub>57</sub>	1.32	.54	.25

Note. *F* values from ANCOVA analyses. Fifth-grade use (alcohol, smoking, marijuana), sex, ethnicity, and type of school are controlled for in the analyses. Analyses using the resistance skills measure at the individual level of analysis are based on approximately a randomly selected third of the cases (*N* = 1011).

\**p* < .05.

\*\**p* < .01.

use (*N* = 3077). The results revealed that Resistance Skills Training<sub>57</sub> significantly predicted RESIST<sub>7</sub> ( $b = .15$ ,  $SE = .02$ ,  $p < .01$ ), but RESIST<sub>7</sub> did not significantly predict ALC<sub>8</sub>, SMK<sub>8</sub>, or MAR<sub>8</sub>. The indirect effects of Resistance Skills Training<sub>57</sub> through RESIST<sub>7</sub> on ALC<sub>8</sub>, SMK<sub>8</sub>, and MAR<sub>8</sub> were not statistically significant. Normative Education<sub>57</sub> significantly predicted RESIST<sub>7</sub> ( $b = .08$ ,  $SE = .02$ ,  $p < .01$ ), OFFERS<sub>7</sub> ( $b = -.10$ ,  $SE = .01$ ,  $p < .01$ ), and NA<sub>7</sub> ( $b = .09$ ,  $SE = .02$ ,  $p < .01$ ). Further, OFFERS<sub>7</sub> and NA<sub>7</sub> significantly predicted ALC<sub>8</sub> (OFFERS<sub>7</sub>  $b = .03$ ,  $SE = .00$ ,  $p < .01$ ; NA<sub>7</sub>  $b = -.07$ ,  $SE = .00$ ,  $p < .01$ ), SMK<sub>8</sub> (OFFERS<sub>7</sub>  $b = .03$ ,  $SE = .00$ ,  $p < .01$ ; NA<sub>7</sub>  $b = -.06$ ,  $SE = .00$ ,  $p < .01$ ), and MAR<sub>8</sub> (OFFERS<sub>7</sub>  $b = .02$ ,  $SE = .00$ ,  $p < .01$ ; NA<sub>7</sub>  $b = -.04$ ,  $SE = .00$ ,  $p < .01$ ). There were significant indirect effects of Normative Education<sub>57</sub> through OFFERS<sub>7</sub> on ALC<sub>8</sub> (IE =  $-.0025$ ,  $SE_{IE} = .0005$ ,  $p < .01$ ), SMK<sub>8</sub> (IE =  $-.0025$ ,  $SE_{IE} = .0005$ ,  $p < .01$ ), and MAR<sub>8</sub> (IE =  $-.0019$ ,  $SE_{IE} = .0004$ ,  $p < .01$ ). There were also significant indirect effects of Normative Education<sub>57</sub> through NA<sub>7</sub> on ALC<sub>8</sub> (IE =  $-.0060$ ,  $SE_{IE} = .0010$ ,  $p < .01$ ), SMK<sub>8</sub> (IE =  $-.0056$ ,  $SE_{IE} = .0010$ ,  $p < .01$ ), and MAR<sub>8</sub> (IE =  $-.0038$ ,  $SE_{IE} = .0007$ ,  $p < .01$ ). A summary of the statistically significant path coefficients is shown in Fig. 2.

The generalizability of the findings for the overall model of eighth-grade use was tested by performing the same type of path analysis for nine subgroup models. Again, the models tested for eighth-grade use included

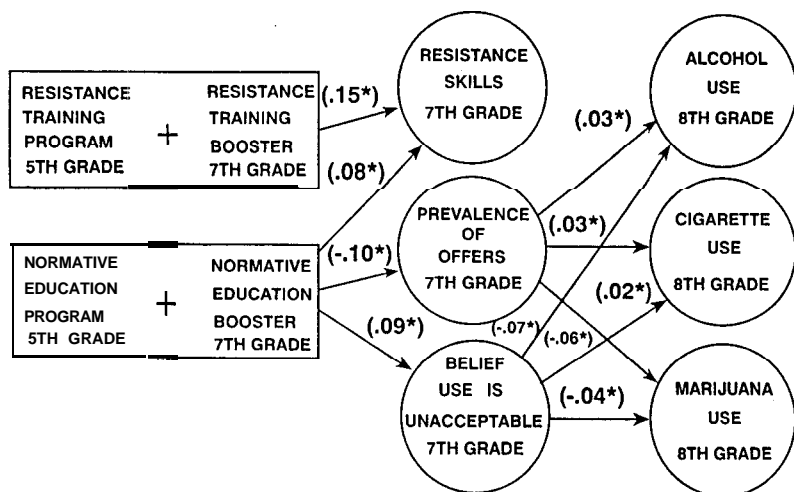


Fig. 2. Results of the path analysis predicting eighth-grade use while controlling for fifth-grade use, sex, ethnicity, and type of school.

