Relative Effectiveness of Comprehensive Community Programming for Drug Abuse Prevention With High-Risk and Low-Risk Adolescents

C. Anderson Johnson, Mary Ann Pentz, Mark D. Weber, James H. Dwyer, Neal Baer, David P. MacKinnon, and William B. Hansen
Institute for Health Promotion and Disease Prevention Research and Department of Preventive Medicine, University of Southern California School of Medicine

Brian R. Flay
Prevention Research Center, School of Public Health
University of Illinois at Chicago

This article reviews major risk factors for cigarette smoking, alcohol, and other drug abuse and promising community-based approaches to primary prevention. In a longitudinal experimental study, 8 representative Kansas City communities were assigned randomly to program (school, parent, mass media, and community organization) and control (mass media and community organization only) conditions. Programs were delivered at either 6th or 7th grade, and panels were followed through Grade 9 or 10. The primary findings were (a) significant reductions at 3 years in tobacco and marijuana use and (b) equivalent reductions for youth at different levels of risk. This study provides evidence that a comprehensive community program-based approach can prevent the onset of substance abuse and that the benefits are experienced equally by youth at high and low risk.

Nearly 60% of all high school seniors have experimented with illicit drugs. Recent national surveys indicate that marijuana, crack, and cocaine use have declined since 1987, perhaps as a result of increased awareness of the social and health risks associated with these drugs (Johnston, 1989; Johnston, O'Malley, & Bachman, 1988). Although alcohol consumption has decreased somewhat, the National Council on Alcoholism estimates that 3 million teenagers continue to be problem drinkers (MacDonald, 1987). Cigarette smoking, the leading cause of premature mortality, has not declined since 1984; 29% of all high school seniors smoke regularly (Johnston et al., 1988; Johnston, 1989).

These rates of substance abuse fail to take into account high school dropouts, who make up 15%–20% of that age cohort and are much more likely to be substance abusers than other youth (Johnston et al., 1988). Consequently, a key component in prevention policy should include innovative approaches for reaching these typically "unreachable" young people, preferably by middle or junior high school when most are still in school. Implementing successful prevention programs must be made top priority by federal, state, and local drug control agencies in order to maintain or improve declines in substance abuse. Primary prevention is especially important because research indicates that prevention efforts are much more successful than treatment programs (Emrick, 1979; Johnson, 1986; Nathan, 1988). In this article we review research on drug and alcohol abuse and present a recent study reporting effects on high-risk youth of a comprehensive community-based program that has already shown a significant impact on prevalence rates of use in a general population of adolescents (Pentz, Dwyer, et al., 1989).

It is important to understand the conditions under which community-based programs are effective, the populations that benefit most, and particularly any populations that may fail to benefit. Especially important is whether programs are similarly effective with those who are at high risk to use drugs as well as those who are at low risk. Some have suggested that this may not be the case (Newcomb & Bentler, 1988). Programs that reach only low-risk adolescents would be of limited value. Ideally a school-based prevention program would be well suited to the general population of adolescents, those at high risk and those at low risk equally, because it is impractical to separate out high-risk youth for special programming at school.

Background

Risk Factors

The major risk factors for drug abuse in adolescence may be classified into three categories: behavioral, social, and demographic. Consistently the strongest predictor of drug use has been past use (Newcomb & Bentler, 1988). Furthermore, certain substances—specifically alcohol, tobacco, and marijuana—have been shown to predate entry into other forms of drug use, including each other (Collins et al., 1987; Kandel & Logan, 1984). The strongest social predictors have been use by adolescents' parents and friends (Hurd et al., 1980; Oetting & Beauvais, 1987), and the most consistent demographic predictors have been age and gender (Newcomb & Bentler, 1988). Numerous studies have emphasized the relation of specific social and
psychological factors to drug use, including (Friedman, 1985; Halebsky, 1987; Oetting & Beauvais, 1987); depression (Joshi & Scott, 1988); poverty (Dawkins, 1988; Gibbs, 1984; Thompson & Simmons-Cooper, 1988); poor academic achievement (Mills & Noyes, 1984); antisocial behavior (Hawkins, Lishner, & Catalano, 1986; Jessor & Jessor, 1977); parent drug use (Fawzy, Coombs, & Gerber, 1983; Halebsky, 1987); and parent alcohol abuse (Blane, 1988). More complex risk factor models hypothesize that substance abuse is related to exposure to and the interaction of a confluence of risk factors (Bry, 1983; Newcomb, Maddahian, Skager, & Bentler, 1987; Schorr, 1988). Recent research indicates that as much as 50% of the variance in adolescent drug use can be explained by a risk factor index that includes 12 risk factors that each contribute a unique proportion of variance (Newcomb et al., 1987; Newcomb, Maddahian, & Bentler, 1986).

