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# Promoting Reduced and Discontinued Substance Use among Adolescent Substance Users: Effectiveness of a Universal Prevention Program

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## Abstract

Efforts to address youth substance use have focused on prevention among non-users and treatment among severe users with less attention given to youth occupying the middle ground who have used substances but not yet progressed to serious abuse or addiction. Using a sample from 35 middle schools of 1,364 youth who reported using substances, this study examined the effectiveness of a universal youth substance use prevention program, the SAMHSA Model Program *keepin' it REAL*, in promoting reduced or recently discontinued alcohol, cigarette, and marijuana use. Discrete-time event history methods modeled the rates of reduced and recently discontinued use across four waves of data. Each substance (alcohol, cigarettes, and marijuana) was modeled separately. Beginning at the second wave, participants who reported use at wave 1 were considered at risk of reducing or discontinuing use. Since the data sampled students in schools, multi-level models accounted for the nesting of data at the school level. Results indicated that prevention program participation influenced the rates of reduced and recently discontinued use only for alcohol, controlling for baseline use severity, age, grades, socioeconomic status, ethnicity and gender. Among youth who reported use of alcohol in wave 1 ($N$= 1,028), the rate of reducing use for program participants was 72% higher than the rate for control students. The rate of discontinuing use was 66% higher than the rate for control students. Among youth who reported use of one or more of the three substances in wave 1 ($N$ = 1,364), the rate of discontinuing all use was 61% higher for program participants than for control students. Limitations and implications of these findings and plans for further research are discussed.

### Keywords

Universal prevention; Substance use reduction; substance users; Adolescents



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## Introduction

Efforts to ameliorate substance use among youth have focused overwhelmingly on prevention, generally attempting to inhibit or delay the onset of substance use. Youth are less likely than adults to have substance use experience (CASA, 1999), making them natural targets for prevention focusing on the non-user. Furthermore, because earlier substance use is associated with greater risk of progression to problem use (CASA, 2003) and to use of more harmful substances (CASA, 1994), preventing onset of use among youth is viewed as a public health priority (NIDA, 2003).

Using the Institute of Medicine's framework, prevention programs have been categorized as universal, selective, or indicated (SAMHSA, 2003). *Universal* programs serve an entire population (e.g., a community or school) and focus on the general risk level shared by all group members. While universal programs are designed using the general risk level assumption, typically no screening for substance abuse risk is performed before the program is delivered, and it is acknowledged that group members' individual risk for substance abuse can vary widely (Pentz, 1994). Nevertheless, universal programs typically assume that participants have never used substances and have the goal of preventing any future use despite the acknowledgment of variable risk—and variable current use—among participants. For example, it is widely accepted that the majority of adolescents in the U.S. drink alcohol at some point, and many of those do so in a risky manner (Marlatt & Witkiewitz, 2002).

*Selective* prevention programs target individuals who exhibit a high risk for future substance use based on personal- or environmental-level factors, such as being the child of an addict or living in a neighborhood where drugs are readily available. This program type emerged in the last decade in response to criticisms that universal programs were wasteful because they were most likely to reach youth who would not use drugs (Pentz, 1994). Like universal programs, the goal of selective programs is to prevent substance use onset. A third type, the *indicated* prevention program, targets youth who already use substances and attempts to reduce or discontinue substance use and prevent other risky behaviors (Leshner, 1997). Proponents of indicated programs argue that other program types may be inadequate to meet the special needs of substance-using youth who may exhibit multiple problem behaviors and thus require multiple forms of intervention (Mathias, 1997).

The continuum of prevention services, then, parallels the substance use severity continuum. Non-users and universal prevention are at one end, and users and indicated prevention are at the opposite end, suggesting that universal prevention programs have diminishing returns as use severity increases. Yet, relatively little attention has been given to possible effects that universal or selective programs may have on substance-using youth, despite acknowledgment that they exist in groups receiving these programs. Prevention researchers have tended to concentrate on the effectiveness of these programs in delaying initiation of substance use (Dwyer & MacKinnon, 1991). Yet, while they do not target current users, universal and selective programs might also influence the transition from user to nonuser or from heavier use to less use, at least for some substance-using youth. Some research has even documented these effects (Ellickson & Bell, 1990; Green & Kelly, 1989; Ellickson *et al*., 1988; Swisher *et al*., 1985; Best *et al*., 1984).

While indicated programs are an important part of the prevention services continuum, the emphasis in studies of universal and selective prevention on delayed use onset as the "real" marker of a program's effectiveness is problematic because it casts as less important substance-using youths' outcomes. Shouldn't a program be accountable for its effects on all participants, not just prior non-users? If so, measures of program effectiveness must include

not only outcomes which non-users can achieve (delayed use onset) but also those which current users can achieve (reduced or recently discontinued use).

What we know about early substance use suggests that not all users are alike and that some users may be responsive to universal and selective prevention programs despite their more advanced position of risk on the substance use continuum. First, we know that much early use is experimental (Byrnes, 2003; Vega & Gil, 1998). Adult legal drugs, such as alcohol and cigarettes, are so widely used and easily attainable in most communities that underage youth's experimentation with these drugs is common by mid-adolescence. Adolescence itself is marked by experimentation in many behaviors, enabling youth to understand the social world around them and locate themselves within it (Vega & Gil, 1998). Unlike their more rare youth counterparts who are heavy and regular users, youth who experiment tend to be light and infrequent substance users (Byrnes, 2003). As the previous statement suggests, use severity is commonly captured by continuous measures of the frequency and amount of substance use, with higher values indicating greater severity (see for example the National Survey on Drug Use and Health, Substance Abuse and Mental Health Services Administration, 2005; and the Monitoring the Future survey, Johnston *et al*., 2005). However, experimental adolescent users are also distinguished from more severe users in that they have fewer chronic problems and fewer risk factors, such as less access to drugs and less or no family dysfunction, and their problem behavior is short term–that is, it tends not to persist into adulthood (Rowe *et al*., 2004; Eggert *et al*., 1996).

Second, we know that use of a substance at one stage does not necessarily lead to use of harder drugs (Golub & Johnson, 1994) or mean that current use will continue indefinitely (Chen & Kandel, 1995). Despite the possibility of continued use and a transition to even more problematic use, many youth "outgrow" substance use. As their responsibilities increase, their desire to use substances may wane (Institute of Medicine, 1999). They may come to view substance use as bad for their health and relationships, and their contact with other users may decline (Bailey *et al*., 1992). Third and finally, although some substance-using youth exhibit multiple problem behaviors (Jessor & Jessor, 1977), substance use is not necessarily accompanied by other risk behaviors (Byrnes, 2003).

