Combining in-school and community-based media efforts: reducing marijuana and alcohol uptake among younger adolescents

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Abstract

This study tests the impact of an in-school mediated communication campaign based on social marketing principles, in combination with a participatory, community-based media effort, on marijuana, alcohol and tobacco uptake among middle-school students. Eight media treatment and eight control communities throughout the US were randomly assigned to condition. Within both media treatment and media control communities, one school received a research-based prevention curriculum and one school did not, resulting in a crossed, split-plot design. Four waves of longitudinal data were collected over 2 years in each school and were analyzed using generalized linear mixed models to account for clustering effects. Youth in intervention communities (N = 4216) showed fewer users at final post-test for marijuana [odds ratio (OR) = 0.50, P = 0.019], alcohol (OR = 0.40, P = 0.009) and cigarettes (OR = 0.49, P = 0.039), one-tailed. Growth trajectory results were significant for marijuana (P = 0.040), marginal for alcohol (P = 0.051) and non-significant for cigarettes (P = 0.114). Results suggest that an appropriately designed in-school and community-based media effort can reduce youth substance uptake. Effectiveness does not depend on the presence of an in-school prevention curriculum.

Introduction

Despite some encouraging downward trends, use of substances including marijuana and alcohol remains widespread among American adolescents. Early initiation is commonplace, with 14.6% of eighth graders reporting marijuana use and 38.7% reporting alcohol use in the past year (Johnston et al., 2002). Reducing the rate of early uptake is especially important given evidence that early initiation is predictive of a variety of negative outcomes (Grant and Dawson, 1997).

A premise of the present study, consistent with a social-ecological framework (Berkman and Kawachi, 2000), is that the norms and expectations that influence substance uptake among younger adolescents are formed through a variety of social experiences, including experience in school and in the larger community. Reinforcement of non-use norms and expectations, therefore, should ideally be echoed and reinforced across these social environments (Flay, 2000). In the present study, we test an intervention that includes an in-school media campaign reinforced by participatory, community-based media efforts. This intervention is crossed with implementation of a research-based prevention curriculum in selected schools.

There is evidence that carefully designed, community-wide anti-drug advertising efforts can

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reduce youth marijuana (Palmgreen et al., 2001a) and cigarette (Farrelly et al., 2002) use, and that community-wide anti-smoking advertising in conjunction with in-school prevention curricula can reduce smoking uptake (Flynn et al., 1992, 1994). There are two primary challenges to the effectiveness of such media-based prevention efforts: obtaining sufficient exposure to the messages to achieve measurable impact (Hornik, 2002), and identifying and executing message strategies that can achieve such impact given adequate exposure (Worden, 1999; Pechmann et al., 2003).

Ensuring exposure to anti-drug messages is typically expensive, requiring paid advertising to ensure delivery of the message to the desired audience. However, the school environment provides a unique opportunity to inexpensively ensure a relatively high level of exposure to anti-use communication. In addition, focusing communication efforts within a school may influence youth perceptions of the norms and expectations within an environment in which they spend much of their day.

A variety of message strategies have shown some success in influencing substance use-related attitudes and behaviors (Flynn et al., 1994; Palmgreen et al., 2001a; Pechmann et al., 2003). In this study, we emphasized non-use as an expression of personal identity and the consistency of non-use with youth aspirations (Slater and Kelly, 2002), in the belief that such messages would not be redundant with already existing information regarding substance risks, more likely to reinforce non-use norms and less likely to generate reactivity (Ringold, 2002). Another advantage of this strategy is that the same messages could address a variety of substances (i.e. marijuana, alcohol and tobacco), whereas risk messages are typically substance specific. Given the limited resources of most communities and schools, developing effective cross-substance prevention strategies is advantageous (Griffin et al., 2003).

The school is nested within the larger community (Flay, 2000): participatory, community-based approaches may help change youth substance behaviors (Aguirre-Molina and Gorman, 1996; Perry et al., 2002), although, like media prevention approaches, their record is mixed (Merzel and D’Afflitti, 2003). Participatory community efforts focused on mobilizing media, events and other communication strategies have the potential to reinforce in-school communication efforts. We therefore expected a main effect for the combined community/in-school media treatment on reducing increase in substance uptake.

