

Effects of a School-Based Drug Abuse Prevention Program for Adolescents on HIV Risk Behavior in Young Adulthood

By: Kenneth W. Griffin, Gilbert J. Botvin, [Tracy R. Nichols](#)

Griffin, K.W., Botvin, G.J. & Nichols, T.R. (2006). Effects of a school-based drug abuse prevention program for adolescents on HIV risk behavior in young adulthood, *Prevention Science*, 7(1), 103-112.

The final publication is available at Springer via <http://dx.doi.org/10.1007/s11121-006-0025-6>.

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Abstract:

Early onset of substance use among adolescents has been found to be associated with later risky sexual behaviors. This study examined long-term follow-up data from a large randomized school-based drug prevention trial to (1) investigate the long-term impact of the prevention program on drug use and sexual behaviors that put one at elevated risk for HIV infection; and (2) use growth modeling procedures to examine potential mechanisms of intervention effects. Self-report survey data were collected from students in the 7th grade, prior to the intervention in 1985, and in grades 8, 9, 10, and 12. Participants in the intervention condition received a 30-session drug prevention program in 7th through 9th grades. Follow-up surveys were completed by 2042 young adults (mean age = 24) in 1998. As young adults, participants were considered to be engaging in high-risk behavior for HIV infection if they reported having multiple sex partners, having intercourse when drunk or very high, and recent high-risk substance use. The intervention had a direct protective effect on HIV risk behavior in the overall sample in young adulthood. Furthermore, among participants receiving 60% or more of the prevention program, analyses showed that the intervention significantly reduced growth in alcohol and marijuana intoxication over the course of adolescence, which in turn was associated with a reduction in later HIV risk behavior. The behavioral effects of competence-enhancement drug prevention programs can extend to risk behaviors including those that put one at risk for HIV infection.

Keywords: adolescence | drug abuse prevention | HIV risk behavior | latent growth curve

Article:

HIV/AIDS and other sexually transmitted diseases are among the most pressing public health problems in the United States and throughout the world. As of the end of 2002, it was estimated that over 859,000 people in the United States had been diagnosed with AIDS since the epidemic

began, and over 501,000 had died of AIDS (CDC, 2003). Furthermore, while rates of AIDS deaths have declined in recent years in the United States, this appears to be primarily due to advances in treatment (i.e., highly active anti-retroviral therapies) rather than changes in HIV risk behaviors. Annual national incidence rates of HIV infection have remained constant or increased slightly in the past 10 years, although this figure is difficult to estimate because newly infected individuals often do not know they are infected (CDC, 2003). HIV/AIDS is an epidemic that disproportionately affects young people in the United States. AIDS is the seventh leading cause of death among Americans aged 15–24 (Hoyert *et al.*, 1999). Given the long latency between infection and symptoms of immunodeficiency, it is believed that most young adults with AIDS contracted HIV as adolescents. It is estimated that at least 50% of new infections in the United States are among young people under the age of 25 (CDC, 2002). Furthermore, among those diagnosed with non-HIV sexually transmitted diseases in the United States, it is estimated that two-thirds are young adults under the age of 25 (CDC, 2002).

Drug and alcohol abuse are also major public health problems in the United States. According to the 2002 National Survey on Drug Use and Health, an estimated 19.5 million Americans age 12 years or older were current (past month) users of an illicit drug, representing over 8% of the US population (SAMHSA, 2003). Two ongoing national school-based surveys indicate that alcohol, tobacco, and marijuana are the most widely used substances among adolescents in the United States (Grunbaum *et al.*, 2002; Johnston *et al.*, 2003) and nearly half of high school seniors report having used illicit substances besides marijuana. Recent evidence indicates that binge drinking is a serious and growing problem in the United States, particularly among youth. Overall rates of binge drinking increased by 35% from 1995 through 2001, and rates are highest among youth aged 18–25 (Naimi *et al.*, 2003).

Substance use and sexual activity typically begin during adolescence. In fact, the age of initiation for both drug use and sexual intercourse is getting younger in the United States (Grunbaum *et al.*, 2002), and it is often the same individuals that initiate both behaviors at an early age. Furthermore, early onset of substance use is an important risk factor for the development of later substance abuse (Anthony & Petronis, 1995; Griffin *et al.*, 2002) and adolescent drug abuse is an important risk factor for HIV infection (Rotheram-Borus *et al.*, 2000). While the number of youth directly infected with HIV due to injection drug use (IDU) is fairly low, substance use impairs decision-making and the combination of substance use and sexual activity can increase risk for HIV infection among youth (Langer & Tubman, 1997). A recent study found that adolescents who engage in binge drinking or use marijuana were more likely to engage in risky sexual behavior during young adulthood, including sexual activity with multiple sex partners and less condom use (Guo *et al.*, 2002). Furthermore, over one-quarter (26%) of all adolescents report having used either alcohol or drugs the last time they had sexual intercourse, up from 18% in 1991, while other indicators of HIV risk such as number of sexual partners decreased over this same time period (MMWR, 2002).