Thus, within the population of substance using youth, there may be yet another continuum, this one reflecting variations in responsiveness to universal and selective prevention programs, in terms of reduced use or non-use rather than delayed use onset. Some youth, while they may fall into the at-risk category because of their substance use experience, may be similar to non-using peers in their receptiveness to universal or selective programs' anti-drug messages and skill building, and they may not require multiple support components, such as those included in indicated programs, to transition to reduced or recently discontinued use. Among users, experimental or light users may be most receptive to intervention, either discontinuing or reducing their use. Middle-range users may be less likely to quit use but instead be amenable to reduced use. Least likely to respond positively to universal or selective programs are severe users. Because they use substances more heavily or more frequently, they are at greater risk for subsequent substance use, consistent with the process toward dependence and/or addiction. Studies have shown, for example, that youth who smoke more cigarettes and with greater frequency are less likely to attempt to or successfully quit smoking (Engels *et al*., 1998; Sargent *et al*., 1998).

Much remains to be learned about the array of factors that determine whether adolescents progress from experimental substance use to abuse, addiction and other problem behaviors. Adolescent brain development and related neural alterations increasingly indicate that adolescents have unique developmental vulnerabilities for drug use (Spear, 2002). The developmental process of adolescence influences general responsiveness to alcohol and

other drugs (Philpot *et al*., 2003). Maturational processes, particularly involving the brain and reproductive system, exacerbate low psychological self-regulation that may be evidenced during childhood and then promote initiation into drug use (Tarter, 2002). In addition, the prominent transformations identified in the prefrontal cortex and limbic dopamine projection brain regions of adolescents across a variety of species have been associated with increased drug use (Spear, 2000). Further research in these areas may clarify the nature and scope of challenges for universal or selective prevention programs in addressing the particular needs of adolescents who are already substance users. More basic research is also needed to determine the degree to which such programs, especially those already found to be efficacious overall, are effective in helping substance using adolescents reduce or discontinue their use.

One way that universal or selective programs could benefit substance-using youth is through resistance skills education (Botvin & Griffin, 2003). We know that some youth feel pressure to use drugs, although they themselves may have little interest in using. Poor resistance skills leave these youth unprepared in the face of drug offers, resulting in un-desired use (Trost *et al*., 1999; Moon *et al*., 1999; Hecht *et al*., 1992; Alberts *et al*., 1992). Because universal and selective prevention programs, including *keepin' it REAL* (Gosin *et al*., 2003), teach resistance skills, they empower youth to resist drug offers and effectively avoid substance use. In the case of substance-using youth, the acquisition of resistance skills could facilitate reduced or recently discontinued use whereas in the case of non-using youth, it facilitates continued abstinence or delayed use initiation. For prior substance users as well as non-users, these prevention programs may also inculcate or strengthen anti-drug norms, and change perceptions of the prevalence of substance use among peers.

Universal or selective programs could also benefit substance-using youth by serving a harm reduction function. Harm reduction prevention programs, while aimed at preventing misuse or abuse, not promoting abstinence, have conceptualized "safer use" as requiring abstinence under certain circumstances, and among other positive outcomes, have documented a reduction of use among program participants (e.g. Botvin *et al*., 2000; McBride *et al*., 2000). Harm reduction prevention programs include awareness and education, fostering positive peer support, and development of decision making skills (Dickson *et al*., 2004). Specifically, these programs teach users to identify the health risks of using, make decisions about the need to reduce risk, and modify behavior to reduce those risks. Youth who learn resistance skills may be better able to avoid use in situations they have decided are unsafe, for example, drinking alcohol while driving, resulting in an overall reduction in use.

## *keepin' it REAL*: A SAMHSA model program

To examine the efficacy of a universal prevention program among substance using youth, this study draws on the results of a randomized trial of a culturally grounded substance use prevention curriculum called *keepin' it REAL*, which is recognized as a model program by the Substance Abuse and Mental Health Services Administration (SAMHSA). The prevention program, named for the drug refusal skills it teaches (Refuse, Explain, Avoid, Leave), was developed as a culturally appropriate intervention, incorporating traditional ethnic values and practices that promote protection against drug use (Castro *et al*., 1999). The program specifically identified aspects of Mexican American, European American and African American culture to develop a 10-lesson, classroom-based curriculum (Marsiglia & Hecht, 2005) that extended resistance and life skills models (Botvin *et al*., 2001), using a culturally based narrative and performance framework (Holland & Kilpatrick, 1993). The objective was to enhance anti-drug norms and attitudes and to facilitate the development of students' risk assessment, decision-making, and drug resistance skills. For details of the curriculum design, including the qualitative phases of the research that utilized drug

resistance narratives and communication styles of the local population and the incorporation of relevant cultural group values to develop lesson content, see Holleran *et al*. (2002) and Gosin *et al*. (2003).

The randomized trial of *keepin' it REAL* documented the program's effectiveness in preventing substance use, strengthening anti-drug norms and attitudes, and increasing the use of drug resistance strategies (Hecht *et al*., 2003), but it did not differentiate any effects on current substance users from those on non-users. Although *keepin' it REAL* is not geared specifically toward prior substance users and does not explicitly promote reduction or discontinuation of use, it aims to enhance participants' resistance skills and therefore, may enable participants who are already experimenting with substance use to succeed in resisting future offers, reducing the frequency of or eliminating their use.

The main hypothesis for this study was that, among prior substance users, students participating in the *keepin' it REAL* intervention would have higher rates of reducing or discontinuing substance use than students in the control group. Secondary hypotheses were that more severe prior substance use would lessen the likelihood of these transitions for both the intervention and control groups, and that severe prior substance use would moderate—and more specifically mitigate—program participation impacts on substance use reduction and recent discontinuation. Stronger desirable program participation impacts on these transitions were also expected to occur shortly after the completion of the intervention curriculum rather than at later intervals.

## Methods

### Data and sample

Data came from students who participated in a two-year, four-wave drug prevention study in 35 schools in a large Southwestern city. The participating public schools were stratified according to enrollment size and ethnicity (% Latino) and then assigned to treatment (program participation) or control groups through block randomization. Tests for equivalence of the program and control groups found no significant differences in the representation of Latinos, who comprised a majority of the sample, and no gender differences. There were slight differences in the representation of some other ethnic groups, with somewhat lower proportions of non-Hispanic Whites and slightly higher proportions of African American students in the control group (see Hecht *et al*., 2003 for details). These differences are addressed in the analyses by controlling for ethnicity at the individual level.

The original sample included 7,304 seventh and eighth grade students, 4,626 of whom completed the wave 1 pretest. The subsample for the current analysis consisted of current substance users only—that is, the 1,364 students who self-reported in the pre-test survey (Fall 1999) that they had used either alcohol, marijuana, or cigarettes at least one day in the 30 days prior to the survey date. This group excludes the one case in which it was unknown whether the student participated in the prevention program.