(1) females ( $N = 1631$ ), (2) males ( $N = 1446$ ), (3) whites ( $N = 1754$ ), (4) Hispanics ( $N = 831$ ), (5) nonwhites (including Hispanics;  $N = 1323$ ), (6) public-school students ( $N = 1908$ ), (7) private-school students ( $N = 1169$ ), and (8) adolescents at elevated risk ( $N = 1135$ ). The overall model for ninth-grade use ( $N = 2706$ ) was also analyzed and reported. With a few minor exceptions,<sup>7</sup> the results revealed that the intervening mechanisms identified in the overall analysis predicting eighth-grade use are consistent across type of drug, sex, ethnicity, context of implementation (type of school), adolescents at elevated risk, and time (ninth-grade use). The  $b$  weights and standard errors for all the path analyses are given in Table IV.

## DISCUSSION

The results demonstrate convincingly that both social influence-based prevention programs activated the causal processes they targeted. That is, for the most part, resistance training significantly improved resistance skills,

<sup>7</sup>The relationship between  $NORM_{57}$  and  $OFFERS$ , for males and the relationship between  $OFFERS$ , and  $SMK_8$  for private-school students failed to meet the  $p < .01$  criterion. Although these relationships were relatively weak, they were statistically significant at  $p < .05$ . However, the relationship between  $RT_{57}$  and  $RESIST$ , for Hispanics was not statistically significant.

Table IV. Unstandardized Path Coefficients and Standard Errors for the Path Analyses

Program	Mediator	8th grade overall			Females			Males			Whites			Hispanics		
		<i>b</i>	SE		<i>b</i>	SE	<i>P</i>	<i>b</i>	SE	<i>P</i>	<i>b</i>	SE	<i>P</i>	<i>b</i>	SE	<i>P</i>
RT <sub>57</sub>	RES.7	.15	.02	*	.15	.03	*	.15	.03	*	.17	.03	*	.07	.05	ns
RT <sub>57</sub>	OFF.7	-.02	.01	ns	-.05	.02	ns	-.02	.02	ns	-.01	.02	lls	-.04	.03	ns
RT <sub>57</sub>	NA <sub>7</sub>	.02	.02	ns	.03	.02	ns	.01	.02	ns	.01	.02	ns	.03	.03	ns
NORM <sub>57</sub>	RES.7	.08	.02	*	.11	.03	*	.04	.03	ns	.04	.03	ns	.12	.05	ns
NORM <sub>57</sub>	OFF.7	-.10	.01	*	-.14	.02	*	-.05	.02	ns	-.10	.02	*	-.08	.03	*
NORM <sub>57</sub>	NA <sub>7</sub>	.09	.02	*	.10	.02	*	.09	.02	*	.09	.02	*	.09	.03	*
	Mediator	Outcome														
RES.7	ALC <sub>8</sub>	-.01	.01	ns	-.01	.01	ns	-.00	.01	ns	-.02	.01	ns	.01	.03	ns
RES.7	SMK <sub>8</sub>	-.01	.01	ns	-.01	.01	ns	-.00	.01	ns	-.01	.01	ns	.01	.01	ns
RFS.7	MAR <sub>8</sub>	.00	.01	ns	-.01	.01	ns	.01	.01	ns	.00	.01	ns	.02	.01	ns
OFF.7	ALC <sub>8</sub>	.03	.00	*	.02	.01	*	.03	.01	*	.02	.01	*	.04	.01	*
OFF.7	SMK <sub>8</sub>	.03	.00	*	.02	.01	*	.03	.01	*	.03	.01	*	.03	.01	*
OFF.7	MAR <sub>8</sub>	.02	.00	*	.02	.00	*	.02	.01	*	.02	.01	*	.04	.01	*
NA <sub>7</sub>	ALC <sub>8</sub>	-.07	.00	*	-.07	.01	*	-.06	.01	*	-.07	.00	*	-.07	.01	*
NA <sub>7</sub>	SMK <sub>8</sub>	-.06	.00	*	-.07	.00	*	-.06	.01	*	-.06	.00	*	-.06	.01	*
NA <sub>7</sub>	MAR <sub>8</sub>	-.04	.00	*	-.04	.00	*	-.05	.01	*	-.04	.00	*	-.04	.01	*