School based prevention programs are an efficient way to reach a large proportion of youth prior to the onset of substance use and sexual behavior. A large number of school-based prevention programs for adolescent drug abuse and a smaller but growing number of HIV prevention programs have been developed and tested over the past two decades (Botvin & Griffin, 2003; Kirby, 2000). Contemporary prevention approaches for adolescent substance abuse are based on a comprehensive consideration of substance abuse etiology and recognize the importance of social and psychological factors in promoting substance use initiation and escalation. Competence-enhancement approaches to prevention posit that youth with poor personal and social skills are more susceptible to influences that promote drug use and may be motivated to use drugs as an alternative to more adaptive coping strategies (Botvin, 2000). Therefore, these programs emphasize the teaching of generic social and personal skills such as communication, assertiveness, decision-making, goal-setting, self-control, and coping skills. School-based drug abuse prevention programs that combine general social and personal skills training with drug resistance skills have been found to be most effective (Botvin,2000). Because competence enhancement approaches to drug prevention target etiologic factors common to both drug abuse and HIV and teach skills that have a broad application, such programs may reduce later HIV risk. The goals of the present study were to (1) investigate the long-term impact of the prevention program on drug use and sexual behaviors that put one at elevated risk for HIV infection; and (2) use growth modeling procedures to examine potential mechanisms of intervention effects, if warranted.

METHODS

Sample

The data for the present study were collected as part of a larger long-term follow-up study of a randomized drug abuse prevention trial. At the baseline assessment in 1985, surveys were completed by 5569 participants prior to the start of the intervention, of which 3815 (68.5%) received the prevention program. Students were followed-up into high school, with approximately 75% of the original sample completing surveys in the 9th grade and 60% as high school seniors. In 1998, an additional follow-up assessment of this cohort was conducted. Of the 2042 youth who participated in the 10-year follow-up, 1360 (66.6%) received the prevention program and 682 were in the control group of the original prevention study. Participants were primarily from middle-class suburban and rural areas of New York State, and 77.6% lived in two-parent families during junior high school. The final follow-up sample consisted of 1080 girls and 962 boys, and the vast majority of the sample was White (91.2%). Almost half (49.6%) were college graduates, 39.6% were married or cohabitating, and the median age was 24.6 years (range 23.8–27.5). The research protocol and consent procedures for this study were reviewed and approved by the Institutional Review Board at Cornell University Medical College.

Design

In the original school-based prevention trial, a randomized block design was used. Prior to the intervention, schools ($N=56$) were surveyed and divided into high, medium, or low smoking prevalence. Schools were then randomized into one of three conditions from within these blocks: (1) prevention program with 1-day training workshop for providers, (2) prevention program with videotaped training, and (3) “treatment as usual” control group. Students in the two experimental conditions received a drug abuse prevention program consisting of a primary year of intervention in the 7th grade (15 classes) and booster interventions during the 8th (10 classes) and 9th (5 classes) grades, for a total of 30 class sessions. At the 7th grade baseline assessment, data were collected in all regular classrooms of the participating schools during a single class period, prior to the onset of the prevention program. The survey was administered again after the first year of the intervention in the 7th grade, and at 1-year intervals thereafter through the end of high school (except for the 11th grade, where no survey was administered). Research staff administered the surveys rather than school administrators or teachers, and students were assured that their responses would not be available to any school personnel and would be completely confidential. Concurrently with the survey data collection, carbon monoxide breath samples were collected to enhance the validity of the self-report data (Evans *et al.*, 1977). Furthermore, in order to assess the completeness of program implementation, trained observers monitored randomly selected classes taught by the teachers providing the prevention program throughout the 3 years of the intervention. A quantitative assessment of the completeness of program implementation was calculated on the basis of the proportion of curriculum points and objectives covered during each class session observed, and a cumulative implementation score was calculated for each student who received the intervention.

Prevention Program

The preventive intervention tested in this study (Life Skills Training, or LST) teaches alcohol and drug resistance skills and material designed to facilitate the development of important personal and social skills. The goals of the prevention program are to reduce potential motivations to use substances by increasing general personal and social competence and to provide adolescents with the knowledge and skills needed to effectively resist social influences to engage in substance use. The program teaches students a variety of cognitive-behavioral skills for building self-esteem, resisting peer pressure and media influences, managing anxiety, communicating effectively, developing personal relationships, and asserting one's rights. The program also teaches problem-specific skills related to alcohol and drug use such as ways to be assertive in situations where one experiences interpersonal pressure from peers to engage in substance use. Material is also provided to reinforce norms against substance use. This material is taught using a variety of interactive teaching methods including group discussion and skills-training techniques such as demonstration, modeling, behavioral rehearsal, feedback and reinforcement, and behavioral “homework” assignments for out-of-class practice.