Similarly, we expected the prevention curriculum intervention to reduce substance uptake as well (Tobler and Stratton, 1997). As Flay (Flay, 2000) notes, however, prevention curriculum effects tend to decay and may require reinforcement (e.g. via media) elsewhere in the environment. Therefore, we also examined interaction effects of the media intervention and the school prevention curriculum.

Methods

Design, participants and data collection
This study utilized a randomized community design to assess the effects of the community/in-school media intervention, with eight media treatment and eight control communities. Communities randomized to the media treatment condition received both community- and in-school media prevention efforts. Data were collected in two middle or junior high schools in each of these 16 communities. In each community (media treatment or media control), one of the two schools also received an

![Fig. 1. Study experimental design.](image_url)
in-school prevention curriculum and the other did not, creating a crossed design (see Figure 1); as noted below, assignment of schools receiving the prevention curriculum was not fully randomized.

Four waves of data collection were conducted: the first prior to initiating the in-school curriculum, the second immediately following the last session, the third early in the fall of the second school year, and the fourth and final wave in late spring of the second year. Data collection in the control schools was matched as closely as possible to data collection times in the schools receiving the prevention curriculum.

Students (N = 4216) were recruited to the study using active consent procedures, required in this study given the provision of identifying information. Sixty-six percent of eligible students returned signed consent forms and participated in at least one survey. A total of 68.6% of these participating students provided data at all four measurement occasions; 16.8% provided data on three, 10.9% provided data on two and 3.7% provided data on just one of the measurement occasions. Missing data were primarily the result of absence from school on the day of the survey or missed survey items. In addition, the data for individual students who had indicators of inconsistent responding or exaggeration at a given measurement occasion were removed from the dataset. At any one measurement occasion, this equated to the removal of less than 2% of the students. The sample was approximately equal by gender (52% female/48% male). The majority of the sample was white (83.3%); 10.4% of respondents were African-American, 2.9% were Hispanic and 3.4% were of some other ethnic background.

As we were concerned with assessing students in their first year of middle or junior high school, we recruited sixth graders from the former and seventh graders from the latter (mean age at baseline = 12.2 years). As noted below, we balanced school/grade type between treatment and control conditions.

Communities were recruited using the National Center for Educational Statistics (NCES) database, excluding the two largest census groupings, as the time required to gain approval for inclusion of a prevention curriculum in larger districts would have been prohibitively lengthy. Treatment and control communities were located in each of the four major regions of the US (northeast, southeast, midwest and west). Because of the complexities of implementing and managing this 2-year intervention, recruitment and implementation were staggered over a 4-year period, following an initial start-up year. The first communities began intervention activities in the fall of 1999 and the last communities completed the intervention in spring 2003. Communities that entered the project were randomly assigned to condition using a group-matching strategy to minimize the potential for confounded effects due to random differences between treatment and control communities. Data on community income, region, size, ethnic make-up, junior high versus middle school configuration and readiness to engage as a community in prevention efforts (Edwards et al., 2000) were gathered from NCES and other databases as well as from data collection within each community. All possible assignment combinations were generated in the latter 2 recruitment years, including those communities previously assigned in earlier years (in the first year pure random assignment was used for three communities). Treatment or control assignment was based on random selection of one of the combinations in which no variables were different at $P < 0.15$ (from two such combinations in recruiting year 2 and from 10 such combinations in the crucial recruiting year 3).

The two schools within each community were, when possible, randomly assigned to either the curriculum or no curriculum condition. However, problems of scheduling and staffing in seven of the 16 communities precluded assignment of a school to the curriculum treatment condition (usually because key school staff members were new hires and administrators were unwilling to burden them with a new curriculum). In such cases, school administrators provided written documentation to assure us that assignment was not based on perceived need. As assignment to school condition, unlike the media treatment, was not fully random, inferences about prevention curriculum effects are qualified accordingly. Because school curriculum was
of secondary concern (i.e. we wanted to examine possible interactions of curriculum and media intervention effects), this limitation does not affect our analyses of primary interest.