Table IV. Continued

Program	Mediator	Nonwhites			Public school			Private school			Users, 5th			9th grade overall		
		<i>b</i>	SE	<i>P</i>	<i>b</i>	SE	<i>P</i>	<i>b</i>	SE	<i>P</i>	<i>b</i>	SE	<i>P</i>	<i>b</i>	SE	<i>P</i>
RT <sub>57</sub>	RES.7	.11	.04	*	.15	.03	*	.13	.03	*	.15	.04	*	.15	.03	*
RT <sub>57</sub>	OFF.7	-.05	.02	ns	.00	.02	ns	-.03	.02	ns	-.01	.02	ns	-.01	.02	ns
RT <sub>57</sub>	NA <sub>7</sub>	.03	.02	ns	.01	.02	ns	.04	.02	ns	.04	.03	ns	.03	.02	ns
NORM <sub>57</sub>	RES.7	.13	.04	*	.06	.03	*	.11	.03	*	.15	.04	*	.07	.03	*
NORM <sub>57</sub>	OFF.7	-.08	.02	*	-.08	.02	*	-.11	.02	*	-.07	.02	*	-.09	.02	*
NORM <sub>57</sub>	NA <sub>7</sub>	.09	.02	*	.08	.02	*	.10	.02	*	.13	.03	*	.08	.02	*
Mediator	Outcome															
RES.7	ALC <sub>8</sub>	.00	.01	ns	-.01	.01	ns	-.01	.01	ns	-.01	.01	ns	.00	.01	ns
RES.7	SMK <sub>8</sub>	-.01	.01	ns	-.01	.01	ns	-.01	.01	ns	-.01	.01	ns	-.01	.01	ns
RES.7	MAR <sub>8</sub>	.00	.01	ns	-.00	.01	ns	.01	.01	ns	-.01	.01	ns	.01	.01	ns
OFF.7	ALC <sub>8</sub>	.03	.01	*	.02	.00	*	.02	.01	*	.04	.01	*	.03	.00	*
OFF.7	SMK <sub>8</sub>	.03	.01	*	.03	.01	*	.02	.01	ns	.03	.01	*	.03	.00	*
OFF.7	MAR <sub>8</sub>	.02	.00	*	.02	.01	*	.03	.01	*	.03	.01	*	.02	.01	*
NA <sub>7</sub>	ALC <sub>8</sub>	-.06	.01	*	-.07	.00	*	-.06	.01	*	-.07	.01	*	-.05	.00	*
NA <sub>7</sub>	SMK <sub>8</sub>	-.06	.01	*	-.07	.00	*	-.05	.01	*	-.07	.01	*	-.05	.00	*
NA <sub>7</sub>	MAR <sub>8</sub>	-.04	.00	*	-.05	.00	*	-.02	.00	*	-.05	.01	*	-.05	.00	*

\**p* < .01.

and normative education significantly reduced prevalence estimates and strengthened beliefs about the unacceptability of drug use. These findings suggest that **the** implementation of resistance training and normative education programs in the fifth grade, followed by booster programs in the seventh grade, may be highly successful strategies for developing resistance skills and for correcting misperceptions about the prevalence and acceptability of adolescent drug use.

More importantly, the results strongly support the theoretical underpinnings of normative education interventions. Not only did the normative education program affect prevalence estimates and beliefs about acceptability of drug use, but these mediators consistently predicted subsequent adolescent substance use. These findings imply that efforts to combat passive social pressures to use drugs (i.e., social modeling and overestimation of peer use) are effective components of adolescent drug prevention curricula.

Conversely, this study revealed that training adolescents to refuse explicit drug offers (i.e., to resist active social influence) did not appear to be an effective method of adolescent drug prevention. The problem is that resistance skills alone do not significantly predict subsequent adolescent drug use. The results of this study strongly suggest that the failure of resistance training is due to invalid program theory, not program failure.