The LST program has been shown to be highly effective in over 15 randomized controlled efficacy and effectiveness trials, and evaluation studies have consistently shown reductions in

smoking, alcohol use, and marijuana use of 50% or more in students receiving the LST program relative to controls, as well as improvements in important risk and protective factors for adolescent drug abuse (Botvin & Griffin, 2004). In the longitudinal cohort examined in the present study, previous analyses have reported significant intervention effects on alcohol, tobacco, and marijuana use when students were in the 9th grade (Botvin *et al.*, 1990) and 12th grade (Botvin *et al.*, 1995a), as well as effects on illicit drug use at the end of high school (Botvin *et al.*, 2000). Furthermore, students who received the intervention during junior high school had fewer violations and points on their Department of Motor Vehicles driving records at the end of high school compared to control participants (Griffin *et al.*, 2004). Taken together, these results illustrate that the LST program produces behavioral effects on a range of drug use outcomes and can generalize to risk behaviors beyond the initial focus of the intervention.

Follow-Up Procedures

For the follow-up assessment during young adulthood, we attempted to obtain updated contact information for all participants who completed the baseline survey. Methods used to confirm contact information included directory assistance searches, telephone matching services, department of motor vehicles databases, internet resources, mailings with address correction requests, searches of credit databases, and information from previous follow-up attempts including contacts with parents. We were successful in confirming the current home address for 56% ($N=3108$) of the original sample and obtained home addresses (not confirmed by telephone or mail) for 27% ($N=1519$) of the original sample. We were unable to obtain any contact information for 17% of the original sample. The follow-up survey was mailed to those for whom we had confirmed or unconfirmed home addresses, and participants were offered \$20 as an incentive to complete the survey. The response rate to the mailing was 44% ($N=2042$), which represents 37% of the original baseline sample.

Measures

School-Based Surveys

The survey assessed several standard demographic variables (gender, race, and family structure) as well as questions related to participants' substance use behavior. To assess the frequency of alcohol intoxication (i.e., "drunkenness"), respondents were asked "Have often (if ever) do you get drunk?" with response options including "I don't drink" (1), "I drink but never get drunk" (2), "Less than once a month" (3), up to "More than once a day" (9). To assess the frequency of marijuana use, respondents were asked "Have often (if ever) do you usually smoke marijuana?" with response options including "Never tried it" (1), "Tried it, but don't use it now" (2), "Less than once a month" (3), up to "More than once a day" (9).

Young Adult Follow-Up Survey

Measures included several demographic variables including marital and cohabitation status, years of education, and household income. HIV risk behavior outcomes included several high risk sexual and substance use behaviors. Questions related to risky sexual behavior included the following items, with higher scores indicating greater risk. Items included “About how many different people would you say that you had sexual intercourse with during the past year?” with response options on an 8-point scale including “None” (1), “1 person” (2), “2 people” (3) up to “More than 15 people” (8); and “In general, how often would you say that you are drunk or very high when you have intercourse?” with response options on a 6-point scale including “None of the time” (1), “Some of the time” (2), “About half the time” (3), up to “Every time” (6). Participants were also asked “About how often would you say that you or your partner(s) use a condom when you have intercourse?” with response options on a 6-point scale including “Every time” (1), “Almost every time” (2), “Most of the time” (3), up to “None of the time” (6). Illicit substance use was assessed by asking participants how often (if ever) they have used any of 13 different illicit drug categories based on those used in the Monitoring the Future study (e.g., Johnston *et al.*, 2003), including marijuana, cocaine, amphetamines, Quaaludes, barbiturates, tranquilizers, heroin, narcotics other than heroin, inhalants, amyl or butyl nitrites, LSD, PCP, and MDMA, with response options on a 7-point scale including “Never” (1), “Tried it, but not in last year” (2), “A few times a year” (3), up to “Daily” (7). Alcohol and marijuana intoxication were assessed with items that asked “How often (if ever) do you drink until you get drunk” and “How often (if ever) do you smoke marijuana or hashish until you get high or stoned?” with response options on a 9-point scale including “Never” (1), “Tried it, but don't use now” (2), “Less than once a month” (3), up to “More than once a day” (9). As young adults, participants were identified as high risk substance users if they reported alcohol or marijuana intoxication or using any other illicit substance in the past month. Furthermore, young adult participants were considered to be engaging in high-risk behavior for HIV infection if they reported (1) having multiple sex partners, (2) having intercourse when drunk or very high, and (3) recent (past month) high risk substance use. If participants reported all three of these behaviors, they received a score of 1 for the HIV risk index; others received a score of 0.