Following the pre-test survey the *keepin' it REAL* curriculum was implemented in the 25 program schools, while the 10 schools assigned to the control condition continued to implement a variety of existing prevention programs that had been instituted by their school or school district personnel. These programs were state mandated to be research based, but varied considerably across the nine school districts represented in the sample. Subsequent survey data collection occurred in all schools in Spring 2000, Fall 2000, and Spring 2001, approximately 2, 8 and 14 months after the *keepin' it REAL* curriculum was implemented. Most of the participating schools, both program and control, had a majority of students of Mexican heritage and a minority of students who were non-Latino White. They served

primarily lower income, urban neighborhoods. Within these schools, every student in 7th grade at the onset of the study was selected as a participant. One hundred students from several 8th grade classes in one of the schools also participated.

Prior to survey administration, school administrators sent letters to the parent(s) of every student explaining the study and requesting their consent to have their child participate in the study and complete the study surveys. During regular school hours in either a science, health, or home-room class, university-trained survey proctors administered a 45-minute written questionnaire, available back-to-back in either English or Spanish, to students. Proctors informed students that the survey was part of a voluntary university research project rather than a normal school activity and that their responses would remain confidential. All students present the day of survey administration agreed to complete the questionnaire. Absent students were not contacted further.

Of the 1,364 students who reported substance use on the pre-test survey, 43% were female and 57% were male. Respondents' ages ranged from 11 to 16 years, and the average age was 13 years. Most of the students were from low-income families; 82% received either a free or reduced-price school lunch. Students claiming some Latino heritage comprised 77% of the sample. Of these respondents 95% identified as either Mexican, Mexican American, or Chicano, and 47% were Spanish language dominant. Respondents identifying as White or Anglo constituted 13% of the sample. The remaining 10% of students identified as African American or Black, American Indian, and Asian or Pacific Islander.

Comparing the subsample of substance-using youth to the rest of the original study sample, the substance users were older on average (13 versus 12), more likely to be male (57% versus 51%) and to receive lower usual grades (means of 6.1 and 6.7), and less likely to receive a free or reduced price school lunch (82% versus 91%). In terms of ethnicity and acculturation—as indicated by reliance on English or Spanish—substance-using youth were more likely to be Spanish-dominant Latinos (34% versus 23%) and less likely to be English-dominant Latinos (39% versus 46%), White (11% versus 14%), or Other-Ethnicity (8% versus 12%).

## Measures

**Reduced or recently discontinued substance use—**Within an event history analysis framework, the two events of interest were a transition from more to less substance use (i.e., reduced use) and a transition from use to non-use (i.e., recently discontinued use). Thus, we predicted rates of reduction and rates of recent discontinuation. Alcohol, cigarette, and marijuana use were measured separately. Reduction was defined as a report in the current wave of less frequent substance use in the past 30 days, with use defined in terms of days of use. Less frequent use was defined as fewer days of use than the amount reported at baseline. Recently discontinued use was defined as a report in the current wave of no substance use in the past 30 days. The category of youth who reduced use also included youth who recently discontinued use. Following typical procedures for creating a discrete-time event history dataset, periods in which youth reduced use or recently discontinued use were coded as 1; and afterwards the youth no longer contributed to the data; other periods were coded as 0.

Our measures of reduction and recent discontinuation of substance use have some limitations. First, respondents were asked to report behavior, not to explain or categorize it. They were not explicitly asked whether they reduced or recently discontinued their substance use, or whether they intended or attempted to do so. While behavioral measures are generally considered to be stronger than attitudinal measures in predicting future use, in this case the absence of use in a particular period may not necessarily indicate an intention

to either reduce consumption or never use again. Other circumstances, such as lack of access to a substance, could preclude use, and a change in those circumstances could lead to a resumption of use. Second, the reduction and recent discontinuation measures in this study captured information about use only in the thirty days prior to the survey dates. It is possible that some respondents used substances five weeks before or a few days after the survey date, in which case the findings here may overestimate the extent of permanent reduction or permanent discontinuation among the sample.

However, we are careful to note that our outcomes represent recent reduction and recent discontinuation, which our measures accurately reflect. These initial reductions and discontinuations are important outcomes because they are, by definition, the first requirements of long-term or permanent reduction and discontinuation. In addition, as measures of recent reduction and recent discontinuation, our measures may be conservative because they are imprecise measurements of the transition to reduction and discontinuation. The students who reduced or discontinued use far earlier than the last 30 days should be recorded as having higher rates of reducing or discontinuing use, yet due to measurement limitations they will be grouped with students who had these transitions only in the prior month. The inability to distinguish between those who made the transition only one month ago versus many months ago may attenuate program effects.

Lastly, there is support for using a 30-day time period due to recall issues. Because there is evidence for the reliability of self reports of substance use when restricted to the last 30 days (Johnston, 1989), especially as part of a repeated measures design (Smith-Donals & Klitzner, 1985), our measures of reduction and recent discontinuation avoid retrospective biases in measures based on respondents' recall of the timing of reduction or recent discontinuation of use occurring over a longer interval.

**Time to reduction/recent discontinuation or censoring—**Since the sample consisted of current substance users based on a report of current use in wave 1, the beginning of exposure to risk (time = 0) for all cases was wave 1. In event-history terminology exposure to risk is simply the possibility of transition. In our case, this transition is from use to recent reduction or discontinuation of use, which is a beneficial outcome. Thus exposure to risk should not be confused with risk in the sense of harmful behaviors. The end of exposure to risk was either the wave in which an event occurred, the wave in which a participant dropped out of the study, or the wave in which the study ended (wave 4). In the case of the last two possibilities, a case takes a zero value on the event variable and is called "censored." Duration, or the time to event or censoring, was measured in waves, and therefore, could range from 1 to 3, given the four survey waves. A duration of 1 indicated that the respondent reduced use, recently discontinued use, or failed to complete a survey in wave 2. A duration of 2 indicated that the respondent reduced use, recently discontinued use, or failed to complete a survey in wave 3. Finally, a duration of 3 indicated that the respondent reduced use, recently discontinued use, failed to complete a survey in wave 4, or reported drug use in wave 4.

**Program participation—**Respondents were divided into two groups: program and control. The program group, 77% of the sample, participated in the *keepin' it REAL* substance use prevention program whereas the control group (23%) did not. A dichotomous variable captures this distinction (1 = program, 0 = control). We expected the rates of reduction and recent discontinuation to be higher among the respondents in the prevention program than among the respondents in the control group.

**Substance use severity—**The number of days of substance use in the past 30 days, as reported in the previous wave, served as a time-varying indicator of severity of substance

use. Alcohol, cigarette, and marijuana use were measured separately on 6-point Likert scales (1 = None; 2 = One; 3 = 2–3; 4 = 4–7; 5 = 8–15; 6 = 16 to 30 days). These measures were modeled on questionnaire items about the frequency of drug use created by Flannery *et al*. (1994), and were chosen so that question wording and response categories were developmentally appropriate for the age group under study and for their similarity to measures used in other large early adolescent drug use studies (e.g., Kandel & Wu, 1995; Newcomb & Bentler, 1986). The distributions for the prior substance use severity measures were skewed toward infrequent use, with 45 percent of the alcohol and cigarette users and 38 percent of the marijuana users reporting use in only one of the previous 30 days. Nevertheless, for all three substances the remaining prior users were distributed rather evenly across the other categories, from occasional (2–3 days) to very frequent use (16–30 days). Thus, the analysis included substantial numbers of the most frequent users; the number reporting use in more than half the days of the previous month included 55 alcohol, 51 cigarette, and 94 marijuana users.