**Intervention design**

Social marketing principles were used to guide the development of the media campaign to ensure a focus on influencing behavior change (Goldberg *et al.*, 1997; Kotler and Zaltman, 1971). Specifically, primary and secondary research was used to better understand adolescents’ attitudes, values and behaviors regarding substance use, and this knowledge guided the message strategy for the in-school media campaign, ‘Be Under Your Own Influence’. Additionally, through focus groups and personal interviews we learned what types of promotional items (the products) and media channels (the places) were valued and attended to by the adolescent audience. These materials accordingly included print materials such as a series of posters as well as promotional items such as book covers, tray liners, T-shirts, water bottles, rulers and lanyards.

The central premise of our message strategy was that the primary task of adolescence is attaining greater independence and autonomy. A principal benefit of substance use therefore is likely to be the accompanying feeling of rebellious noncompliance and independence. A principal cost is the risk to aspirations associated with greater maturity and autonomy. Our campaign was intended, therefore, to emphasize the inconsistency of drug (primarily marijuana) and alcohol use—and to a lesser extent tobacco use—with one’s aspirations (Oman *et al.*, 2004). In addition, the campaign sought to reframe substance use as an activity that impaired rather than enhanced personal autonomy (Williams *et al.*, 1999).

We thereby sought to decrease the cost and increase the benefit of the non-use choice by adolescents. We also often used images such as rock-climbing and four-wheeling that were appealing to risk-oriented, sensation-seeking youth (Palmgreen *et al.*, 2001b). The campaign was monitored via qualitative and quantitative process evaluations several times throughout campaign implementa-

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sessions in the second year; teachers were trained by experienced All Stars™ staff.

Measures
For the lifetime incidence of alcohol intoxication score, students responded to three questions: "Have you ever gotten drunk?", "How old were you the first time you got drunk?", "How often in the last month have you gotten drunk?". For the lifetime smoking score, students responded to three questions: "Have you ever smoked cigarettes?", "Do you smoke cigarettes?", "In using cigarettes are you a ... (non-user, very light user, light user, moderate user, heavy user or very heavy user)?". For the lifetime marijuana score, students responded to five questions: "Have you ever tried marijuana?", "How often in the past month have you used marijuana?", "How old were you the first time you used marijuana?", "Have you ever used marijuana when alone?", "In using marijuana are you a ... (non-user, very light user, light user, moderate user, heavy user or very heavy user)?". Items were from the American Drug and Alcohol Survey™, used by permission of the Rocky Mountain Behavioral Science Institute.

An affirmative response to any of the items resulted in a score of "1" for that particular lifetime use score, while students who indicated in all the items that they had never tried the substance received a score of "0". As one would expect, given that students experimenting with use might endorse past trial but not past month use, reliability across these items was quite good, but not perfect. The α values for the lifetime marijuana use measure varied from 0.88 to 0.92 across the four waves; α varied from 0.83 to 0.88 for lifetime intoxication, and from 0.88 to 0.90 for lifetime cigarette use.

The timing of the data collection varied among participants. Therefore, our model was constructed to allow for intervals of different lengths between measurements (Brown and Prescott, 1999; Wallace and Green, 2002).

Missing data
For our study, missing data were treated using multiple imputation (MI). We employed the MI procedure incorporated in SAS version 9.0 (SAS Institute, Cary, NC).

The imputation model was as rich as our analytic model (Schafer, 1999), reducing the chance that the imputation would bias the results. In addition, the imputation model included auxiliary items that were not used in the analyses, but were useful in predicting missing values (i.e. attitudes, normative beliefs, demographic variables, etc.) The parameter estimates reported below reflect combined estimates from analyses done on 10 imputed data sets. The 10 data sets yielded a relative efficiency estimate of 95% for our parameter estimates (Rubin, 1987).

Statistical analysis
The unit of randomization in our design (the community) was used to compute degrees of freedom for the test statistics (Murray et al., 1998, 2004). This approach permits relatively unqualified assertions of support for causal claims, in that the degrees of freedom reflect a true community-randomized experimental design.