Other "risk" analyses have focused on drug effects, which include gateway or stage theories (Czechowicz, 1988; Kandel & Logan, 1984; Macdonald, 1988; Oetting & Beauvais, 1987) and addiction theories (Oetting & Beauvais, 1987; Peele, 1985). Gateway theories suggest that taking one drug leads to an inclination to use stronger drugs either because of greater familiarity with drug use and those who use drugs or addictive effects of the drugs first used. Addiction theories emphasize substance abuse as a result of the addictive effects of drugs. Both types of theories have strong limitations because they do not explain sporadic drug use or why relatively few youths move from alcohol and marijuana to cocaine or heroin.

Consequences of Substance Abuse

Although most adolescents are not physiologically or psychologically addicted to drugs, the consequences of drug experimentation can be quite serious. The acute psychological effects of drug and alcohol use include mood changes, impaired judgment and motor function, decreased attention span, memory loss, and poor school performance (Macdonald, 1987; Quinn, Kuehl, Thomas, & Joanning, 1988). Unfortunately, the chronic physiological effects of drugs—cancer, cirrhosis, and AIDS among IV drug users—may not be seen directly by most adolescents and are not good deterrents (Macdonald, 1987). Prevention programs that emphasize physiological and psychological health consequences of drug use may not encourage abstinence, even when effectively raising consciousness of chronic outcomes (Johnson, Hansen, Collins, & Graham, 1986).

Theoretical Basis for Primary Prevention

Primary prevention programs are designed to discourage experimentation and especially regular drug use from occurring. Programs are usually targeted at late childhood or early adolescence, the first risk period for drug use onset (Johnson, 1986; Pentz, 1983). An additional advantage of prevention programs delivered at this time is that absenteeism and dropout rates tend to be lower in the middle school years than in high school. Johnson, Amatetti, Funkhouser, & Johnson (1988) classify primary prevention programs into three different categories: psychosocial models, mass communication models, and public policy models. Psychosocial models draw heavily on Bandura's (1977) social learning theory, which asserts that behavior is shaped by one's observations of others. Prevention programs that follow the social learning approach rely on peers, families, and communities in which behaviors can be modeled and resistance skill norms can be practiced and reinforced. In concert with this approach is social competence skill training (Botvin, Eng, & Williams, 1980; Flay, 1986; Johnson, 1986; Pentz, 1983), in which adolescents are taught specific skills to use in situations they may encounter later and are given clarification about drug use norms. Recent research has shown promise for prevention programs that incorporate components that teach youth peer pressure resistance (Flay et al., 1987; Hansen, Johnson, Flay, Graham, & Sobel, 1988; Killen, 1985; Tobler, 1986) and inoculation against mass media messages (Duryea, 1983; Hurd et al., 1980; McGuire, 1972). Perceptions of social norms (use by similar others and belief in social sanctions from using drugs) are not only strong predictors of drug use onset, norms are perhaps the strongest mediator of prevention program effects. Experimentally induced changes in perception of prevalence of use by peers and probably sanctions from friends following one's own use have been found to better predict decreased drug use than other program components, including resistance skills training (MacKinnon et al., in press; Hansen & Graham, 1989). These successful approaches to prevention have built upon research from social psychology that emphasizes the role of social comparison (Festinger, 1954); persuasion (McGuire, 1985); person perception, attributional (Jones, 1985); and social learning processes in shaping behavior and the contributions of developmental psychology in clarifying the special vulnerability of young adolescents to social influences (Bandura, 1977).