**Ethnicity and control variables—**Non-Latino White students constituted the reference group category (13%) in regression analyses. Non-Latino, Other ethnicity students constituted a second category (10%). Students identifying as “Mexican, Mexican American, or Chicano/a” or as “Other Latino/a or Hispanic” in any survey wave constituted the Latino group. However, this group was broken down by degree of linguistic acculturation into the third and fourth categories. Students who opted to complete a Spanish questionnaire, indicated that they spoke Spanish with their friends all or most of the time, or indicated that they spoke Spanish and English about equally with their friends were considered to be Spanish-dominant and assigned to the Less Linguistically Acculturated Latino category (36% of substance users). Remaining members of the Latino group were assigned to the More Linguistically Ac-culturated Latino category (41%).

Although linguistic acculturation is only one dimension of the acculturation process, we use it for two reasons. First, prior research has shown linguistic acculturation to be an important marker of differences in substance use in Latino populations (Marsiglia *et al*., 2004; Marsiglia & Waller, 2002; Nielsen & Ford, 2001; Epstein *et al*., 2001, 2000). It has been demonstrated to be comparable to multi-dimensional measures, accounting for up to 65% of the variance on acculturation status (Rogler *et al*., 1991; Samaniego & Gonzales, 1999). Second, theory suggests that linguistic acculturation is especially important in substance use. English language predominance is associated with an erosion of family communication and cohesion, when parents English acquisition trails behind their children’s and children lose their Spanish fluency (Rogler *et al*., 1991; Marsiglia *et al*., 2003). It is also associated with an expansion of adolescents’ social networks, greater exposure to pro-drug norms and behaviors (Dalton *et al*., 2003; Escobar, 1998), acculturation stress (Beauvais, 1998; Gil & Wagner, 2000; Vega *et al*., 1997), and a loss of the protective, identity enhancing effects of maintaining cultural ties through continued use of Spanish (Ardila, 2005).

The previous wave’s value of the student’s age in years,[1] socioeconomic status, and academic performance served as time-varying control variables in the multivariate analyses. Socioeconomic status was captured by a dichotomous variable (1 = participation in the Federal free or reduced-price school lunch program, 0 = no participation). Academic performance was measured by the student’s report of his/her “usual grades in school,” on a Likert scale from 0 (mostly F’s) to 9 (mostly A’s).

[1]A time-invariant measure of age (in years at wave 1) was tested in the multi-variate models. The direction and statistical significance of the effects were identical to those found using the time-varying measure.

## Analysis

Discrete-time event history methods modeled the rate of use reduction and the rate of recent use discontinuation. Discrete-time methods have been used successfully in previous studies of substance use (e.g., Guo *et al*., 2002; Wilcox *et al*., 2002; Masse & Tremblay, 1997). Event history models offer advantages over a simple binary logistic regression with a simple yes/no indicator of a reduction or recent discontinuation event during the study period. One advantage is that event history models capture the variation in the pace or rate at which these events occur. Another advantage is that event history models allow the inclusion of time-varying variables. These are predictor variables whose values are allowed to change over the progression of the hazard, as students progress through subsequent survey waves. Note that we used discrete-time event history methods (which can easily be estimated with logistic regression) instead of a continuous-time method such as Cox regression. Because our measurement of the time to reduction or recent discontinuation was based on survey waves and not exact measures of time, discrete-time methods were more appropriate (Allison, 1995).

Each substance (alcohol, cigarettes, and marijuana) was modeled separately, using the sub-sample of users of that substance. Person-survey waves were the units of exposure to the risk of reduction and of recent discontinuation across four waves of data. Beginning at the second wave, participants who reported use at wave 1 were considered to be at risk of reducing or discontinuing use. Unlike in Cox proportional hazards models, the baseline hazard must be specified in discrete-time models (Allison, 1995). We specified the baseline hazard with a series of dummy variables to represent each wave of exposure to the risk of reduction or recent discontinuation. Since we examine the three waves of data after the first pre-program survey, we have dummies for wave 3 and wave 4, and we leave wave 2 as the reference.

There are two types of missing data in our analyses: missing data on individual characteristics at baseline, and missing data over time due to attrition. We handle baseline missing data with listwise deletion. Among the 1,364 prior substance users who completed the baseline survey, very few cases were missing on the predictor variables employed in analyses. The variable with the largest number of missing cases was gender (5% missing); for all other predictor variables, fewer than 1% of the cases were missing. Because these rates of missingness are low, it is unlikely that substantial bias is introduced by listwise deletion of cases for baseline missing data.

The most frequent causes for missing data over time due to attrition include student absences on the days the survey was given and students moving to another school. Of the 1,364 substance using students who completed the baseline survey, less than half (602) completed wave 4. Although this appears substantial, fortunately event history models are designed to handle this type of attrition, which is known as right-hand censoring (Allison, 1995). No bias is introduced if it can be assumed that the attrition mechanism is unrelated to the dependent variable, a process known as non-informative censoring (Allison, 1995). In our study, however, attrition is likely to be correlated with substance use patterns. We address this complication with sensitivity analyses that re-estimate the models under the assumption that none of the students who drop out experience the event (reduction or discontinuation). This is a very conservative assumption because it assumes there were no program effects for students lost to attrition. As we describe in the results, even under these most conservative assumptions, our models show the same patterns. Thus there is reason to believe that attrition is not introducing substantial bias into our findings.