The model used was a four-level (measurement occasion within individual within school within community) random-intercept model. Random-slope models were initially attempted, but failed to converge because the variance among slopes approached zero. Slopes were therefore treated as fixed (global tests of model fit indicated the fixed slope model fit the data better than a random slope model). Two-stage analyses were not used to permit estimation of random slopes because such analyses ignore variability in subordinate cluster sizes (school size was quite variable in this study, so this limitation would have distorted results in a non-trivial way) and because of problems associated with estimation of standard errors in two-stage analyses (Verbeke and Molenberghs, 2000). To address non-linearity issues, over-dispersion (i.e. conditional variance larger than implied by the model) and the clustering effects, we used generalized linear mixed models (McCullagh and Nelder, 1989; Rotnitzky and Jewell, 1990; Hastie and Pregibon, 1993; Lee and Nelder, 1996; McCulloch and Searle, 2001).
The intra-class correlations (ICCs) indicated that relatively little variation in the outcome variables (0.01% for marijuana, 0.02% for alcohol and 1.3% for cigarettes) was explained at the school level. Clustering at the community level accounted for 5.7% of the variance for marijuana, 8.5% for alcohol and 19.5% for cigarettes; all analyses incorporated the random intercepts for individual, school and community.

The fixed-effects portion of the model treated substance use as a function of media treatment, curriculum treatment, time and treatment interacting with time. Other interactions (e.g. media treatment × school curriculum treatment and the various higher-order interactions) were also assessed. Only those interactions that were significant for at least one substance outcome were included in the final model (summarized in Table I).

One test of our hypothesis regarding effects at the conclusion of our intervention is a test of the treatment’s main effect on Wave 4 intercepts; the model intercept was placed at the last measurement occasion (Raudenbush and Bryk, 2002). This test has the advantages of superior statistical power and easily interpreted odds ratios (ORs). The treatment × time interaction provides useful additional information regarding the effect of treatment on the linear rate of change. It also provides a more rigorous, although less statistically powerful, test of hypotheses, because it is not subject to baseline differences in outcome measures. (However, it should be noted that these baseline differences did not approach statistical significance).

We report one-tailed tests of significance because our hypotheses are directional and because we conducted preliminary examination of the data.

### Table I. Fixed effects for four-level random effects models using Murray et al. d.f. recommendations

<table>
<thead>
<tr>
<th></th>
<th>Log-odds</th>
<th>SE</th>
<th>t</th>
<th>d.f.</th>
<th>P</th>
<th>OR</th>
</tr>
</thead>
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<tr>
<td><strong>Marijuana</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>intercept</td>
<td>−1.528</td>
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<td>−7.14</td>
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<td>0.217</td>
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<td>time</td>
<td>1.203</td>
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<td>14.39</td>
<td>14</td>
<td>&lt;0.001</td>
<td>3.329</td>
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<td>media treatment</td>
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<td>−2.30</td>
<td>14</td>
<td>0.019</td>
<td>0.501</td>
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<tr>
<td>curriculum treatment</td>
<td>−0.259</td>
<td>0.084</td>
<td>−3.08</td>
<td>14</td>
<td>0.004</td>
<td>0.772</td>
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<tr>
<td>media treatment by time</td>
<td>−0.234</td>
<td>0.124</td>
<td>−1.89</td>
<td>14</td>
<td>0.040</td>
<td>0.791</td>
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<td><strong>Cigarettes</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>intercept</td>
<td>−0.830</td>
<td>0.267</td>
<td>−3.11</td>
<td>14</td>
<td>&lt;0.001</td>
<td>0.436</td>
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<tr>
<td>time</td>
<td>0.767</td>
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<td>9.11</td>
<td>14</td>
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<td>media treatment</td>
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<td>−1.90</td>
<td>14</td>
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<td>0.492</td>
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<td>curriculum treatment</td>
<td>−0.328</td>
<td>0.084</td>
<td>−3.92</td>
<td>14</td>
<td>&lt;0.001</td>
<td>0.720</td>
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<td>media treatment by time</td>
<td>−0.152</td>
<td>0.121</td>
<td>−1.26</td>
<td>14</td>
<td>0.114</td>
<td>0.859</td>
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<tr>
<td><strong>Alcohol</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>intercept</td>
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<td>0.115</td>
<td>−1.75</td>
<td>14</td>
<td>0.051</td>
<td>0.817</td>
</tr>
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</table>