Other approaches to prevention emphasize specific motivations to use drugs that are developmentally relevant. Erickson's stage theory of development suggests that adolescents use drugs because this represents adult behavior and can therefore serve as a sign of independence (Johnson et al., 1988). Programs informed by this theory stress self-esteem and self-image enhancement. One study, however, found that such "affective" approaches used alone were not successful in preventing onset of tobacco, marijuana, and alcohol use among adolescents (Hansen et al., 1988). However, in combination with social resistance skills, training affective education components have been found to produce effects superior to resistance skills training alone (Johnson, Graham, Hansen, & Flay, in press).

Recently, various health behavior formulations have been integrated into drug prevention programs. Several researchers have suggested that prevention programs might emphasize healthy living behaviors, including diet, exercise, and stress reduction, in order to create a mutual reinforcement and synergy among various health behaviors (Funkhouser & Amatetti, 1987; Johnson et al., 1988; Perry, 1986; Perry & Jessor, 1983). The conditions under which multipurpose health programs can be effective and for what purposes have not been determined. One recent study (Johnson et al., 1990) found that combination programs aimed at prevention of cigarette smoking, alcohol, and marijuana use, as well as promotion of lower fat diets and more regular exercise, were effective in achieving smoking, diet, and exercise objectives but not reduction in alcohol and
marijuana use. This study suggests that there may be limitations in the scope of what can be achieved in a limited duration prevention program.

**Primary Prevention Program Channels**

Several primary prevention programs have been implemented using single sites or channels for delivery, including the school, community, family, and mass media. The most common kind of prevention program is school-based, in which the prevention curriculum is delivered by teachers or specially trained school personnel. School-based programs that draw on theories of social influences and teach peer pressure resistance and social competence skills have shown significant reductions: between 29% and 67% in adolescent smoking rates, with more moderate success in reducing alcohol and marijuana use (Botvin, 1986; Pentz et al., 1989). Many school-based drug prevention programs have met with little success because they have focused on increasing knowledge or changing attitudes rather than on changing behavior (Flay, 1985; Moskowitz, Malvin, Schaeffer, & Schaps, 1984; Schaps, Moskowitz, Malvin, & Schaeffer, 1986; Tobler, 1986). However, programs that have multiple components (e.g., social skills development, peer resistance training) have been more successful in preventing the onset of drug use, especially when the programs are presented in late elementary and early middle or junior high school (Dielman, Shope, Butchart, & Campanelli, 1986; Johnson et al., in press; Hansen et al., 1988; Pentz et al., 1989).

Programs that intervene within the family traditionally rely on secondary or tertiary prevention approaches with parents and are often aimed at changing the behavior of adolescents who have some history of drug abuse. These programs often use trained therapists to identify problems of family dynamics that may encourage adolescents to experiment with drugs (Quinn et al., 1988; Stanton, Todd, & Associates, 1982). Parent-based programs typically focus on a small proportion of parents, employ well-trained personnel, and treat adolescents who already have established patterns of drug abuse that may be difficult to break.

In addition to school and family programs, mass media programs also have been implemented widely. Research suggests that mass media probably show the most promise for increasing awareness and knowledge of prevention skills and, to a lesser extent, motivation to change behavior and the least promise for actual behavior change (Flay, 1985; Pentz, 1985). However, a recent review of mass media component programs suggests that even awareness, knowledge, and motivational change may depend on the extent to which mass media programming is complemented by other program components, including school and parent programs, that may serve as cues for selecting prevention-oriented mass media programs over other alternatives (Flay & Pentz, 1985).

With the advent of increased mass media attention to adolescent drug abuse, grass-roots community programs that involve community agencies, businesses, or other organizations have increased in popularity, including the Lions Club QUEST program, Just Say No campaigns, PRIDE, and task forces developed from the Chemical People mass media programs. These eclectic approaches have received little experimental evaluation as prospective prevention program channels compared with school, parent, and mass media programs. Limited qualitative analyses of grass-roots community efforts that have been associated with public service television and parent groups suggest that these programs may increase community awareness of drug abuse and drug abuse prevention technologies, as well as motivation of community leaders and parents to participate in prevention efforts (Macdonald, 1986; Moskowitz & Jones, 1985).