Since the data sampled students in schools, multi-level models accounted for the nesting of data at the school level. Ignoring the clustering of students within schools increases the

possibility of deflated standard errors and biased hypothesis tests. To protect against such problems, we used multi-level modeling techniques that have been success fully applied to discrete-time hazard models (Barber *et al*., 2000). Our specification for the discrete-time multilevel hazard model is as follows:

Level 1

$$\log\ (p_{ijk}/(1-p_{ijk}))=\beta_{0j}+\beta_1(\text{LESSACCULTURATED}_{ij})+\beta_2(\text{NONLATINOWHITE}_{ij})+\beta_3(\text{OTHERETHNICITY}_{ij})+\beta_4(\text{GENDER}_{ij})+\beta_5(\text{AGE}_{ijk})+\beta_6(\text{GRADES}_{ijk})+\beta_7(\text{SES}_{ijk})+\beta_8(\text{USESEVERITY}_{ijk})+\beta_9(\text{WAVE3})+\beta_{10}(\text{WAVE4})$$

Level 2

$$\beta_{0j}=\gamma_{00}+\gamma_{01}(\text{PROGRAM}_j)+u_{0j}$$

where $p_{ijk}$ is the probability that student *i*, in school *j*, at time *k* experiences the transition (either reduction or discontinuation, depending on the specific analysis), given that they have not experienced it before. The intercept, $\beta_{0j}$, is allowed to vary randomly across the *j* schools, because there is likely to be variation in reduction or discontinuation rates across schools that is not captured by the measured predictors. These models are typically called random intercept models (Raudenbush & Bryk, 2002 ), and they are a widely accepted way of addressing clustered data in event history models. Coefficients for other predictors are treated as fixed, but their degree of measurement variation differs: the indicator for program participation varies only across schools, since all students at all time periods in a given school have the same indicator. Predictors for race/ethnicity and gender vary across students, but they do not vary over time because these attributes are static. Lastly, predictors for age, grades, SES, and use severity vary across time within individual students. Note that we also explored whether effects of several individual-level predictors varied across schools. This was done by changing these coefficients, $\beta_1$ through $\beta_8$, from fixed effects to random effects in the estimation. There was no evidence that the effects of ethnicity, gender, age, grades, SES, or use severity varied significantly across schools. Thus we present results from only the random intercept models.

We first compared the survival times (i.e., time to reduction or recent discontinuation) of program and control group participants in Kaplan-Meier survival curves. Then, we estimated the effect of program participation on the rate of reduction and rate of recent discontinuation, controlling for other factors. Subsequently, we tested whether the effect of program participation was moderated by the youth's previous use severity or by time. Finally, using the entire sample of prior users of the three different substances, we estimated the effect of program participation on the rate of simultaneous recent discontinuation of use of all three substances, again controlling for other factors.

## Findings

Table 1 presents the proportions of prior users of each substance who reduced or recently discontinued use at wave 2, 3 or 4. Figures are shown first for all prior users of a particular substance and then separately for those in the program and control groups. Results of chi-square tests for differences between program and control groups in the proportion experiencing these events are summarized in the table. Among the 1,028 prior alcohol users, 40% reduced alcohol use and 32% recently discontinued use in the course of the study. The

alcohol reduction and discontinuation rates were significantly higher in the program than in the control group, by an additional 13% for reduced use and 10% for discontinued use. Among the 544 prior cigarette smokers, 35% reduced cigarette use and 29% recently discontinued use overall. The reduction and discontinuation rates again were higher in the program than in the control groups, but the gap declined to 3% for reduced use and 5% for discontinued use, both of which were non-significant differences in chi-square tests. Among the 614 prior marijuana smokers, 31% reduced marijuana use and 25% recently discontinued use. Differences between program and control groups in marijuana reduction and discontinuation narrowed even more, to only a one or two percent non-significant difference between the program and control groups. The last panel of Table 1 presents the proportions of prior users of any one of the substances or combination of them (alcohol, cigarettes, marijuana) who subsequently discontinued use of all of them. Among all prior users, 26% discontinued use of any and all of the three substances. This comprehensive discontinuation rate was significantly higher in the program than in the control groups, with 7% more of the program than of the control group users discontinuing all use. Coinciding reduction of all substance use was not assessed in the analysis.

We produced Kaplan-Meier estimates of the survivor function for reducing and discontinuing alcohol use and the differences in survival between the program and control groups. Program participants reduced their alcohol use at higher rates than the rates at which control students reduced use, and this difference was statistically significant, using both the log-rank (10.13, df = 1, $p = 0.00$) and Wilcoxon tests (8.63, df = 1, $p = 0.00$). Similarly, program participants recently discontinued alcohol use at higher rates than control students did, and this difference was statistically significant (Log-Rank = 7.16, df = 1, $p = 0.01$; Wilcoxon = 7.14, df = 1, $p = 0.01$). The two groups did not, however, have significantly different survival times to reduction or recent discontinuation of cigarette or marijuana use.

Multi-level discrete-time hazard models were generated to examine the impact of program participation on the rate of reduction and the rate of recent discontinuation of the use of alcohol, cigarettes, marijuana, and all three substances, controlling for other variables. Table 2 shows the raw estimates and exponentiated coefficients (i.e., odds ratios), first for alcohol use reduction, and then for reduced use of cigarettes and of marijuana. The exponentiated coefficients represent the effect of the predictor on the rate.[2] An odds ratio greater than one is a positive effect on the rate, or in other words, an effect that accelerates use reduction or recent discontinuation. We expected odds ratios greater than one for the program effect because the program is hypothesized to lead to higher rates of reduction or recent discontinuation. An odds ratio less than one is a negative effect on the rate. An odds ratio equal to one is a null effect that does not influence the rate.

Program participation had a significant effect on the rate of reduced alcohol use. For program participants who reported alcohol use in wave 1, reduction rates were 72% (= (1.72 − 1) * 100) higher than the reduction rates for control students. In addition, students with higher grades had higher reduction rates. Time also had a significant effect: the rate of transition to reduced alcohol use was lower in the third wave than in the second wave.

In the models predicting cigarette and marijuana use reduction, program participation was not a significant predictor, although the direction of effects was positive. The estimates of the size of these program effects (odds ratios of 1.05 for cigarettes and 1.19 for marijuana)

[2]Although we refer to the coefficients as influencing the rate, discrete-time models actually estimate the effects of the predictors on the odds of the transition. When the number of events is small relative to the number of person-periods of risk, the odds (= Number for whom event occurred/number for whom event did not occur) converge to the rates (= Number for whom event occurred/Number of person periods of exposure to risk of event).

were much smaller than found for rates of reduced alcohol use. However, ethnicity was a significant factor in predicting reduced cigarette use. Non-Latino White students who used cigarettes had lower rates of cigarette use reduction than More Acculturated Latino/a students did. Time was the only substantial predictor of reduced marijuana use, with rates of reduction dropping sharply in the fourth wave compared to the second wave.

Separate models with interaction terms tested whether program effects on reduction were influenced by previous substance use severity and whether they weakened over time, but none of these tests demonstrated significant interactions (tables not presented). The effects of program participation on alcohol, cigarette, and marijuana reduction were not moderated by previous use severity. Odds ratios for the treatment-by-prior-use-severity interaction terms were 0.91 ($p$ =.42) for predicting alcohol reduction, 0.97 ($p$ = .85) for cigarettes, and 1.08 ($p$ = .48) for marijuana. These results indicate that heavier prior users did not have significantly different rates of reduction than lighter prior users. Similarly, program participation effects were not moderated by time, indicating that program effects did not vary significantly across survey waves.