RESULTS

Pretest Equivalence

A series of chi-square analyses revealed that there were no pretest differences in the young adult follow-up sample between the experimental and control groups in terms of any of the demographic variables (gender, minority status, or percent from two parent families), or in terms of rates of substance use or grades received in school in the 7th grade. At the follow-up assessment, there were no differences across conditions in terms of percent married or cohabitating, percent of college graduates, or percent with incomes of \$15,000 per year or less.

Attrition Analysis

The overall attrition rate from the baseline to the young adult follow-up assessment was 63.3% and was similar across conditions. Analyses were conducted to determine if there were differential attrition rates across condition according to pretest substance use or demographic variables. Findings indicated that those who reported smoking, drinking, or marijuana use at baseline were more likely to drop out of the study relative to those who did not report using these substances. For example, 9% of dropouts had smoked marijuana at baseline versus 3% of those who stayed in the study, $t(5590)=9.02, p < .001$. However, the rate of attrition of substance users did not differ across experimental conditions. In terms of demographic factors, males and minorities dropped out of the study at a higher rate compared to females and non-minorities, but this did not differ across experimental condition.

Table 1. Experimental Condition as Predictor of HIV Risk Index Including Covariates Measured at Baseline and Follow-Up

	Percent at high HIV risk	OR	95% CI	GEE <i>p</i> -value
Intervention				
No	13.6			
Yes	10.3	0.70	0.51, 0.96	.0138
Gender				
Female	7.4			
Male	15.8	2.00	1.46, 2.73	.0001
Minority				
No	11.1			
Yes	13.3	1.08	0.65, 1.79	.7756
Covariates measured in the 7th grade (in 1985)				
Ever smoked cigarettes				
No	10.1			
Yes	13.7	1.25	0.87, 1.81	.2471
Ever drank alcohol				
No	9.1			
Yes	13.3	1.24	0.88, 1.76	.2177
Ever smoked marijuana				
No	10.9			
Yes	21.7	1.26	0.64, 2.49	.4909
Living in two-parent families				
No	11.6			
Yes	11.2	1.04	0.71, 1.51	.8731
Grades in school of "C" or less				
No	11.2			
Yes	14.4	1.02	0.51, 2.04	.9505
Covariates measured in young adulthood (in 1998)				
Married				
No	15.6			
Yes	0.4	0.02	0.00, 0.07	.0001

Cohabiting				
No	12.0			
Yes	5.6	0.26	0.14, 0.49	.0002
College graduate				
No	11.3			
Yes	11.3	0.93	0.67, 1.27	.6656
With income <\$15,000/year				
No	11.8			
Yes	10.0	0.75	0.52, 1.08	.1144

Note. Reference group for each predictor is the first of the two listed. Odds ratios and 95% confidence intervals are adjusted for all remaining covariates.

Logistic Regression Model of Intervention Effects

To examine the effect of the intervention on the HIV risk index, we first conducted a logistic regression analysis with intervention status measured using a dummy variable coded 1 for participants assigned to the LST intervention group and 0 for participants assigned to the control group. The dependent variable was the dichotomous HIV risk index score, and demographic covariates included gender and minority status, along with several covariates measured in the 7th grade (lifetime smoking, lifetime alcohol use, lifetime marijuana use, percent living in two-parent families, percent receiving grades in school of C or less) and at the follow-up assessment (percent married, percent cohabitating, percent college graduates, and percent with incomes of \$15,000 per year or less). As shown in Table 1, findings indicated that the intervention had a protective effect on the HIV risk index (OR = 0.70, 95% CI = 0.51, 0.96). Covariates that were predictive of being at high HIV risk included being male (OR = 2.00, 95% CI = 1.46, 2.73), and protective factors for being at high HIV risk included being married (OR= 0.02, 95% CI = 0.00, 0.07) or cohabitating with a partner (OR= 26, 95% CI = 0.14, 0.49). The analysis was also run using PROC GENMOD in SAS in order to determine the *p*-values adjusted for potential school clustering effects. The results showed that the protective effect of the intervention was significant ($p < .0138$) after controlling for clustering.