The most recent drug prevention program channel to receive attention in research is policy. Studies on adults and adolescents suggest that community, worksite, and school policies regulating smoking can decrease the amount of smoking by smokers in the short term (Cleary, Hitchcock, Semmen, Flinchbaugh, & Pinney, 1986; Moskowitz & Jones, 1988; Pentz et al., 1989; Stanton et al., 1982; Rosenstock, Stergachis, & Heaney, 1987). Lower smoking may be related to the emphasis of policy on reinforcing nonsmoking rather than punishing smoking. Less is known about the potential of policy to affect smoking prevalence rates over the long term (Pentz, Brannon, et al., 1989). Also, relatively little is known about whether drug prevention policy is effective in changing use of other substances, although at least two studies suggest that the potential effectiveness of school-based drug prevention policy for students may be related to the comprehensiveness, or number of clearly explicated components, of the policy (Moskowitz & Jones, 1988; Pentz, Brannon, et al., 1989).

**Comprehensive Community-Based Drug Prevention**

Recently researchers, policymakers, and drug prevention program planners have questioned whether single channel programs (e.g., school educational programs for drug abuse prevention or health promotion) are sufficient to effect significant and lasting changes in adolescent drug use behavior (Battjes, 1985; Johnson, 1986; Pentz, 1986). The question has evolved from critical reviews of more than a decade of prevention studies, the results of which suggest that effectiveness of prevention programs may be related to length of intervention, quality of implementation, background support of implementation by administrators, extent of participation by family members, and whether more than one program channel or component is included in the intervention (Johnson & Solis, 1983; Perry, 1986). Added to these results are the developmental and social learning theories suggesting that adolescents face pressures to engage in precocious behaviors, including early drug use, from multiple sources outside of the school and acquire these behaviors from multiple models, including peers, parents and other adults, mass media, and environmental models represented by community policies regarding drug use (Moskowitz & Jones, 1985; Pentz, 1986). Theory and research argue strongly for a comprehensive approach to drug abuse prevention with adolescents that addresses these multiple influences to use drugs. It seems logical that a comprehensive community intervention would include multiple program channels to increase intervention exposure, that the program channels would represent means to resist the influences on adolescent drug use (including schools, parents, community organizations, mass media, and policy), and that the use of the program channels would be
designed to promote community support of drug prevention practices and a social norm for nondrug use.

Because communities are complex and diverse, a comprehensive community drug prevention program must take into account the needs of various high-risk subgroups as well as the developmental needs of youth in general (Orlandi, 1986). Most large-scale, social influences drug prevention programs, particularly primary prevention programs, are focused on the latter needs of adolescents but not the former.

The conventional wisdom underlying this focus is that a primary prevention program, by definition, is targeted at the whole population, using methods that are assumed to be generalizable across different subgroups and communities. The problem with this approach is that it may not acknowledge individual differences in youth that constitute especially high levels of risk for regular drug use and later drug abuse (Pentz, 1983). Several of the factors contributing to high risk for drug abuse are the same social influences that predict drug use onset, including past history of experimental use, age, and gender (Hawkins, Lishner, & Catalano, 1986; Newcomb et al., 1986; Newcomb & Bentler, 1988). Several of these risk factors also predict outcome of drug abuse treatment for adolescents (Hawkins, Catalano, & Wells, 1986). Ethnicity or cultural identification and socioeconomic status (SES) are also important risk factors for drug abuse, but these relations are complex. Greater drug use is associated with lower SES even among younger adolescents but is less common among minority youth than Whites when controlling for SES. By late adolescence and early adulthood, the ethnicity–drug relation appears to have reversed.

The risk factor approach to analyzing drug prevention program effectiveness has become a high priority of federal policymakers for several reasons. First, health care reports have shown that high-risk groups of youth have the least access to prevention program channels and community services for early intervention (Tucker, 1985). Second, recent studies indicate a lack of change in drug abuse treatment rates among high-risk populations, suggesting that current community prevention education efforts may not be affecting these groups (Hawkins, Lishner, & Catalano, 1986). Third, youth at high risk for drug abuse are also at high risk for other problem behaviors, including school failure and delinquency (Hawkins, Lishner, & Catalano, 1986; Jessar, 1982). Thus, drug prevention programs that reduce drug use behavior could also have a high likelihood of changing problem behaviors of interest to educational policymakers and the judiciary, as well legislators concerned with drug abuse. Acknowledging these relations, the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA), as well as other federal research agencies, has developed several initiatives for research on preventive interventions with high-risk youth in the 1980s (Macdonald, 1986). In addition, the Omnibus Anti-Drug Abuse Act of 1986 created the Office of Substance Abuse Prevention (OSAP), a major focus of which is the funding of community demonstration grants for drug abuse prevention with high-risk youth.