To guard against the possibility that our results were sensitive to attrition, we performed sensitivity analyses. We reran the reduction models under the assumption that all students who were lost to attrition would never have reduced use. Note that the assumption that all attrition cases never reduced is likely to be an overly conservative assumption. Some attrition is due to reasons not associated with substance use, such as illness or moving between schools. Nevertheless, we performed these analyses to explore how our results changed in response to different assumptions. As expected, the program effects became smaller (dropping from 72% to a 48% higher rate of reduction compared to controls) and not significant, but they remained in the hypothesized direction, giving confidence to our initial findings.

Table 3 shows the raw estimates and exponentiated coefficients (i.e., odds ratios) for recently discontinued use of alcohol, cigarettes and marijuana. For those who reported alcohol use in wave 1, the estimated rate of subsequently discontinuing such use was 66% (= (1.66 − 1) * 100) higher for program participants than for control students, a difference that was statistically significant at $p$ = .056. Older adolescents were less likely to report recent discontinuation of prior alcohol use, with rates decreasing by 20% ( = (0.80 − 1) * 100) with each additional year of age. In contrast, adolescents with higher grades in the previous wave were more likely to report recent discontinuation; these rates increased by 9% ( = (1.09 − 1)* 100) with each increment in grades, which represented about half a letter grade (from E to A). Heavier alcohol use in the previous wave was associated with lower rates of recent discontinuation-specifically, 20% (= (0.80 − 1) * 100) lower with each unit increase in use severity.

Again, although the direction of effects was similar to that for alcohol, program participation was not a statistically significantly predictor of recent discontinuation of cigarette and marijuana use. The direction of the non-significant program effect estimates indicated that such effects were less than half the size of those obtained for alcohol. The estimated relative increase in the rate of discontinued use for program participants compared to controls was about 30 percent for cigarette and marijuana users, compared to 66 percent for alcohol users. As in the model predicting discontinued alcohol use, prior use severity was a significant predictor of discontinued use of cigarettes and of marijuana. The heavier the cigarette or marijuana use reported in the previous wave, the lower the rates of recent discontinuation were with each unit increase in severity: 15% lower for cigarette use and 33% lower for marijuana use. In addition, Non-Latino White students who used cigarettes had lower rates of recently discontinued cigarette use than More Acculturated Latino/a students did.

In the separate models testing for moderated program effects on recent discontinuation (tables not shown), the interaction of program participation with previous use severity was statistically significant for alcohol use but not cigarette or marijuana use (the respective odds ratios and *p*-values were 0.78, $p = .02$; 0.94, $p = .60$; and 1.00, $p = .95$). Program participation was thus less effective in discontinuing alcohol use for heavier than for less frequent prior users of alcohol. The program effect was reduced by 22% for every one unit increase on the 6-point ordinal measure of alcohol use severity. The program was not, however, less effective over time; program effects on recent discontinuation did not vary significantly across survey waves for any of the three substances.

Because our definition of recently discontinued use may have influenced the results, we performed sensitivity analyses in which we varied the definition. We reran the discontinuation models for the three substances under two alternate conditions (tables not presented). First, we recoded the event variable such that a student had to discontinue use and remain non-using for the remaining waves to qualify as having recently discontinued use. With this redefinition, similar results were found as those reported above: significant program effects for alcohol (program participants' rate of recently discontinued use was 79% greater than that of control students) but not cigarettes or marijuana.

Second, to examine effects of attrition, we reran the analyses under the assumption that all students who were censored due to attrition would never have discontinued use–that is, they would have continued their substance use. Again, this test is likely to be overly conservative. Not surprisingly, the effect of program participation on recent discontinuation of alcohol use, although still positive, became smaller in magnitude and not significant (dropping from a 66 to a 46% higher rate of recently discontinued use compared to controls). However, we know that a high rate of school-transfers was a factor in attrition. Many students left the study due to transfers to schools not participating in the study and not necessarily due to substance use. Exploratory analyses of comparative attrition rates also suggested that prior substance use was not the principal factor determining attrition. Attrition rates among prior substance users were about 10% higher than among prior abstainers across three different substances and across the three post-test surveys. Among prior substance users, there were no significant differences in alcohol use severity between students who dropped out of the study and students who remained.

Two-thirds (67%) of the entire sample of prior users reported using more than one of the three gateway substances in wave 1. Therefore, while these students could report discontinued use of one substance, it was possible they would continue to use another substance. To determine the effectiveness of the prevention program in promoting discontinued use of any and all of the three substances under analysis, we estimated a model in which the dependent outcome was the rate of simultaneously discontinuing use of all three substances (Table 4). This model revealed that among those who reported use of one or more of the three substances in wave 1, the rates of discontinued use of all three were 61% higher for program participants than for control students, and this result was statistically significant. In addition to program participants, students with higher grades also had significantly higher rates of complete discontinued use. In contrast, heavier prior users and older students had significantly lower rates. Despite the evidence of program effectiveness in achieving discontinued use of all three gateways substances simultaneously, additional analysis suggested that multi-substance use was nevertheless more resistant to change. Among program participants 43% of users of only one substance reported recently discontinued use as compared to only 20% of users of more than one substance, suggesting that program effects were stronger among users of a single substance.

## Discussion

This study explored the effectiveness of a prevention program in prompting youth substance users to reduce or discontinue their recent substance use. The findings reveal that program participation positively affected rates of reduction and recent discontinuation of alcohol use as well as rates of complete recent discontinuation of use of all three gateway substances, and that these desired program effects did not reverse or diminish across time. These findings are particularly important when compared to other universal prevention programs, such as DARE, that have been shown to result in increased use among participants in later years (Vega & Gil, 1998).

Although the overall proportions of prior users who reduced or recently discontinued use were roughly similar among alcohol, cigarette and marijuana users, no significant program effects on reduction or recent discontinuation were found for cigarette or marijuana use specifically. Findings from the outcomes study of the *keepin' it REAL* program addressing overall program effects for all participants, including the large majority who were not prior substance users, also found the program to have greater and more consistent desired effects on alcohol (Hecht *et al*., 2003), the most widely used substance in the sample, than on other gateway substances. It is possible that the *keepin' it REAL* program was less effective in tobacco reduction or discontinuation because of tobacco's highly addictive nature (NIDA, 2006a). Tobacco reduction or discontinuation might be better achieved by pairing the program with pharmacological treatment for addiction. Because marijuana use has also been shown to be addictive for some users (NIDA, 2006b), addiction may also have affected marijuana reduction or discontinuation in this sample. In addition, the curriculum developers may have infused more alcohol related content in the classroom exercises and to some degree in the videos because of their awareness of the relatively higher consumption of alcohol than of cigarettes and marijuana among students in the sample. If so, more extensive alcohol content in the curriculum may have resulted in a stronger alcohol program effect.

Findings from the current study showing that the program was also effective in promoting simultaneous recent discontinuation of use of all three gateway substances suggest that recently discontinued use of alcohol was not accomplished merely by switching to use of another substance. However, fewer users of multiple substances reported complete discontinuation of substance use than users of a single substance. Users of multiple substances may be at higher risk and, therefore, more difficult to persuade to not use at all.