Intercepts are centered at Time 4. A random-intercept model is used; random-slope models did not converge as their variance was too close to zero. The parameter estimates, shown in the first column, are log-odds. The last column shows the estimates as ORs. The ORs for main treatment effects compare the treatment group to the control group at Time 4. The OR for the media treatment × time interaction reflects the comparison of the treatment group linear rate of change to that of the control group. The time scores representing the preceding points were recoded as negative indicating they preceded the intercept in time. The P values shown are for a one-sided test with 14 d.f., to correspond with community as unit of randomization. The curriculum treatment × time, media treatment × curriculum treatment and higher-order interactions were not statistically significant, and were not included in the final model.
prior to project completion to ensure that our intervention was not causing iatrogenic effects. Had we observed such effects, the experiment would have been terminated. Therefore, use of two-tailed tests for these data is superfluous as effects opposite the hypothesized direction would not have had the opportunity to be assessed in this model.

Results

Process evaluation and exposure manipulation check
Qualitative results using in-depth interviews with key community coalition and school district participants indicated that the community and in-school media interventions were successfully implemented, although with some variation in intensity, in all treatment communities. The mix of media and communication approaches used varied based on community interest, capabilities, resources and needs, consistent with a participatory model. Quantitative assessment of treatment versus control exposure differences was possible only with respect to a sampling of advertisement-type messages that were used primarily in the in-school media intervention. Three such messages were reproduced in the evaluation instrument along with a foil (a fake) message intended to reduce false recognition, response set and research demand bias problems associated with recognition measurement (Slater and Kelly, 2002). After adjusting for recognition of the foil, students exposed to the media campaign were more likely to report recognition of selected campaign messages at all post-test waves (Time 2, OR=4.70, P < 0.0001; Time 3, OR=6.80, P < 0.0001; Time 4, OR=10.13, P < 0.0001).

Intervention effects
Results using community as the unit of randomization (Verbeke and Molenberghs, 2000) in a four-level random effects model were supportive of hypothesized community and in-school media effects (see Table I). The OR for using marijuana was 0.50, for alcohol 0.40 and for cigarettes 0.49 for treatment communities at the last measurement occasion, i.e. substance use uptake for youth in treatment communities was half or less than that of control communities by Wave 4. The Wave 4 results for the media treatment were clearly significant for marijuana \( t(14) = 2.30, P = 0.019 \) and alcohol \( t(14) = 2.72, P = 0.009, \text{one-tailed} \). Even though the Wave 4 effects for cigarettes were statistically significant, they were less robust than were effects on the other substances \( t(14) = 1.90, P = 0.039 \). The percent of youth using each substance by study condition at Time 4 is shown in Figure 1.

The treatment \( \times \) time interaction, as noted above, provides a more rigorous though less statistically powerful and less easily interpreted test of treatment effect. For the media treatment \( \times \) time interaction on marijuana, effects were significant \( t(14) = 1.89, P = 0.040 \). The media treatment \( \times \) time interaction was marginally significant for alcohol \( t(14) = 1.75, P = 0.051 \) and was not statistically significant for cigarettes \( t(14) = 1.26, P = 0.114 \). Figure 2 illustrates the media treatment effect on rate of change in marijuana, alcohol and cigarette use.

Effects of the curriculum were statistically significant at Wave 4 for each of the three substances

![Fig. 2. Percent of youth using each substance by study condition at final Wave 4 post-test.](image-url)
Discussion

Results provide support for the effectiveness of in-school media efforts combined with participatory communication efforts at the community level by final post-test—the odds of uptake at Time 4 were approximately twice as high for previously non-using members of the control group compared to their counterparts in the community-based and in-school media treatment group.