Despite the recent attention to the question of community drug prevention effectiveness with high-risk youth, evaluation in experimental research studies has been limited. For example, risk factors have been evaluated for their additive or linear relationship to drug use in individuals (Bry, 1983). However, few of these factors have been systematically evaluated in high-risk subgroups (Newcomb & Bentler, 1988). Most studies have been limited in the number of schools or communities available to generate high-risk sample sizes that are large enough to assess complex risk factor relationships or to detect significant prevention program effects in high-risk population subgroups.

A comprehensive community-based program that is large enough to be evaluated for effects on high-risk subgroups of youth as well as the general population would provide valuable information about the potential of primary prevention programs for reducing the drug abuse problem over the long term and for reducing costs associated with drug abuse treatment. The following discussion will consider the Midwestern Prevention Project as an example of a comprehensive community-based program for drug prevention that is evaluated for effects on high-risk youth as well as on a general metropolitan population of youth.

The potential risk factors we have selected for study fall into three categories: behavioral (prior drug use history), social (parental and peer influences), and demographic (age and gender). Other social and cultural factors undoubtedly are equally important in community programming, including SES and ethnicity. We have not included them because they are thought to be more causally distal (Jessor & Jessar, 1977); and as such their effects would be expected to be mediated through more proximal behavioral and social factors. Consideration of cultural and economic factors calls for a different and more complex kind of modeling than we have undertaken. The models we have reported, assessing theoretically proximal variables as risk factors for drug use and their interactive effects with prevention programming, provide a necessary first step designed to evaluate more complex socioeconomic and demographic factors. A second kind of risk factor assessment not undertaken here is of psychologically predisposing variables, some of which might also mediate ethnic and economic effects including low self-esteem, depression, social isolation, need for affiliation and social approval, aggressiveness, risk-taking tendencies, and rebelliousness.

Method

Study Design

The overall (Midwestern Prevention Program) research design includes a quasieperimental trial in Kansas City and an experimental trial in Indianapolis to test the effectiveness and replicability of a multi-component community drug abuse prevention program. Our study evaluated interactions between an experimental prevention program and individual risk factors for drug abuse on a panel of sixth- and seventh-grade adolescents in 8 Kansas City public schools between September 1984, when students were in Grades 6 and 7, and September 1987, when they were in Grades 9 and 10. Data were collected annually from the same students but are reported here only for 1984 and 1987. Schools were assigned randomly to program or control conditions from a larger set of 16 schools that agreed to participate in the panel study. The program was delivered at grade of transition (i.e., the first year of middle or junior high school, either sixth or seventh grade).
Participants in half of the experimental schools and their respective control schools were sixth graders and half were seventh graders.

**Program Intervention**

The program components delivered from September 1984 through September 1987 consisted of (a) a 10-session school program emphasizing drug use resistance skills training, delivered at Grade 6 or 7, with homework sessions involving active interviews and role plays with parents and family members; (b) a parent organization program for reviewing school prevention policy and training parents in positive parent-child communication skills; (c) initial training of community leaders in the organization of a drug abuse prevention task force; and (d) mass media coverage (see Pentz, Dwyer, et al., 1989, for greater detail on program components). Program schools received all four components. Control schools received only Components c and d. The youth education program was delivered in school using science or health education classes and included topics and methods that prior research has suggested may be effective in reducing drug use onset (Killen, 1985; Flay, 1985). The topical areas included psychosocial consequences of drug use; correction of beliefs about drug use prevalence; recognition and counteraction of adult, media, and community influences on drug use; peer and environmental pressure resistance; assertiveness in practicing pressure resistance; problem solving for difficult situations involving potential drug use; and statement of public commitment to avoid drug use. Methods for delivery of prevention skills included the use of demonstration and rehearsal (role playing), feedback with discussion, and extended practice outside the program site. Considerable media coverage was given to the program, especially in the fall of each year, with students in program and control schools having equal access to the coverage.