Latent Variable Models of Intervention Effects

Since we had collected data over the course of junior and senior high school among this cohort, we attempted to use this information to explore the mediating mechanisms of how the intervention impacted HIV risk among the young adult sample. Structural equation modeling and latent growth curve analyses using Mplus 3.1 (Muthén & Muthén, 2004) were used to analyze potential mechanisms of effects. Prior to testing for intervention effects, we conducted a confirmatory factor analysis to examine the measurement properties of the HIV Risk Behavior latent factor, which was designed to capture covariation among three dichotomous indicator items assessing whether the participant had multiple sex partners, had sex when drunk or high, and reported high risk substance use. Approximately 22% of the young adult follow-up sample reported having had multiple sex partners in the past year, 35% reported having sex when

drunk or high, and 34% reported high risk substance use in the past month. As shown in Fig. 1, the percentage of the intervention group engaging in each behavior was lower than the percentage of the control group.¹ The confirmatory factor analysis showed that the factor loadings for these three indicators on the HIV Risk Behavior latent factor were 0.52, 0.88, and 0.86, respectively, and all were statistically significant at $p < .001$. The CFA showed that the measurement model was appropriate and had an excellent model fit, CFI = 1.000, RMSEA < 0.0001.

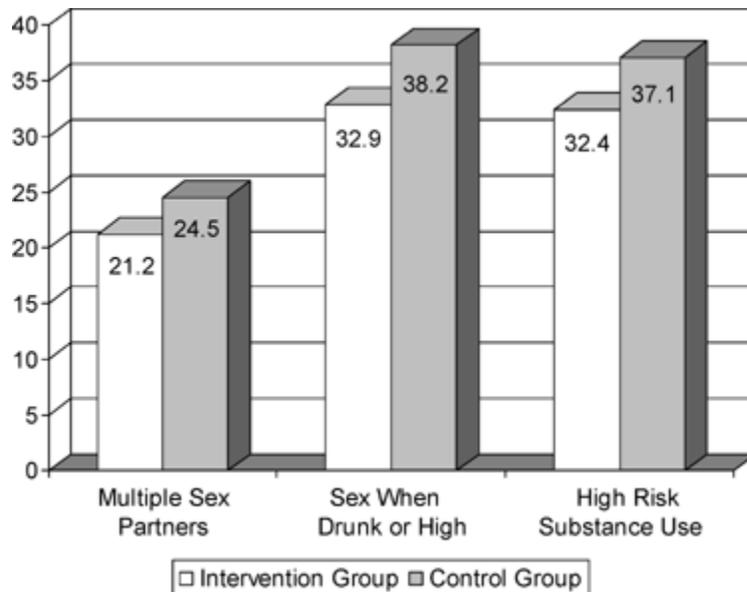


Fig. 1. Rates of HIV risk behavior during young adulthood by experimental condition.

Next, prior to looking at mediating mechanisms, we tested a direct effect model of the intervention on HIV Risk Behavior within a SEM framework. However, findings indicated that the path from Experimental Condition to HIV Risk Behavior was not significant for the entire sample. To more precisely analyze intervention effects, we conducted additional analyses on a subgroup of participants who received a relatively complete version of the prevention program. This high-fidelity subgroup consisted of participants who, based on classroom observation data, were judged to have received at least 60% of the intervention during the three intervention years, while excluding those who received only part of the prevention program. The high-fidelity follow-up sample consisted of 1487 young adults, which included 690 men and 797 women. The demographic characteristics of this sample were virtually identical to those of the full follow-up sample. Among this high-fidelity subset, findings indicated that the path from Experimental Condition to HIV Risk Behavior was significant, $\beta = -.08$, $p < .01$, indicating that there was a protective effect of the intervention on HIV Risk Behavior in young adulthood, with those assigned to the intervention condition reporting less HIV risk behavior at the end of follow-up compared to control participants. This model provided an excellent fit to the data, $\chi^2(2) = 0.24$, $p = .89$, CFI = 1.00, RMSEA < 0.001.

In examining potential mechanisms of intervention effects, we hypothesized that the intervention may have been protective for HIV risk during young adulthood by decreasing serious levels of substance use throughout the course of adolescence. Participants reporting that they drink until drunk and use marijuana on at least a monthly basis from the 7th through 12th grades were identified as an important subset of students with serious levels of substance use involvement that may be particularly relevant to later HIV risk. Thus, we tested the hypothesis that the intervention reduced the rate of growth in alcohol and marijuana intoxication during junior and senior high among intervention participants relative to controls, and this lower rate of growth in serious substance involvement was in turn associated with less HIV risk behavior in young adulthood. Figure 2 shows the prevalence rates of alcohol and marijuana intoxication in the past month by experimental condition from the 7th through 12th grades.