Higher risk may also explain why previous use severity consistently predicted lower rates of recently discontinued use for each of the three substances. On the other hand, this outcome may be explained by a "ceiling to floor" effect. Heavier users have more to give up than moderate users, and consequently, their odds of completely discontinuing substance use are lower. Reductions in use may better capture program effects among this group. The finding that more severe prior use generally decreased the likelihood of recently discontinued use but *not* reduced use among program participants is an indicator of this possibility. Further evidence came from the finding that, although there was a substantial minority of students in the sample who were regular users of substances (i.e., half the days of the month), and some students at all points on a continuum from infrequent (once per month) to very frequent use, prior substance use severity did not moderate the program effects on reduction of recent use. Together these findings suggest that program effects were not concentrated exclusively among occasional users but rather extended to users across the prior use spectrum. Nevertheless, in considering the implications of the present findings for other populations of substance using youth, it will be important to consider how the distributions of prior use severity compare to those from our sample and to investigate the degree to which the substance use is problematic.

A limitation of the study lies in the measures of reduction and discontinuation. Future research should involve more precise measurement of substance use reduction and recent discontinuation. For example, respondents' reports of current use could be examined at more frequent intervals to pinpoint the timing and duration of reduction and discontinuation, and information about decisions to reduce or discontinue use could supplement behavioral measures.

High rates of respondent attrition throughout the course of the study were another limitation but one whose impact could be partially assessed. Employing the most conservative assumption—that all students lost to attrition would not reduce or discontinue their substance use—lowered estimates for program impacts enough to make them nonsignificant, but the estimates remained large, e.g. still pointing to nearly a 50% improvement in the rates of the desired transitions for program participants compared to controls.

Research on youth substance use cessation is fairly new and has focused primarily on tobacco. The tobacco research has identified several variables, such as parent's history of quitting, as influential in predicting quitting by youth (Backinger & Leischow, 2001). These variables are distinct from those commonly used to predict use itself. While the prevention program cannot directly influence parental behaviors, it may alter perceptions of parents who smoke and those who have quit, and may change perceptions of parental reactions and friends reactions to the students' use of substances. These variables may be important in determining the mechanism of the intervention's effects on reduction and recent discontinuation. Since the prevention program analyzed here was designed to prevent use rather than to promote reduction or cessation, many possible mediating variables were not captured in the surveys, but should be included in future research on prevention programs that include sizable subpopulations of prior substance users. In general, additional research is needed on reduction and discontinuation and on substances other than tobacco, which is commonly associated with addiction, since behavior patterns may vary across substances. The reduction and discontinuation effects of existing prevention programs and of any new interventions specifically promoting reduction or discontinuation by the non-addicted or recreational user should be further explored to fill gaps in understanding about the substance use behavior of youth across the use spectrum.

The large differences in rates between program participants and the control group in the transition toward reduced or recently discontinued alcohol use show that the *keepin' it REAL* universal prevention program had beneficial program effects for many prior users of substances. The salience of the findings for prevention research can be extended beyond the question of whether this particular universal prevention program achieved desired outcomes for a particular group of prior substance users, a group that was not the explicit target of the intervention design. Clearly, universal prevention programs can achieve desirable outcomes other than continued abstinence, such as reductions in and even recent discontinuation of prior substance use. This finding is important because universal programs may be able to reach a diverse array of youth, from non-users to light, moderate and perhaps heavier users.

Further research is indicated to assess how well these programs address the common and different needs of these groups of youth. While we are not suggesting that universal prevention programs are a substitute for treatment programs for youth with serious substance abuse problems, future research might examine what effects a universal prevention program might have on this group, including the potential for these youth to be more amenable to entering treatment. Future studies could explore program effects on reduction in a user's drug repertoire (i.e., transitioning from poly-drug to single drug use) and on simultaneous reduction of use of all substances in a user's repertoire, outcomes that may reflect attempts to reduce harm associated with use. A comprehensive investigation of

why the program worked for prior substance users is also merited on the agenda for future research. Among other tests for mediation, further analysis might include whether the program increased learning or activation of drug resistance skills for this population, whether pro-drug norms and positive drug use expectancies were changed, and whether confidence (or self efficacy) to refuse substance use offers was bolstered.

### Implications for prevention programming

Because substance users are a substantial minority of the population targeted by universal prevention programs, the results of this study suggest that the needs and experiences of prior users should be included in the curriculum. Curricular vignettes can include characters that have experience using substances, but wish to reduce or discontinue use. Program staff should expect and welcome participants who raise issues related to prior use in class discussions. Further, prevention programs should expand the definition of desired outcomes beyond delayed onset of substance use. If prevention programs affect other desired outcomes that are not currently measured, the field loses an opportunity to promote the allocation of additional resources. Future research also is needed on the similarities and differences in the mediational mechanisms that lead to desirable program outcomes for prior substance users and the mechanisms that lead to delayed substance use initiation for non-users. Such an analysis could yield important insights into why prevention programs are effective and into the applicability of prevention concepts for different target populations.

As prevention programs become more responsive to the demographic changes of the nation, they may need to address different normative aspects of substance use. In this analysis, the use of alcohol appears to have been normative among certain members of the majority Mexican heritage population represented in the sample. Although ethnic differences did not appear in the rates of youth transitions to reduced or discontinued alcohol use, more acculturated Latino youth who used cigarettes and marijuana had different rates of reducing or discontinuing use of those substances than some other ethnic groups. Those differences also deserve further exploration. All of these considerations point toward the need for additional research on how to make prevention programs supportive of youth from different cultural backgrounds— especially those who are transitioning into or adjusting to our evolving multicultural society—by providing the tools needed to prevent, cease or reduce substance use. From a policy standpoint these considerations raise issues about resource allocation, such as whether universal programs should be expected to have broad effects in both preventing and reducing use, how to combine program elements effectively to reach both objectives, and how to refine knowledge about sub-populations that require specialized and distinctive interventions.

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**Table 1**

Proportions of users of each substance who reduced use or recently discontinued use

| | Reduced use | | | Discontinued use | | |
|---|---|---|---|---|---|---|
| | **All** | **Program** | **Control** | **All** | **Program** | **Control** |
| Alcohol | 40% | 43% | 30% | 32% | 34% | 24% |
| N | 1,028 | 795 | 233 | 1,028 | 795 | 233 |
| | | $\chi^2$ =8.2, $p < .01$ | | | $\chi^2$ =12.6, $p < .001$ | |
| Cigarettes | 35% | 36% | 33% | 29% | 31% | 26% |
| N | 544 | 409 | 135 | 544 | 409 | 135 |
| | | $\chi^2$ = 0.3, n.s | | | $\chi^2$ = 1.28, n.s | |
| Marijuana | 31% | 32% | 30% | 25% | 25% | 24% |
| N | 614 | 470 | 144 | 614 | 470 | 144 |
| | | $\chi^2$ = 0.2, n.s | | | $\chi^2$ = 0.04, n.s | |
| Any* | | | | 26% | 27% | 20% |
| N | | | | 1,364 | 1046 | 318 |
| | | | | | $\chi^2$ =6.0, $p < .05$ | |

*Note*. Chi-square tests are based on crosstabulations of program participation status (yes/no) by occurrence of the indicated use reduction or discontinuation event (yes/no); n.s. indicates a non-significant chi-square ($p > .05$).