These effects were confirmed by the treatment × time interaction for marijuana and were marginally supported (at \( P = 0.051 \)) for alcohol, testing differences between slope trajectories. Initially smaller treatment/control differences grew larger over time, as illustrated by Figure 2, culminating in the relatively large Wave 4 treatment effects. Media intervention effects on reducing cigarette initiation were more problematic, as the analysis of trajectory effects was not significant. Effects on cigarette uptake were less robust, perhaps because only some messages included tobacco use, while all mentioned drugs (or marijuana specifically) and alcohol.

A particularly encouraging dimension of this intervention is that it appeared to influence several substance outcomes, in particular marijuana and alcohol use. The focus on autonomy and aspirations (‘Be Under Your Own Influence’) was equally applicable to both substances. Such multi-substance approaches are particularly advantageous given the limited resources and time available in most school settings (Griffin et al., 2003).

The apparent effectiveness of this media intervention may be attributed to several factors. One is the message strategy, emphasizing the ways that non-use meets immediate adolescent needs regarding autonomy, and both personal and social success. Another possibility is that the media intervention had the advantage of ubiquity. Among young teens, beliefs and attitudes are highly dynamic and changes in beliefs and attitudes tend to decay (Resnicow and Botvin, 1993), even when the interventions that trigger such changes are relatively intensive. If so, a media intervention in the school which remains continuously visible may serve to keep desirable attitudes salient, accessible and more likely to influence behavior (Fazio et al., 1989), even though the intervention at any one time cannot be considered an intensive one.

Inferences regarding the school curriculum cannot be confidently drawn given problems with random assignment of the curriculum. However, this is not a significant concern with respect to our primary objective of testing the media intervention. The pattern of results in Figure 1 suggests treatment strategies are not contingent nor synergistic (i.e. effectiveness of neither the media nor the curriculum treatment depended on the presence of the other treatment), although as one would expect the strongest effects appeared to be in the combined condition. Study results are also qualified by

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*(Fig. 3. Community treatment effect on rate of change in marijuana, alcohol and cigarette use (averaged growth curves as a function of elapsed time baseline data collection).)*
possible selection bias associated with use of active consent, as some research suggests that at-risk youth disproportionately do not provide parental consent (Unger et al., 2004). Also, as noted earlier, the data structure was most appropriately analyzed with random intercept rather than random slope models, which could not be estimated due to the minimal variability of these slopes. While the small ICC for slope variability (less than 1% of variance) suggests this should have little impact on results, it is a limitation on inference, as random slope analyses provide the most complete analyses of group randomized trials (Murray et al., 2004).

During the period of this research the Office of National Drug Control Policy was engaged in an active media campaign on national television focused primarily on marijuana use prevention, and the latter years of this effort also overlapped with national advertising by the Legacy Foundation and the truth™ campaign to discourage youth smoking. The effects of these national campaigns on both treatment and control communities should make for a more conservative test of hypothesized intervention impacts, but should not create any systematic bias.

Another limitation of the present study is that the relative contributions of the in-school media/social marketing effort and the community-based communication efforts are impossible to disentangle within the media treatment condition. Clearly, the combination has considerable potential. However, costs for taking the in-school intervention to wide-scale dissemination would probably be much lower than for the community media effort.

From a research perspective, too, it is important to establish the relative contributions of each program component (Flay, 2000). We do have evidence that amount of exposure to the media materials within the treatment schools is predictive of treatment outcomes (Slater and Kelly, 2002). In particular, we found that students from a subsample of schools early in the study who recognized having seen more of the campaign’s messages had greater aspirations inconsistent with marijuana use and that the effects of aspirations on marijuana use were mediated by intentions, consistent with the Theory of Reasoned Action (Ajzen and Fishbein, 1980).

We also found, based on coding a minimum of six pre- and post-test interviews with community key informants, that there were impacts of the media intervention on community knowledge of the substance use issue and marginally on community climate (Slater et al., 2005). We are conducting further research to identify paths of influence for the in-school and community campaigns, and to determine the relative contributions of the in-school and the community campaign components.

In the meantime, these results suggest that appropriately designed in-school and community-based media efforts can significantly reduce youth substance uptake, and that such efforts can be used independently of, or in addition to, classroom prevention curricula.

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