**Subjects**

The baseline sample consisted of a sixth/seventh grade cohort in eight schools. Ninety-four percent of the samples contacted received parental consent. Program and control schools did not differ in consent rates. The total sample of students observed at baseline in the eight schools of the panel study was 76.6% White, 19.2% Black, 2% Hispanic, and 1.2% Asian. There were no significant differences between the program and control schools in covariates or grade-adjusted drug use. Based on the 1,607 students who were tracked individually over time, 3.1% had no follow-up at any wave after baseline, and 84% were assessed at both baseline and 3-year follow-up. Chi-square tests revealed that attrition rates and drug use among students lost to follow-up did not differ between program and control schools (p > .15), although, consistent with other prevention studies, users in both experimental conditions were more likely overall to be absent after baseline com-

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### Table 1

**Summary of Logistic Regression Analyses for Cigarette, Alcohol, and Marijuana Use and Risk Factors**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cigarettes</th>
<th>Alcohol (2+ drinks)</th>
<th>Marijuana</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$x^2$</td>
<td>$p$</td>
<td>$x^2$</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>4.10</td>
<td>.021</td>
<td>0.33</td>
</tr>
<tr>
<td>Cigarette use</td>
<td>14.29</td>
<td>.0001</td>
<td>3.62</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>17.69</td>
<td>.0000</td>
<td>1.74</td>
</tr>
<tr>
<td>Marijuana use</td>
<td>1.16</td>
<td>ns</td>
<td>1.21</td>
</tr>
<tr>
<td>Friends' use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarette</td>
<td>0.88</td>
<td>ns</td>
<td>0.35</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.41</td>
<td>ns</td>
<td>17.83</td>
</tr>
<tr>
<td>Marijuana</td>
<td>0.17</td>
<td>ns</td>
<td>0.10</td>
</tr>
<tr>
<td>Parents' use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarette</td>
<td>9.01</td>
<td>.0013</td>
<td>0.38</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.05</td>
<td>ns</td>
<td>12.60</td>
</tr>
<tr>
<td>Marijuana</td>
<td>1.29</td>
<td>ns</td>
<td>0.01</td>
</tr>
<tr>
<td>Grade</td>
<td>0.04</td>
<td>ns</td>
<td>5.65</td>
</tr>
<tr>
<td>Gender</td>
<td>2.71</td>
<td>.0997</td>
<td>0.17</td>
</tr>
<tr>
<td>Treatment × Grade</td>
<td>7.85</td>
<td>.0051</td>
<td>13.09</td>
</tr>
</tbody>
</table>

*Note. One-tailed tests appropriate for main effects; two-tailed tests appropriate for interactions.*

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### Table 2

**Percentage of Students who Used Tobacco, Marijuana, and Alcohol Over a 30-Day Period**

<table>
<thead>
<tr>
<th>Condition</th>
<th>1984 (Grades 6/7)</th>
<th>1987 (Grades 9/10)</th>
<th>1984 (Grades 6/7)</th>
<th>1987 (Grades 9/10)</th>
<th>1984 (Grades 6/7)</th>
<th>1987 (Grades 9/10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program schools</td>
<td>9.8</td>
<td>24.8</td>
<td>3.4</td>
<td>33.8</td>
<td>2.3</td>
<td>12.3</td>
</tr>
<tr>
<td>Control schools</td>
<td>10.0</td>
<td>30.5</td>
<td>5.3</td>
<td>32.6</td>
<td>0.7</td>
<td>19.7</td>
</tr>
</tbody>
</table>

*Note. 30-day prevalence rates adjusted by grade.

*2 or more drinks in the last 30 days.*
pared with nonusers ($p < .05$). Complete data from both the 1984 and 1987 questionnaires were available from 1,105 of the original panel of 1,607 adolescents.

**Measurement of Drug Use**

The focus of this study was on the leading behavioral (prior drug use), social (use by parents and friends), and demographic (gender and age) influences on drug use. Drug use was measured in a questionnaire administered to students in classrooms. The questionnaire included demographic characteristics; gateway drug use (cigarettes, alcohol, and marijuana); and psychosocial variables related to drug use.