Follow-up analyses of the significant Resistance Training x Normative Education interaction at the individual and classroom levels of analysis revealed that adolescents in the Resistance Training Only condition had the highest prevalence estimates. However, adolescents who had the lowest prevalence estimates received both resistance training and normative education (the COMBINED condition). This suggests that resistance training by itself may lead adolescents to believe that drug use among their peers is prevalent. This potentially harmful unintended outcome of resistance training does not appear to exist when normative education and resistance training curricula are delivered simultaneously. Future research is needed to explore alternative mechanisms through which resistance skills training might produce beneficial and/or counterproductive effects (which might offset beneficial effects). For example, resistance skills may predict subsequent substance use only when adolescents want to refuse (motivation) and they receive drug offers (exposure).

Other researchers evaluating prevention programs have also failed to find overall program effects for resistance training (e.g., see Hansen, 1992; Shope et al., 1992). Analyses of AAPT programs implemented in seventh grade confirm that while normative education consistently delays the onset of adolescent drug use, resistance skills training by itself does not appear to be an effective prevention strategy (Graham *et al.*, 1994; Hansen and

Graham, 1991). Similarly, MacKinnon *et al.* (1991) found that peer-group norms mediated prevention program effects at the school level of analysis. Overall, the evidence is beginning to suggest that successful social influence-based adolescent drug prevention programs may be driven primarily by their ability to foster social norms that reduce an adolescent's social motivation to begin using drugs.

One of the most striking aspects of the findings of this study was the stability of the intervening mechanisms across subgroups. Although we found considerable differences between subgroups on absolute levels of drug use, resistance skills, prevalence estimates, and beliefs about acceptability of adolescent drug use, the relationships between these factors were virtually the same across sex, ethnicity, context (public versus private school), drugs (even though alcohol use was the main emphasis of the programs), and levels of risk and were durable across time.

The findings of this study should be evaluated in light of several methodological limitations. First, most of the constructs measured in this study were based on one method of measurement (namely, self-report). While relying on one method of measurement is always a limitation, some prevention researchers have provided evidence for the validity of self-report measures of drug use (Biglan *et al.*, 1985; Pechacek *et al.*, 1984). For example, Pechacek *et al.* (1984) found self-reported smoking to be significantly correlated with carbon monoxide levels. Significant correlations between self-reports of smoking (.52) and alcohol use (.40) and reciprocal best friends' reports of the: subjects' use were found in the AAPT data (Graham *et al.*, 1991). Further, reliability and validity analyses conducted in this study as well as in other studies using the same or similar measures (e.g., Graham *et al.*, 1984b, 1989; Rohrbach *et al.*, 1987) have been favorable. However, one must always be cautious when interpreting analyses based on a single method of measurement (Graham *et al.*, 1993a).

Another limitation is that students who either missed the booster program or failed to provide eighth-grade outcome data were not included in the analyses. That is, we chose to focus specifically on effects for participants who received entire versions of the programs. Participant attrition is often considered a limitation of drug prevention program evaluations. Hansen *et al.* (1990) found that differential attrition in prevention programs most often leads researchers to underestimate program effects. Although traditional tests for determining whether attrition is a problem (Hansen *et al.*, 1985) failed to show significant differential attrition in our sample, recent work has shown that these tests may not always be accurate or the best way to evaluate attrition problems (Graham and Donaldson, 1993).

The external validity of this study is also questionable. Because we did not use probability sampling techniques to select schools, it is not clear whether the participants in our sample are representative of American adolescents in general or even of adolescents in Los Angeles and San Diego Counties. Although we found that the pattern of results generalizes across many **conditions** or subgroups, future research on the theoretical foundations of social influence prevention programs in other parts of the country and/or with representative samples is needed to determine the robustness of our findings.

Programmatic efforts to prevent, or at least delay, the onset of adolescent substance use are of paramount importance to our society's fight against drug abuse. This study has shown the value of prevention programs that effectively reduce passive social influences that motivate adolescents to begin using alcohol, cigarettes, and marijuana. It is our hope that the findings of this study will (1) encourage school district decision makers to ensure that their drug prevention efforts are not limited to resistance skill strategies that address only active social pressure (many programs focus only on "just say no" themes), (2) encourage program developers to describe the **process(es)** through which their programs prevent adolescent substance use, and (3) inspire other researchers to use theory-driven program evaluation approaches so that we may continue to develop a cumulative empirically based understanding of how to prevent drug abuse.

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