*This last panel, based on all prior users of alcohol, cigarettes or marijuana, or any combination of them, presents the proportion of students who discontinued use of all the substances they had used previously.

**Table 2**

Estimates and odds ratios for transitions to reduced use of alcohol, cigarette, and marijuana

| | Alcohol | | Cigarettes | | Marijuana | |
|---|---|---|---|---|---|---|
| | **Estimate (standard error)** | **Odds ratio** | **Estimate (standard error)** | **Odds ratio** | **Estimate (standard error)** | **Odds ratio** |
| Program participation | 0.54*(0.26) | 1.72 | 0.05 (0.32) | 1.05 | 0.18 (0.31) | 1.19 |
| Less acculturated Latino/as | −0.01 (0.15) | 0.99 | 0.09 (0.21) | 1.09 | 0.22 (0.21) | 1.25 |
| Non-Latino/a whites | 0.04 (0.21) | 1.04 | −0.77*(0.32) | 0.46 | −0.18 (0.34) | 0.83 |
| Other ethnicity students | −0.15 (0.25) | 0.86 | 0.44 (0.32) | 1.55 | 0.51 + (0.28) | 1.67 |
| Gender (1 = male, 0 = female) | 0.02 (0.13) | 1.03 | −0.07 (0.19) | 0.93 | 0.12 (0.18) | 1.12 |
| Previous wave's age | −0.14 (0.09) | 0.87 | −0.08 (0.12) | 0.93 | −0.01 (0.11) | 0.99 |
| Previous wave's grades | 0.09**(0.03) | 1.10 | 0.05 (0.05) | 1.05 | 0.07 + (0.04) | 1.07 |
| Previous wave's SES | 0.19 (0.18) | 1.22 | −0.04 (0.25) | 0.96 | 0.10 (0.24) | 1.11 |
| Previous wave's use severity | 0.07 (0.05) | 1.08 | 0.11 (0.07) | 1.12 | −0.03 (0.06) | 0.97 |
| Wave 3 | −0.44*(0.17) | 0.64 | −0.18 (0.26) | 0.83 | 0.001 (0.23) | 1.00 |
| Wave 4 | −0.51+(0.27) | 0.60 | −0.99 +(0.57) | 0.37 | −0.97*(0.49) | 0.38 |
| Intercept | −0.02 (1.24) | 0.98 | −.26 (1.72) | 0.77 | −1.47 (1.55) | 0.23 |
| N (Person-waves) | 1,317 | | 655 | | 778 | |

*Note*. Two-tailed tests:

+ $p < .10$;

* $p < .05$;

** $p < .01$.

**Table 3**

Estimates and odds ratios for transitions to discontinued use of alcohol, cigarette, and marijuana use

| | Alcohol | | Cigarettes | | Marijuana | |
|---|---|---|---|---|---|---|
| | Estimate (standard error) | Odds ratio | Estimate (standard error) | Odds ratio | Estimate (standard error) | Odds ratio |
| Program participation | 0.51$^{+}$(0.26) | 1.66 | 0.26 (0.28) | 1.30 | 0.27 (0.30) | 1.31 |
| Less acculturated Latino/as | −0.06 (0.15) | 0.94 | 0.19 (0.21) | 1.21 | 0.21 (0.22) | 1.23 |
| Non-Latino/a whites | −0.02 (0.22) | 0.98 | −1.07$^{**}$(0.37) | 0.35 | −0.28 (0.37) | 0.76 |
| Other ethnicity students | 0.23 (0.26) | 1.26 | 0.51 (0.31) | 1.67 | 0.41 (0.29) | 1.51 |
| Gender (1 = male, 0 = female) | 0.20 (0.13) | 1.23 | −0.06 (0.19) | 0.94 | 0.21 (0.20) | 1.24 |
| Previous wave's age | −0.23$^{*}$(0.09) | 0.80 | −0.06 (0.13) | 0.93 | −0.14 (0.12) | 0.87 |
| Previous wave's grades | 0.09$^{*}$ (0.04) | 1.09 | 0.02 (0.05) | 1.02 | 0.08$^{+}$(0.05) | 1.09 |
| Previous wave's SES | 0.32$^{+}$(0.19) | 1.38 | −0.10 (0.25) | 0.91 | 0.06 (0.27) | 1.07 |
| Previous wave's use severity | −0.23$^{***}$(0.06) | 0.80 | −0.16$^{*}$(0.08) | 0.85 | −0.40$^{***}$(0.07) | 0.67 |
| Wave 3 | −0.31$^{+}$(0.17) | 0.74 | 0.24 (0.23) | 1.27 | 0.23 (0.23) | 1.26 |
| Wave 4 | −0.47$^{+}$(0.25) | 0.63 | −0.01 (0.42) | 0.98 | −0.18 (0.37) | 0.84 |
| Intercept | 1.37 (1.33) | 3.93 | −.26 (1.72) | 1.02 | 0.75 (1.69) | 2.12 |
| N (person-waves) | 1,449 | | 713 | | 852 | |

*Note*. Two-tailed tests:

$^{+}p$ <.10.

$^{*}p$ <.05;

$^{**}p$ <.01.

## Table 4

Estimates and odds ratios for simultaneous discontinued use of alcohol, cigarette, and marijuana

| | Estimate (standard error) | Odds ratio |
|---|---|---|
| Program participation | 0.47*(0.23) | 1.61 |
| Less acculturated latino/as | 0.79 (0.15) | 1.08 |
| Non-Latino/a whites | −0.29 (0.22) | 0.75 |
| Other ethnicity students | 0.03 (0.22) | 1.03 |
| Gender (1 = male, 0 = female) | 0.24+(0.13) | 1.27 |
| Previous wave's age | −0.23**(0.09) | 0.80 |
| Previous wave's grades | 0.09*(0.04) | 1.09 |
| Previous wave's SES | 0.04 (0.18) | 1.05 |
| Previous wave's use severity | −0.60***(0.09) | 0.55 |
| Wave 3 | −0.20 (0.15) | 0.82 |
| Wave 4 | −0.35 (0.22) | 0.70 |
| Intercept | 1.78 (1.22) | 5.96 |
| N (Person-waves) | 2,026 | |

*Note*. Two-tailed tests:

+ $p < .10$

* $p < .05$;

** $p < .01$.