Unless otherwise noted, the 1984 Grade 6–7 student questionnaire provided data on the influence variables, and the 1987 Grade 9–10 student questionnaire provided data on subsequent drug use. Behavioral variables included 30-day use of tobacco, alcohol, and marijuana (coded yes or no). Reliability of these items is high (the average Cronbach's alphas for cigarettes, alcohol, and marijuana use items are .84, .86, and .86, respectively, and test-retest reliabilities are .78, .53, and .67, respectively). Social influence variables included use of tobacco, alcohol, and marijuana by one or both parents (coded yes or no) and the number of friends using each drug. Demographic variables were gender and age (Grade 6 or 7). Since the parent drug use variables appeared on only two thirds of the student questionnaires, parent responses to similar items from a mailed questionnaire coded in the same way were substituted for missing cases. The response rate to the parent questionnaire was 49%.

Immediately before questionnaire administration, a MiniCO Indicator (Catalyst Research Corporation, 1986) was used to measure carbon monoxide (CO) concentration in expired air to increase the accuracy of subsequent student self-reported drug use (Pechacek et al., 1984). Each student was measured for CO level at each measurement.
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#### Table 5

<table>
<thead>
<tr>
<th>No. of risk factors</th>
<th>No prevention program</th>
<th>1984 alcohol use</th>
<th>Friends' cigarette use</th>
<th>Parents' marijuana use</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>.07</td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>.09</td>
</tr>
<tr>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>.14</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>.19</td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>.20</td>
</tr>
</tbody>
</table>

#### Data Analyses

Multiple logistic regression, utilizing maximum likelihood parameter estimation, was used to test for Program × Risk Factor interactions. Independent variables included treatment condition; 1984 pretest 30-day use of cigarettes, alcohol, and marijuana; subject gender; and pretest grade level. Two-way interactions between program and each of the 11 risk factors were tested in separate models, with each model containing all 11 risk variables and one of the Program × Risk Factor interaction terms. Dependent variables were 30-day use of cigarettes, alcohol, or marijuana at the 1987 posttest. Canonical correlation analysis was also used to create composite risk factor variates from this set of independent variables. Two strategies were used to create the canonical variates. The first strategy used 30-day cigarette, alcohol, and marijuana use in 1987 as one set of variables and all 1984 risk factors listed above as the other set of variables. The second strategy created risk factor composites separately for cigarette, alcohol, and marijuana. The cigarette composite used 30-day cigarette use in 1987 as one set and 30-day cigarette use in 1984, close friends and important adults' cigarette use, gender, and pretest grade as the other set of variables. Risk factor composites were created in a similar fashion for alcohol and marijuana. Dependent variables in all analyses were 30-day cigarette, alcohol, or marijuana use in 1984, close friends and important adults' cigarette use, gender, and pretest grade as the other set of variables. Risk factor composites were created in a similar fashion for alcohol and marijuana. Dependent variables in all analyses were 30-day cigarette, alcohol, or marijuana use in 1987, binary coded as 0 (no use) and 1 (any use). Separate logistic regression models were used to test for interactions between the program and risk factor composites created by the canonical analyses. Each regression included as independent variables treatment status, the risk factor variate, and an interaction between treatment status and the risk factor variable. The dependent variables remained the same as in the other models.

#### Results

Multiple logistic regression functions revealed significant main effects for the prevention program on tobacco and marijuana use in the last month, but no significant effect on alcohol use (See Table 1). As expected, prevalence rates for all three substances increased over time, but the rate of increase for tobacco and marijuana was less for adolescents in program schools than for those in control schools. Grade adjusted estimates of substance use are presented in Table 2.

Multiple logistic regression analysis revealed three independent risk factors for cigarette use at Grade 9–10 (1987): cigarette use in 1984 (Grade 6–7), alcohol use in 1984, and parents' cigarette use in 1984. Gender was marginally significant with girls smoking slightly more than boys. There were four independent risk factors for alcohol use: cigarette use in 1984, friends' alcohol use in 1984, parents' alcohol use in 1984, and age (grade). Independent risk factors for marijuana use were 1984 alcohol use and marijuana use, friends' cigarette use, parents' marijuana use, and age (grade). See Table 1.