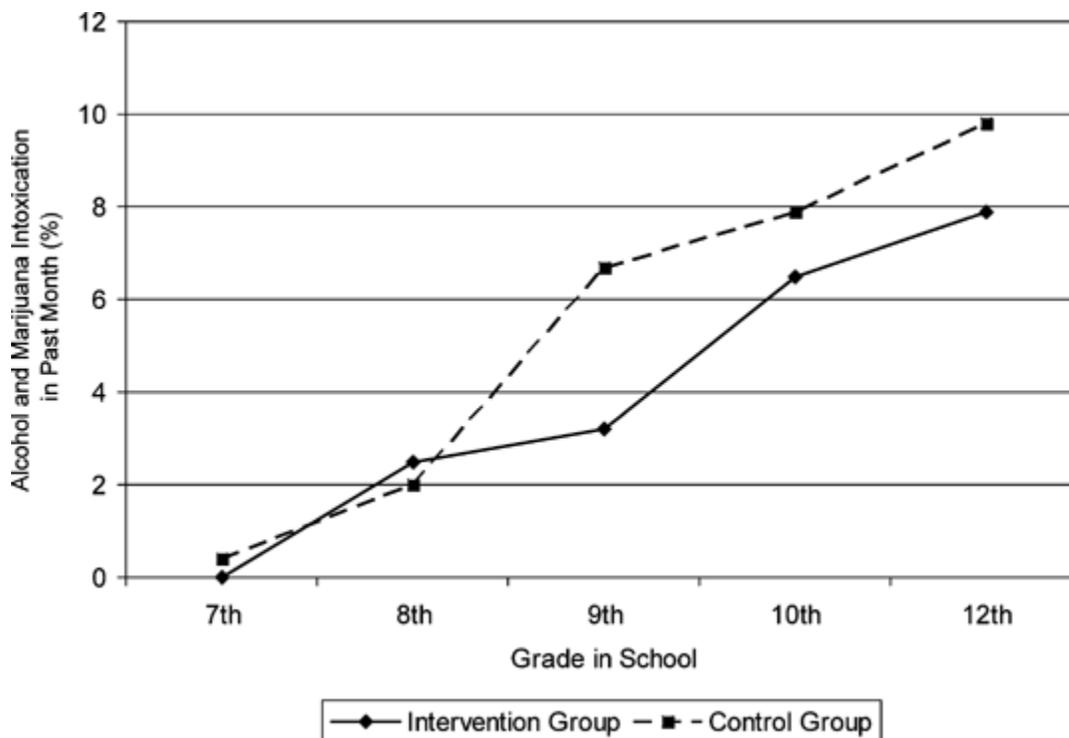


Fig. 2. Growth in alcohol and marijuana intoxication during junior and senior high school by experimental condition.

In the latent growth curve model shown in Fig. 3, growth in serious levels of substance use involvement was measured by Alcohol and Marijuana Intoxication (AMI) during the 7th through 12th grade. The model included an AMI Slope factor to estimate growth over time and an AMI Intercept factor to estimate individual differences in alcohol and marijuana intoxication at baseline. The correlation between slope and intercept factors were estimated in the model to account for the possibility that differences in initial levels of substance use may affect rate of growth over time. We also included a path from Experimental Condition to the AMI Intercept factor to control for pretest differences. Using one-tailed significance

levels,² findings indicated that there was a significant direct effect from Experimental Condition to the AMI Slope factor, $\beta = -.08$, $p < .05$, indicating that the rate of growth in alcohol and marijuana intoxication was lower in the intervention group relative to controls. There was also a significant direct effect from the AMI Slope factor to the HIV Risk Behavior factor, $\beta = .49$, $p < .05$, indicating that more growth in alcohol and marijuana intoxication during junior and senior high school was associated with greater HIV risk behavior in young adulthood. In the final model, the correlation between the AMI Intercept and Slope factors was not statistically significant, nor was the path from Experimental Condition to the AMI Intercept factor. Furthermore, the direct effect from Experimental Condition to HIV Risk Behavior dropped to nonsignificance, suggesting that the effect of the intervention on HIV risk during young adulthood was partially mediated by reduced growth in alcohol and marijuana intoxication over the course of adolescence. The final model provided an excellent fit to the data, $\chi^2(16) = 47.3$, $p = .001$, CFI = 0.98, RMSEA < 0.04.