Only 2 of 33 Program × Risk Factor interaction terms were significant. Prevention programming interacted with age (grade) such that program effects were greater for both cigarette and alcohol prevention with seventh-grade than sixth-grade implementation. The composite index of risk, canonical analysis, provided an assessment of combinations of risk factors optimized for their relation to drug use outcomes. The canonical variate created in this way accounted for 27.7% of the variance in drug use. The program by canonical variate interaction was not significant for tobacco (χ² = 0.17), alcohol (χ² = .70), or marijuana (χ² = .27). Separate canonical analyses for tobacco, alcohol, and marijuana use accounted for 18.0%, 16.7%, and 10.7% of the variance, respectively. None of the Canonical Variate × Program interaction terms were significant (chi-squares ranged from .07 to 1.26).

#### Discussion

Findings from the panel study indicated that the community-based prevention program was effective in reducing the prevalence of monthly cigarette smoking and marijuana use at the ninth- and tenth-grade levels. This occurred 3 years after delivery of the school-based program, suggesting that the program, perhaps reinforced by other community program compo-
ments, has lasting effects. Assignment of schools in this study was random, overcoming a limitation of previous reports from the Midwestern Study and contributing greatly to the interpretability of the findings. The study design does not permit assessment of the effects of mass media and community organization efforts, but it is apparent that the mass media program and community organization efforts alone, which were received in control as well as program communities, had a relatively modest impact compared with the total community program. The absence of a program main effect on monthly alcohol use should be reviewed in light of results on earlier follow-up data on all schools in Kansas City, which showed significant effects at 1-year follow-up and effects on heavier use levels at 2-year follow-up. Subsequent cohorts in both Kansas City and Indianapolis have received a program with enhanced alcohol content designed especially to deal with the relative normative nature of alcohol use in the society.

The preponderance of evidence supports the conclusion that prevention programs were equally effective in reducing drug use prevalence in high- and low-risk populations. This is encouraging because a program would be of dubious value if it acted only to reduce use in those already at low risk. Tables 3, 4, and 5 depict risks projected from the data for tobacco, alcohol, and marijuana use by combinations of risks, with and without benefit of the prevention program. It can be seen from the tables that risks for cigarette smoking were cumulative, ranging from a probability of .15 for adolescents with no risks and receiving the program to a probability of .79 for those with three risks and not receiving the program. It can be seen as well that the program was associated with reduced probability of cigarette smoking at any combination of risk factors. The same pattern held for the probability of becoming a marijuana user.

Only 2 of 33 interactions were significant, a finding that might have occurred by chance alone. Both of these were for Grade × Program interactions. Furthermore, the number of sixth- and seventh-grade schools was small, and distribution was unequal, making interpretation of these interactions even more hazardous. Analysis of the implementation and process evaluation now under way may help to clarify this issue.

Another limitation of these findings is that the level of drug use considered, 30-day prevalence, would probably fall into what Newcomb and Bentler (1988) have called "social" rather than "problem" drug use. Hence, both the program effects risk factor analyses and Program × Risk Factor interactions discussed here may be limited to what others refer to as social drug use. We believe that to be unlikely, however, because use of a substance at any level clearly is a risk factor for heavier use at a later point in time. Numerous studies have shown that heavier levels of drug use do not arise suddenly but rather evolve from lower levels of use (Kandel & Logan, 1984; Collins et al., 1987). Hence, lower levels of use must be regarded as necessary if not sufficient precursors of abuse. In that sense the findings reported here are relevant to drug abuse first from the standpoint of clarifying risk factors for the necessary and highly predictive precursors of heavier levels of abuse. Second, what is to be considered a problem or abusive level of use is arguable. We maintain that any level of cigarette smoking especially in youth is abusive because amount of exposure to tobacco smoke is related linearly to heart disease and lung cancer. Perhaps the same cannot be said of alcohol and marijuana use, but it is likely that the probability of accidents and drug-related problems also increases monotonically with level of use. For tobacco at least, we argue that any level of use is problem use.

In summary, a comprehensive community program that includes a social resistance skills training and normative influences modification program delivered at the middle school level was effective in reducing tobacco and marijuana use prevalence, without exception for specific behavioral, social, and demographic risks. Furthermore, effects appear to be quite strong 3 years following active skills training. This study suggests that social/behavioral approaches to prevention that are addressed to whole populations can be effective in reaching high-risk as well as low-risk populations and that prevention effects can be enduring.

References

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