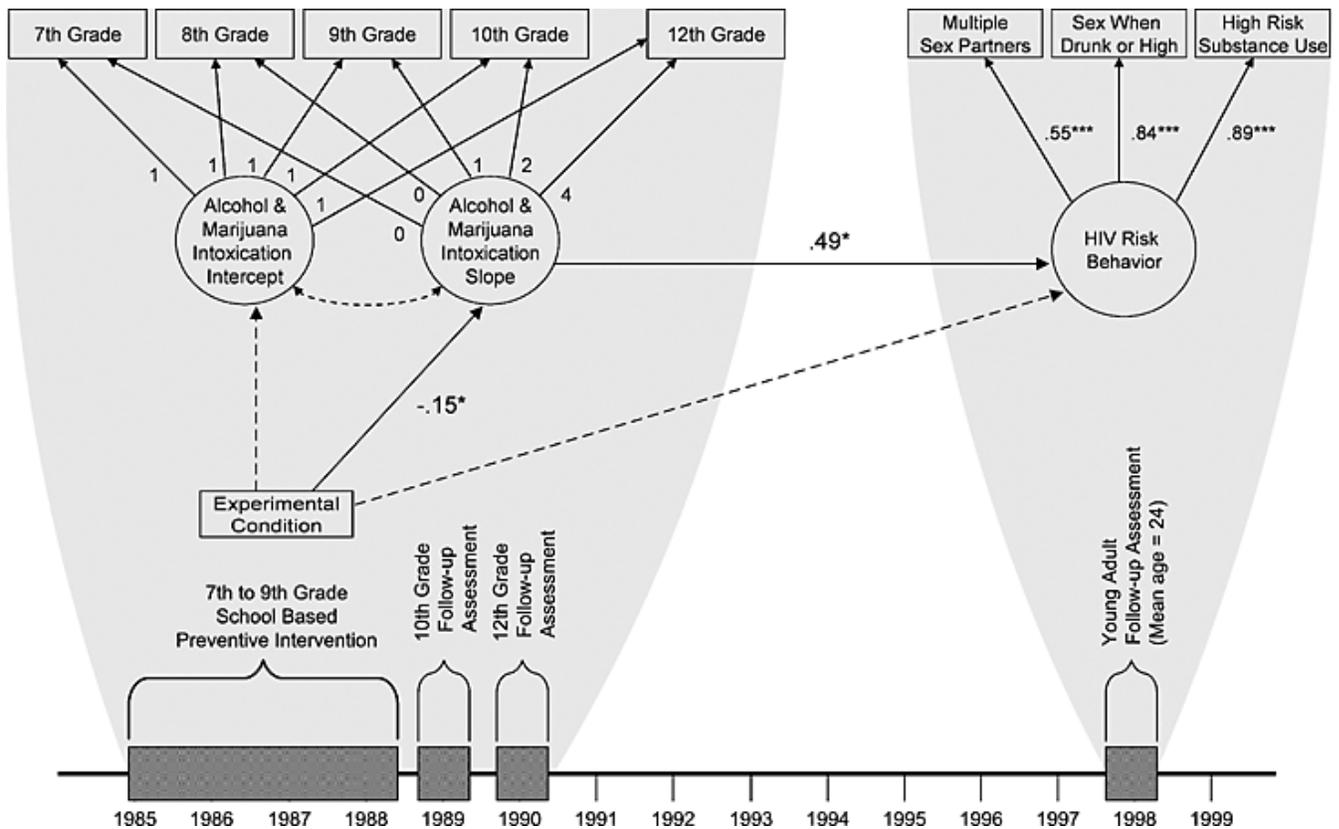


Fig. 3. Final model showing experimental condition, growth and intercept factors for alcohol and marijuana intoxication, and HIV risk behavior in young adulthood. *Note.* * $p < .05$, *** $p < .001$, one-tailed significance levels.

DISCUSSION

The present study examined the extent to which participation in a competence-enhancement drug abuse prevention program during junior high school led to less HIV risk behavior among a sample of young adults assessed 10 years after the completion of the school-based intervention. Overall, students who received the drug abuse prevention program (LST) during junior high school were less likely to engage in HIV risk behavior relative to controls that did not receive the prevention program. Furthermore, among the high fidelity subgroup this effect was partly explained by the fact that participants who received the intervention grew at a lower rate in serious levels of substance use intoxication when compared to control group participants.

Although the initial intervention did not include material on sexual behavior, the intervention addressed several risk and protective factors that have been shown to play a central role in a variety of adolescent problem behavior outcomes. A common finding in the research literature is that young people who are involved in one type of problem behavior are likely to engage in other problem behaviors (Donovan *et al.*, 1988; Resnicow *et al.*, 1995). Negative behaviors may cluster among youth because the behaviors stem from a common set of etiologic determinants (Jessor & Jessor, 1977). From the adolescent's point of view, drug use and sexual behavior may appear functional and instrumental in achieving personal goals such as bonding with peers, asserting independence from authority, coping with feelings of inadequacy or failure, and attempting to appear more mature. Therefore, prevention programs that are broad-based and teach general social and personal competence skills may have broad application. Indeed, such programs have been found to be a useful prevention approach not only for drug abuse, but also for adolescent depression, delinquency, and aggression, and have been found to promote positive youth development and school success as well (Flay, 2002; Frey *et al.*, 2000; Weissberg *et al.*, 1997; Zinset *et al.*, 2000). Such broad-based prevention approaches may be both efficient by targeting multiple risk behaviors within a single program given limited resources for prevention and effective in reducing a variety of negative outcomes including risky sexual behavior.

Limitations and Future Research

There are a number of strengths and limitations in the present study. Strengths include the fact that the intervention tested is a well-established broad-based drug prevention approach, the original prevention trial used rigorous research methods including random assignment of a large number of schools to conditions. Furthermore, the follow-up data were collected over a critical life transition from adolescence to young adulthood. Limitations include a low retention rate of the baseline sample completing the follow-up. The relatively high attrition rates served to reduce the number of individuals of greatest interest (e.g., substance abusers and minorities, who are disproportionately represented in the HIV-positive population). Low retention also limits the external validity or generalizability of these results because participants that remained in the study were at lower risk than the baseline sample as a whole. The lower base rates and potential restricted range in risk behaviors outcomes in the matched longitudinal sample may decrease the statistical power to detect intervention effects, and therefore this study may be a relatively conservative test of the intervention effects on HIV risk behavior. However, the low retention

rate does not affect internal validity of the findings because there was no differential attrition across conditions. Another limitation was that the design of the follow-up assessment during young adulthood did not allow for a detailed event-level analysis of sexual and drug-related risk behaviors. Furthermore, in addition to the limitations inherent in self-reported data, the available measures were limited because they did not measure the full spectrum of behaviors that put one at risk for HIV. For example, we did not assess behaviors such as sex with commercial sex workers, men having sex with men, etc. However, the outcome that was used is a type of HIV risk behavior that is increasingly recognized as important, that is, the combination of intoxication from substance use and sexual activity. The lack of intervention effects on condom use is another limitation of the study. However, effects on condom use, if present, would likely require a more refined subgroup analysis that excludes married and/or monogamous couples that do not use condoms regularly. Finally, because the latent growth analyses focused on a subset of students who received an adequate dosage of the intervention (60% or more), the findings may not generalize to individuals participating in LST or a similar prevention program implemented with low fidelity.

The sample in the present study was largely suburban and White. Thus, it is unclear to what extent the results can be generalized to other subgroups of youth. This is an important limitation because the largest numbers of HIV/AIDS cases in the United States occur among racial/ethnic minorities, in urban areas; particularly Blacks, who now account for more than half of new AIDS cases (Karon *et al.*, 2001). Furthermore, racial/ethnic minority youth engage in the highest levels of risky sexual behaviors. In particular, Black adolescents have been found to be more than twice as likely to report four or more sex partners as White or Hispanic students (Grunbaum *et al.*, 2002), and alcohol, tobacco, and marijuana use have been found to be the strongest predictors of sex with multiple partners among Black high school students (Valois *et al.*, 1999).

Over the past several years, the prevention approach used in the present study has been tested with minority youth (Botvin *et al.*, 1995b) and shown to be effective in preventing substance use among inner-city minority youth in a large randomized trial (Botvin *et al.*, 2001). Thus, an important goal of future research is to examine whether the prevention effects observed in the present study can extend to high risk urban minority populations as young adults, both in terms of risky sexual behavior and drug abuse. It will also be important to examine additional mediating mechanisms by which competence enhancement prevention programs such as LST are effective and how they generalize to behaviors not addressed in the intervention. For example, such prevention programs may reduce HIV risk by reducing the impaired decision-making that may occur when alcohol or other drugs are used during high risk sexual activity, or by helping young people to assertively and effectively negotiate safer sex when engaging in sexual intercourse with one or multiple partners, or by reducing the motivation to engage in intercourse with multiple high-risk partners (IDUs, HIV-positive partners, and those with drug histories). These are important hypotheses for future prevention research.

ACKNOWLEDGMENTS

This research was supported by grants DA07656 from the National Institute on Drug Abuse, National Institutes of Health. Dr. Botvin has a financial interest in the Life Skills Training (LST) program and his consulting company, National Health Promotion Associates (NHPA), provides teacher training and technical assistance for LST. Dr. Griffin is a consultant to NHPA.

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Footnotes

1 There were no differences across experimental condition at the follow-up assessment in terms of the use of condoms during intercourse, with 78.7% of the intervention group reporting that they do not always use condoms compared to 78.2% of controls, $\chi^2(1)=0.05$, $p < .82$.

2 As in previous research (Botvin *et al.*, 1990, 1995a, 1995b), one-tailed significance tests were used for the analyses of intervention effects as warranted by the unidirectional nature of hypothesized effects and the results of previous research using similar prevention approaches.